Federal Energy Regulatory Commission

Office of Energy Projects

August 2007

FERC/FEIS – 0199F

Final Environmental Impact Statement

Hells Canyon Hydroelectric Project Idaho/Oregon (FERC Project No. 1971-079)

888 First Street N.E., Washington, DC 20426

FERC/FEIS-0199F

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR HYDROPOWER LICENSE

Hells Canyon Hydroelectric Project
FERC Project No. 1971-079

Idaho and Oregon

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, DC 20426

August 2007

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

TO THE PARTY ADDRESSED:

Attached is the final environmental impact statement (EIS) for the Hells Canyon Hydroelectric Project, located on the Snake River in Washington and Adams counties, Idaho, and Wallowa and Baker counties, Oregon.

This final EIS documents the view of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Federal Energy Regulatory Commission (Commission) staff. It contains evaluations on Idaho Power Company's proposal and the alternatives for licensing the Hells Canyon Project.

A copy of the final EIS is available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington, DC 20426. The final EIS also may be viewed on the Commission's web site at http://www.ferc.gov under the eLibrary link. Enter the docket number excluding the last three digits in the docket number field to access the document. For assistance, contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll-free at 1-866-208-3676, or for TTY, (202) 502-8659.

Attachment: Final Environmental Impact Statement

COVER SHEET

a. Title: Licensing for the continued operation of Idaho Power Company's Hells Canyon Project, located on the Snake River in Washington and Adams counties, Idaho, and Wallowa and Baker counties, Oregon, Federal Energy Regulatory Commission (Commission or FERC) Project No. 1971-079.

b. Subject: Final Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission

d. Abstract: Idaho Power Company filed an application for license with the Commission for a new license for the Hell's Canyon Project,[1] FERC Project No. 1971, located on the Snake River in Washington and Adams counties, Idaho, and Wallowa and Baker counties, Oregon. The Hells Canyon Project consists of three developments (dams, reservoirs, and powerhouses) on the segment of the Snake River forming the border between Idaho and Oregon. The three developments are Brownlee, Oxbow, and Hells Canyon. The project affects lands included within the Payette National Forest, Wallowa-Whitman National Forest, Hells Canyon National Recreation Area, and lands administered by the Bureau of Land Management.

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f. Transmittal: This final environmental impact statement prepared by the Commission's staff on the hydroelectric license application filed by the Idaho Power Company for the proposed Hells Canyon Project, FERC Project No. 1971, is being made available to the public on or about August 31, 2007, as required by the National Environmental Policy Act of 1969[2]

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[1] Referred to in Idaho Power's application as the Hells Canyon Complex.

[2] National Environmental Policy Act of 1969, amended (Pub. L. 91-190. 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

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FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[3] and the U.S. Department of Energy Organization Act[4] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

> That the project…shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in Section 4(e)…[5]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[6] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[7]

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3 16 U.S.C. § 791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Public Law 99-495 (1986); the Energy Policy Act of 1992, Public Law 102-486 (1992); and the Energy Policy Act of 2005, Public Law 109-58 (2005).

4 Public Law 95-91, 91 Stat. 556 (1977).

5 16 U.S.C. § 803(a).

6 16 U.S.C. § 803(g).

7 18 C.F.R. § 385.206 (1987).

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ACRONYMS AND ABBREVIATIONS

ACEC	area of critical environmental concern
ADA	Americans with Disabilities Act
Advisory Council	Advisory Council of Historic Preservation
AIR	additional information request
aMW	average megawatt
APE	Area of Potential Effect
AR	American Rivers
BLM	Bureau of Land Management
BMP	best management practices
BOR	Bureau of Reclamation
°C	degrees Celsius
cfs	cubic feet per second
CFR	Code of Federal Regulations
Commerce	U.S. Department of Commerce
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CRMP	Cultural Resources Management Plan
CWA	Clean Water Act
CWMA	Cooperative Weed Management Area
DO	dissolved oxygen
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 2005
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FMR	fire modified rock
Forest Service	U.S. Forest Service
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
GBT	gas bubble trauma
HART	Hydropower Application Review Team
HCNRA	Hells Canyon National Recreation Area
HCRMP	Hells Canyon Resource Management Plan
HEP	Habitat Evaluation Procedure
HGMP	Habitat and Genetic Management Plan
HPMP	Historic Properties Management Plan
I&E	information and education
Idaho Power	Idaho Power Company
IDEQ	Idaho Department of Health and Welfare, Division of Environmental Quality
IDFG	Idaho Department of Fish and Game
IDPR	Idaho Department of Parks and Recreation
Interior	U.S. Department of the Interior
IRU	Idaho Rivers United
ISAB	Independent Scientific Advisory Board
IWHP	Integrated Wildlife Habitat Program
kaf	thousand acre-feet
kV	kilovolt

kWh	kilowatt-hour
mg/L	milligram per liter
MHWM	mean high water mark
msl	msl
MW	megawatt
MWh	megawatt-hours
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NPPVA	Northwest Professional Power Vessel Association
NTU	nephelometric turbidity unit
O&M	operation and maintenance
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Department of State Lands
OPRD	Oregon Parks and Recreation Department
ORV	outstanding remarkable value
OSMB	Oregon State Marine Board
OWRD	Oregon Water Resources Department
PA	Programmatic Agreement
pH	potential hydrogen (a measure of acidity and alkalinity)
PME	protection, mitigation, and enhancement
RAMP	Recreation Adaptive Management Plan
RARWG	Recreation and Aesthetics Resource Work Group
RM	river mile
ROS	Recreation Opportunity Spectrum
RRWG	Recreation Resource Work Group
RV	recreational vehicle
SHPO	State Historic Preservation Officer
SMA	special management area
SRBA	Snake River Basin Adjudication
TCP	traditional cultural property
TDG	total dissolved gas
TESSMP	Threatened, Endangered, and Sensitive Species Management Plan
TMDL	total maximum daily load
TRWG	Terrestrial Resources Work Group
TSS	total suspended solids
TSS/L	total suspended solids per liter
μg/L	microgram per liter
USGS	U.S. Geological Survey
VRMP	Visual Resource Management Plan
WMA	wildlife management area
WMMP	Wildlife Mitigation and Management Plan
WUA	weighted useable area

EXECUTIVE SUMMARY

This final environmental impact statement (EIS) for relicensing the Hells Canyon Hydroelectric Project has been prepared by the staff of the Federal Energy Regulatory Commission (Commission or FERC) to fulfill the requirements of the National Environmental Policy Act (NEPA); the Commission's implementing regulations under Title 18, Code of Federal Regulations (CFR), Part 380; and the Council on Environmental Quality regulations for implementing NEPA (40 CFR Parts 1500–1508). The purpose of this document is to inform the Commission, the public, and the various federal and state agencies, tribes, and non-governmental organizations about the potential environmental effects of the proposed project and its reasonable alternatives.

The Commission must decide whether to relicense the Hells Canyon Project and, if so, what conditions to place on any license issued. In deciding whether to authorize the continued operation of the hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality. This final EIS evaluates the potential natural resource benefits, environmental effects, and economic costs associated with granting a new FERC license for the Hells Canyon Project. The alternatives examined include the following: (1) No Action; (2) Idaho Power's Proposal; (3) the Staff Alternative; and (4) the Staff Alternative with Mandatory Conditions, which includes conditions required by agencies under section 18 and section 4(e) of the Federal Power Act and section 401 of the Clean Water Act.

Idaho Power's Proposal

On July 21, 2003, Idaho Power Company (Idaho Power or Applicant) filed an application for license with the Commission for a new license for the Hells Canyon Project, located on the Snake River in Washington and Adams counties, Idaho, and Wallowa and Baker counties, Oregon. The current license expired on July 31, 2005, and the project is operating under an annual license.

The Hells Canyon Project consists of three developments (dams, reservoirs, and powerhouses) on the segment of the Snake River forming the border between Idaho and Oregon. The three developments are Brownlee, Oxbow, and Hells Canyon, which, combined, provide 1,167 megawatts (MW) of power generating capacity.

The Hells Canyon Project is Idaho Power's largest power generating resource, providing approximately 70 percent of Idaho Power's annual hydroelectric generation and about 40 percent of the company's total annual generation. With extensive reservoir storage capacity at the Brownlee development, the Hells Canyon Project provides the major portion of Idaho Power's peaking and load-following capability. In the absence of the Hells Canyon Project, Idaho Power's estimated requirements for new power generating resources over the 2004–2013 planning horizon would more than double to 2,143 MW, and we conclude in this final EIS that there is a continuing need for the project's power generating capacity.

Specifically, Idaho Power's Proposal has four aspects:

1. Continuing to operate and maintain the existing project facilities, which consist of the following:
   - The Brownlee development, completed in 1958, with facilities that include: (1) a 1,380-foot-long, 395-foot-high, clay-core, earth and rockfill dam; (2) an impoundment

approximately 57 miles long with a surface area of 14,621 acres and a total volume of 1,420,062 acre-feet; and (3) a reinforced concrete powerhouse containing five vertical Francis turbine generators, having a combined rated capacity of 585.4 MW.

- The Oxbow development, completed in 1961, with facilities that include: (1) a 960-foot-long, 209-foot-high, clay-core earth and rockfill dam; (2) a 12-mile-long impoundment, with a surface area of 1,150 acres and a total volume of 58,385 acre-feet; (3) a reinforced concrete powerhouse containing four vertical Francis generators, having a combined rated capacity of 190 MW; and (4) a 2-mile-long bypassed reach during low-flow conditions.
- The Hells Canyon development, completed in 1967, with facilities that include: (1) a 910-foot-long, 330-foot-high, cast-in-place concrete gravity dam with integral spillway, intake, and powerhouse sections; (2) a 25-mile-long impoundment, with a surface area of 2,412 acres and a total volume of 167,720 acre-feet; and (3) a reinforced concrete powerhouse constructed against the downstream face of the dam, containing three vertical Francis generators, having a combined rated capacity of 391.5 MW.
- One 19-mile-long, 69-kilovolt transmission line (transmission line 945) running from the Oxbow switchyard to the Pine Creek substation and then to the Hells Canyon substation.
- Four fish hatcheries and three adult fish traps.
- Idaho Power-owned recreational facilities, including: (1) Woodhead Park, (2) McCormick Park, (3) McCormick overflow, (4) Old Carters Landing, (5) Hibbards Landing, (6) Copperfield Park, (7) the Copperfield boat launch, (8) Hells Canyon Park, (9) Airstrip B, and (10) several informal camping and access sites.

2. Continuing to operate the project under essentially the same constraints as those that characterize current operations. The project is currently operated to optimize its power and energy production value, subject to compliance with license requirements, flood control mandates, and certain discretionary criteria adopted by Idaho Power. Because most of the usable reservoir capacity in the Hells Canyon Project is contained in the reservoir farthest upstream (Brownlee), operations of all three powerhouses and dams are driven by operations at the Brownlee development. In summary, typical Brownlee operation over the course of a year consists of the following:

   - Starting in mid-January, Brownlee reservoir is drafted (lowered), under the direction of the U.S. Army Corps of Engineers (Corps), to provide storage space for springtime flood waters.
   - The reservoir refills in late spring, and Idaho Power tries to achieve a near-full condition [elevation 2,069 feet mean sea level (msl)] by early June, while maintaining releases from Hells Canyon dam sufficient to keep the river downstream of Hells Canyon dam above the target flow selected the previous fall for protection of fall Chinook salmon spawning and incubation.
   - Once the reservoir refills, Idaho Power initiates a 30-day period of stable water levels for protection of Brownlee resident fish spawning.
   - During July, Idaho Power typically tries to keep Brownlee reservoir nearly full throughout the month to conserve storage for August, which usually has an above-average monthly system power load, lower market energy availability, and higher average market energy prices. High reservoir levels are also advantageous for

reservoir-oriented recreation activities. During August, Idaho Power typically drafts Brownlee reservoir to meet system power loads.

- During late August and through September, Idaho Power adjusts Brownlee reservoir's draft rate so as to be able to achieve the necessary starting elevation for the fall Chinook program. This starting elevation ensures a stable spawning flow during the spawning period and a nearly full reservoir at the end of the spawning period around the first week of December.
- Beginning in mid-October and lasting through early December, Idaho Power maintains a constant outflow from the project, normally between 8,000 and 13,000 cubic feet per second (cfs), to ensure that fall Chinook construct their redds (nests) below a certain target flow elevation.
- Throughout the year, flows are managed to meet a year-round 5,000-cfs minimum flow and a maximum 1-foot-per-hour ramping rate at Johnson Bar, 18 miles downstream of Hells Canyon dam. Also under the current license, Idaho Power operates the project in the interest of navigation to maintain a target flow of 13,000 cfs in the Snake River at Lime Point (downstream of the Salmon River confluence at River Mile 172), at least 95 percent of the time.

3. Implementing a set of 94 environmental measures, the purposes of which include the following:
   - Maintain or improve the quality of project waters;
   - Improve hatchery facilities and operations;
   - Protect fall Chinook salmon;
   - Improve the white sturgeon population;
   - Enhance native salmonid populations in project tributaries;
   - Protect resident warm-water fish;
   - Acquire and improve approximately 22,761 acres of upland and 821 acres of riparian habitat to benefit wildlife affected by project operation;
   - Control noxious weeds;
   - Protect and interpret archeological and historic resources;
   - Improve recreational sites and facilities; and
   - Improve the appearance of project facilities and minimize visual contrast.
4. Changing the project boundary to exclude 3,800 acres of federal land surrounding the reservoirs above an established reservoir elevation that Idaho Power believes are no longer needed for project purposes.

Staff Alternative

After evaluating Idaho Power's Proposal, along with terms and conditions, prescriptions, and recommendations from resource agencies, tribes, and other interested parties, we compiled a set of environmental measures that we consider appropriate for addressing the resource issues raised in this proceeding. We call this the "Staff Alternative."

Under the Staff Alternative, the project would be operated as proposed by Idaho Power, but with the following additional operational constraints:

- Stricter reservoir refill targets after the flood control season;
- Releases from the project to augment downstream flows for the purpose of enhancing juvenile fall Chinook salmon migration conditions;
- Additional ramping restrictions during the fall Chinook salmon rearing period;
- An 8,500-cfs minimum flow downstream of Hells Canyon dam in medium-high and extremely high water years; and
- Warmwater fish spawning protection levels in Brownlee reservoir;

In addition to the foregoing operation-related measures, the Staff Alternative incorporates most of Idaho Power's proposed environmental measures, but with certain modifications. The Staff Alternative also includes 35 environmental measures additional to those proposed by Idaho Power. In recognition of the substantial cumulative effects that Idaho Power's mid-Snake and Hells Canyon projects have had on fisheries upstream of the project, including the elimination of anadromous fish runs upstream of Hells Canyon dam, numerous measures to benefit resident and anadromous fisheries are included in the Staff Alternative. Measures that are focused on enhancing fisheries downstream of the project include providing flow augmentation water from Brownlee reservoir to benefit outmigrating juvenile fall Chinook salmon, continued management of flows to benefit spawning and incubating fall Chinook salmon, restricted ramping rates during the fall Chinook salmon rearing season, and several measures that would improve water quality downstream of the project. Measures that would benefit resident fisheries and may contribute toward the eventual restoration of anadromous fish to habitat upstream of the project include habitat enhancement measures to be implemented in the Pine and Indian creeks and Wildhorse, Powder, and Burnt river basins; modification and improvement of the adult fish trap at Hells Canyon dam; stocking of surplus hatchery spring Chinook salmon and steelhead in Hells Canyon reservoir and construction of a monitoring weir at Pine Creek; the future construction of an adult trap at Oxbow dam and weirs at Indian Creek and on the Wildhorse River; and measures designed to meet Idaho Power's share of responsibility for nutrient and temperature loads under the TMDL. Because we conclude that resolving water quality and stakeholder issues would require considerable time, we also include measures designed to support tribal ceremonial and subsistence fisheries in the near term by developing a plan to transplant surplus hatchery spring Chinook salmon and steelhead into select tributaries, constructing hatchery facilities to support the streamside incubation box program on the Yankee Fork of the Salmon River, and investigating the potential for augmenting populations of white sturgeon by implementing a conservation hatchery program.

Conditions and Recommendations

Section 4(e) of the Federal Power Act gives the Secretaries of the Interior and Agriculture authority to impose conditions on a license issued by the Commission for hydropower projects located on "reservations" under the respective Secretary's supervision. See 16 U.S.C. §§ 796(2), 797(e).

In a January 26, 2006, filing with the Commission, the U.S Department of the Interior (Interior), on behalf of the Bureau of Land Management, submitted 19 preliminary terms and conditions pursuant to section 4(e). On February 27, 2006, Idaho Power filed alternative conditions, under section 241 of the Energy Policy Act of 2005 (EPAct), for all 19 Interior preliminary conditions. In a May 15, 2006, filing, Interior withdrew six of its preliminary conditions, replacing five of them and withdrawing one without substitution. On January 3, 2007, Interior filed modified conditions numbered 1–18 pursuant to FPA section 4(e).

In a January 26, 2006, filing, the U.S. Forest Service (Forest Service) provided 27 preliminary section 4(e) terms and conditions. On February 27, 2006, also under section 241 of EPAct, Idaho Power filed alternative conditions for 20 of the Forest Service preliminary conditions. The Forest Service withdrew and replaced nine of its preliminary conditions in a filing on May 10, 2006, and withdrew and replaced a tenth preliminary condition in a June 9, 2006, filing. The remaining 10 alternative conditions were subsequently resolved in an agreement between Idaho Power and the Forest Service dated October 6, 2006. Consistent with the agreement, Idaho Power filed a statement amending its alternative conditions on October 6, 2006, and the Forest Service filed its modified conditions on November 2, 2006. For a summary of the Interior and Forest Service modified conditions, see section 2.3.1.3.

Section 18 of the Federal Power Act, 16 U.S.C. § 811, states that the Commission shall require construction, maintenance, and operation by a licensee of such fishways as the Secretaries of the U.S. Department of Commerce (Commerce) and Interior may prescribe.

In a January 26, 2006, filing, Interior (for the U.S. Fish and Wildlife Service) provided preliminary prescriptions for fishways for bull trout, and in a February 27, 2006, filing, Idaho Power, under section 241 of EPAct, presented an alternative to Interior's prescription. Interior's January 26, 2006, filing also requests that the Commission include as a license condition a general reservation of authority to prescribe fishways during the term of a new license. In its January 26, 2006, filing, Commerce (for the National Marine Fisheries Service) elected not to use its fishway authority to require fish passage at any of the project's dams, but, like Interior, requested that the Commission include as a license condition a general reservation of authority to prescribe fishways during the term of a new license. On January 3, 2007, Interior filed its modified fishway prescription. For a summary of these prescriptions, see section 2.3.1.2.

The Staff Alternative includes many measures included in Idaho Power's proposal and its application for section 401 water quality certification as well as some of the section 18 fishway prescriptions, section 4(e) conditions, section 10(j) recommendations, section 10(a) recommendations, and measures developed by the staff. We did not include measures in the Staff Alternative that we find are not justified, are unrelated to the project, or would not provide benefits over the staff-developed measures. We address all recommendations throughout this final EIS and specifically in section 5.2, *Discussion of Key Issues*.

The Staff Alternative with Mandatory Conditions includes all the measures in the Staff Alternative plus three 4(e) conditions related to recreation and land management that we do not include in the Staff Alternative because we conclude that they are not related to the project or are not Idaho Power's responsibility.

Other Alternatives Considered

Under the No-action Alternative, the project would continue to operate under the terms and conditions of the existing license and of existing settlement agreements or memoranda of understanding or agreement. No new environmental measures would be implemented. We use this alternative to establish baseline conditions for comparison with Idaho Power's Proposal and the Staff Alternative, and to judge the benefits and costs of any measures that might be required under a new license.

We also considered federal takeover, issuance of a nonpower license, and project retirement, but concluded that none of these alternatives are reasonable in the context of this proceeding.

Project Effects

We summarize the more significant differences between Idaho Power's Proposal and the Staff Alternative in table ES-1. Because the Staff Alternative with Mandatory Conditions is so similar to the Staff Alternative, we do not list it separately in this summary table. Idaho Power's proposed operation is similar to current operations. Therefore, unless otherwise noted, the ongoing effects of project operation under Idaho Power's Proposal are similar to current conditions.

Based on our independent analysis of the Hells Canyon Project, including our consideration of all relevant economic and environmental concerns, we select the Staff Alternative as our preferred alternative and conclude that our preferred alternative represents the best balance between developmental and non-developmental resources.

Table ES-1. Summary of effects of Idaho Power's Proposal and Staff Alternative. (Source: Staff)

Resource	Idaho Power's Proposal	Staff Alternative[a]
Power Benefits		
Annual generation (MWh)	6,562,244	6,549,344
Net annual benefits	$297,050,500	$283,876,800
Sediment Supply and Transport		
Effects of Operations	Compared to without project conditions: • Beach and terrace erosion would continue downstream of Hells Canyon dam. • The quantity and quality of spawning gravels downstream of Hells Canyon dam would continue to be affected by project reservoirs trapping sand and gravel.	Compared to Idaho Power's Proposal: • Little or no change in beach and terrace erosion compared to Idaho Power's Proposal. • Little or no change in spawning gravel quantity or quality compared to Idaho Power's Proposal.
Effects of Environmental Measures	• The quantity, quality, and usage of spawning gravels downstream of Hells Canyon dam would be monitored. • Restoration of 14 acres on sandbar downstream of Hells Canyon dam would help mitigate for reservoir trapping of sand and gravel.	• Monitoring beach and terrace erosion would provide information about the effectiveness of mitigation strategies and support development of possible additional measures. • Gravel augmentation program would be developed if a reduction in the quantity or quality of spawning gravel is shown to adversely affect production of fall Chinook salmon. • Restoration of 14 acres of sandbar would have the same beneficial effect as Idaho Power's proposal.
Water Quality		
Effects of Operations	• Water temperatures would continue to be cooler in spring and summer and warmer in the fall and winter, potentially resulting in reduced viability of fall Chinook salmon eggs and reduced growth potential of fry. • The project would continue to lower dissolved oxygen (DO) concentrations in and downstream of Brownlee reservoir affecting habitat suitability for fish.	• The temperature of water released from Hells Canyon dam during the flow augmentation period would be slightly increased in extreme low flow years, but reduced warming would occur as flow passes through the reach due to higher flow volumes. These temperature changes would result in negligible effects on Chinook salmon and other fish downstream of Hells Canyon dam. • DO concentrations would be slightly improved downstream of Hells Canyon dam during the flow augmentation period in extremely low flow years.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	• Total dissolved gas levels downstream of Brownlee dam would continue to exceed the 110-percent of saturation criterion when spill exceeds 3,000 cfs. • Total dissolved gas levels downstream of Oxbow dam would continue to exceed the 110-percent of saturation criterion coinciding with most Brownlee spill events of more than 3,000 cfs and independent spills at Oxbow dam. • Total dissolved gas levels downstream of Hells Canyon dam would continue to exceed the 110-percent of saturation criterion during virtually all spill conditions increasing the likelihood of gas bubble trauma. • Project operation would continue to result in ammonia and trace metal concentration in the reservoirs and bioaccumulation in fish.	• Ammonia and trace metals would be flushed from reservoirs more frequently, but bioaccumulation in fish would remain about the same.
Effects of Environmental Measures	• DO supplementation would improve DO levels in the immediate vicinity of the proposed oxygen diffuser system in Brownlee reservoir or upstream phosphorus trading would improve water quality in affected tributaries and downstream reaches. • Hells Canyon turbine aeration would increase summer/fall DO levels downstream of the dam and thereby improve conditions for fall Chinook salmon. • Destratification of the deep pool in the Oxbow bypassed reach would increase DO levels in this pool and thereby improve native resident salmonid habitat. • Installation of spillway flow deflectors at Brownlee and Hells Canyon dams combined with total dissolved gas abatement measures at Oxbow dam, and an adaptive total dissolved gas abatement program would reduce the frequency and magnitude of total dissolved gas levels exceeding the 110 percent of saturation criterion and thereby reduce the potential for gas bubble trauma in Oxbow and Hells	• Monitoring the effectiveness of measures implemented under the DO enhancement plan, annual meetings with agencies and interested tribes, and filing of monitoring and implementation reports should improve the decision-making process for addressing project effects on DO and expedite implementation of associated measures. • Establishing a flow and water quality monitoring site within 5 miles downstream of Hells Canyon dam would improve monitoring of project effects on water quality. • Collection of tissue samples from white sturgeon and other fish species in Brownlee reservoir for monitoring of bioaccumulation of contaminants could lead to improved protection of public health and protection of bald eagles. • Monitoring the effectiveness of measures implemented under the Temperature Adaptive Management Plan, annual meetings with agencies and interested tribes, and filing of monitoring and implementation reports should improve the decision-making process for addressing project effects on water temperature.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	Canyon reservoirs, Oxbow bypassed reach, and the Snake River downstream of Hells Canyon dam. • Implementation of a Brownlee bubble upwelling system or watershed measures as part of a Temperature Adaptive Management Plan would reduce water temperatures early in the fall Chinook salmon spawning period and improve production potential.	
Aquatic Resources		
Effects of Operations	• Daily flow fluctuations downstream of Hells Canyon dam would continue to reduce the abundance of aquatic invertebrates, the primary food base for fish, by about 10 percent. • The reduction in aquatic invertebrates would especially affect fall Chinook juveniles, which rear in shallow areas that are subject to frequent dewatering. • Migration conditions for juvenile fall Chinook salmon would remain the same as years when flow augmentation water has not been provided from Brownlee reservoir, but would be less favorable than conditions in most of the past 14 years when flows were voluntarily augmented.	• More restrictive ramping rates during the rearing period, as well as provisions for monitoring and adaptive management based on monitoring results, could substantially reduce fall Chinook salmon mortalities due to stranding and entrapment and improve the food base during the fall Chinook rearing season. • Invertebrate monitoring would help determine the extent that peaking operations affect rare and sensitive species of mollusks and invertebrate production, and could assist in identifying operational modifications to reduce adverse effects through adaptive management. • Most available information supports a conclusion that flow augmentation should enhance migration conditions for juvenile fall Chinook salmon in the Snake and the lower Columbia rivers, likely increasing adult returns. Review of new information on the efficacy of flow augmentation 6 years after license issuance would allow the timing and quantity of water delivered from Brownlee reservoir to be adjusted, if warranted. • A fall Chinook spawning flow management plan, flow augmentation evaluation report, and monitoring of fall Chinook salmon entrapment and stranding should improve the flow management decision process and the overall survival of fall Chinook salmon in the Snake River downstream from Hells Canyon.
Effects of Hatchery Measures	• Improved hatchery facilities and a monitoring and evaluation program would maintain anadromous fish production at current levels and improve information	• Consulting with the fisheries management agencies and interested tribes to define appropriate goals and objectives of its hatchery program would help ensure that hatchery and genetic

Resource	Idaho Power's Proposal	Staff Alternative[a]
	on the effects of hatchery production on listed species.	management plans are consistent with Idaho Power's responsibilities under the new license, as well as reflect the management goals of the agencies and tribes. • Constructing and operating facilities to spawn and incubate steelhead and Chinook salmon on the Yankee Fork would (1) help rebuild, and facilitate the delisting of, listed ESUs, and (2) support ceremonial, subsistence, and recreational fisheries in the project area and Snake River basin. • Developing and implementing a plan to transport and distribute surplus anadromous fish that return to Idaho Power's hatchery system or the Hells Canyon trap to project reservoirs and tributaries in the project area, as well as other select tributaries in the Snake River basin, would provide several resource benefits because distributing surplus fish would (1) provide a source of marine nutrients; (2) improve forage for bull trout; (3) provide an opportunity to evaluate spawning success, egg viability and survival, as well as smolt outmigration and survival in Pine Creek; and (4) support ceremonial, subsistence, and recreational fisheries in the project area and Snake River basin.
Effects of Other Environmental Measures	• DO supplementation would improve fish habitat in the vicinity of the oxygen diffuser system, if implemented, in the upper end of Brownlee reservoir. • Phosphorus trading and watershed measures, if implemented, would provide broad benefits to water quality and habitat conditions for fish species within and downstream of the project, and in the tributaries where measures are implemented. • Hells Canyon turbine aeration would increase summer/fall DO levels downstream of the dam, improving habitat conditions for aquatic resources, including fall Chinook salmon. • Reductions in total dissolved gas exceedances downstream of Brownlee, Oxbow, and Hells Canyon dams, at low and moderate spill rates, would benefit aquatic resources by reducing gas bubble trauma.	• Potentially greater temperature and habitat benefits would be provided if additional watershed or phosphorus reduction measures are implemented based on monitoring results. • Annual meetings with agencies and interested tribes and filing of monitoring and implementation reports should expedite the implementation of additional measures to reduce gas supersaturation, if needed, and reduce the likelihood of gas bubble trauma within, and downstream from, the project. • Implementation of upstream and downstream passage for native resident salmonids would increase connectivity and gene flow among populations in Pine Creek, Indian Creek, and the Wildhorse River. • Construction of weir and trap fishways on Pine Creek, Indian Creek and the Wildhorse River would allow tracking of bull trout population trends and effectiveness monitoring of brook trout control and tributary enhancement efforts.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	• Improvement of Hells Canyon dam fish trap would reduce stress and injury to fish by allowing onsite sorting and allow fish tagging activities. • Implementation of upstream passage for native resident salmonids could improve gene flow to some populations, but downstream populations may be reduced due to upstream migration. • Construction of a monitoring weir on Pine Creek would allow further monitoring of bull trout migration and enable downstream transfer of outmigrants past Hells Canyon dam. • Pathogen risk assessment would help manage increased risk of pathogen transfer associated with fish transfers. • Tributary enhancements and carcass outplants or other nutrient supplementation would benefit bull trout and redband trout within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the project. • Brook trout suppression efforts could reduce competition and hybridization with bull trout in Indian Creek. • Implementation of the proposed White Sturgeon Conservation Plan and related measures would help rebuild the white sturgeon population in the Swan Falls to Brownlee reach.	• Construction of the Pine Creek weir to operate year-round would improve monitoring of bull trout movements and would enable assessment of spawning success of surplus adult steelhead and spring Chinook salmon released into Hells Canyon reservoir. • Benefits of Hells Canyon trap modifications, pathogen risk assessment, and nutrient supplementation would be the same as Idaho Power's Proposal. • Additional tributary enhancement measures would benefit native resident salmonids in the Powder and Burnt River basins. • Brook trout suppression efforts, if successful, would be expanded to include the Wildhorse River and Pine Creek using methods proven to be successful in Indian Creek. • Sturgeon stocking, if determined to be feasible, could augment white sturgeon populations in all reaches between Swan Falls and Hells Canyon dams, benefiting tribal and recreational fisheries.
Terrestrial Resources		
Effects of Operations	• Slightly increased potential for negative effects on special status plants. • Slightly increased occurrence and expansion of puncture vine at Brownlee reservoir. • Daily flow fluctuations would reduce riparian habitat at Hells Canyon and Oxbow reservoirs by <1 acre and by about 15 acres downstream of Hells Canyon dam.	• Effects on special status plants essentially the same as Idaho Power's Proposal. • Effects on noxious weeds similar to Idaho Power's Proposal, but slightly more weed occurrence at Brownlee reservoir and slightly less occurrence downstream of Hells Canyon dam.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	• Conditions would remain about the same for fish-eating wildlife such as river otters, black bears, and bald eagles. • Brownlee reservoir would continue to pose a small risk to mule deer trying to cross it. • Continued erosion would be likely to affect about 70 additional acres over the term of the license.	• Daily flow fluctuations would reduce riparian habitat by <1 acre at Hells Canyon reservoir, about 1.5 acres at Oxbow reservoir, and about 13 acres downstream of Hells Canyon dam. • More stable flows benefiting fish would improve conditions for fish-eating wildlife, such as river otters, black bears, and bald eagles. • Risks to mule deer crossing Brownlee reservoir would be the same as Idaho Power's Proposal. • Continued erosion would be similar to Idaho Power's Proposal.
Effects of Environmental Measures	• Coordination and planning would improve protection of rare plants and control of noxious weeds. • Transmission line operation and maintenance plans for wildlife and botanical resources would reduce potential adverse operation and maintenance effects on terrestrial resources. • Management of 20,592 acquired acres and 2,990 Idaho Power acres for wildlife habitat would benefit terrestrial resources affected by operation of the project based on a 1:1 replacement ratio. • Habitat enhancement at four Snake River islands would improve habitat for waterfowl, nesting waterbirds, raptors, neotropical migrant songbirds, and aquatic furbearers. • Coordination with agencies to enhance mountain quail habitat and/or participate in relocation projects would benefit mountain quail. • Implementation of the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan would improve coordination and management of wildlife habitat in Idaho Power's ownership. • Threatened, endangered, and sensitive species would continue to be managed on a case-by-case basis.	• Rare plant protection and noxious weed control would be essentially the same as Idaho Power's Proposal, with some additional measures to improve efficiency and coordination and increased emphasis on surveys prior to implementation of ground-disturbing activities. • Transmission line operation and maintenance plan for terrestrial resources would be essentially the same as Idaho Power's Proposal, with some improved efficiency and coordination and increased raptor protection. • Acquisition and management of wildlife habitat would have essentially the same effects as Idaho Power's Proposal, but would also include measures to address ongoing effects on sandbar willow establishment; erosion anticipated to occur during new license period; and the loss of riparian habitat resulting from implementation of staff flow alternative. • Provision of funding for capital improvements and implementation of habitat enhancements to four Snake River islands would yield greater habitat improvement than Idaho Power's Proposal. • Improvements to mountain quail habitat and/or participation in relocation projects would be about the same as Idaho Power's Proposal. • Application of project-wide wildlife habitat planning would improve coordination of habitat management for lands within the project boundary compared to Idaho Power's Proposal.

Resource	Idaho Power's Proposal	Staff Alternative[a]
		• Development of project-wide Threatened, Endangered, and Sensitive Species Management Plan would improve efficiency and coordination of protective measures for those species covered by the plan, compared to Idaho Power's Proposal.
Cultural Resources		
Effects of Operations	• Restoration of 14 acres of sandbar downstream of Hells Canyon dam would help protect some cultural sites from erosion damage. • Beach and terrace erosion would continue to put some cultural sites at risk.	• Restoration of 14 acres of sandbar would have the same beneficial effect as Idaho Power's proposal. • More restrictive ramping rates during the spring would provide a minor increase in cultural resource protection compared to Idaho Power's Proposal.
Effects of Environmental Measures	• Site monitoring would improve protection of monitored sites. • Site stabilization would protect 7 sites on Brownlee reservoir and 20 sites downstream of Hells Canyon dam, and data recovery at 4 sites would prevent possible future damage. • Establishment of Native American, European-American, and Asian-American interpretive sites could contribute to resource protection through visitor education. • Support for local museums would enhance cultural resources protection and education in the local area. • Support for Native American programs would enhance the tribes' informed participation in the management and protection of project resources. • Measures to improve the condition of aquatic resources would benefit culturally important species, including white sturgeon and native resident and anadromous salmonids. • Development of a plan to implement the deferred study of reservoir water level fluctuation effects on cultural resources would enhance understanding of those effects and form the basis for further protective measures, if needed.	• Development of site monitoring plan would improve efficiency and consistency of monitoring efforts. • Site stabilization, data recovery, and establishment of interpretive sites would achieve the same benefits as Idaho Power's Proposal. • Support for Native American programs would provide fewer benefits than Idaho Power's Proposal because scholarships would not be provided. • Renewed offer to prepare oral histories for Shoshone-Bannock and Shoshone-Paiute Tribes would potentially enhance cultural understanding. • Development of a plan to implement the deferred study of reservoir water level fluctuation effects on cultural resources would enhance understanding of those effects and form the basis for further protective measures, if needed. • Continuation of flow augmentation, expansion of tributary habitat improvements to the Powder and Burnt River basins, implementation of the FWS fishway prescription, consultation with agencies and tribes to determine the best use of surplus adult hatchery steelhead and spring Chinook salmon, construction of spawning and incubation facilities on the Yankee Fork, and potential expansion of white sturgeon measures to include stocking in project reservoirs would

Resource	Idaho Power's Proposal	Staff Alternative[a]
		provide additional benefits to tribal fisheries and to culturally important species. • Revision of the HPMP to meet Forest Service 4(e) condition no. 25 would improve the plan overall, including provision for an adaptive management strategy to accommodate unforeseen challenges and conditions, and also provisions for determining when and under what circumstances new survey, or resurvey of previously examined areas, may be required.
Recreation		
Effects of Operations	• Brownlee reservoir level would continue to support flat-water boating and crappie fishing in the late summer and early fall. • Similar to current conditions, flows downstream of Hells Canyon dam would routinely fall below the Corps' recommended 8,500-cfs safe navigation flow. • Flow fluctuations downstream of Hells Canyon dam would continue to adversely affect boaters and campers.	• Flow augmentation would adversely affect flat-water boating opportunities and crappie fishing compared to current conditions and Idaho Power's Proposal. • Implementing an 8,500-cfs minimum flow downstream from Hells Canyon dam in medium-high and extremely high flow years would increase boaters' certainty of having those flows available. • Flow augmentation would slightly improve early summer boating opportunities downstream of Hells Canyon dam. • More stabilized flows during the spring downstream of Hells Canyon dam would enhance the quality of the boating experience.
Effects of Environmental Measures	• Preparation and implementation of a Recreation Plan would benefit recreational visitors by providing improved management of recreational programs. • Numerous proposed improvements would benefit recreational visitors by improving boat moorage, road maintenance, developed and dispersed recreation sites, and boat access in low water years, and would benefit cultural and natural resources by providing additional protection near recreation uses. • Proposed changes in the litter and sanitation management program would substantially improve upon existing conditions.	• Adding specificity to the implementation standards of the Recreation Plan would clarify plans and improve delivery of the intended benefits. • Expansion of Recreation Plan to include site improvements at Oasis, Steck recreation site, Farewell Bend State Park, Jennifer's Alluvial Fan, Deep Creek, and the Hells Canyon launch would provide additional recreation benefits compared to Idaho Power's Proposal. • Expansion of the litter and sanitation management program to include a gray water and sanitary cleaning system at the Hells Canyon Creek put-in/take-out would improve the sanitation system and disposal of human waste for boaters.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	• The I&E Plan would promote protection and preservation of cultural, natural, and historic resources. • Funding O&M at its recreation sites and those of BLM and the Forest Service that Idaho Power upgrades would benefit recreational visitors and resource protection by improving maintenance and management at most of the primary recreation sites in the project boundary. • Continuing to provide flow information for flows downstream of Hells Canyon dam would continue to benefit recreational visitors by providing timely information to be used in trip planning. • Continuance of the Memorandum of Understanding for staffing the Hells Canyon Visitor Center would continue to benefit visitors at the center. • Preparation of a Recreation Adaptive Management Plan would provide a framework for responding to changes in recreational needs. • Implementation of the White Sturgeon Conservation Plan should lead to an improved sturgeon fishery in the Swan falls to Brownlee Reach. • Implementation of the native salmonid plan and tributary enhancements should improve redband trout fisheries in the Pine, Indian and Wildhorse basins.	• Increasing the specificity of the I&E Plan and including information on aquatic invasive species and anadromous fish would promote additional understanding of and protection for project resources. • Clarifying O&M funding and responsibilities at Forest Service and BLM recreational sites at the project through consultation as part of the final Recreation Plan would improve delivery of the intended plan benefits. • Preparing and implementing the navigation plan would increase the benefits of the flow information system by increasing the amount and timeliness of flow information. • Hells Canyon Visitor Center staffing would be the same as under Idaho Power's Proposal. • Adding details to the Recreation Adaptive Management Plan concerning the minimum level of recreational use monitoring and consultation every 6 years related to Form 80 filing would improve the responsiveness of the plan to changing recreational conditions. • Expanded tributary enhancement measures would benefit redband trout fisheries in the Powder and Burnt River basins. • Sturgeon stocking, if determined to be feasible, would improve the sturgeon fishery between Swan Falls and Hells Canyon dams more rapidly than under Idaho Power's proposal.
Land Management and Aesthetics		
Effects of Operations	• The adverse visual effects of Brownlee reservoir drawdown would continue to occur from about July through October. • Visual effects on the shoreline downstream of Hells Canyon dam would continue due to periodic dewatering of the shoreline, beach and terrace erosion, and loss of riparian habitat.	• Flow augmentation would lead to earlier and more rapid drafting of Brownlee reservoir starting in late June, exacerbating the negative visual effect of Brownlee reservoir drawdowns. • Negative visual effects downstream of Hells Canyon dam would be reduced somewhat compared to Idaho Power's Proposal due to more stable water levels during the spring.

Resource	Idaho Power's Proposal	Staff Alternative[a]
Effects of Environmental Measures	• Implementation of the Hells Canyon Resource Management Plan on project lands would enhance the management, conservation, and protection of natural and cultural resources. • Continuation of the project's law enforcement and fire protection programs and sponsorship of biannual law enforcement coordination meetings would help maintain and improve public safety and resource protection at the project. • Proposed boundary modifications to exclude 3,800 acres of federal lands from the project boundary would exclude some lands used for project-related purposes. • Development of a road management plan, application of the Common Policies of the Hells Canyon Resource Management Plan, and continued maintenance of 40 miles of road would lead to improved access, public safety, and resource protection related to those roads • Application of the aesthetic resource elements of the Hells Canyon Resource Management Plan would improve the aesthetic appearance of the project. • Reducing the visual contrast of transmission line 945 would enhance the visual experience of visitors.	• Adding specific details to the Hells Canyon Resource Management Plan to identify which policies need specific management plans and implementation programs would improve delivery of the intended benefits of the plan. • Adding specific agency coordination measures to the Hells Canyon Resource Management Plan would improve protection of resources on BLM and Forest Service lands in the project boundary. • Adding specific components of the law enforcement and fire protection programs to the Hells Canyon Resource Management Plan would improve delivery of the intended benefits of those programs. • Amending the project boundary to include lands acquired for wildlife mitigation, dispersed recreation areas within 200 yards of the shoreline, and the Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites would improve resource protection at those sites; other federally managed lands could be removed from the boundary without adversely affecting resources on those lands. Providing the Forest Service with appropriately marked aerial photographs would enhance coordination of resource protection on Forest Service lands. • Including additional consultation in the road management planning process and integrating that process with the Hells Canyon Resource Management Plan would help ensure that all project-related roads are appropriately maintained. • Adding specificity to the aesthetic resources portion of the Hells Canyon Resource Management Plan, based on previously developed, project-wide standards and guidelines, and formalizing it into an aesthetic improvement management plan would improve delivery of the intended benefits. • Adding aesthetic improvements to Hells Canyon dam would enhance the visual experience for visitors.

Resource	Idaho Power's Proposal	Staff Alternative[a]
		• Including transmission line aesthetic improvements in the aesthetic elements of the Hells Canyon Resource Management Plan would help ensure consistency in the approach to visual resource management.
Socioeconomics		
Effects of Operations	• Potential increase in electricity rates to pay increased cost of producing project power.	• Potentially greater increase in electricity rates to pay increased cost of producing project power. • Flow augmentation could lead to a shift in recreational spending away from warmwater fishing at Brownlee reservoir, but could improve tribal and commercial fisheries for fall Chinook salmon, affecting related businesses accordingly.
Effects of Environmental Measures	• Spending on environmental measures and increased visitor use could increase local business income, but also increase cost to counties to provide services in the project area. • Wildlife habitat restoration and improved conditions for some aquatic resources would benefit tribal cultures compared to current conditions.	• Greater spending on environmental measures could lead to greater increase in local business income. • Additional measures to benefit downstream anadromous fish populations and resident fish populations within and upstream of the project could lead to greater benefits to tribal cultures compared to Idaho Power's Proposal. • Constructing and operating facilities to spawn and incubate steelhead and Chinook salmon on the Yankee Fork and implementing a plan to transport and distribute surplus anadromous fish would provide ceremonial and subsistence fisheries for the tribes.

[a] The Staff Alternative with Mandatory Conditions is not listed in this table, and differs from the Staff Alternative only by the inclusion of three measures related to trail development and maintenance, road maintenance, and law enforcement

Notes:
BLM – U.S. Bureau of Land Management
DO – dissolved oxygen
Forest Service – U.S. Forest Service
GBT – gas bubble traum
HCRMP – Hells Canyon Resource Management Plan
HPMP – Historic Properties Management Plan
IWHP – integrated wildlife habitat program
MOU – memorandum of understanding
MWh – megawatt hours
O&M – operation and maintenance
TDG – total dissolved gas
TMDL – total maximum daily load
WMMP – Wildlife Mitigation and Management Plan

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1.0 PURPOSE OF ACTION AND NEED FOR POWER

On July 21, 2003, Idaho Power Company (Idaho Power or Applicant) filed an application for license with the Federal Energy Regulatory Commission (Commission or FERC) for a new license for the Hells Canyon Project,[8] FERC Project No. 1971, located on the Snake River in Washington and Adams counties, Idaho, and Wallowa and Baker counties, Oregon (figure 1). The current license expired on July 31, 2005, and the project is operating under an annual license.

The Hells Canyon Project consists of three developments (dams, reservoirs, and powerhouses) on the segment of the Snake River forming the border between Idaho and Oregon. The three developments are Brownlee, Oxbow, and Hells Canyon, which, combined, provide 1,167 megawatts (MW) of power generating capacity and 6,562,244 megawatt hours (MWh) of electricity annually. Federal lands within the current Hells Canyon Project boundary equal approximately 5,640 acres, including land managed by the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (Forest Service).

1.1 PURPOSE OF ACTION

The Commission must decide whether to relicense the Hells Canyon Project and, if so, what conditions should be placed on any license issued. In deciding whether to authorize the continued operation of the hydroelectric project and related facilities in compliance with the Federal Power Act (FPA) and other applicable laws, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat); the protection of recreational opportunities; and the preservation of other aspects of environmental quality.

In this final environmental impact statement (final EIS), we, the Commission staff, assess the environmental and economic effects of: (1) continuing to operate the project as it is currently operated (No-action Alternative); (2) operating the project as proposed by Idaho Power (Idaho Power's Proposal); (3) operating the project as proposed by Idaho Power with additional or modified environmental measures (Staff Alternative); and operating the project as recommended under the Staff Alternative with additional mandatory conditions. We also consider federal takeover, issuance of a nonpower license, and project retirement options.

Briefly, the principal issues addressed in the final EIS include: (1) the effects of project operations on the erosion of sand from riverine beaches and terraces and the transport of spawning gravels from the riverbed downstream of Hells Canyon dam; (2) the effects of project operations on reservoir and downstream water quality parameters important to fish and wildlife; (3) the effects of project operations on downstream river navigation; (4) the feasibility of restoring runs of anadromous fish, including Pacific lamprey, to areas upstream of the project; (5) the effects of water level fluctuations within and downstream of the project on aquatic habitat and tributary access for native salmonids; (6) conservation and restoration of populations of white sturgeon; (7) protection and enhancement of wildlife habitat; (8) potential effects on threatened and endangered species; (9) the adequacy of recreational facilities to meet expected demand over the term of a new license; (10) the effects of project operations and potential enhancements on historic and archaeological sites, Native American rock art, traditional cultural properties (TCPs), and historic buildings and structures; (11) the cumulative effects of continued Hells Canyon Project operation in the context of past, present, and reasonably foreseeable water resource development elsewhere in the Snake River basin; and (12) the effects of potential operational changes and the funding of various enhancement measures on the project's electric power output and cost of project power.

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[8] Referred to in Idaho Power's application as the Hells Canyon Complex.

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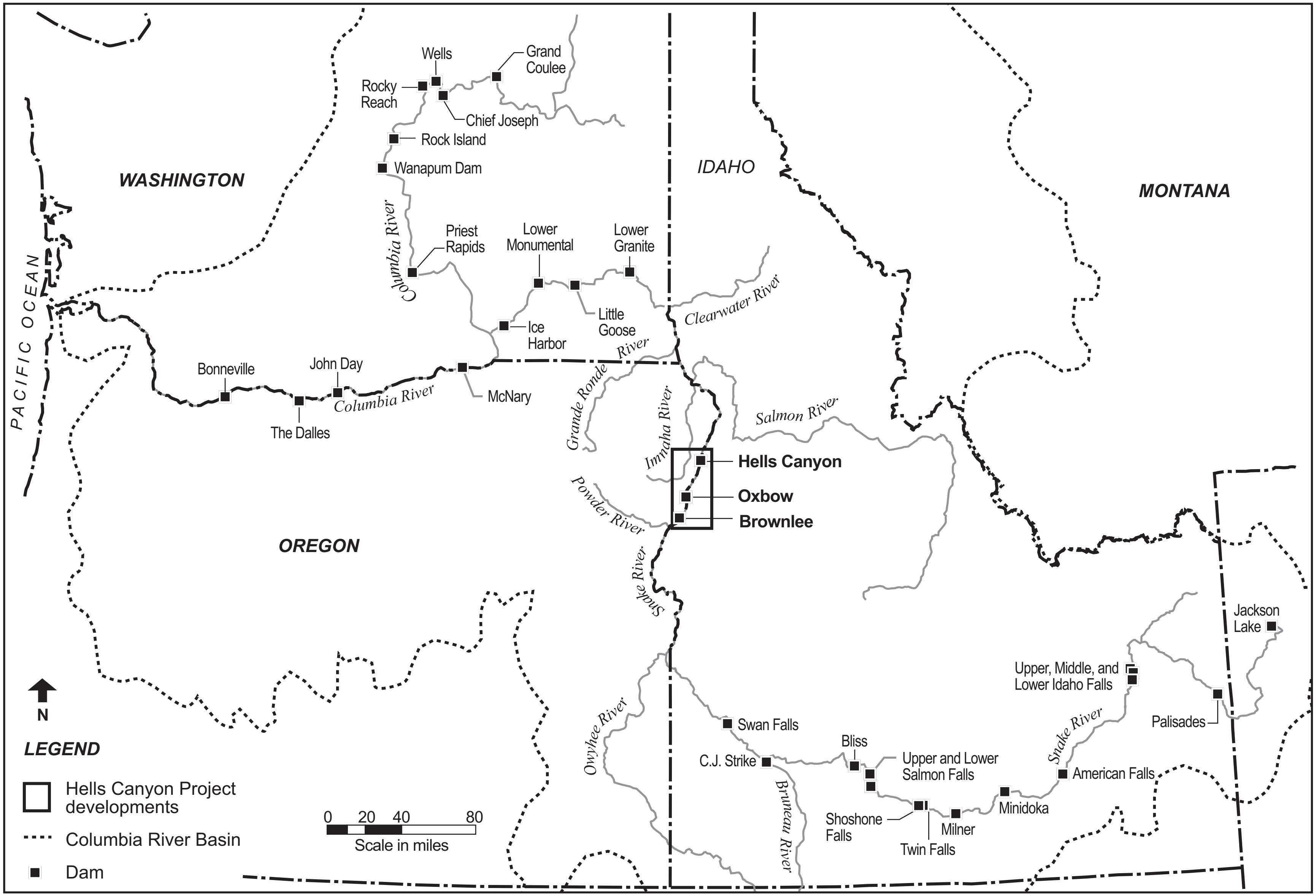

Figure 1. Location of the Hells Canyon Project. (Source: Staff)

1.2 NEED FOR POWER

Idaho Power is an investor-owned utility that serves about 456,000 customers in Idaho and Oregon and anticipates adding 11,000 to 12,000 new retail customers by 2025. As of year-end 2005, Idaho Power's peak electric power resources were 3,085 MW (nameplate), and Idaho Power's historical peak load (occurring in July 2006) was 3,084 MW. Idaho Power's average firm load in 2005 was 1,660 MW. In that year, Idaho Power customers' electrical energy needs were met by thermal generation (42 percent), hydroelectric generation (36 percent), and from power purchases (22 percent) (Idaho Power, 2006a).

Idaho Power owns about 1,379 MW of thermal generating capacity (nameplate). The primary baseload thermal power plants are shares of the Jim Bridger, Valmy, and Boardman coal-fired plants (1,111 MW baseload); the Danskin natural gas-fired plant (90 MW peaking); Bennett Mountain gas fired turbine (173 MW); and the Salmon diesel plants (5 MW emergency). Idaho Power also has more than 90 contracts to purchase power from Qualifying Facilities (cogeneration and small power production projects) with varying contract termination dates through the year 2028 (400 MW nameplate capacity).

Idaho Power's hydroelectric resources consist of 18 generating plants located along the Snake River and its tributaries. The combined nameplate capacity of these plants is 1,708 MW. With a nameplate capacity of 1,167 MW, the Hells Canyon Project is Idaho Power's largest power generating resource. The Hells Canyon Project provides approximately 67 percent of Idaho Power's annual hydroelectric generation and about 40 percent of the company's total annual generation. With extensive reservoir storage capacity at the Brownlee development, the Hells Canyon Project provides the major portion of Idaho Power's peaking and load-following capability.

Every 2 years, Idaho Power produces an Integrated Resource Plan to fulfill regulatory requirements and guidelines established by the Idaho and Oregon Public Utility Commissions. The purpose of the plan is to ensure that there are sufficient power resources to reliably serve Idaho Power's customers over the next 20 years with a portfolio of resources that balances cost, risk, and environmental concerns. Two additional goals include an equal and balanced treatment of both supply-side resources and demand-side measures and a meaningful public involvement program. Demand-side measures included demand response programs in both irrigation and air conditioning sectors. Energy efficiency programs in the residential, commercial, industrial, and irrigation sectors are also evaluated in the Integrated Resource Plan as demand-side measures. Demand-side measures that show positive economic benefits and are considered reasonably feasible for implementation are carried forward into the finalist energy portfolios.

Over the 2005–2025 planning period covered by the 2006 Integrated Resource Plan, Idaho Power forecasts the need for new resources based on an expected average annual growth rate of 2.0 percent in average energy requirements[9]. Idaho Power assumes the continued availability of existing resources under 70th percentile hydrologic conditions, the addition of a 170-MW combustion turbine at the Danskin Project[10] in April 2008, and a 49-MW[11] upgrade at Shoshone Falls in 2010. With those assumptions, Idaho Power estimates a need to add about 350 to 400 MW of power generating capacity between now and 2010 in addition to the 170-MW Danskin Project and 49-MW Shoshone Falls upgrade. By 2025, additional capacity needs could approach 1,800 MW[12] under peak hour summer conditions. Additionally,

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[9] Load growth under the 70th percentile scenario would increase from 1,693 aMW in 2005 to 2,515 aMW in 2025.

[10] The project is located northwest of Mountain Home, Idaho.

[11] The 49-MW upgrade will increase plant capacity to 62.5 MW.

[12] This computation is based on existing and committed resources and takes into account planned retirements.

an increase in transmission capability is needed to address deficiencies in transmission capacity that are forecast to begin during the summer months in 2009 and increase to 1,550 MW by 2025. Two potential early transmission projects include a 250-MW upgrade of the Borah–West transmission line and a 225-MW upgrade of the McNary–Boise transmission line. These projects would facilitate improved power flows and energy imports in the Idaho Power service area.

In the absence of the Hells Canyon Project, the estimated requirements for new resources would increase to 2,717 MW by 2025. A summary of potential capacity additions, including renewables such as wind and geothermal energy, is included in table 1. The precise location of such facilities will be determined based on the outcome of Idaho Power's request for proposals (RFP) process or future agency siting decisions in response to Idaho Power's proposals.

Table 1. Summary of Idaho Power's preferred portfolio summary and timeline. (Source: Idaho Power, 2006d)

Year	**Capacity (MW)**	**Resource**
2008	**100**	**Wind (2005 Request for Proposal)**
2009	**50**	**Geothermal (2006 Request for Proposal)**
2019	**50**	**Combined Heat and Power**
2020	**150**	**Wind**
2010	**225**	**Transmission McNary—Boise**
2012	**250**	**Wyoming Pulverized Coal**
2012	**250**	**Regional IGCC[a] Coal**
2013	**50**	**Transmission Lolo—Idaho Power**
2014	**60**	**Combined Heat and Power**
2021	**100**	**Geothermal**
2022	**50**	**Geothermal**
2023	**250**	**Idaho National Laboratory Nuclear**
	1,585	Total

[a] Integrated gasification combined cycle.

We conclude there is a continuing need for the power generating capacity of the Hells Canyon Project.

1.3 INTERVENTIONS

On December 3, 2003, the Commission issued a notice accepting Idaho Power's application and soliciting motions to intervene and protests. This notice set a 60-day period during which interventions and protests could be filed. The notice requesting comments on the draft EIS, issued on July 28, 2006, also solicited interventions to be filed by October 3, 2006. The following entities filed motions to intervene.

Entity	Filed Date
Payette Water Users Association	December 11, 2003
Washington County Board of County Commissioners	December 16, 2003
Pioneer Irrigation District and Settlers Irrigation District	December 16, 2003
Burns Paiute Tribe	December 19, 2003
American Rivers	January 15, 2004
Idaho Rivers United	January 16, 2004
Northwest Professional Power Vessel Association	January 20, 2004
Nez Perce Tribe	January 20, 2004
U.S. Department of Agriculture, Forest Service	January 23, 2004
U.S. Department of the Interior	January 26, 2004
State of Oregon	January 27, 2004
National Oceanic and Atmospheric Administration, National Marine Fisheries Service	January 29, 2004
State of Idaho	January 29, 2004
Columbia River Inter-Tribal Fish Commission	January 30, 2004
Northwest Resource Information Center, Inc.	January 31, 2004
Shoshone-Paiute Tribes (Protest)	February 2, 2004
Hells Canyon Alliance	February 9, 2004[a]
Shoshone-Bannock Tribes	February 13, 2004[a]
J.R. Simplot Company	February 2, 2005[a]
Adams County, Idaho	February 22, 2005[a]
Idaho Public Utilities Commission	February 23, 2005[a]
Washington County Board of Commissioners	March 7, 2005[a]
Committee of Nine	October 7, 2005[a]
Lower Valley Energy	January 26, 2006[a]
Nampa and Meridian Irrigation District	August 31, 2006
American Whitewater	September 12, 2006
Industrial Customers of Idaho Power	October 3, 2006

[a] Late interventions were granted by notice dated August 18, 2006.

1.4 SCOPING PROCESS

Pursuant to the National Environmental Policy Act of 1969 (NEPA), we held scoping meetings in the project area, including two in Boise, Idaho (November 18, 2003) and one each in Halfway, Oregon (November 19); Weiser, Idaho (November 20); and Council, Idaho (November 20) to provide agencies and interested parties an opportunity to review and provide input concerning our Scoping Document 1, issued on October 20, 2003 (FERC, 2003).

During and immediately after the scoping comment period, the Commission received approximately 36 letters from agencies, tribes, non-governmental organizations (NGOs), and interested businesses, along with approximately 1,175 letters and postcards from individuals. All comments received are part of the Commission's official record for the project.

We revised Scoping Document 1 following the scoping meetings and after reviewing the comments filed during the scoping comment period, and we issued Scoping Document 2 on November 24, 2004 (FERC, 2004).

1.5 CONSULTATION

On October 28, 2005, the Commission issued a notice indicating that the project was ready for environmental review and setting a 90-day period (comments due by January 26, 2006) during which terms, conditions, prescriptions, and recommendations could be filed. Appendix A provides a complete listing of the terms, conditions, prescriptions, and recommendations that were filed, giving each an alpha-numeric identifier that is used throughout this EIS. The following entities filed comments, terms, conditions, prescriptions, or recommendations in response to the Commission's notice.

Entity	Filed Date
Idaho State Historical Society	January 13, 2006 and January 27, 2006
Northwest Professional Power Vessel Association	January 23, 2006
State of Oregon (Oregon Water Resources Department, Department of Environmental Quality, Oregon State Marine Board, Department of Fish and Wildlife, Parks and Recreation Department, State Historic Preservation Office, Department of State Lands)	January 25, 2006
National Oceanic and Atmospheric Administration, National Marine Fisheries Service	January 26, 2006
Burns Paiute Tribe	January 26, 2006
U.S. Department of Agriculture, Forest Service	January 26, 2006
American Rivers and Idaho Rivers United	January 26, 2006
Department of the Army, Corps of Engineers	January 26, 2006
Confederated Tribes of the Umatilla Indian Reservation	January 26, 2006
State of Idaho (Department of Environmental Quality, Department of Fish and Game, Department of Parks and Recreation, Idaho Water Board, Idaho Land Board)	January 26, 2006
Shoshone-Paiute Tribes of the Duck Valley Indian Reservation	January 26, 2006
Lower Valley Energy	January 26, 2006
Nez Perce Tribe	January 26, 2006
U.S. Department of the Interior	January 26, 2006
The Shoshone-Bannock Tribes	January 26, 2006

Idaho Power and the Pioneer Irrigation District, Settler's Irrigation District, and Payette River Water Users Association filed responses to the comments, terms, conditions, prescriptions, and recommendations on April 11, 2006.

1.6 COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The Commission issued its draft EIS for the licensing of the Hells Canyon Project on July 28, 2006; initially requested that comments be filed by October 3, 2006; and later amended the due date to November 3, 2006. In appendix B, we summarize the comments received; provide responses to those comments; and indicate, where appropriate, how we have modified the text of the final EIS. We also include a list of the parties who filed comments, along with the filing dates.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

Under the No-action Alternative, the project would continue to operate under the terms and conditions of the existing license and of existing settlement agreements or memoranda of understanding or agreement. No new environmental measures would be implemented. We use this alternative to establish baseline conditions for comparison with Idaho Power's Proposal and other alternatives and to judge the benefits and costs of any measures that might be required under a new license. The effects of the No-action Alternative contribute to the character of existing environmental conditions, and we describe them in our discussion of the affected environment (refer to section 3.0). A description follows of the existing project facilities, current operations, and current environmental measures.

2.1.1 Existing Project Facilities

The Hells Canyon Project consists of three hydroelectric developments on the segment of the Snake River that forms the border between Idaho and Oregon. The three developments are Brownlee, Oxbow, and Hells Canyon (see figure 2). River mile (RM) 343 just above the upstream margin of Brownlee reservoir marks the upstream boundary; RM 247 of the Snake River downstream of Hells Canyon dam marks the downstream boundary of the project. The project lies approximately 20 miles northwest of Cambridge, Idaho; 90 miles northwest of Boise, Idaho; and 45 miles east of Baker City, Oregon.

Brownlee dam is farthest upstream at RM 284.6. Flow past Brownlee dam discharges into Oxbow reservoir. Oxbow dam is about 12 miles downstream of Brownlee dam, at RM 272.5. Flow past Oxbow dam discharges into Hells Canyon reservoir. Hells Canyon dam is about 25 miles downstream of Oxbow dam, at RM 247.6. The river downstream of Hells Canyon dam is unobstructed by artificial structures until it reaches the headwaters of Lower Granite reservoir, approximately 100 miles downstream of Hells Canyon dam.

2.1.1.1 Brownlee Development

The existing Brownlee development (figure 3), completed in 1958, consists of: (1) a 1,380-foot-long, 395-foot-high, clay-core, earth and rockfill dam with a single reinforced concrete spillway with seven radial gates, comprising four crest gates and three low-level outlet gates and a 173-foot-wide concrete-lined chute, which impounds (2) the approximately 57-mile-long Brownlee reservoir, with a surface area of 14,621 acres and a total volume of 1,420,062 acre-feet at elevation 2,077 feet mean sea level (msl); (3) a 500-foot-long intake channel excavated into the right rock abutment of the dam, leading to (4) five welded steel penstocks, which carry water to (5) a reinforced concrete powerhouse, containing five vertical Francis turbine generators, having a combined rated capacity of 585.4 MW, releasing flow into (6) two separate tailraces, comprising one 800-foot-long tailrace from the powerhouse section housing units 1 through 4 and one 1,350-foot-long tailrace from the powerhouse section housing unit 5; and (7) appurtenant facilities.

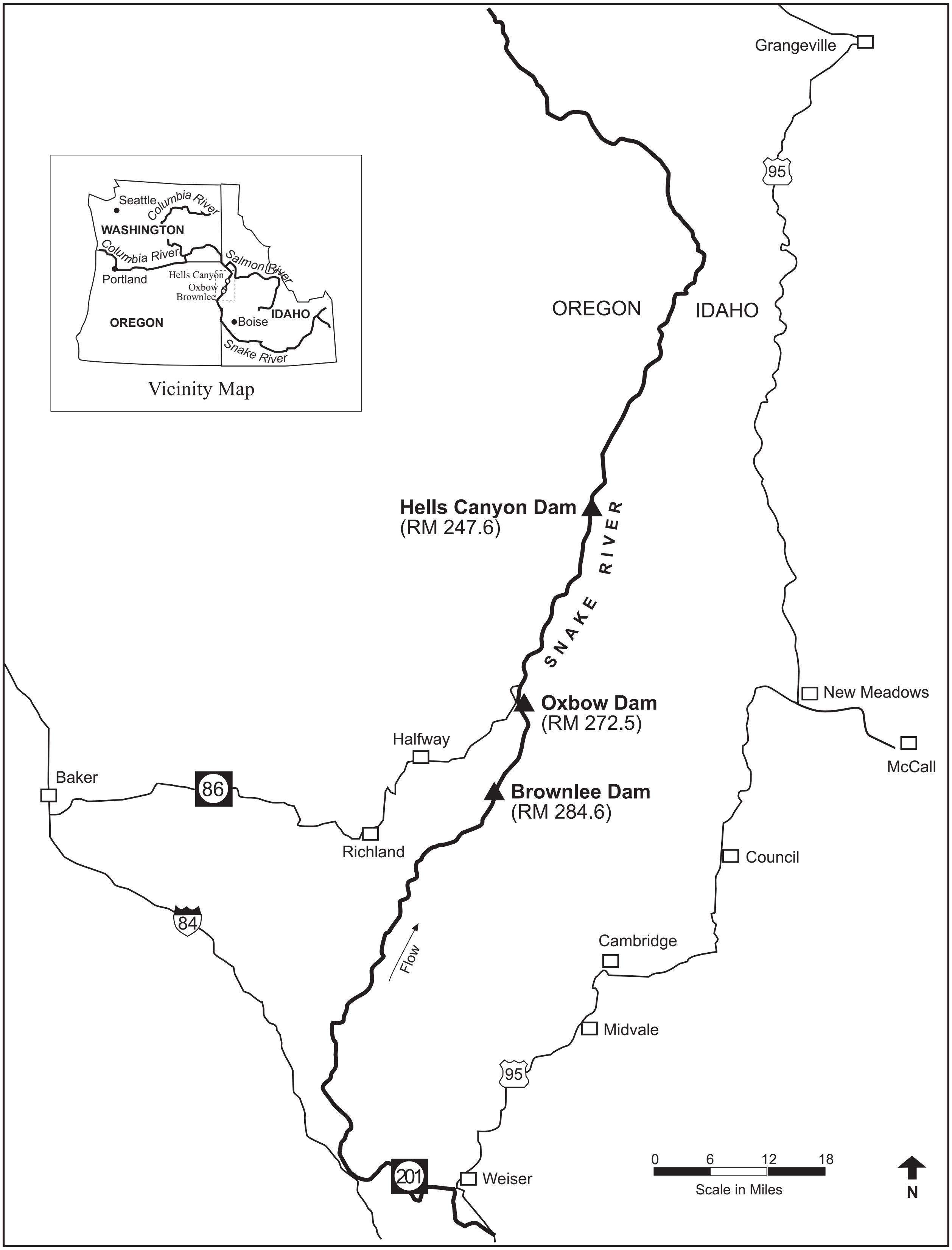

Figure 2. Hydroelectric developments of the Hells Canyon Project. (Source: Staff)

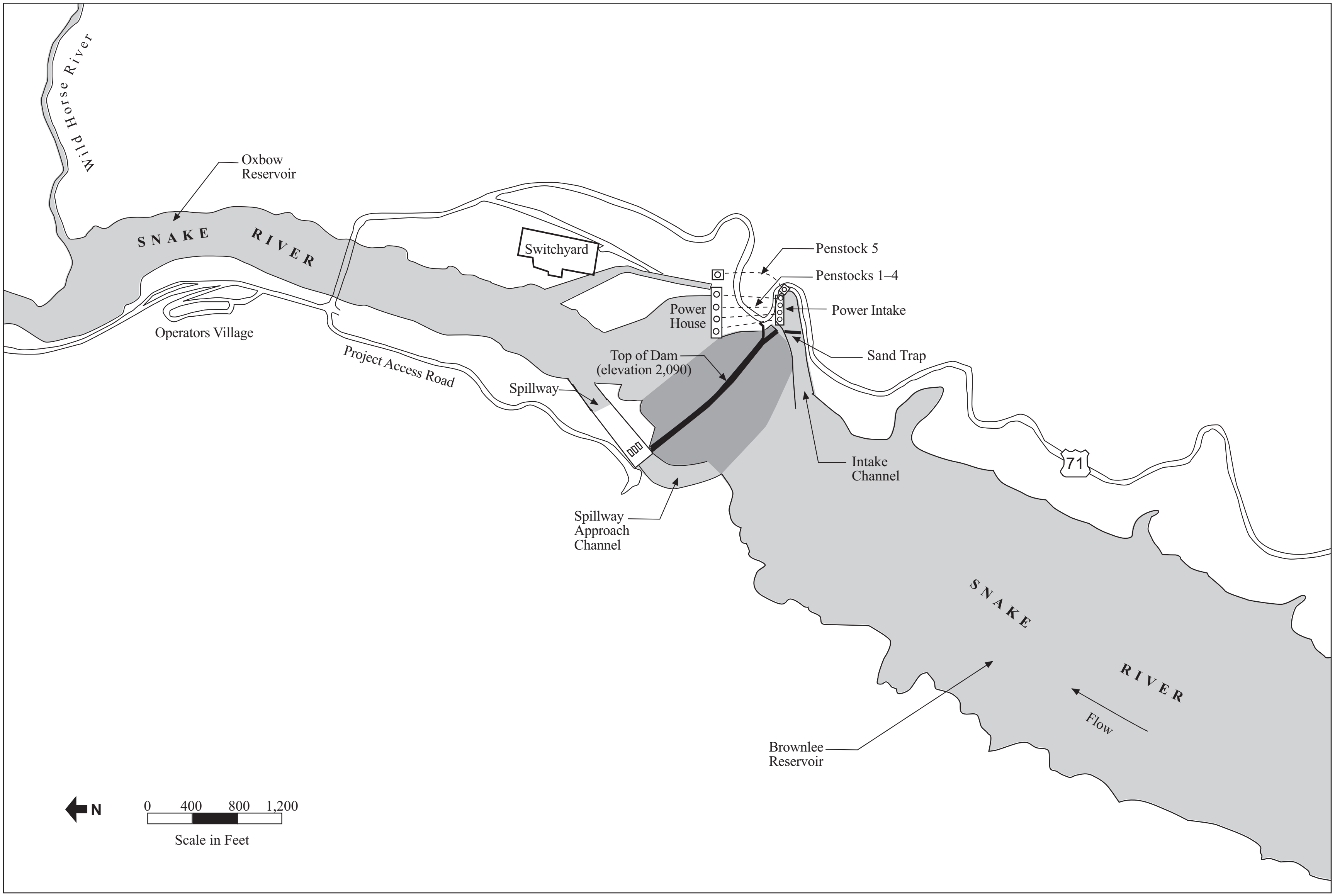

Figure 3. Brownlee Development. (Source: Idaho Power Company, 2003a; as modified by staff)

2.1.1.2 Oxbow Development

The existing Oxbow development (figure 4), completed in 1961, consists of: (1) a 960-foot-long, 209-foot-high, clay-core earth and rockfill dam with two spillways, comprising a 112-foot-wide concrete-lined primary spillway chute on the Oregon side and a 450-foot-long erodible "fuse plug" embankment and a 75-foot-wide concrete-lined emergency spillway chute on the Idaho side, which impounds (2) the 12-mile-long Oxbow reservoir, with a surface area of 1,150 acres and a total volume of 58,385 acre-feet at elevation 1,805 msl; (3) a 106-foot-high reinforced concrete intake structure and two 36-foot-diameter tunnels, one 781-feet-long and one 841-feet-long, connecting the intake structure to two surge tanks; (4) two 173-foot-long, 23-foot-diameter concrete-encased steel penstocks carrying water from the surge tanks to; (5) a reinforced concrete powerhouse containing four vertical Francis generators, having a combined rated capacity of 190 MW, releasing water into (6) a negligible tailrace; and (7) appurtenant facilities. This development has a 2-mile-long bypassed reach, most of which is inundated when Hells Canyon reservoir is at its maximum elevation.

2.1.1.3 Hells Canyon Development

The existing Hells Canyon development (figure 5), completed in 1967, consists of: (1) a 910-foot-long, 330-foot-high, cast-in-place concrete gravity dam with integral spillway, intake, and powerhouse sections, which impounds; (2) the 25-mile-long Hells Canyon reservoir, with a surface area of 2,412 acres and a total volume of 167,720 acre-feet at elevation 1,688 feet msl; (3) three 24-foot-diameter, 164-foot-long, steel penstocks, which carry water to (4) a reinforced concrete powerhouse constructed against the downstream face of the dam, containing three vertical Francis generators, having a combined rated capacity of 391.5 MW, releasing water into (5) an unlined tailrace excavated into the original river channel and bedrock; (6) a reinforced concrete fish trap excavated into the bedrock of the left river bank, immediately downstream of the powerhouse; and (7) appurtenant facilities.

2.1.1.4 Transmission Facilities

One 19-mile-long, 69-kilovolt transmission line (transmission line 945) is included in the license application (figure 6).[13] The line runs from the Oxbow switchyard to the Pine Creek substation and then to the Hells Canyon substation.

2.1.1.5 Fish Hatcheries and Related Facilities

The project includes four fish hatcheries and three adult fish traps. These facilities, from downstream to upstream, include: (1) the Hells Canyon adult upstream migrant fish trap (see section 2.1.1.3, above); (2) the Oxbow fish hatchery; (3) the Rapid River fish trap; (4) the Rapid River fish hatchery; (5) the Niagara Springs fish hatchery; (6) the Pahsimeroi fish hatchery; and (7) the Pahsimeroi upstream migrant fish trap.

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[13] On March 21, 2005, the Commission amended the existing project license to delete the Boise-Brody No. 2 and Boise-Bench-Midpoint transmission lines from the projects after finding that these lines are not primary transmission lines. On October 28, 2005, the Commission further amended the license to delete the Oxbow-Brownlee, Oxbow-Pallette Junction-Hells Canyon, Pallette Junction-Imnaha, Boise-Brownlee-Baker, Brownlee-Boise Bench Nos. 3 and 4, and Pallette Junction-Enterprise transmission lines, effective on the date Idaho Power receives all necessary permits/approvals from the Forest Service and BLM, as appropriate, for the continued use of National Forest System lands and BLM lands. On December 14, 2006, Idaho Power filed right-of-way grants covering the Idaho BLM sections of these lines.

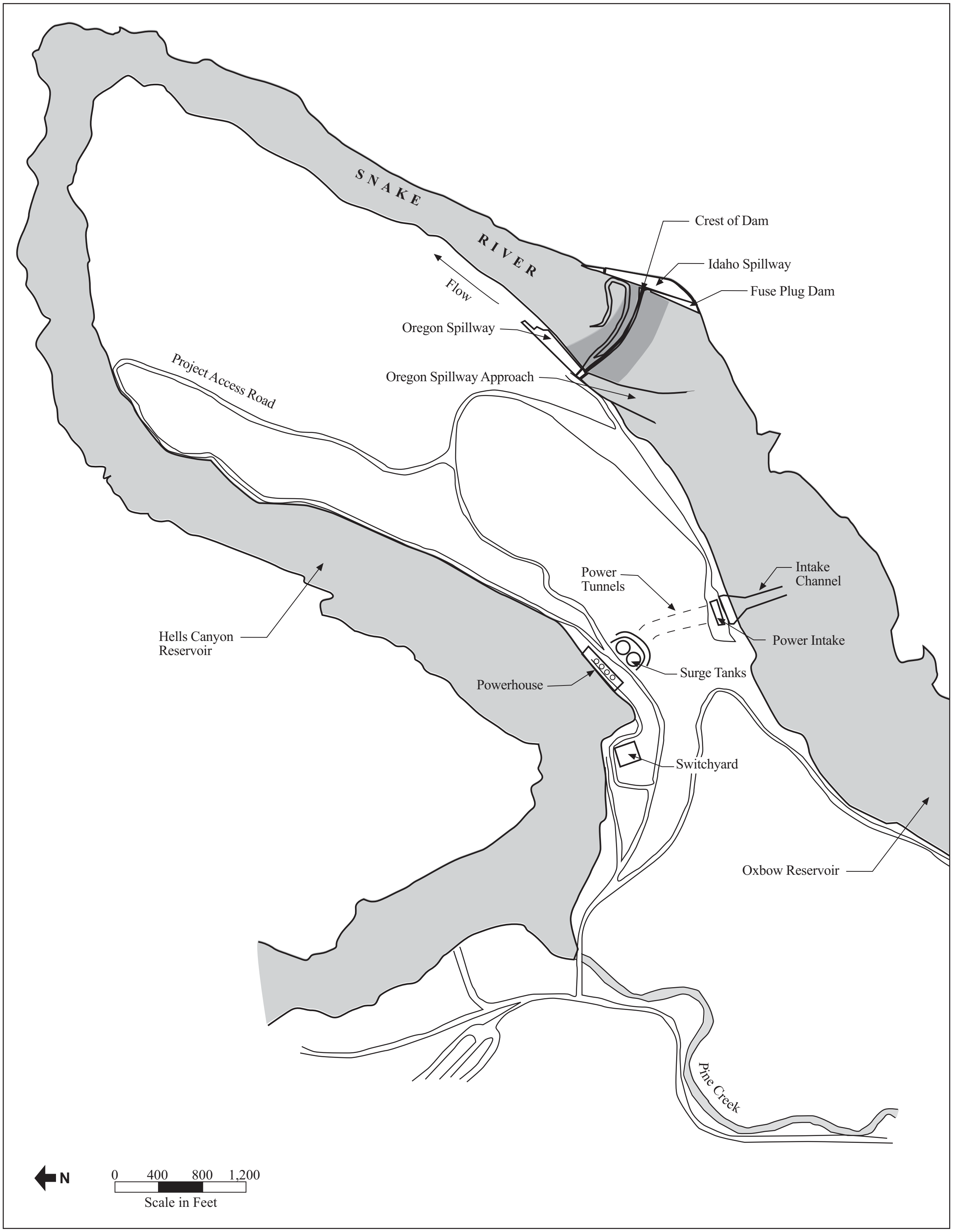

Figure 4. Oxbow Development. (Source: Idaho Power Company, 2003a; as modified by staff)

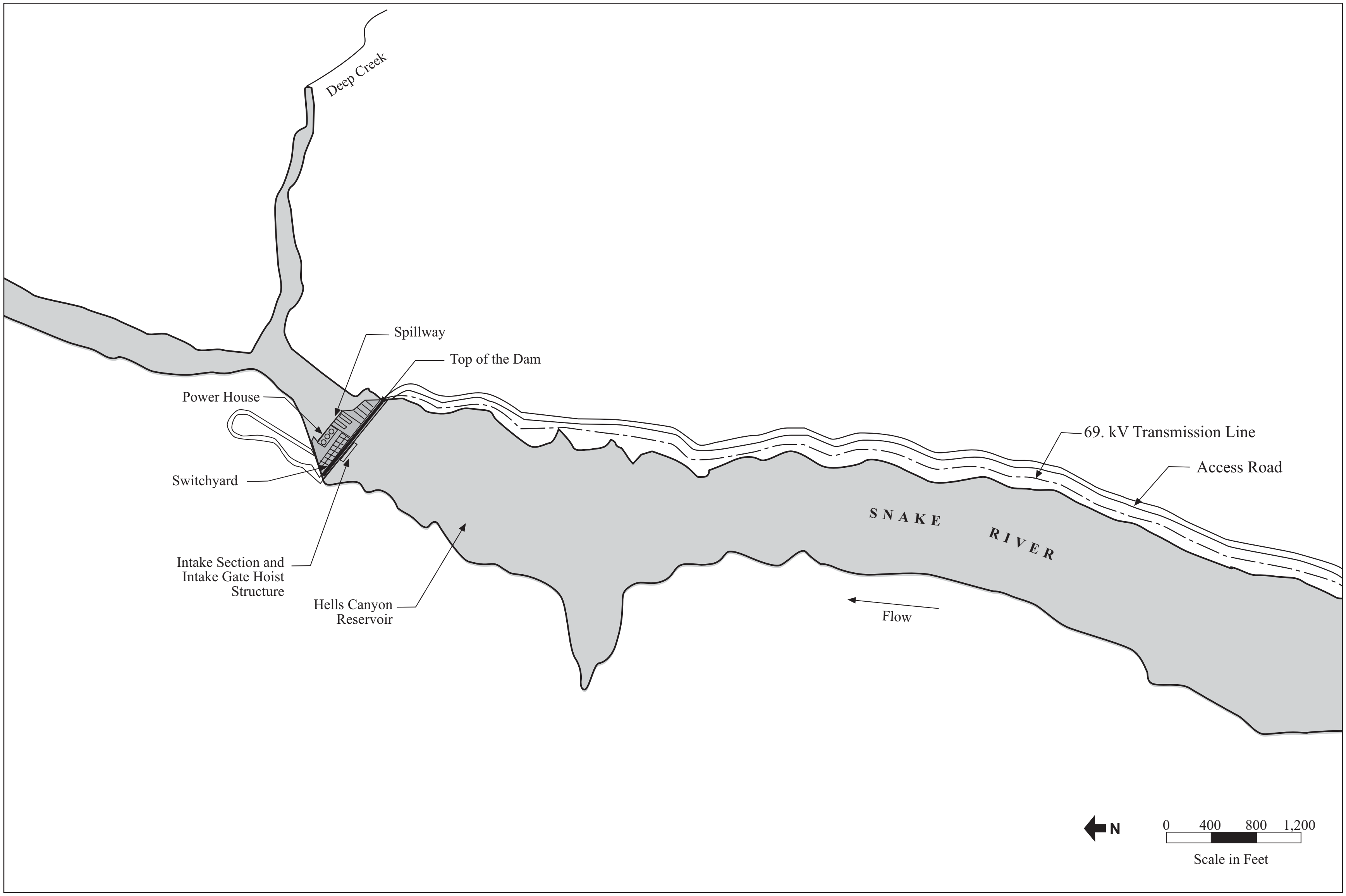

Figure 5. Hells Canyon Development. (Source: Idaho Power Company, 2003a; as modified by staff)

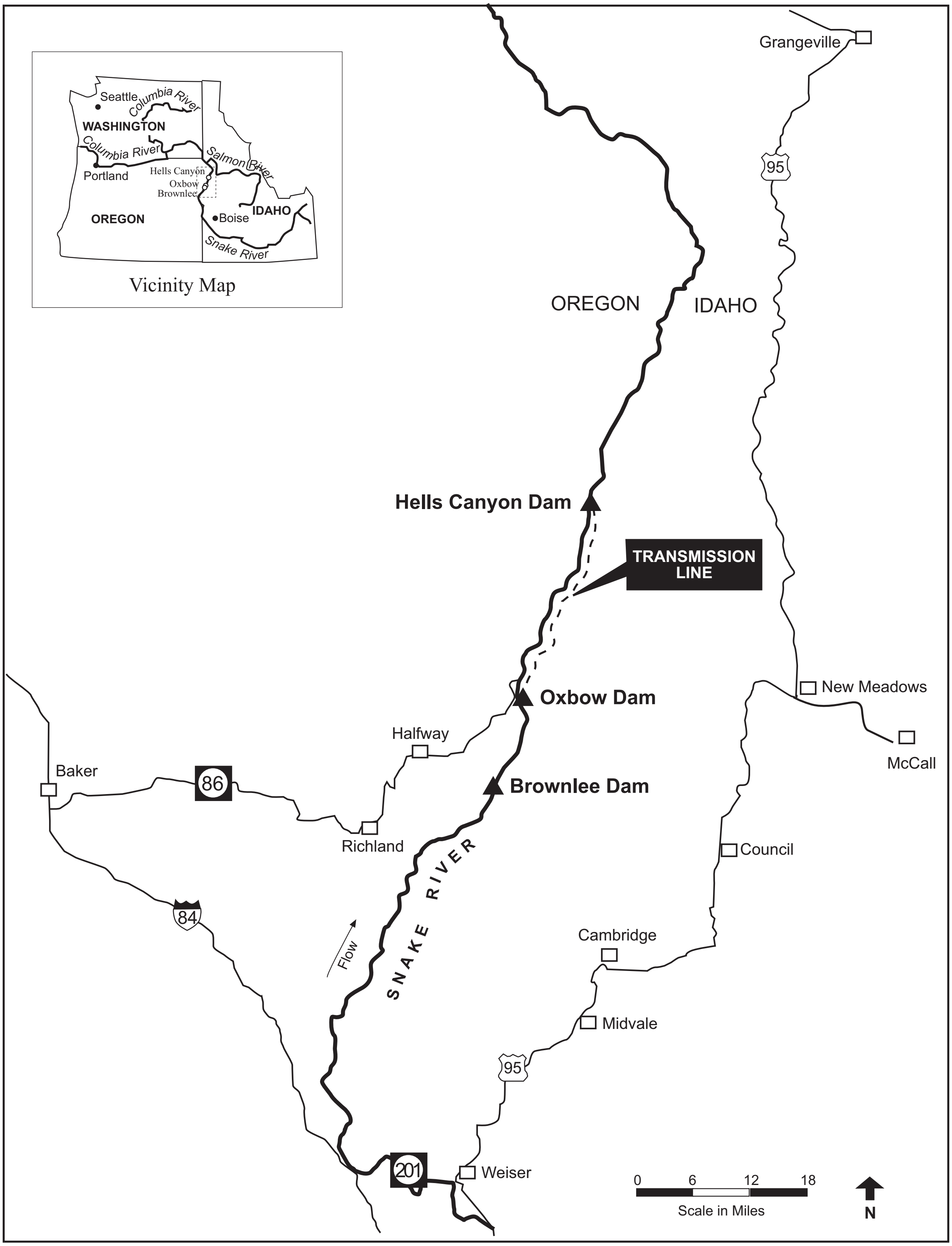

Figure 6. Transmission line associated with the Hells Canyon Project. (Source: Staff)

2.1.1.6 Recreation Facilities

Idaho Power-owned recreational facilities at the project are as follows: (1) Woodhead Park; (2) McCormick Park; (3) McCormick Overflow; (4) Old Carters Landing; (5) Hibbards Landing; (6) Copperfield Park; (7) the Copperfield boat launch; (8) Hells Canyon Park; (9) Airstrip B; and (10) several informal camping and access sites. Together, the sites provide numerous opportunities for launching boats; fishing; camping in tents, recreational vehicles (RV)s, and rental cabins; picnicking; and accessing hiking trails.

2.1.1.7 Project Safety

The project has been operating for 49 years under the existing license and during this time Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant and a consultant's safety report has been submitted for Commission review. As part of the relicensing process, the Commission staff would evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to ensure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance (O&M), and accepted engineering practices and procedures.

2.1.2 Current Project Operations

The three-dam, three-reservoir Hells Canyon Project is operated to optimize its power and energy production value, subject to compliance with license requirements, flood control mandates, and environmental considerations. Because most of the usable reservoir capacity in the Hells Canyon Project is contained in Brownlee reservoir, operations of all three powerhouses and dams are driven by operations at the Brownlee development. All three developments are typically operated in a load-following mode.

2.1.2.1 Brownlee Development

Operation of the Brownlee development varies both seasonally and daily. During the course of a year, the seasonal operation is typically as shown in figure 7. The seasonal fluctuations are the result of the following operational procedures:

- Idaho Power attempts to have a full reservoir by the first week in December to meet winter peak power demands. From early December when the fall Chinook spawning period ends through fry emergence in the spring, flows past Hells Canyon dam are maintained voluntarily to keep the river downstream of Hells Canyon dam above the target flow level selected in the fall. The effect of these maintained flows on Brownlee reservoir depends on the amount of runoff received. With medium and higher-than-normal inflows, minimum target flows downstream of Hells Canyon dam can be maintained without drafting (i.e., lowering) Brownlee reservoir before the spring flood-control draft in mid-January. Under drought conditions, Brownlee reservoir might be drafted during this period to provide the minimum target flow downstream of Hells Canyon dam.

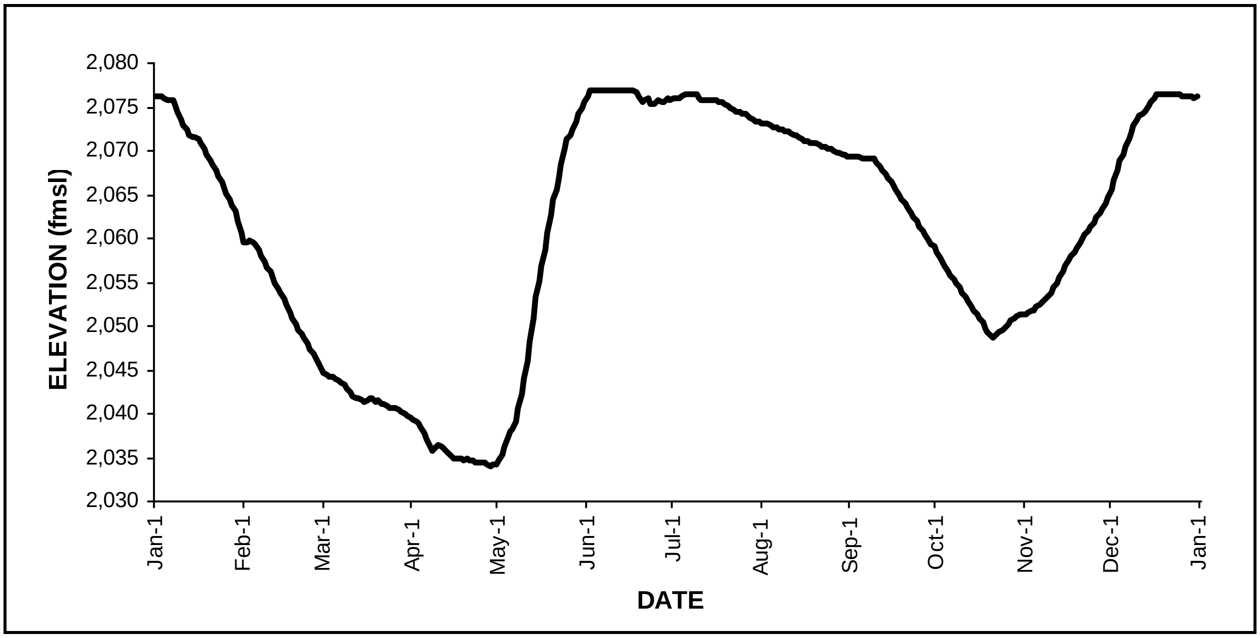

Figure 7. Simulated Brownlee reservoir levels for proposed operations under medium water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

- Starting in mid-January, Brownlee reservoir is drafted, under the direction of the U.S. Army Corps of Engineers (Corps), to provide storage space for springtime flood waters. The Northwest River Forecast Center produces the monthly final water-supply forecasts that are used to derive the draft needed by the flood control target dates of February 28, March 31, April 15, and April 30.

- In May, operations depend on hydrologic conditions. During low and medium to low flow years, there is typically no flood control requirement in May. During May, Idaho Power continues to provide minimum flows for fall Chinook protection through their spring emergence. If emergence is completed in May, Idaho Power continues to provide minimum flows and a higher daily pulsed maintenance flow to prevent the stranding of fall Chinook fry that have not yet moved downstream. During medium to high flow years, Brownlee reservoir is typically filling in May, capturing inflows as part of the spring flood control operation. The rate of refill for Brownlee reservoir and outflow from Hells Canyon reservoir are directed by the Corps and vary yearly. Once the elevation of Brownlee reservoir reaches 2,069 feet msl on or after May 20, Idaho Power initiates a 30-day period for protection of Brownlee reservoir resident warmwater fish spawning. During this period, the reservoir is typically not drafted more than 1 foot from the highest elevation reached during the 30-day period. Depending on hydrologic conditions, Brownlee reservoir may be full on May 20 and remain within the top 1 foot for the 30-day period. Consistent with flood control requirements, Idaho Power tries to achieve a reservoir elevation of 2,069 feet msl or higher by June 7.

- June operations also depend on hydrologic conditions. During low and medium to low flow years, there is typically no flood control requirement in June. If fall Chinook emergence has been completed in May, Idaho Power continues to provide minimum flows and a higher daily pulsed maintenance flow to prevent stranding. During medium to high flow years, Brownlee reservoir may continue to refill in June as part of the spring flood control operation, as directed by the Corps. The 30-day Brownlee reservoir resident warmwater fish spawning period is generally in effect until June 20, during which time the reservoir is typically not drafted more than 1 foot from the highest elevation reached during the 30-day period.

- During July, Idaho Power typically tries to keep Brownlee reservoir nearly full throughout the month to conserve storage for August, which usually has an above-average monthly system power load, lower market energy availability, and higher average market energy prices. The target elevation for July 4 is 2,069 feet msl or higher, and, typically, Brownlee reservoir is full or nearly full at 2,077 feet msl on that date.
- During August, Idaho Power typically drafts Brownlee reservoir to meet system power loads. In the latter part of August, Idaho Power examines the streamflow forecast to begin planning reservoir target elevations and Hells Canyon outflows for the upcoming fall Chinook spawning period, which generally starts around the second or third week of October.
- During late August and through September, Idaho Power adjusts Brownlee reservoir's draft rate so as to be able to achieve the necessary starting elevation for the fall Chinook program. This starting elevation ensures a stable spawning flow during the spawning period and a nearly full reservoir at the end of the spawning period around the first week of December. This drafting typically requires that flows past Brownlee dam be increased during this period.
- Beginning in mid-October and lasting through early December, Idaho Power voluntarily maintains a constant flow from Brownlee reservoir, normally designed to maintain a flow between 8,000 and 13,000 cubic feet per second (cfs) downstream of Hells Canyon dam to ensure that fall Chinook construct their redds (nests) below a certain target flow level. The spawning season and minimum flows vary from year to year.
- Throughout the year, flows are managed to meet a required 1-foot-per-hour ramping rate at Johnson Bar, 18 miles downstream of Hells Canyon dam.

On a daily basis, Idaho Power operates the Brownlee powerhouse to meet the flow and reservoir targets described above while maximizing the power and energy production value of the Hells Canyon Project. Normally, flow through the powerhouse is ramped up and down during the course of each day to follow regional electricity demands. Peak flow through the Brownlee powerhouse is 35,000 cfs. Minimum flow may fall to zero during the middle of the night when regional electrical loads are at their minimum. Because of the large size of Brownlee reservoir (14,621 acres at full pool elevation 2,077 feet msl), the daily fluctuation in the reservoir level is 3 feet or less.

2.1.2.2 Oxbow Development

The hydraulic capacity of the Oxbow development is less than the hydraulic capacity at the Brownlee development immediately upstream, and the Oxbow reservoir has limited usable storage capacity. Therefore, Oxbow operations are largely dictated by Idaho Power's operation at Brownlee dam. Specifically, Oxbow reservoir is normally drafted late in the day to provide some storage room for the next day's peak generation period. As system loads climb early the following day, flows through the Oxbow powerhouse are ramped up in concert with the ramping up of flows through the Brownlee powerhouse. The previous night's drafting of Oxbow reservoir enables Oxbow to absorb the peaking flows at Brownlee dam during daily periods of heavy load without having to spill at Oxbow. In keeping with existing license requirements, Idaho Power maintains a 100-cfs year-round minimum release to the bypassed reach.

2.1.2.3 Hells Canyon Development

Because of the limited usable capacity in Hells Canyon reservoir, operations at Brownlee dam and minimum flow and ramping rate restrictions that apply downstream of the development substantially control and limit daily operations at the Hells Canyon development.

Under normal hydrologic conditions, flows through Hells Canyon powerhouse are ramped up in the morning, concurrently with the ramping up of flows at the Brownlee and Oxbow powerhouses, to follow the regional electrical load. Flows through the Hells Canyon powerhouse are ramped down late in the evening to retain as much inflow as possible to use for generating electricity during heavy load periods the following day.

During spring runoff when flow through the Hells Canyon Project exceeds the hydraulic capacity of the power plants, the flow below Hells Canyon dam is controlled by the amount of flow through the project and does not vary by how the powerhouses are operated.

Under Article 43 of the current license, Idaho Power must operate the project in the interest of navigation to maintain 13,000 cfs[14] in the Snake River at Lime Point (RM 172) at least 95 percent of the time, when the Corps determines it to be necessary for navigation. Regulated flows of less than 13,000 cfs at Lime Point are to be limited to July, August, and September, during which time operation of the project is to be in the best interest of power and navigation, as mutually agreed to by the Corps and Idaho Power. The Corps does not require Idaho Power to draft Brownlee reservoir to meet the 13,000-cfs Lime Point flow requirement.

Under the same navigation-related license article, Idaho Power is required to maintain a year-round, 5,000-cfs minimum flow downstream of Hells Canyon dam at Johnson Bar (RM 230). However, as noted above, Idaho Power voluntarily maintains a constant flow from Brownlee reservoir from mid-October through early December that is designed to maintain a flow between 8,000 and 13,000 cfs downstream of Hells Canyon dam. The intent is to ensure that fall Chinook construct their redds below a certain target flow level.

2.1.3 Current Environmental Measures

Currently, in addition to the operation-related measures identified in the preceding section, Idaho Power provides the following environmental mitigation and protection measures:

- preferential use of the upper spillgates at Brownlee dam during spill periods to minimize elevated total dissolved gas (TDG) concentrations (voluntary),
- anadromous fish production at four hatchery facilities (current license requirement),
- O&M of monitors to provide flow information about river flows downstream of Hells Canyon dam, (voluntary),
- implementation of the Memorandum of Understanding between the Forest Service and Idaho Power with regard to staffing the Hells Canyon Visitor Center (voluntary),
- O&M of Idaho Power-managed parks and recreational facilities (current license requirement),

[14] IIdaho Power does not explicitly propose 13,000 cfs at Lime Point, but this value is consistent with the flow releases from Hells Canyon dam assumed by Idaho Power for modeling purposes. In the absence of an explicit alternative proposal, we consider it part of Idaho Power's proposed operation. Idaho Power proposes that any navigation flow requirement for the Snake River reach from the Salmon River confluence to Lewiston be measured at McDuff Rapids (RM 175.5), 4 miles upstream of Lime Point

- a litter and sanitation program, which includes recreational waste disposal to prevent waste from contaminating the river (voluntary),
- public safety programs (current license requirement), and
- aid to local law enforcement in Adams County, (voluntary).

2.1.4 Current Project Boundary

The project boundary extends just over 95 river miles, from just above Porter Island at RM 343, within Malheur County, Oregon, about 5 miles northwest of Weiser, Idaho, to Hells Canyon dam (RM 247.6) in Wallowa County, Oregon. On private lands the project boundary is based on reservoir elevations (contour lines). On federal lands the project boundary follows surveyed section lines or sectional subdivision lines of the United States Public Land Survey. The existing project boundary on federal lands thus includes about 3,800 acres above the contour line. Except in a few places where Idaho Power has larger areas of ownership, the project boundary normally measures several hundred feet in width. Notable exceptions are on the lower Burnt River, near Spring Recreation Area; at the upper end of the Powder River pool; and at Brownlee and Oxbow villages.

2.2 IDAHO POWER'S PROPOSAL

2.2.1 Proposed Project Facilities

Idaho Power's proposed modifications to existing project facilities are limited to those associated with protecting, mitigating, or enhancing environmental conditions (see section 2.2.3, below).

2.2.2 Proposed Project Operations

With one exception, Idaho Power proposes to operate all three developments under the same constraints as those that characterize existing current operations. These operating constraints are summarized in table 2. The exception, where Idaho Power's Proposed Operations differ from current operations, relates to winter flood control requirements. Specifically, upon a request from the Corps, Idaho Power would provide flood storage at Brownlee reservoir earlier than is currently required. The early flood storage draft would be equivalent to a maximum drawdown rate without spill of 3 feet per day over a 2- or 3-day period, not to exceed a total of 9 feet of drawdown. This provision would apply only to the months of December and January, and it would occur only on a case-by-case request from the Corps.

Table 2. Summary of operating constraints for Idaho Power's Proposed Operations. (Source: Staff)

Operating Constraint	Brownlee	Oxbow	Hells Canyon
Maximum reservoir elevation	2,077 feet msl	1,805 feet msl	1,688 feet msl
Minimum reservoir elevation	1,976 feet msl	1,795 feet msl	1,678 feet msl
Flood control requirement	Corps flood control rule curve, supplemented with case-by-case request for extra 9 feet during December and January	NA	NA
Daily reservoir level fluctuation	3 feet, except 1 foot during 30-day resident fish spawning period (approximately May 21 thru June 21)	5 feet, except 10 feet under atypical conditions[a]	5 feet, except 10 feet under atypical conditions[a]

Operating Constraint	Brownlee	Oxbow	Hells Canyon
Ramping rate restriction	NA	NA	1 foot per hour (both up and down)[b]
Daily limit between minimum and maximum release	NA	NA	
6/1–9/30			10,000 cfs, except 16,000 cfs under atypical conditions[a]
10/21–12/11[c]			No load following per fall Chinook plan
Minimum flow	NA	100-cfs bypass flow year-round	
10/21–12/11[c]			8,000–13,000 cfs per fall Chinook plan[d]
12/12–5/31[c]			Dependent on most critical shallow redd per fall Chinook plan
6/1–10/20			6,500 cfs, except 5,000 cfs under atypical conditions[a]

Note: NA – not applicable

[a] Atypical conditions, as defined by Idaho Power, are conditions when Idaho Power determines that operation of the project (which operation may occur automatically or manually) is needed to: (1) protect the performance, integrity, reliability, or stability of Idaho Power's electrical system or any electrical system with which it is interconnected; (2) compensate for any unscheduled loss of generation; (3) provide generation during severe weather or extreme market conditions; (4) inspect, maintain, repair, replace, or improve Idaho Power's electrical systems or facilities related to the Project; (5) prevent injury to people or damage to property; or (6) assist in search-and-rescue activities.

[b] Compliance would be measured at Johnson Bar, located approximately 18 miles downstream of Hells Canyon dam.

[c] Actual dates vary per fall Chinook plan.

[d] The constant fall Chinook flow releases can vary between 8,000 and 13,000 cfs, depending on water-year conditions, forecasts, or turbine performance to minimize unnecessary wear during operation.

2.2.3 Proposed Environmental Measures

Idaho Power proposes the following environmental measures. These measures are grouped by resource topic. Measures numbered 1P through 81P reflect Idaho Power's original proposal; measures 101P through 113P reflect changes to Idaho Power's proposal filed between the draft EIS and the final EIS.

Sediment Supply and Transport

101P. Develop and implement a program to monitor beach and terrace erosion, substrate, and gravel.

102P. Create a mitigation fund to be used by the Forest Service to restore and maintain 14 acres of sandbars on or adjacent to National Forest System lands between Hells Canyon dam and the confluence of the Snake and Salmon rivers.

Water Use and Quality

1P. Continue 100-cfs minimum flow in Oxbow bypass to help maintain water quality in the bypassed reach.

2P. Continue recreation waste disposal to prevent waste from contaminating the river.

3P. Continue preferential use of the upper spillgates at Brownlee dam during spill periods to minimize elevated total dissolved gas as an interim measure until spillway flow deflectors are installed at Brownlee dam.

4P. Implement one of two measures (in-reservoir aeration or upstream phosphorus trading) to fully meet the Snake River-Hells Canyon TMDL Brownlee reservoir DO allocation (an average of 1,125 tons of oxygen during the summer into the transition zone of Brownlee reservoir).

103P Aerate Hells Canyon outflows using a forced air (blower) system at Hells Canyon powerhouse that would add 1,500 tons of oxygen per year.

104P. Install and operate a destratification system in the Oxbow bypassed reach at the deep pool just upstream of the Indian Creek confluence to prevent anoxic conditions at this location.

5P. Install Hells Canyon dam spillway flow deflectors to reduce TDG levels in the tailrace of Hells Canyon dam and the Snake River downstream of the dam.

105P. Install Brownlee dam spillway flow deflectors to reduce TDG levels in Oxbow and Hells Canyon reservoirs and the Snake River downstream of Hells Canyon dam.

106P. Evaluate and implement measures on the Oxbow dam spillway or bypassed reach to reduce TDG levels as necessary to meet the Snake River-Hells Canyon TMDL load allocation.

107P. Adaptively manage TDG-abatement measures to ensure that Idaho Power meets its TDG load allocation below each of the project dams.

108P. Work with ODEQ and IDEQ to develop a TDG monitoring plan that would include monitoring during spill to determine compliance with the TMDL load allocation assigned to Idaho Power.

109P. Implement Idaho Power's Temperature Adaptive Management Plan, which would: (1) define the extent of appropriate project temperature responsibility, (2) include an evaluation of potential measures; and (3) identify an appropriate measure(s) for implementation.

Fish and Snails

6P. Continue the fall Chinook plan.

6Pa. Continue reservoir operations in the fall, winter, and early spring for protection of fall Chinook salmon spawning and salmon incubation.

6Pb. Measure 6b in the draft EIS (concerning fall Chinook salmon redd and temperature monitoring) has been replaced by measures 110P and 10S.

110P. Implement the Fall Chinook Salmon Spawning and Gravel Monitoring Plan described in appendix B of Idaho Power's comments on the draft EIS.[15]

7P. Implement the warmwater fish plan.

7Pa. Protect peak spawning periods for smallmouth bass and crappie by limiting Brownlee reservoir drafts to no more than 1 foot from the highest elevation reached during a 30-day period starting on May 21, and by maintaining an elevation of at least 2,069 feet msl from the end of the 30-day period through July 4.

7Pb. Continue warmwater fish population monitoring to detect long-term effects on fish populations.

8P. Implement native salmonid plan.

8Pa. Conduct pathogen survey in the Pine-Indian-Wildhorse core area to support development of a pathogen risk assessment plan.

8Pb. Prepare and implement a plan to allow for the capture of resident salmonids and other species migrating upstream and for their transfer to areas above Hells Canyon and Oxbow dams. The plan would include modification of the Hells Canyon fish trap to capture juvenile salmonids, construction of facilities for sorting and holding fish and for scanning PIT-tag returns, and potentially expansion to year-round operations. The plan also would include a provision to construct a fish trap at Oxbow dam a minimum of 5 years after the Hells Canyon trap has been modified.

8Pc. Prepare and implement a tributary habitat enhancement plan within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the Hells Canyon Project reservoirs.

8Pd. Supplement marine-derived nutrients to enhance the forage base within bull trout rearing areas (Pine, Indian, and Wildhorse core area).

8Pe. Conduct Eagle Creek presence/absence survey to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek Basin.

8Pf. Design, construct, and monitor a permanent monitoring weir at Pine Creek to establish a long-term monitoring program of fluvial[16] fish migrating upstream and downstream in the Pine Creek System.

8Pg. Evaluate the feasibility of, and possibly implement, an experimental brook trout suppression program in Indian Creek.

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[15] During the section 10(j) meeting held December 5 to 7, 2006, in Boise, Idaho, Idaho Power stated that this measure should be considered part of its proposal.

[16] Bull trout may exhibit up to three life forms or life history strategies: (1) fluvial fish migrate between streams where they may seek temperature refugia and spawning habitat; (2) adfluvial fish that rear in lacustrine environments but migrate into tributaries for spawning and early rearing,; and (3) resident, non-migratory populations.

9P. Continue anadromous fish production at hatchery facilities.

9Pa. Continue to operate the Oxbow fish hatchery.

9Pb. Continue to operate the Rapid River fish hatchery.

9Pc. Continue to operate the Niagara Springs fish hatchery.

9Pd. Continue to operate the Pahsimeroi fish hatchery.

10P. Upgrade and enhance anadromous mitigation hatchery facilities.

10Pa. Make improvements to the Pahsimeroi fish hatchery to control pathogens, develop a locally adapted steelhead broodstock, and monitor and evaluate hatchery performance.

10Pb. Make improvements to the Oxbow fish hatchery by constructing adult holding pond and spawning facilities, expanding the fall Chinook rearing program, distributing carcasses, generally upgrading the hatchery facilities, and monitoring and evaluating hatchery performance.

10Pc. Make improvements to the Niagara Springs fish hatchery by expanding the hatchery building, acquiring an additional smolt tanker, acquiring a fish marking unit, upgrading employee housing, and monitoring and evaluating hatchery performance.

10Pd. Make improvements to the Rapid River fish hatchery by constructing an adult holding pond and spawning facilities, distributing carcasses, upgrading employee housing, generally upgrading the hatchery facilities, constructing an offsite smolt acclimation/adult collection facility, and monitoring and evaluating hatchery performance.

11P. Implement Snake River White Sturgeon Conservation Plan.

11Pa. Assess water quality-related effects on early life stages of white sturgeon in the Swan Falls-Brownlee reach.

11Pb. Translocate reproductive-sized white sturgeon into the Swan Falls-Brownlee reach to increase spawner abundance and population productivity, if water quality is found to be adequate.

11Pc. Develop an experimental conservation aquaculture plan to maintain adequate population size and genetic variability of white sturgeon in the Swan Falls-Brownlee reach, if approved by Idaho Department of Fish and Game (IDFG) and Oregon Department of Fish and Wildlife (ODFW).

11Pd. Make periodic population assessments to monitor white sturgeon populations in the Swan Falls-Brownlee, Brownlee-Hells Canyon, and Hells Canyon-Lower Granite reaches of the Snake River.

11Pe. Monitor genotypic frequencies of white sturgeon between Shoshone Falls and Lower Granite dams.

Wildlife

12P. Acquire, enhance, and manage approximately 22,761 acres of upland and 821 acres of riparian habitat in the vicinity of the Hells Canyon Project reservoirs to mitigate for the estimated effects of project operations on wildlife.

13P. In cooperation with ODFW and IDFG, enhance habitat on four Snake River islands (Gold, Hoffman, Patch, and Porter) for waterfowl and for threatened, endangered, candidate, and special status species.

14P. Cooperate with state and federal wildlife management agencies to enhance low-elevation riparian habitat and reintroduce mountain quail in areas adjacent to the project reservoirs.

15P. Through an interdisciplinary team, develop and implement an Integrated Wildlife Habitat Program (IWHP) and Wildlife Mitigation and Management Plan (WMMP) to manage wildlife resources on Idaho Power-owned lands associated with the Hells Canyon Project to ameliorate identified impacts and provide general land stewardship.

16P. Develop and implement an operation and maintenance plan for the Pine Creek-Hells Canyon transmission line to minimize effects on wildlife, protect wildlife resources, and enhance habitat conditions.

Botanical Resources

17P. Acquire, enhance, and manage upland and riparian habitat to mitigate for the estimated effects of project operations on botanical resources.

18P. Formalize cooperative relationships to accomplish noxious weed control and non-native invasive weed management, site monitoring, and re-seeding along the Snake River corridor from Weiser downstream to the confluence of the Salmon River.

19P. Formalize cooperative relationships, including establishment of a rare plant advisory board, to protect and monitor sensitive plant sites along the Snake River corridor from the headwaters of Brownlee reservoir downstream to the confluence of the Salmon River.

20P. Develop and implement an operation and maintenance plan for the Pine Creek-Hells Canyon transmission line and service road and adaptively manage operation and maintenance activities to minimize adverse effects on botanical resources and manage noxious weeds.

21P. Implement cooperative projects recommended by agencies and included in the Transmission Line Operation and Maintenance Plan.

Historic and Archaeological Resources

22P. Monitor sites along transmission line 945 that are eligible for inclusion on the National Register of Historic Places (National Register).

23P. Monitor the known burial site on Oxbow reservoir.

24P. Monitor known eligible sites on Oxbow and Hells Canyon reservoirs.

25P. Monitor known eligible sites on Brownlee reservoir.

26P. Monitor known eligible sites downstream of Hells Canyon dam.

27P. Stabilize approximately 20 archaeological sites downstream of Hells Canyon dam after identifying sites requiring stabilization.

28P. Stabilize seven archaeological sites on Brownlee reservoir.

29P. Recover archaeological data at four archaeological sites on Brownlee reservoir to prevent possible damage by reservoir operations.

30P. Establish Native American interpretive sites on Brownlee reservoir to enhance visitors' awareness of Native American presence and land use in the project area.

31P. Establish Native American interpretive sites on Oxbow and Hells Canyon reservoirs to enhance visitors' awareness of Native American presence and land use in the project area.

32P. Establish European-American interpretive sites on Brownlee, Oxbow, and Hells Canyon reservoirs to enhance visitors' awareness of European-American presence and land use in the project area.

33P. Establish Asian-American interpretive sites on Brownlee, Oxbow, and/or Hells Canyon reservoirs to enhance visitors' awareness of Asian-American presence and land use in the project area.

34P. Support European-American and Asian-American interpretive projects by assisting local community museums with collections acquisition, display, and curation related to Hells Canyon area trappers, miners, homesteaders, ranchers, and river runners of European and Asian descent.

35P-40P. Provide support for Native American programs of the Burns Paiute Tribe, Confederated Tribes of the Warm Springs Indian Reservation, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Shoshone-Paiute Tribes, and Shoshone-Bannock Tribes in their efforts to obtain funding for participating in and/or administering cultural resources protection, mitigation, and enhancement measures, educating their youth by providing scholarship/training funds, and providing funds to facilitate several cultural enhancement programs.

41P. Fund additional section 106 projects to protect sites and mitigate for any unforeseen adverse effects attributed to Hells Canyon Project operations.

Recreational Resources

42P. Continue to operate and maintain monitors to provide flow information about river flows downstream of Hells Canyon dam.

43P. Continue the Memorandum of Understanding between the Forest Service and Idaho Power with regard to staffing the Hells Canyon Visitor Center.

44P. Continue existing general measures for all zones.

44aP. Continue the litter and sanitation program.

44bP. Continue public safety programs.

44cP. Continue aid to local law enforcement in Adams County.

44dP. Continue road maintenance.

44eP. Continue operation and maintenance of Idaho Power-managed parks and recreational facilities.

45P. Provide additional boat moorage on Hells Canyon Project reservoirs to improve angling access.

46P. Enhance Litter and Sanitation Plan to improve litter cleanup and access to portable and vault toilets at dispersed recreational sites.

47P. Develop and implement an integrated information and education (I&E) plan to promote protection and preservation of cultural, natural, and historic resources through education.

48P. Coordinate the prioritization of law enforcement resource use among appropriate law enforcement agencies to address public safety issues.

49P. Develop and implement a Recreation Adaptive Management Plan (RAMP) to identify and address the adequacy of Idaho Power's Recreation Plan over the life of the new license.

50P. Enhance road maintenance to improve public safety and further protect at-risk cultural and natural resources.

51P. Perform O&M at Idaho Power-enhanced BLM sites and all Forest Service reservoir-related recreation sites consistent with the settlement (FS modified 4(e) condition no. 18) to benefit recreation, provide public access, enhance visitor services and user satisfaction, and reduce the responsibilities of federal agencies to provide operations and maintenance services. This measure includes a safety review and improvements of the Deep Creek Trail (FS modified 4(e) condition no. 16), and brings the Deep Creek Trail into the project boundary.

52P. Enhance Eagle Bar dispersed recreational site and improve boat ramp access to Hells Canyon reservoir.

53P. Develop site plan for Big Bar recreation site consistent with the settlement (FS modified 4(e) condition no. 13).

54P. Measure 54 in the draft EIS (boat ramp and associated facilities at Big Bar section D) has been incorporated into Idaho Power measure 52P.

55P. Develop site plan and enhance Eckels Creek dispersed recreational site to benefit recreation and provide cultural and natural resource protection.

56P. Supplement the existing O&M budget to accommodate enhancements at Idaho Power-managed parks and recreational facilities.

57P. Develop and implement a site plan for the Copper Creek dispersed recreational site to benefit recreation and provide cultural and natural resource protection.

58P. Reconstruct Hells Canyon Park to benefit recreation, improve public access, and protect cultural and natural resources.

59P. Develop Airstrip A&B dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

60P. Develop and implement a site plan for Bob Creek Section A dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

61P. Develop and implement a site plan for Bob Creek Section B dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

62P. Develop and implement a site plan for Bob Creek Section C dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

63P. Develop and implement a site plan for Westfall dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

64P. Enhance Copperfield boat launch area to benefit day-use activities.

65P. Implement a site plan for Oxbow boat launch to benefit recreation, improve public access, and protect cultural and natural resources.

66P. Implement a site plan for Carters Landing and Old Carters Landing recreational sites to benefit recreation, improve public access, and protect cultural and natural resources.

67P. Reconstruct McCormick Park to meet current standards of services, benefit recreation, improve public access, and protect cultural and natural resources.

68P. Develop and implement a site plan for Hewitt and Holcomb Parks to accommodate recreational use and provide cultural and natural resource protection.

69P. Develop and implement a site plan for a low-water boat launch at or near Swedes Landing to improve boat access to Brownlee reservoir during seasonal reservoir drawdowns and periods of low reservoir levels.

70P. Develop and implement a site plan for Swedes Landing to benefit recreation, improve public access, and protect cultural and natural resources.

71P. Develop and implement a site plan for Spring recreational site to enhance recreational facilities and improve boat ramp access to Brownlee reservoir.

Land Management and Aesthetics

72P. Implement the Hells Canyon Resource Management Plan (HCRMP), creating virtual buffer zones between some otherwise incompatible uses, to establish or maintain compatibility between and among the various land and water uses near the Hells Canyon Project.

73P. Incorporate aesthetic concerns when upgrading or repairing the existing transmission line 945.

111P. Implement the aesthetic improvements to the Hells Canyon dam site and recreational portal, consistent with the settlement (FS modified 4(e) condition no. 22).

112P. Implement the Scenery Management Plan, consistent with the settlement (FS modified 4(e) condition no. 24).

74P. Measure 74 in the draft EIS (standards and guidelines for physical structures) is incorporated in measure 112P.

75P. Measure 75 in the draft EIS (transmission line aesthetics) is incorporated in measure 112P.

76P. Measure 76 in the draft EIS (general aesthetic clean-up plan) is incorporated in measure 112P.

77P. Measure 77 in the draft EIS (guard rails and Jersey barriers) is incorporated in measure 112P.

78P. Measure 78 in the draft EIS (visual contrast) is incorporated in measure 112P.

79P. Cooperate with BLM and the Forest Service to develop and assist them with implementing proposed design standards and guidelines at specific BLM and Forest Service facilities, including the Spring recreational site on Brownlee reservoir (BLM), Copper Creek trailhead on Hells Canyon reservoir (BLM), and Big Bar and Eagle Bar on Hells Canyon reservoir (Forest Service).

80P. Provide signs and/or facilities that interpret some elements of the Hells Canyon Project that cannot be effectively modified to reduce their visual contrast.

81P. Implement the common policies of the HCRMP to provide for the management, protection, and/or conservation of natural and cultural resources.

113P. Provide the Forest Service with a map and aerial photos depicting the approximate location of the project boundary together with Geographic Information System (GIS) shapefiles with Metadata for the project boundary on National Forest System lands. The project boundary GIS data would be compatible with Forest Service GIS and would be positionally accurate to ±40 feet, in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. This measure is consistent with the settlement (FS modified 4(e) condition no. 26).

2.2.4 Proposed Project Boundary

Idaho Power proposes to change its project boundary to exclude 3,800 acres of federal land surrounding the project reservoirs above an established reservoir elevation that it believes are no longer needed for project purposes.

2.3 MODIFICATIONS TO IDAHO POWER'S PROPOSAL

2.3.1 Mandatory Conditions

2.3.1.1 Water Quality Certification

Under section 401 of the Clean Water Act (CWA), 33 U.S.C. § 1341, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. In July, 2005, Idaho Power initially filed requests for water quality certification with the Idaho Department of Environmental Quality (IDEQ) and the Oregon Department of Environmental Quality (ODEQ), which Idaho Power subsequently withdrew. On December 27, 2005, Idaho Power filed new water quality certification requests with the two agencies; the two agencies received the re-filed request on the same day. On February 22, 2006, ODEQ requested additional information pertaining to the revised application, and Idaho Power provided the agency with addenda addressing temperature, DO, and TDG on March 31, 2006. On October 5, 2006, Idaho Power withdrew its application for water quality certification with IDEQ and ODEQ, noting that more work was needed relative to resolving water quality issues than could be accomplished within the 1-year timeframe allowed for the agencies to take action on the applications. On January 31, 2007, Idaho Power filed new applications for water quality certification with IDEQ and ODEQ (Idaho Power, 2007a). Decisions by the two state water quality agencies are pending, with the certifications due by January 31, 2008.

2.3.1.2 Section 18 Fishway Prescriptions

Federal Section 18 Fishway Prescriptions

Section 18 of the FPA, 16 U.S.C. § 1341, states that the Commission must require the construction, maintenance, and operation by a licensee of such fishways as the Secretaries of Commerce and Interior may prescribe.

In its January 26, 2006, filing, the U.S. Department of the Interior (Interior) (for the U.S. Fish and Wildlife Service [FWS]) provided preliminary prescriptions for fishways for bull trout. Interior prescribed that the licensee: (1) continue to rehabilitate, operate, maintain, and monitor the Hells Canyon trap-and-haul fishway; (2) construct, operate, and maintain a future fishway/trap at the base of Oxbow dam; (3) construct, operate, maintain, and monitor permanent weirs and trap and haul fishways near the mouths of Pine Creek, Indian Creek and Wildhorse River for the downstream transport of bull trout to a suitable release point downstream of Hells Canyon dam; and (4) develop a Bull Trout Passage Plan for implementing the foregoing measures. These measures were discussed in the draft EIS in sections 3.6.2.8, *Resident Fish Passage*; 3.6.2.6, *Anadromous Fish Restoration*; and 3.6.2.7, *Fish Passage Facilities*.

Interior's January 26, 2006, filing also requested that the Commission include as a license condition a general reservation of authority to prescribe fishways during the term of a new license. The reservation of authority includes, but is not limited to, authority to prescribe fishways for spring/summer Chinook salmon, summer steelhead trout, Pacific lamprey, bull trout, redband trout, fall Chinook salmon, white sturgeon, and any other fish to be managed, enhanced, protected, or restored to the Snake River basin during the term of the license.

In its January 26, 2006, filing, the U.S. Department of Commerce (for the National Marine Fisheries Service, NMFS) elected not to use its fishway authority to require fish passage at any of the project's dams, but, like Interior, requested that the Commission include as a license condition a general reservation of authority to prescribe fishways during the term of a new license.

Alternative Section 18 Fishway Prescriptions

The Energy Policy Act of 2005 (EPAct) provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary prescriptions. In a February 28, 2006, filing in accordance with section 241 of EPAct, Idaho Power presented an alternative prescription under which Idaho Power would prepare a Bull Trout Passage Plan that would include: (1) final design plans for the Hells Canyon trap modifications; (2) final engineering design plans for the Pine Creek monitoring weir and trap fishway; (3) specific protocols for the period of operation, location of release point, and handling of all life-stages of bull trout and other fish captured at these two facilities; (4) provisions for transport of bull trout between Pine Creek and Hells Canyon dam; (5) an assessment of monitoring necessary to evaluate the potential and risk of introducing deleterious pathogens; and (6) a post-construction monitoring plan. Under this alternative condition, the plan would include a description of specific triggers related to the timeline of construction and implementation of the Oxbow upstream trap fishway, the Indian Creek permanent weir and trap fishway, and the Wildhorse River weir and trap fishway. The plan would also include the specific monitoring necessary to determine when established triggers have been satisfied. The measures are discussed further in sections 3.6.2.8, *Resident Fish Passage*; 3.6.2.6, *Anadromous Fish Restoration*; and 3.6.2.7, *Fish Passage Facilities*.

Pursuant to section 241 of EPAct, Public Law 109-58, and 50 CFR section 221, American Rivers (AR), Idaho Rivers United (IRU), and the Shoshone-Bannock Tribes on February 27, 2006, filed an alternative prescription to NMFS's reservation of authority under section 18 of the FPA. Their alternative prescription calls for: (1) establishment of a Technical Advisory Committee to guide the development and implementation of a fish passage program; (2) modifying and improving the Hells Canyon dam fish trap; (3) providing safe, timely and effective upstream and downstream passage for spring Chinook and steelhead to and from tributaries above and within the project reach; (4) implementing a fish pathogen risk assessment; (5) providing safe, timely, and effective upstream passage for fall Chinook populations above the project. The measures are discussed further in sections 3.6.2.8, *Resident Fish Passage*; 3.6.2.6, *Anadromous Fish Restoration*; and 3.6.2.7, *Fish Passage Facilities*.

The Oregon Water Resources Department (OWRD) also filed an alternative prescription to NMFS's reservation of authority. OWRD's alternative prescription calls for Idaho Power to provide for the safe, timely and effective upstream and downstream passage of spring and fall Chinook salmon and summer steelhead by: (1) developing and implementing a fish passage plan; (2) modifying and improving the Hells Canyon dam fish trap; (3) constructing and operating a downstream passage and collection facility at Hells Canyon dam; (4) implementing fish health monitoring; (5) providing summer steelhead and spring Chinook salmon passage into Pine Creek; (6) providing summer steelhead and spring Chinook salmon passage into the Powder River basin (Eagle, Daly, and Goose creeks); and (7) studying and providing fall Chinook salmon passage into the Swan Falls to Brownlee reach of the Snake River. The measures are discussed further in sections 3.6.2.8, *Resident Fish Passage*; 3.6.2.6, *Anadromous Fish Restoration*; and 3.6.2.7, *Fish Passage Facilities*.

Modified Section 18 Fishway Prescriptions

On January 3, 2007, Interior filed its modified fishway prescription, which incorporated the trigger criteria proposed by Idaho Power's alternative fishway prescription. The primary differences between Interior's modified fishway prescription and Idaho Power's alternative fishway prescription are: (1) the modified prescription maintains language from the preliminary prescription regarding the need for appropriate attraction flows when the Oxbow dam fish trap is constructed, which Idaho Power omitted; (2) the modified prescription specifies that the Pine Creek weir is to be constructed within two years from license issuance; and (3) the modified prescription includes language to reflect the need for further information and discussion to define the operational period for downstream passage facilities, while Idaho Power's alternative prescription limited the period of operation to October through November. The modified fishway prescription is discussed further in sections 3.6.2.8, *Resident Fish Passage*; 3.6.2.6, *Anadromous Fish Restoration*; and 3.6.2.7, *Fish Passage Facilities*.

2.3.1.3 Section 4(e) Federal Land Management Conditions and Alternative Conditions

Section 4(e) of the FPA, 16 U.S.C. § 797(e), provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. EPAct provides parties to this proceeding the opportunity to propose alternatives to the 4(e) conditions specified by the Secretary(ies), and also provides a mechanism for parties to request trial-type hearings regarding issues of material fact that underlie the conditions. Within the proposed project boundary, the Hells Canyon Project occupies approximately 1,510 acres of BLM-administered land and 330 acres of Forest Service land (see section 3.12.1.2, *Land Ownership and Management Jurisdictions*).

Interior

On January 26, 2006, Interior filed with the Commission 19 preliminary terms and conditions for the proposed relicensing of the Hells Canyon Project. In its filing, Interior stated its intent to file modified terms and conditions, if necessary, by no later than 60 days after closure of the comment period for the Commission's draft EIS.

On February 27, 2006, in accordance with EPAct section 241 and 43 CFR Part 45, Idaho Power filed a request for expedited trial-type hearing regarding disputed issues of material fact supporting the preliminary BLM terms and conditions numbered 3, 4, 11, 12, 16, and 19 and proposed alternative conditions to preliminary BLM terms and conditions numbered 1–18. Idaho Power and BLM resolved the differences on all six of the preliminary terms and conditions that were the subject of the Idaho Power request for trial-type hearing, and Interior filed revised preliminary conditions numbered 3, 4, 11, 12, and 16 and withdrew preliminary condition number 19 on May 15, 2006, and Idaho Power filed revised alternative conditions with Interior on May 19, 2006. The Commission's draft EIS, issued July 28, 2006, addressed Interior's terms and conditions as they stood at that time.

On January 3, 2007, Interior filed modified conditions numbered 1–18 pursuant to FPA section 4(e). Interior's modified conditions are listed here and discussed further in section 3.0 within the relevant resource subsections; in section 5.2, *Discussion of Key Issues*; and in section 5.3.2, *Interior and Forest Service 4(e) Conditions*. Appendix C includes the complete text of each of Interior's modified 4(e) conditions.

1. General requirements for Idaho Power activities on or affecting BLM-administered land;
2. Consultation with BLM and preparation of an annual report summarizing progress on implementing articles of the license that would affect recreation, cultural, aquatic, and terrestrial resources administered by BLM on BLM lands within and adjacent to the project boundary;
3. Development and implementation of a Travel and Access Management Plan;
4. Development and implementation of a Law Enforcement and Emergency Services Plan;
5. Revision, finalization, and implementation of the Historic Properties Management Plan for historic properties on BLM-administered lands;
6. Development and implementation of a Comprehensive Recreation Management Plan;
7. Development and implementation of a Litter and Sanitation Plan;
8. Development and implementation of a Project Boat Moorage Plan;
9. Development and implementation of a Site Enhancement Plan for BLM's Airstrip, Bob Creek Section C, and Westfall sites;
10. Development and implementation of a Swedes Landing Enhancement Plan;
11. Development and implementation of a Spring Recreation Site Enhancement Plan;
12. Development and implementation of a Steck Recreation Site Enhancement Plan;
13. Development and implementation of a Jennifer's Alluvial Fan Site Enhancement Plan;
14. Development and implementation of an improvement plan for Site No. 2 below Hells Canyon Bridge and a Litter and Sanitation Plan for that site and other dispersed sites;
15. Development and implementation of Oxbow Boat Launch and Carter's Landing Enhancement Plans;
16. Development and implementation of an Oasis Site Enhancement Plan;
17. Development and implementation of a Copper Creek Site Enhancement Plan; and
18. Development and implementation for a Low Water Boat Launch Plan for a facility at or near Swedes Landing.[17]

Forest Service

In January 26, 2006; May 10, 2006; and June 9, 2006, filings, the Forest Service provided preliminary section 4(e) terms and conditions. On February 27, 2006, Idaho Power filed alternative conditions for 20 of the Forest Service preliminary conditions and requested a hearing on 10 of the preliminary conditions (nos. 4, 5, 6, 7, 8, 9, 12, 20, 21, and 25). All 10 of the issues were resolved prior to hearing, and that resolution was reflected in the Forest Service preliminary conditions addressed in the draft EIS. Ten of Idaho Power's alternative conditions stated in its February 27, 2006 filing (nos. 1, 2, 3, 13, 16, 18, 22, 23, 24, and 26) were subsequently resolved with the Forest Service in a Settlement Agreement reached October 6, 2006. Consistent with the Settlement Agreement, Idaho Power filed with the Commission on October 16, 2006, a statement amending its February 27, 2006, alternative conditions

[17] This condition is to take effect if, within 1 year of license issuance, Idaho Power has not constructed a low water boat launch at Private Dude's Cove and if BLM condition no. 10 for Swede's Landing has not been implemented.

by substituting revised preliminary conditions 1, 2, 3, 13, 16, 18, 22, 24, and 26 and withdrawing alternative condition 23. The Forest Service modified conditions, filed with the Commission November 2, 2006, are listed here and discussed further in section 3.0 within the relevant resource subsection; in section 5.2, *Discussion of Key Issues*; and in section 5.3.2, *Interior and Forest Service 4(e) Conditions*. Appendix C includes the complete text of each modified condition.

1. Forest Service approval of site-specific designs prior to implementation of Idaho Power activities on National Forest System lands;
2. Preparation and implementation by Idaho Power of a Resource Coordination Plan;
3. Preparation and implementation of a Fire Prevention Plan;
4. Creation of a Mitigation Fund to be used by the Forest Service for the purposes of restoring and maintaining 14 acres of sandbars on or adjacent to National Forest System lands between Hells Canyon dam and the confluence of the Snake and Salmon rivers;
5. Preparation and implementation of an Integrated Wildlife Habitat Program and a Wildlife Mitigation and Management Plan;
6. Preparation and implementation of a Land Acquisition and Management Program to meet the purposes of the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan;
7. Preparation and implementation of an Integrated Weed Management Plan;
8. Preparation and implementation of a Threatened and Endangered Species Management and Monitoring Strategy;
9. Preparation of a Sensitive Species Management Plan;
10. Implementation of the Mountain Quail Habitat Enhancement Program;
11. Development and implementation of a transmission line O&M plan;
12. Finalization and implementation the Hells Canyon Complex Comprehensive Recreation Management Plan;
13. Development and implementation of a Big Bar Site Development Plan;
14. Implementation of the Eagle Bar Site Development Plan;
15. Implementation of Idaho Power's proposed Eckels Creek Dispersed Site Development Plan;
16. Condition and safety inspection of Deep Creek Stairway/Trail #218 and correction of any deficiencies;
17. Improvement and maintenance of parking and signage at four Forest Service roadside parking areas along the Hells Canyon reservoir;
18. O&M over the term of a new license at Eagle Bar, Eckels Creek, Big Bar, Hells Canyon reservoir parking areas, Black Point Viewpoint, and dispersed areas on National Forest System lands in the project area pursuant to the Recreation Plan;

19. Management of Hells Canyon reservoir drawdown to minimize effects on recreation resources during the summer months;[18]
20. Trail maintenance on nine specified trails;
21. Design, construction, and maintenance of facility enhancements at the Hells Canyon Creek launch site and Visitor Center;
22. Development and implementation of an aesthetic improvement plan for enhancing the upper deck, entrance, and egress areas of Hells Canyon dam;
23. Condition 23 in the draft EIS has been deleted;
24. Preparation and implementation of a Scenery Management Plan for Forest Service lands within the project boundary and adjacent to the project boundary if they are affected by the project;
25. Finalization and implementation of the Historic Properties Management Plan for cultural resources within the APE;
26. Provision of a map and aerial photographs depicting the approximate location of the project boundary, in a form compatible with Forest Service GIS files; and
27. Reservation of authority for the Commission to require any additional measures necessary to ensure the adequate protection and use of the public land reservations under Forest Service authority.

2.3.2 Other Recommendations by Agencies and Interested Parties

2.3.2.1 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

Section 10(j) fish and wildlife recommendations were filed by IDFG, Interior, NMFS, and ODFW. Commission staff held a meeting with the agencies and other interested parties in Boise, Idaho, on December 5 through 7, 2006, to discuss and attempt to resolve differences over section 10(j) measures that were not adopted in the draft EIS. Agency recommendations and our attempts to resolve inconsistencies between the agencies' recommendations and the Staff Alternative are discussed further in section 3.0 within the relevant resource subsections; section 5.2, *Discussion of Key Issues*; and section 5.3.1, *Fish and Wildlife Agency Recommendations*.

2.3.2.2 Section 10(a) Recommendations

Under section 10(a) of the FPA, in issuing a hydroelectric license, the Commission must be satisfied that the project to be licensed is best adapted to a comprehensive plan for improving or

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[18] If the reservoir is drawn down for protracted periods to more than 5 feet below full pool elevation, this condition would require Idaho Power to reconstruct or modify boat ramps to provide reservoir access.

developing the waterway. In making this judgment, the Commission considers comprehensive plans prepared by federal and state entities, and it considers the recommendations of federal and state agencies exercising administration over flood control, navigation, recreation, cultural, and other relevant resources; the recommendations (including fish and wildlife recommendations) of Native American tribes affected by the project; and the recommendations of local governments, NGOs, and the public.

Section 10(a) recommendations were provided by the Idaho State Historical Society, State of Oregon, NMFS, Forest Service, Corps, State of Idaho, Interior, and the Burns Paiute, Umatilla, Shoshone-Paiute, Nez Perce, and Shoshone-Bannock Tribes. The measures are discussed further in section 3.0 within the relevant resource subsections and in section 5.2, *Discussion of Key Issues*.

2.3.3 Staff Alternative

After evaluating Idaho Power's proposal and recommendations from resource agencies, tribes and other interested parties, we compiled a set of environmental measures that we consider appropriate for addressing the resource issues raised in this proceeding. We call this the "Staff Alternative." The Staff Alternative includes some measures included in Idaho Power's proposal, Interior's modified section 18 fishway prescription (see section 5.2.4.4), section 4(e), section 10(j) recommendations, section 10(a) recommendations, and measures developed by the staff.

Under the Staff Alternative, the project would be operated as proposed by Idaho Power (see section 2.2.2, table 2), but with the following operational changes: (1) reservoir refill targets after the flood control season; (2) flow augmentation to enhance juvenile fall Chinook salmon migration conditions; (3) additional ramping restrictions during the fall Chinook rearing period, a seasonal 8,500 cfs minimum flow in medium-low and extremely low water years; and (4) warmwater fish spawning protection levels in Brownlee reservoir. The operational modifications included in the Staff Alternative are as follows:

1. Idaho Power would consult with the Corps to develop a flood control plan for operating Brownlee reservoir consistent with regional and local flood control requirements. Consistent with the flood control plan, Idaho Power would refill Brownlee reservoir to a level between: (a) 1 foot below the April 15 and April 30 required flood control draft; and (b) the required flood control draft on those dates. After April 30, Idaho Power would coordinate the refill of Brownlee reservoir with the Corps, NMFS, ODFW, IDFG, and the interested tribes[19] to ensure that the refill of Brownlee reservoir does not result in unnecessary reductions of spring flows as measured at Lower Granite dam. This measure would not in any way diminish the Corps' discretion over the project's flood control operation.

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[19] We use the term "interested tribes" to be inclusive of all tribes that have been active participants in the relicensing proceeding, including the Nez Perce, Umatilla, Shoshone-Bannock, Shoshone-Paiute, and Burns Paiute tribes. Several of these tribes do not have federally recognized treaty fishing rights pertaining to existing anadromous fisheries downstream of the project. However, all of these tribes historically hunted and fished in areas that have been affected by the existence and operation of the project. It is our view that all of these tribes, including those that historically used areas upstream of the project, should be offered the opportunity to participate in consultation regarding measures that could affect anadromous and resident fish (to include measures affecting habitat and water quality), as well as plants and wildlife species of value to the tribes. This view is based on the premise that even measures that would affect only downstream habitat could help increase the abundance of fish that could be used in upstream restoration efforts, and that both fish and wildlife may move among the lands that are or were used by multiple tribes.

2. Consistent with flood control requirements, Idaho Power would refill Brownlee reservoir to full pool (elevation 2,077 feet msl) by June 20 of each year and, in order to enhance migration conditions for juvenile fall Chinook salmon, would release 237 thousand acre-feet (kaf) of stored water from Brownlee reservoir (draft to elevation 2,059 feet msl) between June 21 and July 31, except as may be restricted by the Corps for system flood control between June 20 and July 1. Idaho Power would release at least 150 kaf of this water (draft to elevation 2,066 feet msl) no later than July 15 of each year, but would maintain Brownlee elevations through the Fourth of July holiday to enhance recreational use of the reservoir. Idaho Power would not refill Brownlee reservoir at any time between June 21 and August 31.[20]

3. The maximum variation in river stage would not exceed 1 foot per hour as measured at the Snake River at Johnson Bar gaging station 13290460 (RM 230), except during the March 15 to June 15 fall Chinook rearing period when the maximum variation in river stage would not exceed 4 inches per hour.

4. From Memorial Day weekend to September 30 in medium-high and extremely high flow years, Idaho Power would provide an instantaneous minimum flow of 8,500 cfs upstream of the mouth of the Salmon River, as measured at the Hells Canyon dam gaging station.[21] If the 3-day moving average inflow to Brownlee reservoir is less than 8,500 cfs, the instantaneous minimum release required from Hells Canyon dam for the current day would be equal to the previous 3-day moving average.

5. Idaho Power would protect warmwater fish spawning locations in Brownlee reservoir from May 21 through July 4. For the initial 30-day period beginning May 21, Brownlee reservoir would not be drafted more than 1 foot from the highest elevation reached during the 30-day period. From the end of the 30-day period though July 4, the reservoir could be drafted more than 1 foot, but an elevation of at least 2,069 feet above mean sea level would be maintained.[22]

In addition to the foregoing operation-related measures, the Staff Alternative incorporates Idaho Power's proposed environmental measures (refer to section 2.2.3), modified as follows:

- 101P—modified to include development and implementation of a 5-year volumetric monitoring of sand and gravel.
- 4P—modified to include development and implementation of a dissolved oxygen (DO) enhancement plan that documents consultation with IDEQ and ODEQ regarding the appropriate DO load allocation for the project, documents efforts to identify upstream phosphorus trading partner(s), evaluates whether reservoir DO supplementation or phosphorus trading is the preferred method for meeting Idaho Power's Brownlee reservoir TMDL DO allocation, evaluates the feasibility and effectiveness of turbine aeration measures at Hells Canyon and Brownlee dams, evaluates the potential for each measure to elevate total dissolved gas to greater than the applicable water quality criterion (i.e., 110 percent of

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[20] Staff measure 8S would require Idaho Power to prepare a report 6 years after license issuance that summarizes available information on the effectiveness of this measure for improving the migration survival of juvenile salmon and steelhead, and evaluating whether any changes in the timing or quantity of flow augmentation water released from Brownlee reservoir are warranted.

[21] Staff measure 4S would require Idaho Power to install a new flow compliance gage within 5 miles downstream of Hells Canyon dam. Once it is operational, compliance for the minimum navigation flow would be measured at the new gage.

[22] The requirement for warmwater fish spawning protection (item 4, above) would be secondary to any conflicting operational requirement.

saturation); (2) monitoring the effectiveness of implemented measures; (3) holding annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, NMFS, and interested tribes to evaluate whether measures need to be modified or additional measures implemented to meet the DO load allocation for the project; and (4) filing an annual monitoring and implementation report with the Commission that summarizes monitoring results and outlines any modifications or new measures that warrant consideration and/or are proposed for implementation.

- 107P—modified to include: (1) annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, NMFS, and interested tribes to evaluate whether measures need to be modified or additional measures implemented to meet TDG responsibility for the project; and (2) filing of an annual report with the Commission that summarizes monitoring results and any modifications or new measures that warrant consideration and/or are proposed for implementation.
- 109P—modified to include: (1) monitoring of the effectiveness of implemented measures; (2) annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, and NMFS to evaluate whether measures need to be modified or additional measures implemented to meet the project's temperature responsibility; and (3) filing of an annual report with the Commission that summarizes monitoring results and any modifications or new measures that warrant consideration and/or are proposed for implementation.
- 6Pa—modified to indicate that the stable flows to be maintained below Hells Canyon dam during the fall Chinook spawning season must be between 8,500 and 13,500 cfs, at a level selected (based on runoff forecasts) to ensure that spawning fall Chinook salmon redds are created at elevations that are protected during the winter peak load period.
- 110P—supplemented to include: (1) annual consultation with NMFS, Interior, IDFG, ODFW, and interested tribes to report on monitoring results to date and to guide monitoring efforts in the coming year; and (2) the development and implementation of a gravel augmentation program if monitoring results indicate that project-related effects on the quantity or quality of spawning habitat are adversely affecting the spawning or incubation success of fall Chinook salmon.
- 7Pb—modified to include gill netting or other measures to monitor the abundance of channel catfish in project reservoirs; filing of an annual report on the results of warmwater fisheries monitoring including an assessment of any operational effects on warmwater fisheries; and consultation with ODFW, IDFG and BLM on any feasible means to minimize or avoid adverse effects on the warmwater fishery in Brownlee reservoir.
- 8Pa—included within Idaho Power measure 8Pb.
- 8Pb—modified to incorporate the FWS modified fishway prescription, which prescribes that Idaho Power prepare a bull trout passage plan that would include: (1) final design plans for the Hells Canyon trap modifications; (2) final engineering design plans for the Pine Creek monitoring weir and trap fishway, and construction of the weir and trap fishway within 2 years of license issuance; (3) specific protocols for the period of operation,[23] location of release point, and handling of all life-stages of bull trout and other fish captured at these two facilities; (4) provisions for transport of bull trout between Pine Creek and Hells Canyon dam; (5) an assessment of monitoring necessary to evaluate the potential and risk of

[23] The period of operation would be determined in consultation with the agencies and tribes, but may include year-round operation.

introducing deleterious pathogens; and (6) a post-construction monitoring plan.[24] Under this modified prescription, the plan would include a description of specific triggers related to the timeline of construction and implementation of the Oxbow upstream trap fishway, the Indian Creek permanent weir and trap fishway, and the Wildhorse River weir and trap fishway. The plan would also include the specific monitoring necessary to determine when established triggers have been satisfied.

- 8Pc—modified to include enhancement measures to support redband and bull trout restoration in portions of the Powder and Burnt River basins where such measures would provide substantial benefits to native resident salmonids.
- 8Pf—included within Idaho Power measure 8Pb.
- 8Pg—modified to include implementation of brook trout suppression in the Wildhorse River, and possibly Pine Creek using techniques proven effective in Indian Creek.
- 9P—modified to note that hatchery operations are to be in keeping with any hatchery and genetic management plans (HGMPs)[25] that are developed for these hatcheries. We recommend that Idaho Power's obligation to fund the HGMPs be based on continuation of current smolt production targets, but may include improvements that are needed to better attain goals for adult returns and societal use.
- 11Pb—modified to be dependent upon the findings of an evaluation of alternative approaches for rebuilding white sturgeon populations in affected reaches (part of modified Idaho Power measure 11Pc).
- 11Pc—modified to include a feasibility assessment of alternative approaches for rebuilding sturgeon populations in reaches of the Snake River between Swan Falls and Hells Canyon dams, to include comparison of the risks and benefits of hatchery supplementation with the translocation of juvenile or adult sturgeon.
- 11Pe—modified to exclude genetics monitoring upstream of Swan Falls dam, which is addressed in the licenses for the mid-Snake and C.J. Strike projects.
- 13P—modified to include support for capital improvements needed to implement enhancement projects, as recommended by ODFW and IDFG.
- 14P—modified to include consultation with state and federal wildlife management agencies to develop and implement habitat improvements or relocation projects.
- 15P—clarified to indicate that Idaho Power would establish a terrestrial resource work group to provide consultation in finalizing and implementing the management plan and implementing other measures to prevent wildlife disturbance.
- 16P—combined with Idaho Power measure 20P and reflected in staff measure 13S, below.
- 18P—supplemented to include agency consultation in the development and implementation of a project-wide integrated weed management plan to cover National Forest System and BLM-administered lands within the project boundary and lands affected by the project, as well as Idaho Power's ownership, and establishment of a Cooperative Weed Management

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[24] The post-construction monitoring plan for the fish trap at Oxbow dam, if constructed, would include evaluation of flows needed to provide effective passage through the Oxbow bypassed reach.

[25] Because the hatcheries are operated by IDFG, HGMPs would be developed by IDFG in consultation with NMFS.

Area (CWMA), as specified by the Forest Service. The plan would cover pesticide reporting to BLM.

- 19P—supplemented to include agency consultation in the development and implementation of a project-wide Threatened, Endangered and Sensitive Species Management Plan for plants and animals to cover National Forest System and BLM lands within the project boundary and National Forest System and BLM administered lands affected by the project and lands affected by the project, as well as Idaho Power's lands, as described in staff measure 12S, below.
- 20P—combined with Idaho Power measure 16P and reflected in staff measure 13S, below.
- 21P—clarified to indicate that the measure includes agency consultation in the development of the O&M plan.
- 24P—expanded to include all known eligible resources in the areas of potential effect (APE) of these reservoirs.
- 25P—expanded to include all known eligible resources within the APE of the reservoir.
- 26P—expanded to include all known eligible resources in the APE.
- 35P to 40P—modified to delete the funding of scholarships and clarify that support for tribal programs is intended to support the tribes' participation in natural and cultural resource management.
- 45P—modified to include details of the boat moorage plan as part of the final Recreation Plan.
- 46P—modified to address the need for, location of, and maintenance standards for floating restrooms; to develop maintenance and service standards for trash receptacles; and to design, install, and maintain a graywater carryout system in the vicinity of the Hells Canyon Creek put-in/take-out area.
- 47P—modified to have the I&E plan indicate the location and type of information materials to be provided and include information about anadromous fish, invasive species, and sensitive wildlife.
- 48P—modified to have Idaho Power provide coordination by planning and hosting biannual meetings of the parties responsible for law enforcement in the project, but not funding law enforcement by third parties.
- 49P—supplemented to indicate that the RAMP should address dispersed site management and procedures for recreational use monitoring and reporting and should be part of the overall Recreation Plan.
- 51P—modified to bring into the project boundary dispersed recreational sites that are within 200 yards of project waters as well as Airstrip, Steck Park, Swedes Landing, and Westfall recreational sites and the trail to Deep Creek (see staff measure 23S below).
- 72P—supplemented to include clarifications regarding consultation, coordination, and reporting and to include resource maps, maps depicting road maintenance responsibilities, and maps for public use as part of the proposed GIS atlas of critical and sensitive resources.
- 73P—supplemented to include a monitoring strategy to analyze future modifications to the line, incorporating all viewpoints identified in the Technical Report on Aesthetics from which the line is visible, and a schedule for implementing aesthetic improvements on the line.

- 81P—supplemented to address law enforcement, fire prevention, and road management in the Common Policies.

Finally, the Staff Alternative would also include the following measures additional to those proposed by Idaho Power. Measures numbered 2S through 27S reflect original staff measures presented in the draft EIS; measures 101S through 106S reflect staff measures added between the draft EIS and the final EIS.

1S. Staff measure 1S in the draft EIS (beach and terrace erosion, substrate, and gravel monitoring) has been incorporated into Idaho Power's proposal (measure 101P).

Water Use and Quality

2S. Staff measure 2 in the draft EIS (develop and implement a temperature management plan) has been incorporated in Idaho Power's proposal (measure 109P).

3S. Staff measure 3S in the draft EIS (develop and implement a TDG abatement plan) has been incorporated into Idaho Power's proposal (measure 107P).

4S. Develop and implement an operational compliance and water quality monitoring plan to monitor compliance with minimum flows, reservoir levels, and ramping rates specified in the license, and to monitor water quality downstream of Hells Canyon dam. Develop the plan in consultation with IDEQ, ODEQ, IDFG, ODFW, NMFS, FWS, USGS, and interested tribes. The plan should, at a minimum, include:

- Identification of an appropriate location for continuous monitoring of river flow, stage, water temperature, DO, and TDG within 5 miles downstream of Hells Canyon dam, preferably within 3 miles of the dam;
- A schedule for the construction of a flow measurement gage at the selected site, and for the installation of water quality monitoring equipment;
- A description of procedures that would be followed to determine a ramping rate at the new gage site that is equivalent to any ramping rate specified for other locations in the new license;
- A description of the method that would be used to measure water surface elevations at Brownlee, Oxbow, and Hells Canyon reservoirs, as well as flow rates in the Oxbow bypassed reach; and
- The time steps for which real-time and historical flow, water surface elevation and water quality information from each location would be posted on the Internet and annually reported to the Commission.

5S. If requested by IDEQ or ODEQ, make available tissue samples from white sturgeon within and downstream of the project area and from Brownlee reservoir fish for the purpose of monitoring toxic bioaccumulants. These samples would be collected during the routine population monitoring efforts proposed by Idaho Power (Idaho Power measures 7b and 11d).

Aquatic Resources

6S. Every 5 years, file a report that summarizes water quality changes in response to TMDL implementation upstream of Brownlee dam to determine when habitat becomes suitable to support any future reintroduction efforts.

7S. Staff measure 7 in the draft EIS (gravel augmentation pilot program) has been deleted.

8S. Six years after license issuance, prepare a flow augmentation evaluation report that evaluates the efficacy of flow augmentation water provided from Brownlee reservoir for aiding the downstream migration of juvenile salmon and steelhead; to include consideration of how these releases are coordinated with flow augmentation water contributed from the Snake River basin upstream from Brownlee dam and from Dworshak reservoir; and to include any recommendations, for Commission approval, for modifying flow augmentation releases from Brownlee reservoir.

9S. Develop and implement a stranding and entrapment management plan to evaluate, and if needed, develop and implement approaches to protect and enhance rearing juvenile fall Chinook salmon and bull trout downstream of Hells Canyon dam.

101S. Develop and implement an invertebrate monitoring plan to evaluate trends in the abundance and distribution of rare and sensitive species of mollusks, as well as to evaluate the effects of load following operations on rare and sensitive mollusks and the food supply available to fall Chinook salmon and to bull trout. As part of the plan, prepare annual monitoring reports and provide for updates to the monitoring plan every 5 years, addressing the need to alter project operations or implement other measures to address project effects based on monitoring results.

10S. Develop and implement a fall Chinook spawning and incubation flow management plan to determine appropriate monitoring methods to assist with determining flow levels to be maintained downstream of Hells Canyon dam during the fall Chinook spawning and incubation season. The plan should be developed in consultation with NMFS, FWS, IDFG, ODFW, and the interested tribes.

102S. Fund the development and implementation of a HGMP for each mitigation hatchery, including establishment of mitigation goals, but retaining current smolt production targets. As part of the plan, prepare annual reports on the hatchery program, including data on adult returns, to ensure the goals and objectives of the plan are being met.

103S. Develop a plan, in consultation with the Shoshone-Bannock Tribes, IDFG, NMFS, and FWS, to design, construct, and operate facilities on the Yankee Fork to collect, spawn, and incubate 1,000,000 steelhead or Chinook salmon eggs to support the Shoshone-Bannock Tribe's existing streamside incubator program. The facilities would need to be operated in compliance with a HGMP[26] approved by NMFS. Production numbers from the Yankee Fork hatchery should be included in the annual reports on the hatchery program prepared by Idaho Power (102S).

104S. In consultation with ODFW, IDFG, FWS, NMFS, and interested tribes, develop and implement a plan to use surplus adult hatchery spring Chinook salmon and steelhead to: (1) provide marine nutrients and improve forage for bull trout in tributaries within the project area; (2) facilitate the evaluation of spawning success, egg viability and survival, and smolt outmigration and survival in Pine Creek; and (3) support ceremonial, subsistence, and recreational fisheries in select tributaries to the Snake River, including the Salmon River basin where appropriate.

105S. Participate in regional forums on lamprey restoration in the Snake River basin, file a summary of the activities with the Commission every 3 years, and identify and implement any feasible measures to address project effects on Pacific lamprey.

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[26] Because the facilities would be operated by the Shoshone-Bannock Tribes, the HGMP would be developed by the tribes in consultation with NMFS.

106S Hold annual meetings of the White Sturgeon Technical Advisory Committee to review the results of past monitoring and enhancement efforts, and to guide such efforts in the upcoming year, and file with the Commission an annual report on the results from the previous year of monitoring and enhancement efforts, and any recommendations for revising the monitoring or enhancement measures.

Wildlife and Botanical Resources

11S. Develop and implement a plan to assess the feasibility of stabilizing/revegetating erosion sites around project reservoirs and along the river downstream of Hells Canyon dam; implement a pilot project and monitor results to determine feasibility of implementing a long-term stabilization/revegetation program; and, if erosion predicted to occur during the new license period cannot be stabilized, acquire up to 70 acres of riparian habitat in coordination with Idaho Power measure 12P, above.

12S. Develop and implement a project-wide Threatened, Endangered, and Sensitive Species Management Plan to address plants (in coordination with Idaho Power measure 19P, above) and animals, including bald eagles, southern Idaho ground squirrel, bats, amphibians, and reptiles.

13S. Develop and implement a Transmission Line Operation and Maintenance Plan for transmission line 945 to address protection and enhancement of wildlife and botanical resources, including monitoring electrocution and collision mortality and scheduling O&M to minimize disturbance to wintering mule deer.

14S. In coordination with Idaho Power measure 12P, above, acquire 13.2 acres of riparian habitat to mitigate for the loss of riparian habitat predicted to occur as the result of implementing the staff's alternative flow measures; and 49 acres of riparian habitat to address the loss of suitable substrate for native willows along the Snake River downstream of Hells Canyon dam.

15S. Extend the WMMP to apply to all lands within the project boundary, including National Forest System and BLM-administered lands, as well as Idaho Power lands. As part of the WMMP, develop and implement an I&E program to minimize risk of wildlife disturbance. As part of the plan, schedule O&M to minimize disturbance on deer winter range.

Historic and Archaeological Resources

16S. Renew the licensee's offer to arrange for oral histories for the Shoshone-Bannock and Shoshone-Paiute Tribes.

17S. Develop and implement a monitoring plan for archaeological sites, rock art, and TCPs.

18S. Develop a plan to implement Idaho Power's deferred monitoring program concerning effects of reservoir water level fluctuations on cultural resources.

19S. Staff measure 19 in the draft EIS (file the Historic Properties Management Plan (HPMP) with 1 year of license issuance) has been dropped because the Commission has ordered the plan filed by August 3, 2008.

20S. Develop and implement a program to re-evaluate buildings and structures within the project boundary as they reach 50 years old.

Recreational Resources

21S. Finalize the proposed Recreation Plan to add specificity to implementation standards and expand the scope of the plan to address the following additional elements:

21Sa. Oasis recreational site improvements;

21Sb. Improved Brownlee reservoir communication system and, if recreational use demonstrates the need, expansion of Steck Park;

21Sc. Control and removal of sediment accumulation at Farewell Bend State Park;

21Sd. Improvements at Jennifer's Alluvial Fan, including toilet facilities, vehicular barriers, signage, and regular maintenance;

21Se. Staff measure 21e in the draft EIS (Deep Creek Trail improvements and incorporation in the project boundary) has been included in Idaho Power's proposal (measure 51P);

21Sf. Improvements at Hells Canyon launch to enhance access and safety, provide potable water, and provide a portable human waste disposal system; and

21Sg. O&M at primary recreational sites within the project boundary and clarification of O&M standards and responsibilities.

107S. Consult with ODFW to coordinate and provide form 80 recreational use data on recreational fishing effort in the project vicinity.[27]

108S. As part of the Recreation Plan, consult with the Corps, NPPVA, the Forest Service, and other interested parties to prepare a navigation plan that addresses non-flow measures that could be implemented to improve boating safety downstream of Hells Canyon dam, including the installation of additional stream gages.

Land Management and Aesthetics

22S. Develop an Aesthetics Management Plan as part of the Hells Canyon Resource Management Plan to be applied to all lands within the project boundary, including transmission line 945 and the right-of-way, and to include Idaho Power's proposed aesthetic measures (see Idaho Power's proposed aesthetic measures, items 73 through 80 above), a monitoring strategy for all viewpoints established in the Technical Report on Aesthetics, and an estimated maintenance schedule and schedule for implementing aesthetic improvements.

23S. Include within Idaho Power's proposed boundary modification to include dispersed recreational sites that are within 200 yards of project waters; Airstrip, Steck Park, Swedes Landing, and Westfall recreational sites; Hells Canyon Creek launch area; Deep Creek trail; and all lands acquired for wildlife mitigation.

24S. Provide the Forest Service with aerial photographs at a scale acceptable to the Forest Service showing the approximate location of the project boundary throughout Forest Service-managed lands.

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[27] Agreed to by Idaho Power during the 10(j) meeting.

25S. Coordinate with BLM and the Forest Service concerning project-related activities on lands managed by those agencies.

26S. Staff measure 26 in the draft EIS (aesthetics improvement for the upper deck, entrance, and egress of Hells Canyon dam) has been included in measure 111P, above.

Oversight and Adaptive Management

27S. Establish Technical Advisory Committees to facilitate consultation on the development and implementation of plans required by the new license and to provide consultation on the ongoing implementation of license requirements using adaptive management principles.

2.3.4 Staff Alternative with Mandatory Conditions

The Department of Commerce (for NMFS) has filed preliminary fishway prescriptions for the project and Interior (for FWS) has filed preliminary and modified fishway prescriptions (see section 2.3.1.2, *Section 18 Fishway Prescriptions*) which, when finalized, the Commission may need to include in a new license for this project. Similarly, Interior (for BLM) and the Forest Service have specified preliminary and modified 4(e) conditions (see section 2.3.1.3, *Section 4(e) Federal Land Management Conditions*) which, when finalized, the Commission may also need to include in a new license for this project. Incorporation of these mandatory conditions into a new license would add three measures that are not included in the Staff Alternative, as follows (see section 2.3.1.3 for the numerical designation of these measures):

- Interior-3—Development and implementation of a travel and access management plan;
- Interior 4—Development and implementation of a law enforcement and emergency services plan; and
- FS-20—Trail maintenance on nine specified trails.

Except for these three measures, all of the mandatory conditions are included in the Staff Alternative.

2.4 OTHER ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

2.4.1 Federal Government Takeover of the Project

We do not consider federal takeover to be a reasonable alternative. Federal takeover of the Hells Canyon Project would require Congressional approval. Although that fact alone would not preclude further consideration of this alternative, there is currently no evidence showing that a federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed an interest in operating the Hells Canyon Project.

2.4.2 Issuance of Nonpower License

A nonpower license is a temporary license the Commission would terminate whenever it determines that another governmental agency is authorized and willing to assume regulatory authority and supervision over the lands and facilities covered by the nonpower license. At this time, no government agency has suggested a willingness or ability to take over the project. No party has sought a nonpower license, and we have no basis for concluding that the Hells Canyon Project should no longer be used to produce power. Thus, we do not consider a nonpower license a reasonable alternative in this case.

2.4.3 Project Retirement

Retiring the Hells Canyon Project would require denying Idaho Power's license application and would lead to the surrender and termination of Idaho Power's existing license with any necessary conditions. The project would no longer be authorized to generate power. The Hells Canyon Project is an integral part of Idaho Power's electric generation system, generating an average of about 6,053 gigawatt-hours of electricity annually[28] and providing about 40 percent of the utility's total generation. The project serves an important role in meeting both daily and seasonal peaks in power demand in the region and contributes to the reliability and stability of the regional electric system. These benefits would be lost if the project were retired.

Brownlee reservoir is one of several Northwest storage reservoirs that are coordinated to provide flood control protection for the lower Columbia River, a function that would be lost upon project retirement. Camping, flat-water boating and fishing, and other recreational pursuits associated with the reservoirs and reservoir-based recreational sites would also be lost. Additionally, there would be significant costs involved with retiring the project and/or removing any of the project's facilities. Finally, retirement would foreclose any opportunity to implement environmental enhancements that would be funded by Idaho Power associated with the project.

Project retirement with dam removal would provide ecological benefits by restoring passage for anadromous and resident fish in the mainstem Snake River and the lower portions of its tributaries between Hells Canyon and Swan Falls dams, by increasing the availability of winter habitat for mule deer, and by reducing the adverse effects of erosion on beaches and armoring of spawning gravels. However, these ecological benefits would be limited by the existence of other barriers to fish passage on all tributaries, and by the passage of higher nutrient loads to downstream areas and higher water temperatures during the summer months, which could adversely affect anadromous fish habitat in the lower Snake and lower Columbia River migratory corridor. Removing the project dams would also provide opportunities for whitewater recreation and riverine fisheries in areas that are now inundated by the project reservoirs, but it would eliminate flatwater recreation and the existing warmwater fishery in Brownlee reservoir. Because of the importance of the project in meeting regional power needs and flood control requirements, we conclude that the ecological and recreational benefits described above do not warrant a detailed evaluation of the tradeoffs involved in dam removal, and we do not consider project retirement to be a reasonable alternative.

[28] Based on January 1, 1981, through December 31, 2001, a period when all three developments were operating.

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3.0 ENVIRONMENTAL ANALYSIS

3.1 GENERAL DESCRIPTION OF THE AREA

The project is located in west-central Idaho and northeastern Oregon on the Snake River, which forms a part of the Idaho-Oregon border. Landscape characteristics vary greatly throughout the region. Upstream of Brownlee reservoir, the river is low gradient, with several island complexes. This reach is surrounded by farmland and rural development on flat to gentle topography. Brownlee reservoir is a steep-sided reservoir with a maximum depth approaching 300 feet near the dam. Large rock outcrops occur along the entire length of the reservoir, and the transition from riverine habitat to lacustrine habitat is evident. Oxbow reservoir is surrounded by moderate to steep topography (20 to 75 percent slopes). The shorelines are primarily basalt outcrops and talus, except where small tributaries have created alluvial fans. Similarly, the shoreline of Hells Canyon reservoir is generally very steep, with substrates consisting primarily of basalt outcrops and talus slopes.

The Snake River downstream of Hells Canyon dam is a high-gradient river with a wide diversity of aquatic habitat, including numerous large rapids, shallow riffles, and deep pools. Substrates are highly diverse, ranging from large basalt outcrops and boulders to cobble/sandbars. This unimpounded reach of Hells Canyon, considered the deepest gorge in North America, is surrounded at the upstream end by nearly vertical cliff faces. At the mouth of Granite Creek, about 7 miles below Hells Canyon dam, the river elevation is 1,480 feet msl and the canyon depth is 7,913 feet. The canyon becomes somewhat wider near Johnson Bar (RM 230), with moderate to steep topography continuing to the confluence with the Salmon River.

The current climate in the Snake River basin is influenced primarily by Pacific maritime polar air masses that travel eastward over the continent. Hells Canyon itself is primarily affected by the rain shadow of mountain ranges to the west. Data from four regional weather stations indicate that the average annual precipitation ranges from about 11 to 18 inches, depending on elevation. It is lowest at the southern (upstream) end of the region, equaling 11.3 inches at the Weiser, Idaho weather station. It increases northward through the project area (11.7 inches at Richland, Oregon), peaks near Brownlee dam (17.5 inches), and declines north (downstream) of the project area, equaling 12.8 inches near Lewiston, Idaho. Nearly 45 percent of the average annual precipitation at the Brownlee weather station falls between November and January, while just 9 percent falls between July and September, the hottest months of the summer.

Mean annual temperatures are similar among the four weather stations, although the climate tends to become drier and warmer downstream of Brownlee reservoir. At Brownlee dam, mean temperatures above 6,562 feet range from 16 degrees Fahrenheit (°F) in January to 55°F in July. In contrast, mean temperatures below 3,281 feet range from 32°F in January to between 82°F and 91°F in July. The canyon bottom area is dry, with seasonal temperatures ranging from about 23°F in January to about 95°F in July. As a general rule, winters in the canyon are mild, while summers on the canyon floor are hot.

Climate exerts the strongest influence on the vegetation in the area. The relatively mild winters below the canyon rim have allowed the development of species not normally found in this part of the country, including species such as netleaf hackberry (*Celtis reticulata*), which most often occurs in the southwestern states. Within the context of the regional climate, topography is a major influence on the development and distribution of vegetation. Grassland, shrubland, riparian, and coniferous forest communities occur near one another. Interfingering of grassland and forest occurs at a number of sites throughout the canyon because of variations in aspect (Tisdale, 1979, as cited by Idaho Power, 2003a, exhibit E.1).

Vegetative cover adjacent to the project reflects the low level of precipitation in the area and the definitive shoreline edges of the reservoirs. Riparian vegetation occurs intermittently along the margins of the Snake River and its tributaries. Many shoreline sections have no riparian vegetation; instead upland vegetation of steep canyon slopes meets the rocky shoreline. The dry climate and typically stony, shallow soils of the canyon have favored the development of grassland steppe communities at lower and middle elevations. Coniferous forest communities generally occur at higher elevations of steep canyon slopes, although they reach down to the river at certain locations.

3.2 CUMULATIVELY AFFECTED RESOURCES

According to the Council on Environmental Quality's regulations for implementing NEPA (§ 1508.7), a cumulative effect is the effect on the environment that results from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time to include hydropower and other land and water development activities.

Based on information in the license application, agency comments, other filings, comments from the scoping process, and preliminary staff analysis, we identified sediment transport, water quality, anadromous fish, resident fish, federally listed aquatic mollusks, riparian/wetland habitat, native grasslands and shrublands, noxious weeds and invasive exotic plants, MacFarlane's four-o'clock, bald eagles, peregrine falcons, and recreation use patterns as resources that could be cumulatively affected by the continued operation of the Hells Canyon Project in combination with other activities on the Snake River. Cumulative effects of the Hells Canyon Project, along with those of seven Idaho Power-owned projects, were included in our cumulative analysis of all eight projects presented in our final environmental impact statement (final EIS) for the four mid-Snake River projects (FERC, 2002). The evaluation of cumulative effects on anadromous fish (Snake River spring/summer and fall Chinook, Snake River steelhead, and Pacific lamprey), MacFarlane's four-o'clock, and noxious weeds and invasive exotic plants was deferred to this document. This EIS for the Hells Canyon Project tiers off the mid-Snake final EIS, as necessary, to assess the cumulative effects of the Hells Canyon Project in a basin-wide context.

3.2.1 Geographic Scope

3.2.1.1 Sediment Transport

The supply and movement of sediment upstream, within, and downstream of the project area shape the geomorphic features of the Snake River that provide habitat for aquatic life, support recreational activities, and protect important cultural resources. Initial development of the basin involved many activities that increased the rate and volume of sediments delivered to the project area. These included widespread trapping and eradication of beavers and the eventual release of sediments stored behind beaver dams in low gradient reaches of many tributaries, extensive hydraulic and dredge mining for gold throughout the basin, logging and road construction in timber production areas, widespread livestock grazing and the use of flood irrigation techniques, and an increase in the frequency of high-intensity wildfires due to many years of fire suppression efforts. The construction of 13 mainstem dams on the Snake River upstream of the project between 1901 and 1957 and the construction of many smaller dams in tributary basins between Brownlee and Swan Falls dams served to trap the majority of both coarse and fine sediments that originated from sources upstream of the project. In addition, the three project dams retain the sediment that enters the Snake River between the Swan Falls and Hells Canyon dams, reducing the amount of sediment that is delivered to the free-flowing reach downstream of Hells Canyon dam. Changes in the seasonal flow regime due to flood control storage in Brownlee reservoir and daily flow fluctuations associated with load following operations also affect the sediment transport regime downstream of Hells Canyon dam. To encompass the effects of upstream activities on sediment transport into the project area and the effects of project dams on the sediment regime downstream of Hells Canyon dam, we have defined the geographic scope of our analysis to include the entire Snake River basin upstream of Lower Granite reservoir, the first impoundment downstream of Hells Canyon dam.

3.2.1.2 Water Quality

Snake River water temperature and water quality determines the level of support for numerous beneficial uses including anadromous and resident fishes; wildlife; recreation; and domestic, industrial, and irrigation water supplies. Much of the Snake River has been listed as water-quality limited due to excessive levels of sediments, nutrients, mercury, pesticides (e.g., DDT metabolites, dieldrin, and chlordane), temperature; and low DO levels (IDEQ, 2005a; ODEQ, 2005; WDOE, 2005a). Several water-resource and land use management practices conducted in the Snake River basin influence the river's water temperature and water quality in and downstream of the project area. Both ongoing and historical mining activities increase the potential for metal loadings. Management of cropland and range affects loadings of sediments, nutrients, pesticides, and metals. Discharges from aquaculture facilities and wastewater treatment plants also supply the river with sediments and nutrients.

Dams, located throughout the basin, cause localized deposition of sediments/nutrients, which can affect growth of macrophytes and algae and subsequently result in hypoxic/anaerobic conditions. These low DO conditions can result in fish kills and increased releases of toxic contaminants from sediments that can lead to bioaccumulation of these contaminants. Operation of hydropower projects, withdrawal of surface waters for irrigation, and pumping of groundwater for irrigation can alter the flow regime throughout the Snake River and its tributaries and, thus, can influence water temperatures in the project area and further downstream. Operation of Dworshak dam, which is located on the North Fork Clearwater River, can alter the flow and thermal regimes in the Clearwater River along with the lower Snake and Columbia rivers (Ecovista et al., 2003).

To address these potential effects on water temperature and water quality, the geographic scope of our cumulative analysis includes the entire Snake River basin.

3.2.1.3 Anadromous Fish

Snake River stocks of anadromous fish must migrate through more than 300 miles of the lower Columbia River during their upstream and downstream migrations, including passage through four mainstem federal dams and their associated reservoirs: Bonneville, The Dalles, John Day, and McNary. Most Snake River stocks must also pass through another four federal dams and reservoirs on the lower Snake River: Ice Harbor, Lower Monumental, Little Goose, and Lower Granite. Although each of these dams is equipped with fish passage facilities, cumulative losses during passage through these dams and reservoirs has contributed to a reduction in the abundance of the Snake River stocks. Similarly, operation of Brownlee reservoir and the Bureau of Reclamation's (BOR's) storage reservoirs in the upper Snake River basin and operation of Dworshak reservoir on the North Fork Clearwater River can alter river flows and water temperatures in ways that may have beneficial or adverse effects on juvenile and adult anadromous fish as they migrate through the lower Snake and Columbia rivers.

The nine Idaho Power dams on the Snake River also contribute to water quality effects that may extend downstream into the lower Snake and Columbia rivers and have the potential to affect the rearing and migration of anadromous fish stocks in both rivers. All of these factors may have a cumulative effect on the abundance of anadromous fish species and affect the prospects for restoring anadromous fish runs to historical habitat upstream of Hells Canyon dam. The location of mainstem dams on the Snake and Columbia rivers is shown on figure 1, and information on the ownership, date of construction and reservoir length associated with each dam is provided in table 3.

Table 3. Mainstem hydroelectric projects on the Snake River from Shoshone Falls downstream and on the lower Columbia River. (Source: Idaho Power, 2003b, as modified by staff)

Online Date	Project	Current Ownership	River Mile[a]	Reservoir Length (miles)
1907	Shoshone Falls	Idaho Power	SR 614.7	1.8
1947	Upper Salmon Falls B	Idaho Power	SR 580.8	4.7
1937	Upper Salmon Falls A	Idaho Power	SR 579.6	0
1910	Lower Salmon Falls	Idaho Power	SR 573.0	7.2
1950	Bliss	Idaho Power	SR 560.0	5
1952	C.J. Strike	Idaho Power	SR 494.0	24
1901	Swan Falls	Idaho Power	SR 458.0	10.8
1958	Hells Canyon (Brownlee development)	Idaho Power	SR 284.6	55
1961	Hells Canyon (Oxbow development)	Idaho Power	SR 273.0	12
1967	Hells Canyon (Hells Canyon development)	Idaho Power	SR 247.6	22.3
1975	Lower Granite	Corps	SR 107.5	37
1970	Little Goose	Corps	SR 70.3	37.2
1969	Lower Monumental	Corps	SR 41.6	28.7
1962	Ice Harbor	Corps	SR 9.7	31.9
1957	McNary	Corps	CR 292	62
1971	John Day	Corps	CR 215.6	76
1960	The Dalles	Corps	CR 191.5	24
1938	Bonneville	Corps	CR 146.1	45

Notes: CR – Columbia River
SR – Snake River

To encompass these potential effects on anadromous fish, the geographic scope of our cumulative effects analysis includes the entire Snake River basin, and the mainstem lower Columbia River extending from its confluence with the Snake River to downstream of Bonneville dam.

3.2.1.4 Resident Fish

Changes in water quantity and water quality and impediments to fish migration can also affect resident fish populations in a cumulative manner. Mainstem dams on the Snake River block the upstream movement of white sturgeon, which historically were able to migrate throughout much of the Snake and Columbia rivers and their major tributaries to access suitable spawning habitats and to take advantage of seasonally abundant food resources. Project peaking operations may affect resident fish habitat extending downstream to Lower Granite reservoir, including bull trout and redband trout that use tributary habitats for spawning and summer rearing. Water quality conditions in the middle and lower Snake River that may affect the reproductive success of white sturgeon and the distribution of native resident salmonids are affected by nutrient loads and elevated water temperatures in tributaries, as well as irrigation return flows, which occur primarily from Milner dam (RM 639) downstream. Considering these factors, the geographic scope for our cumulative effects analysis on resident fish includes the Snake River extending from Milner dam to the upstream limit of Lower Granite reservoir, as well as the tributaries that enter this section of the river.

3.2.1.5 Federally Listed Aquatic Mollusks

In Scoping Document 2, we stated that we would analyze project effects on macroinvertebrates, including federally listed mollusks, and we noted that we had requested additional surveys to evaluate the presence or absence of listed, rare, or sensitive mollusks. Idaho Power filed the results of these additional surveys on February 3, 2005. Idaho Power's surveys did not identify any federally listed mollusks within the section of the Snake River that may be affected by operation of the project, so we do not assess cumulative effects on federally listed mollusks. We do, however, summarize the results of Idaho Power's invertebrate surveys and project effects on invertebrates, including mollusks, in section 3.6, *Aquatic Resources*.

3.2.1.6 Riparian/Wetland Habitat

Riparian and wetland habitats in the semi-arid west have high ecological value because they support unique microclimates and plant communities; provide foraging, cover, and movement corridors for wildlife; and contribute to landscape diversity. The characteristics of geology, soils, and climate in the region limit the extent of these habitat types, and in both Idaho and Oregon, they comprise only about 2 percent of the landscape (Scott et al., 2001; USGS, 2005a).

The most dramatic effects on Snake River riparian and wetland habitats occurred in the late 1800s and early 1900s when homesteaders first settled in the Snake River basin. Cattle and sheep congregated along streams and rivers, trampling banks and destroying vegetation. Mining, irrigation withdrawals, and the near-total eradication of beavers compounded these adverse effects. The first dam on the Snake River was constructed in 1904, and since that time 25 other dams have been constructed in the Snake River System upstream of Hells Canyon dam. The dams inundated upstream riparian and wetland habitats and altered hydrologic support for downstream habitats.

Under current conditions, many of the same factors continue to affect riparian and wetland habitats, but trends are more positive. Management of grazing and mining on federal lands has improved, and several federal and state programs now provide incentives for protection of riparian habitat on private lands. New licenses for the mid-Snake hydroelectric projects contain provisions designed to reduce or mitigate the effects of reservoir fluctuation and peaking operations on riparian and wetland habitats.

The effects of relicensing the Hells Canyon Project on riparian and wetland habitats may overlap geographically with the effects of the actions described above. For this reason, we consider the Snake River basin as the geographic area for our cumulative effects analysis.

3.2.1.7 Native Grasslands and Shrublands

Compared to riparian and wetland habitats, native grasslands and shrublands support relatively few plant and animal species. However, they provide critical habitat for a number of species that are found nowhere else (Vander Haegen et al., 2001). Although native grasslands and shrublands remain abundant in Idaho and Oregon, several factors have reduced the quantity and quality of these cover types since European settlement. These include conversion to agricultural land uses, overgrazing, urbanization, fragmentation, inundation as a result of dam construction, invasion by exotic invasive plants, and an altered fire disturbance regime.

The effects of relicensing the Hells Canyon Project on native grasslands and shrublands may overlap with the effects of past, current, and reasonably foreseeable future actions described above. For this reason, we consider the Snake River basin as the geographic area for our cumulative effects analysis.

3.2.1.8 Noxious Weeds and Invasive Exotic Plants

Noxious weeds and invasive exotic plants are a growing problem throughout the western states, including Idaho and Oregon (ODA, 2001; IWCC, 2005). Estimates for Idaho indicate that more than 8 million acres are severely infested with at least 1 of the 36 state-designated weeds (IWCC, 2005). In Oregon, three species alone infest more than 5.4 million acres (ODA, 2001). Noxious weeds and invasive exotic plants degrade native plant communities, out-compete rare species, and reduce wildlife habitat values.

Several factors contribute to the establishment and spread of weeds, including soil and vegetation disturbance resulting from construction, timber harvest, offroad vehicle use, fire, flooding, erosion, and overgrazing. Vehicles, heavy equipment, domestic animals, and human beings then serve as vectors for the spread of weeds. As weed populations expand, they alter the environments they occupy, which promotes further spread.

The effects of actions taken in the Hells Canyon Project area may overlap with the effects of action taken on adjacent ownerships because weeds tend to spread across property boundaries. For this reason, we use the Snake River basin as the geographic extent of our cumulative effects analysis.

3.2.1.9 MacFarlane's Four-o'clock

MacFarlane's four-o'clock (*Mirabilis macfarlanei*) is federally listed as an endangered species (44 FR 209). It is known only from the Snake River downstream of Hells Canyon dam and a few sites in the Imnaha River and Salmon River basins (61 FR 52). Past, present, and future actions that could affect habitat for this species include instream flow regulation; conversion of native plant communities to agricultural, ranching, or residential use; trespass grazing; and construction, maintenance, and traffic on roads and trails.

Project-related actions that may affect MacFarlane's four-o'clock occurrences in the Snake River could affect a large proportion of the total population. For this reason, we evaluate cumulative effects on MacFarlane's four-o'clock within the species' range.

3.2.1.10 Bald Eagles and Peregrine Falcons

For the bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus anatum*), we evaluate cumulative effects using the same geographic extent selected during relicensing of the mid-Snake projects, i.e., the Snake River basin. Although the range of both species extends far beyond the Snake River basin, this area is adequate to allow for a comparison of potential project effects with the effects of past, current, and reasonably foreseeable future actions on the bald eagle and peregrine falcon.

Bald eagle populations throughout the United States have been increasing during the past 25 years as a result of habitat protection and restrictions on the use of DDT and other pesticides (FWS, 2005a). Surveys in Idaho recently documented the largest number of occupied nests and the highest levels of productivity on record for the state (Sallabanks, 2005). Although the number of nests in some zones is below the recovery goal identified in 1986 (FWS, 1986), the overall goals for the state have been met and exceeded. With the discovery of four new nests since 2003, Zone 14 (which encompasses the Hells Canyon Project area) has met the recovery target of six active nesting territories (Carpenter and Holthuijzen, 2006). The number of wintering bald eagles in the state is also increasing (Steenhof et al., 2004).

Peregrine populations in the United States are also increasing (FWS, 2003a). Restrictions on organochlorine pesticides improved the reproductive rate of surviving wild pairs, and an aggressive re-introduction program led to successful recolonization of many historical and several new sites (64 FR 164). As of 2006, Idaho supported 34 occupied territories (Sallabanks, 2006), and Oregon reported 124 in 2005 (Peterson, 2006), well above recovery goals of 30 and 17, respectively (63 FR 165). Idaho Power documented an occupied eyrie near Hells Canyon dam in 1996 (Akenson, 2000). One young fledged from the nest in 1996. Although surveyors observed adult peregrines in the vicinity from 1997 through 2000, Idaho Power reports that nest success could not be confirmed.

3.2.1.11 Recreational Resources

Flows from the Hells Canyon Project influence boating, angling, and other recreational use of the Snake River downstream of the Hells Canyon dam and outside of the project boundary. Flows from the project may affect the amount, timing, type, location, and quality of recreational use in the Hells Canyon National Recreation Area (HCNRA). For example, boaters accessing the upper portion of the Hells Canyon require certain minimum flows to navigate Granite Creek and Wild Sheep rapids. Also, demand for riverine recreational opportunities is typically associated with summer and fall months. Changes in the timing and magnitude of releases from the project as a result of relicensing could limit or enhance recreational opportunities for different types of boaters accessing this portion of the canyon.

Increased recreational use of the canyon resulting from changes in project operations could also have secondary effects on the quality of the recreational experience in the HCNRA. For example, increased boating activity may result in user conflicts between power and float boaters trying to access limited camping sites or run congested rapids. In addition, additional recreational use of the HCNRA could affect cultural sites and sensitive riparian habitats associated with more visitors accessing these areas.

In contrast, it is possible that changes in project operations could reduce recreational opportunities in the HCNRA by altering flows in a manner that may not support current demand for the timing and type of recreational use in the HCNRA. Such changes could result in displaced demand for boating and angling opportunities to other western rivers. A reduction in recreational opportunities could result in a decline in commercial boater and angler revenues that could adversely affect communities surround the project that receive economic benefits from supporting recreational use of the HCNRA.

These positive or negative effects could be incrementally small, but could accrue over the term of any new license for the project. To consider these potential cumulative effects on recreational use downstream and outside of the project boundary, the geographic scope of our cumulative effects analysis includes the Snake River from the Hells Canyon dam downstream to the northern end of the HCNRA.

3.2.2 Temporal Scope

The temporal scope of our cumulative analysis in this environmental document includes past, present, and future actions and their possible cumulative effects on each resource. Based on the license term, the temporal scope will look 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource.

3.3 WATER QUANTITY

3.3.1 Affected Environment

The Hells Canyon Project covers more than 96 river miles of the Snake River from RM[29] 343 just above the upstream margin of Brownlee reservoir to RM 247 just downstream of Hells Canyon dam. Points of reference relevant to water quantity issues include upstream dams, project features, Snake River tributaries, stream gages, and other key locations (table 4, figure 8).

Table 4. Key features along the main stem of the Snake River. (Source: Idaho Power, 2003a; USGS, 2005b)

Location	**Snake River Mile**	**Drainage Area (square miles) (if available)**
Swan Falls dam	458	
USGS Gage No. 13172500, Snake River near Murphy	453.5	41,900
Walters Ferry	444	
Boise River	394	
USGS Gage No. 13213100, Snake River at Nyssa	385.2	58,700
Payette River	365.5	
Weiser River	351.8	
USGS Gage No. 13269000, Snake River at Weiser	351.3	69,200
Brownlee reservoir upstream end	339.2	
Huntington/Marsing	328	
Burnt River	327	
Powder River	296	
USGS Gage No. 13289700, Brownlee reservoir at Brownlee dam	285	72,590
Brownlee dam	284.6	
Oxbow reservoir upstream end	284.6	
Wildhorse River	283.3	
Oxbow dam	272.5	
Hells Canyon reservoir upstream end	272.5	
Indian Creek	271.3	
Pine Creek	271	
Hells Canyon dam	247.6	
USGS Gage No. 13290450, Snake River at Hells Canyon dam	247	73,300
Johnson Bar	230	

29 River miles are measured moving upstream from the mouth of the Snake River at its confluence with the Columbia River in Washington.

Location	Snake River Mile	Drainage Area (square miles) (if available)
USGS Gage No. 13290460, Snake River at Johnson Bar	229.9	73,400
Pittsburg Landing	215	
Imnaha River	191.6	
Salmon River	188.2	
USGS Gage No. 13317660, Snake River below McDuff Rapids, at China Gardens, Idaho	175.7	
Lime Point	172	
Grande Ronde River	168.7	
USGS Gage No.13334300, Snake River near Anatone	167.2	92,960

In this section, we describe inflows to the project, the three project reservoirs, and flows downstream of Hells Canyon dam. Additionally, we discuss navigation, flood control, and water rights.

3.3.1.1 Surface Water

In estimating the quantity of water entering the Hells Canyon Project, Idaho Power starts with the flows passing the Snake River at the Weiser Gage (U.S. Geological Survey [USGS] Gage No. 13269000) located at RM 351 (USGS, 2005c), and then makes adjustments to account for accretion flows downstream of the Weiser Gage based on flows from the Wildhorse River at Brownlee dam (USGS Gage No. 13289960), Pine Creek near Oxbow, Oregon (USGS Gage No. 13290190), and the Snake River at Hells Canyon dam (USGS Gage No. 13290450). In making inflow estimates, Idaho Power also takes into account any changes in reservoir content.

Brownlee Inflows

Idaho Power uses the inflow estimates to evaluate current conditions and potential alternative operations. Since hydrologic conditions vary greatly from one year to the next, Idaho Power selected five representative years spanning a variety of water conditions. The five representative calendar years and the corresponding hydrologic conditions are 1992 (extremely low); 1994 (medium-low); 1995 (medium); 1999 (medium-high); and 1997 (extremely high). For each representative water condition, figure 9 displays the seasonal variability of inflows to the project. Average daily inflows to Brownlee reservoir during the five representative years ranged from a low of 4,712 cfs to a high of 93,029 cfs and averaged 19,681 cfs.

To provide the reader with an estimate of the frequency of each of these years[30] we plotted inflows on the flow duration curve and obtained an estimate of the percent exceedance associated with each inflow value. The percent exceedances for each representative condition are summarized in table 5.

[30] Page 146 of Idaho Power's January 31, 2007, section 401 application includes table 6.1-4, which provides the latest information on Brownlee inflows from Idaho Power's modeling efforts. Additionally, figure B-3 on page B-33 of the final license application includes a flow duration curve. This information was used to develop frequency estimates.

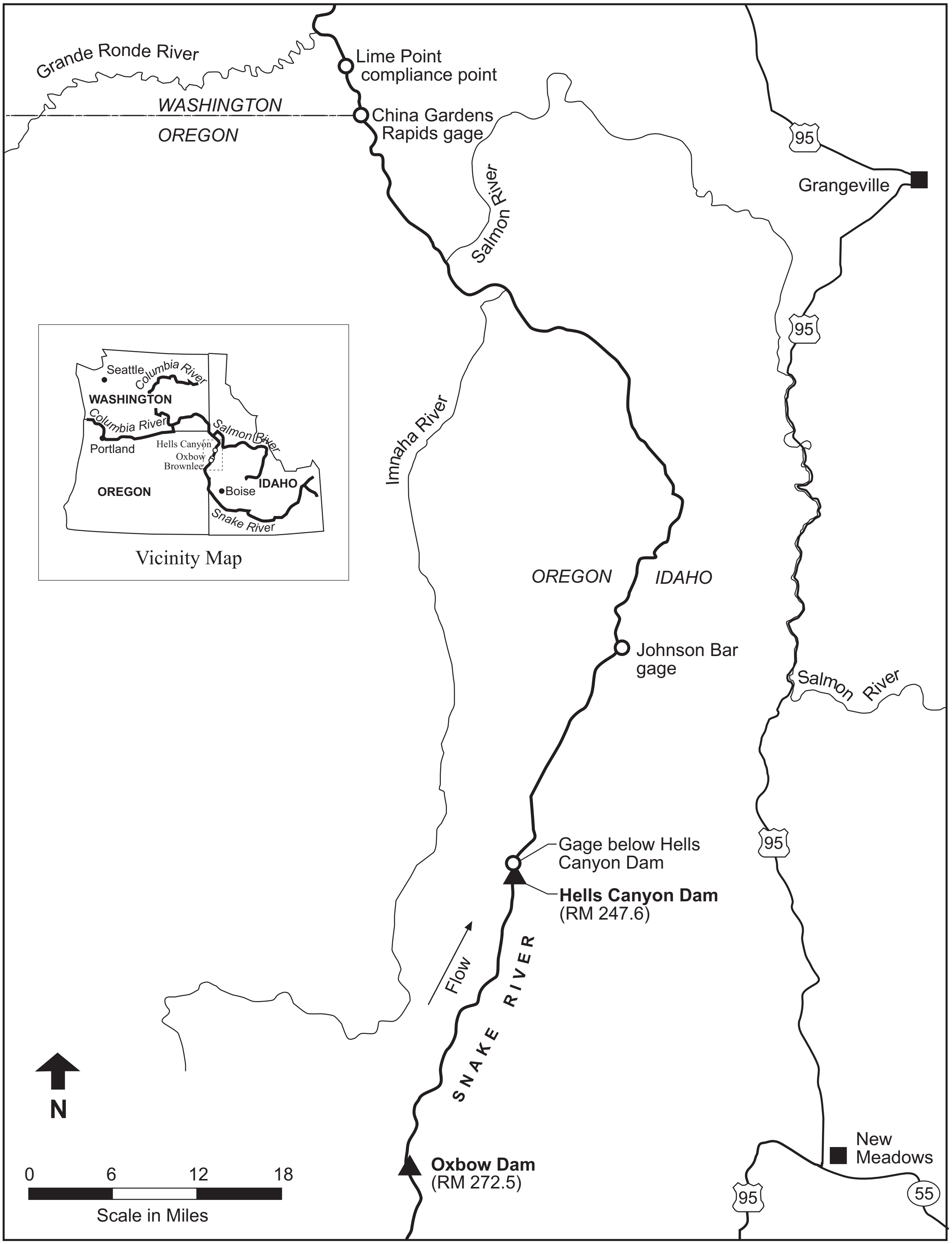
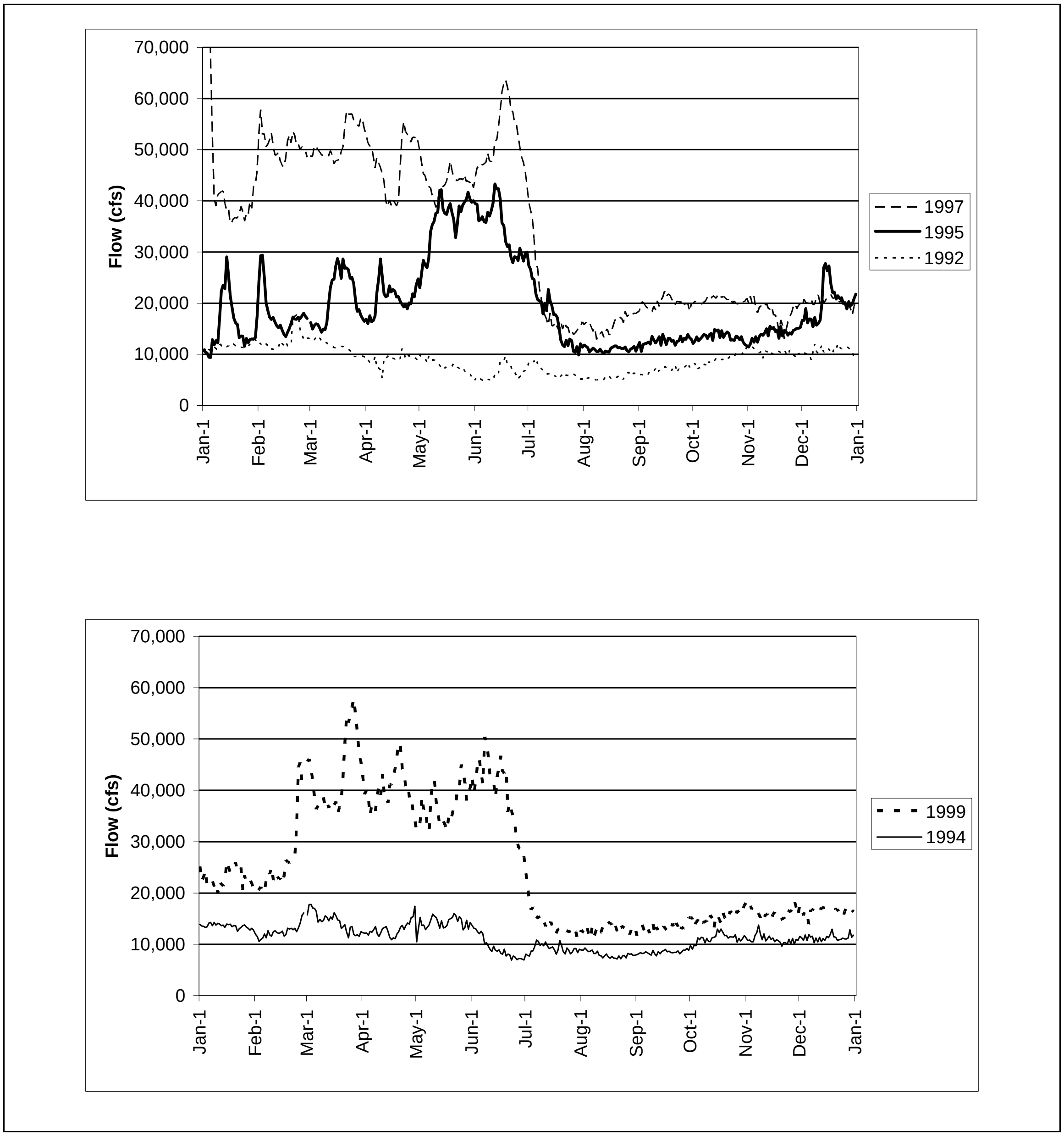


Figure 8. Selected USGS gage locations downstream from Hells Canyon dam. (Source: Staff)



[a] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Figure 9. Comparison of Brownlee reservoir inflows under extremely high (1997), medium (1995), extremely low (1992), medium-high (1999) and medium-low (1994)[a] water conditions. (Source: Idaho Power, 2004)

Table 5. Frequency of annual inflows to Brownlee reservoir for five representative years. (Source: Idaho Power as modified by staff)

Year	Water Condition	Average Annual Inflow (cfs)	Percent Exceedance
1992	Extremely low	8,400	18
1994	Medium low	10,800	28
1995	Medium	17,500	42
1999	Medium high	22,900	85
1997	Extremely high	31,300	97

As shown here, only about 18 years in 100 would be as dry or drier than 1992. Only about 3 years in 100 would be expected to be as wet or wetter than 1997

Tributaries

Several major tributaries flow into the Snake River and project reservoirs within the project boundary; these are the Burnt River, Powder River, Brownlee Creek, Wildhorse River, Indian Creek, and Pine Creek (refer to table 18). The Weiser River flows into the Snake River just above Brownlee reservoir, and Granite Creek enters the Snake River 8.6 miles downstream of Hells Canyon dam. Deep Creek is the first perennial tributary downstream of Hells Canyon dam, entering the river just downstream of the dam on the Idaho side of the river. We characterize the drainage areas and key flow parameters for major tributaries in table 18 (see section 3.5.1.2, *Temperature*).

Reservoirs

The physical characteristics of the three project reservoirs are described in table 6. Brownlee reservoir is the dominant storage feature, accounting for more than 86 percent of the project's total water storage.

Table 6. Physical characteristics of Brownlee, Oxbow, and Hells Canyon reservoirs. (Source: Idaho Power, 2003a)

Characteristics	Brownlee Reservoir	Oxbow Reservoir	Hells Canyon Reservoir
Drainage basin area (square miles)	72,590	72,800	73,300
Surface area (acres)	15,000	1,150	2,412
Length (river miles)	58	12	25
Shoreline perimeter (miles)	193	26	56
Total volume (acre-feet)	1,420,000	57,500	170,000
Full pool (feet msl)	2,077	1,805	1,688
Minimum pool (feet msl)	1,976	1,800	1,683

Characteristics	Brownlee Reservoir	Oxbow Reservoir	Hells Canyon Reservoir
Mean depth (feet)	100	50	70
Maximum depth (feet)	300	81	245
Mean width (feet)	2,242	795	1,000
Average retention time (days)[a]	36	1.4	4
Penstock centerline elevation (feet msl)	1,948	1,750	1,571.5
Maximum powerhouse discharge (cfs)	35,000	28,000	30,500

[a] Based on a typical inflow of 20,000 cfs. For Brownlee reservoir, we computed retention time as 36 days, not the 34 days reported by Idaho Power.

Brownlee Reservoir

Brownlee reservoir fluctuates over a range of 101 feet from elevation 1,976 feet msl to 2,077 feet msl. Typically, the minimum lake elevation occurs during the late winter to early spring period as the reservoir is lowered (or, "drafted") to provide flood storage capacity (see *Flood Control* section below). Drafting to achieve this objective begins in mid-January under the Corps' direction. The Corps requires that the reservoir be no higher than elevation 2,034 feet msl[31] by March 1 each year. Additional storage to manage flooding in the Columbia River may also be required by the Corps. Over the five representative years, minimum elevations during this period ranged from 2,022.57 feet msl to 2,076.85 feet msl as shown in figure 10.

Navigation needs also enter into Idaho Power's management of outflow from Hells Canyon dam; navigation needs are discussed further in section 3.3.1.3, *Navigation*.

The project as a whole, including the water released from Hells Canyon dam, is operated such that a one-foot per hour ramping rate is maintained at Johnson Bar, located about 18 miles downstream of Hells Canyon dam at RM 230.

Refill of Brownlee reservoir occurs during the spring and summer months and varies depending on the allowable reservoir elevations required by the Corps. Typically Idaho Power attempts to refill Brownlee reservoir by the end of June. Maintenance of minimum instream flows below Hells Canyon dam may also affect refill. During the months of July and August, historical reservoir elevations ranged from 2,045.50 feet msl to 2,076.85 feet msl over the five representative years.

Over the 6-year period from 1995 through 2001, Brownlee reservoir storage was used to provide up to 237,000 acre-feet of water during the summer months for flow augmentation to assist with the outmigration of juvenile salmon and steelhead from the lower Snake River under an energy exchange agreement with the Bonneville Power Administration and cooperative agreement with federal wildlife agencies involved in the Federal Columbia River Power System (USGS, 2005d). After 2001, Idaho Power and Bonneville Power were unable to come to terms on a new energy exchange agreement and the program was discontinued. In January 2005, the Interim Agreement under the Hells Canyon

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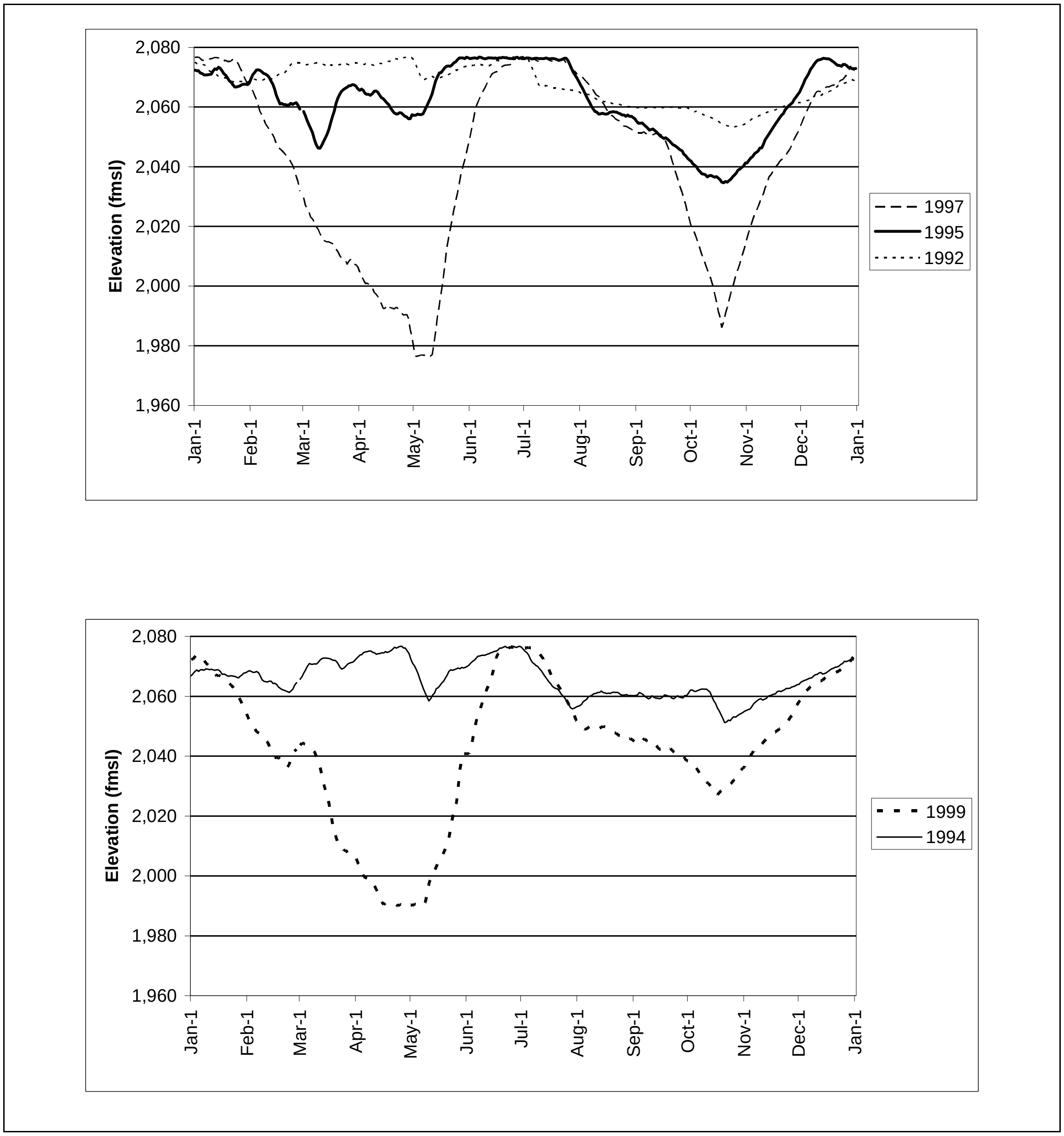
[31] This corresponds to an available storage of 500,000 acre-feet for flood control.



[a] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Figure 10. Comparison of Brownlee reservoir average daily elevations under extremely high (1997), medium (1995), extremely low (1992), medium-high (1999) and medium-low (1994)[a] water conditions. (Source: Idaho Power, 2004)

Hydroelectric Project Settlement Process became effective. Under the terms of the Interim Agreement, Idaho Power agreed to make best efforts to hold Brownlee reservoir at or near full elevation (about 2,077 feet msl) through June 20 each year, and thereafter, subject to certain conditions, to draft Brownlee reservoir to elevation 2,059 feet msl, effectively releasing up to 237,000 acre-feet of water for flow augmentation by August 7 each year (Idaho Power, 2005a).

In September, Brownlee reservoir is once again drafted to provide storage of inflows above required releases to support the upcoming fall Chinook spawning period. A relatively constant flow, normally between 8,000 cfs and 13,000 cfs, is maintained downstream of Hells Canyon dam to ensure that fall Chinook salmon construct their redds below a certain target flow elevation. Inflows in excess of these releases are stored in Brownlee reservoir.

Once the fall Chinook spawning period ends in early December, Idaho Power attempts to maintain the Snake River downstream of Hells Canyon dam at or above the flow target selected in the preceding fall. Under moderate and higher inflow conditions, target flows are maintained without further drafting of Brownlee reservoir. Under drier conditions, Brownlee reservoir may need to be drafted to provide the minimum target flow downstream of Hells Canyon dam. The annual Brownlee reservoir operations cycle then repeats beginning in mid-January as Brownlee reservoir is drafted in preparation for the next flood control season.

Oxbow Reservoir

Oxbow reservoir fluctuates over a range of 5 feet, from elevation 1,800 feet msl to 1,805 feet msl. Reservoir fluctuations tend to be short-term, even daily, rather than seasonal. As flows are ramped up each day in response to regional demands for electricity, the Oxbow pool is drawn down. As power demand wanes in the late evening, the flow through the Oxbow powerhouse is reduced or eliminated, allowing the Oxbow reservoir to refill in preparation for the next day's heavy load period.

As required by the current license, Idaho Power maintains a minimum 100-cfs flow in the Oxbow bypassed reach, between the Oxbow dam and the powerhouse tailrace.

Hells Canyon Reservoir

Hells Canyon reservoir normally fluctuates over a range of 5 feet, from elevation 1,683 feet msl to 1,688 feet msl. It has a potential minimum operating level of 1,678 feet msl. Reservoir fluctuations tend to be short-term, often daily, rather than seasonal. During low flow periods, ramping constraints below Hells Canyon dam may limit how much powerhouse flows and reservoir pool levels fluctuate.

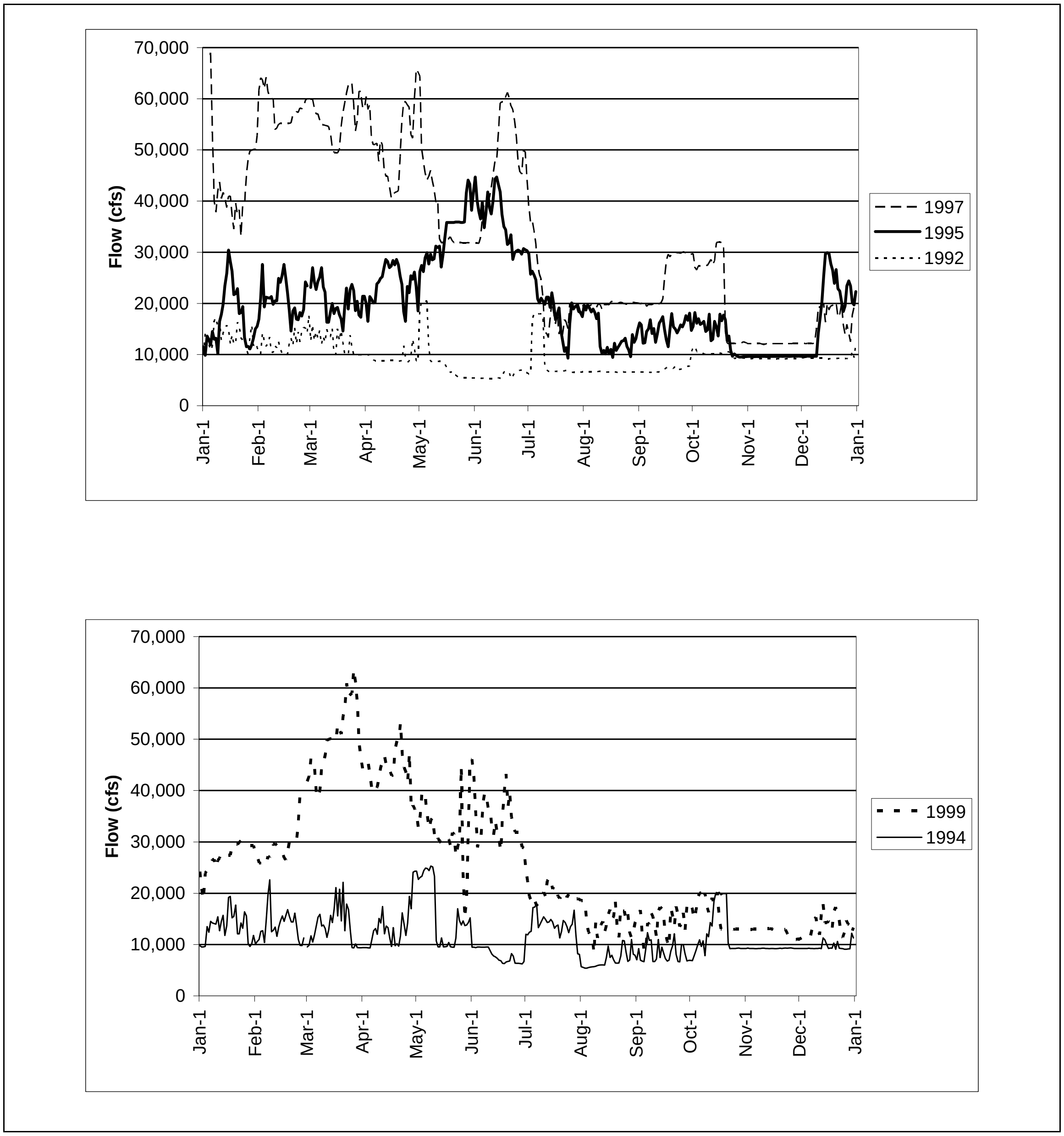
Snake River Downstream of Hells Canyon Dam

Seasonal flows downstream of Hells Canyon dam respond to operations at Brownlee reservoir, as described above. Fall Chinook salmon flow requirements, navigation flow requirements, and ramping rate restrictions have particular influence. Average daily outflows downstream of Hells Canyon dam reservoir during the 5 representative years ranged from a low of 6,960 cfs to a high of 98,100 cfs and averaged 20,741 cfs (figure11). Flows intended to benefit fall Chinook salmon, steelhead, and other fisheries are described in more detail in section 3.6, *Aquatic Resources*.

3.3.1.2 Flood Storage

Idaho Power operates Brownlee reservoir to provide springtime flood control for the lower Columbia River and, if necessary, the lower Snake River under the direction of the Corps. The goal of flood control at Brownlee reservoir is to control major floods so that flows do not exceed 600,000 cfs in the lower Columbia River at The Dalles (RM 188.9) and 400,000 cfs in the mid-Columbia near Hanford, Washington,[32] although flood control at Hanford is usually incidental to what is being targeted at The Dalles. Since Brownlee reservoir initially filled in May 1958, the highest peak flow at The Dalles was

[32] Flow into the Hanford Reach is based on USGS measured flow at Gage No. 12472800, Columbia River below Priest Rapids Dam at RM 394.5.



[a] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Figure 11. Comparison of Hells Canyon outflows (USGS Gage No. 13290450, Snake River at Hells Canyon dam, Idaho-Oregon state line) under extremely high (1997), medium (1995), extremely low (1992), medium-high (1999) and medium-low (1994)[a] water conditions. (Source: Idaho Power, 2004)

699,000 cfs on June 8, 1961.[33] This flood would be lower under today's conditions owing to construction of additional flood control storage under the Columbia River Treaty. The Hells Canyon gage, activated in July 1965, recorded a peak flow of 103,000 cfs on January 2, 1997. The peak inflow to the project (Snake River at Weiser) during this event was 84,100 cfs on January 3, 1997 (USGS, 2005b).

Under the current FERC license, Brownlee reservoir is drawn down to elevation 2,034 feet msl or below in order to provide 500,000 acre-feet of storage space for flood control. By March 31 each year, up to an additional 500,000 acre-feet may be required by the Corps if necessary. Following a period of analysis and revision to flood control rule curves in the 1980s, the Corps implemented a modified rule curve procedure in 1998. Table 7 summarizes the required flood control storage space at Brownlee reservoir as a function of inflow volume forecast at The Dalles and inflow forecast into Brownlee reservoir. Values are interpolated between the various points in the table in accordance with the procedures outlined in Idaho Power (2003a). Flood control requirements for Brownlee reservoir can extend through June, and Idaho Power may have to spill at any or all three project developments (Brownlee, Oxford, and Hells Canyon) to achieve flood control storage objectives.

Table 7. Required flood control draft at Brownlee reservoir based on November 1998 rule curve. (Source: Idaho Power, 2003a)

	Inflow Volume Forecast[a]			
Date	**The Dalles <=75 MAF**			
Storage Space Required	**Brownlee Inflow (≤ 3 MAF)**	**Brownlee Inflow (= 4 MAF)**	**Brownlee Inflow (= 5 MAF)**	**Brownlee Inflow (≥ 6 MAF)**
February 28	0	200	300	400
March 31	0	100	200	350
April 15	0	50	150	250
April 30	0	0	50	150
	The Dalles = 85 MAF			
Storage Space Required	**Brownlee Inflow (≤ 3 MAF)**	**Brownlee Inflow (= 4 MAF)**	**Brownlee Inflow (= 5 MAF)**	**Brownlee Inflow (≥ 6 MAF)**
February 28	150	300	350	400
March 31	100	300	400	450
April 15	50	250	400	500
April 30	0	250	400	500
	The Dalles = 95 MAF			

[33] This flood event was not particularly severe on the Snake River because the maximum flow of the Snake River near Anatone was 84,900 cfs on June 3, 1961, compared to the record flow of 195,000 cfs on June 18, 1974.

	Inflow Volume Forecast[a]			
Storage Space Required	**Brownlee Inflow (≤ 3 MAF)**	**Brownlee Inflow (= 4 MAF)**	**Brownlee Inflow (= 5 MAF)**	**Brownlee Inflow (≥ 6 MAF)**
February 28	200	300	350	400
March 31	150	300	400	500
April 15	100	300	425	550
April 30	50	300	450	600
	The Dalles = 105 MAF			
Storage Space Required	**Brownlee Inflow (≤ 3 MAF)**	**Brownlee Inflow (= 4 MAF)**	**Brownlee Inflow (= 5 MAF)**	**Brownlee Inflow (≥ 6 MAF)**
February 28	300	400	400	400
March 31	200	425	475	500
April 15	150	450	525	600
April 30	100	450	550	700
	The Dalles ≥ 115 MAF			
Storage Space Required	**Brownlee Inflow (≤ 3 MAF)**	**Brownlee Inflow (= 4 MAF)**	**Brownlee Inflow (= 5 MAF)**	**Brownlee Inflow (≥ 6 MAF)**
February 28	300	400	500	500
March 31	250	450	600	750
April 15	200	500	650	850
April 30	150	550	750	980

Note: MAF – million acre-feet

[a] The inflow forecast period is April through July. The inflow forecast is partially based on observed flows on April 15 and 30.

3.3.1.3 Navigation

Article 43 of the current license states that the project is to be operated in the interest of navigation downstream of Hells Canyon dam to maintain a flow of 13,000 cfs in the Snake River at Lime Point (RM 172) at least 95 percent of the time, when determined by the Corps to be necessary for navigation. Regulated flows of less than 13,000 cfs are limited to the months of July, August, and September, during which time the project is to be operated in the best interest of power and navigation, as mutually agreed to by Idaho Power and the Corps. The minimum flow during periods of low flow or normal minimum plant operations is to be 5,000 cfs at Johnson Bar (RM 230), at which point the maximum variation in river stage is not to exceed 1 foot per hour. In September 1988, the Corps and Idaho Power agreed to maintain a higher minimum of 6,500 cfs downstream of Hells Canyon dam. Brownlee reservoir is not drafted to meet either the 6,500 or 13,000 cfs flow targets. Inflow is passed when flows are below 6,500 cfs.

In 2001, under a voluntary agreement with the Corps and the Northwest Professional Power Vessel Association (NPPVA), Idaho Power began providing timed releases of 8,500 cfs below Hells Canyon dam, while maintaining a floor of 6,500 cfs. The timed-release schedule was refined for the summer of 2002, and Idaho Power generally followed it through July of 2006. Timed releases, or pulses, for boating purposes are complicated by the travel time of the pulses from the point of release at the Hells Canyon dam to the various rapids downstream. Releases arrive sooner and are more effective at locations closer to the dam. For example, it takes about 3 hours for a release to arrive at Wild Sheep Rapids, but as many as 16 hours to arrive at McDuff Rapid. At Wild Sheep Rapids the flow is almost identical to the pulsed release, while at McDuff, the pulse is attenuated, or flattened, due to the distance traveled and the intervening flow contribution by tributaries.

Additional information about recreational boating use downstream of Hells Canyon dam is provided in section 3.10.1.1, *Regional Recreational Setting*.

3.3.1.4 Water Rights

Idaho Power operates the project under water rights from both the state of Idaho and the State of Oregon. Table 8 summarizes the water rights for the project. Idaho Power (2003a) provides detailed information about non-project related water rights within the project boundary.

Table 8. Project-related water rights for the Hells Canyon Project. (Source: Idaho Power, 2003a)

No.	Expiration Date (If Applicable)[b] or Priority Date	Development or Location Description	Description	Use(s)
Oregon License No. HE 161	Expires December 31, 2011	Oxbow	26,500 cfs	Hydroelectric generation
Oregon License No. HE 188	Expires December 31, 2010	Brownlee	24,500 cfs and storage up to 1,500,000 acre-feet of which 1,000,000 acre-feet are useable.	Hydroelectric generation
Oregon License No. HE 189	December 31, 2017	Hells Canyon	27,000 cfs and storage up to 183,000 acre-feet of which 12,000 acre-feet are useable.	Hydroelectric generation
Oregon Water Right 50644	December 9, 1988	Overall project boundary	0.22 cfs	Irrigation
Oregon Water Right 50570	February 24, 1986	Overall project boundary	0.20 cfs	Domestic
Oregon Water Right 30551	March 10, 1960	Overall project boundary	0.20 cfs	Domestic/ irrigation
Oregon Water Right Bake 242	May 29, 1987	Overall project boundary	0.77 cfs	Domestic
Oregon Water Right Bake 243	June 1, 1987	Overall project boundary	0.35 cfs	Domestic
Oregon Water Right 72198	1878	Overall project boundary	0.69 cfs	Irrigation

No.	Expiration Date (If Applicable)[b] or Priority Date	Development or Location Description	Description	Use(s)
Oregon Water Right 72611	May 31, 1947	Overall project boundary	1.29 cfs	Irrigation
Oregon Water Right 63298	August 13, 1981	Overall project boundary	130.0 cfs	Fish ladder and attraction for trapping
Oregon Water Right 12778	April 22, 1992	Overall project boundary	0.29 cfs	Fish propagation
Oregon Water Right 15318	November 6, 2000	Overall project boundary	1.80 cfs	Fish propagation
Idaho Water Right 03-10162	May 20, 1960	Overall project boundary	0.086 cfs from Snake River	Irrigation
Idaho Water Right 03-10168	December 31, 1959	Overall project boundary	0.12 cfs from Snake River	Irrigation
Idaho Water Right 69-07098	June 12, 1989	Overall project boundary	0.50 cfs from groundwater	Domestic
Idaho Water Right 69-11490	December 10, 1974	Overall project boundary	0.04 cfs from groundwater	Domestic
Idaho Water Right 03-7063	September 23, 1996	Overall project boundary	0.06 cfs from Snake River	Irrigation
Idaho Water Right 03-10167	December 1, 1967	Overall project boundary	0.20 cfs from Snake River	Irrigation
Idaho Water Right 79-13952	December 1, 1967	Overall project boundary	0.02 cfs from spring	Irrigation
Idaho Water Right 79-13953	December 1, 1967	Overall project boundary	0.04 cfs from groundwater	Domestic

[a] The Idaho Power response to OWRD1 is used in particular.

[b] Idaho Power is in the process of re-applying for the Oregon water rights under the State's Hydropower Application Review Team (HART) Process and is providing updated information on the description of those rights via that process.

Additionally, two important regional processes affect water rights in the project vicinity. Under the Swan Falls Agreement.[34] signed in October 1984, Idaho Power agreed to subordinate its Swan Falls water rights along with the water rights of its other projects located along the Milner-to-King Hill reach of the Snake River to specific flow levels that would allow for some continued and future development of water resources upstream of Swan Falls (Law Offices of Rosholt, Robertson and Tucker, 1997). The agreement is relevant to the Hells Canyon Project because flows into the project are affected by the minimum instream flows of 3,900 cfs from April 1 to October 31 and 5,600 cfs from November 1 to March 31 that are required by the agreement, as measured at Murphy (RM 453.5 near Swan Falls). Inflows to the Hells Canyon Project may be higher than would occur in the absence of the agreement.

The Swan Falls Agreement includes the following elements:

[34] Named for the Idaho Power Swan Falls Hydroelectric Project, FERC No. 503, located upstream of the Hells Canyon Project.

1. the State of Idaho will enforce the State Water Plan and assert that the Snake River is fully appropriated as necessary to enforce that plan;
2. the flows above the established minimums were placed in trust with the State of Idaho and are only to be allocated to other uses upon findings that the proposed appropriations would comply with specific regulatory provisions intended to protect Idaho Power's generation potential;
3. the State of Idaho would initiate a general adjudication of the Snake River basin; and
4. the State of Idaho would support the establishment of an effective water marketing system and recognize Idaho Power's ability to lease, purchase or otherwise acquire water from sources upstream for power generation purposes.

The second major process, which is described in item 3 above, is the Snake River Basin Adjudication (SRBA). Under the terms of the agreement there are three principal components. The Nez Perce Tribal Component quantifies the Tribe's on-reservation consumptive use reserved water right at 50,000 acre-feet per year and provides the Tribe with $60.1 million for water and fisheries purposes, including funds for land acquisition, cultural preservation, and fish related projects, and $23 million for water supply and sewer systems. It provides the Tribe with management authority of the Kooskia National Fish Hatchery and ownership of more than 11,000 acres of BLM-administered land within the reservation valued at $7 million. The second component is the Salmon/Clearwater Habitat Management and Restoration Initiative that provides for the Idaho Water Resource Board (State of Idaho) to hold minimum instream flow water rights on selected streams of importance to the Tribe. Finally, the Snake River Flow Component provides a 30-year agreement to allow the BOR to lease up to 427,000 acre feet of water per year for flow augmentation[35] and provides that the Bureau may acquire up to 60,000 acre-feet of consumptive natural flow water rights from the Snake River. Additionally, the settlement provides the Tribe with the use of 200,000 acre-feet of stored water in Dworshak reservoir for use as temperature control and flow augmentation. Finally, it includes a $12.7 million dollar fish habitat improvement fund for use in improving habitat in the Salmon and Clearwater River basins.

The SRBA District Court partially decreed federal reserved water rights for the Hells Canyon National Recreation Area and quantified the rights based on identified flows and lake levels on 32 streams and lakes. These rights are subject to subordinations to certain existing and future rights. The Court also entered a partial decree for the federal reserved water rights on six Wild and Scenic rivers and quantified the rights for each of the six rivers[36] as an instream flow amount.

3.3.2 Environmental Effects

In this section, we assess the effects of project operations on flood storage, reservoir levels, outflows from Hells Canyon dam, downstream river locations important to navigation and recreation, daily flow fluctuations downstream of Hells Canyon dam, and water rights. In our assessment, we rely on results of Idaho Power's computer simulation of the project (Bowling and Whittaker, 2005; Bowling, 2005a,b; Parkinson et al., 2005a; Idaho Power, 2005b,c; Brink and Chandler, 2005; Parkinson and Bowling, 2005).

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[35] Flow augmentation occurred throughout the middle and later 1990s on an interim basis. A nominal amount of 427,000 acre-feet per year was provided. The agreement makes this a more permanent arrangement.

[36] The six rivers include the Salmon River, Middle Fork Salmon River, Rapid River, Selway River, Lochsa River and Middle Fork Clearwater River. All are tributaries to the Snake River downstream of Hells Canyon dam.

In simulating project operations, Idaho Power used CHEOPS, a simulation model for evaluating physical and operational changes at multiple-development hydroelectric projects. CHEOPS preserves the coordination that characterizes Idaho Power's operation of the three developments. The model is driven by a calculated daily average Snake River inflow to Brownlee reservoir. Brownlee development discharges, combined with Wildhorse River flow, become inflows to the Oxbow development. Oxbow discharges combine with the Oxbow bypassed flow and Pine Creek flow to become inflows to the Hells Canyon development. The CHEOPS model consists of two separate, but linked, modules: a rule curve module and an energy module. The rule curve module uses daily average inflow, along with user-established target reservoir elevations, plant capacity, and minimum flow requirements, to calculate daily average project outflows. These daily average outflow calculations are then input into the energy module, which uses an energy load shape to produce 15-minute water releases responsive to the variation in energy demands during the course of the typical day. Further details of the model can be found in Parkinson (2003).

Idaho Power used five typical annual hydrologic conditions (or pentiles) to capture the range of operations that would occur over the term of a new license. Actual Brownlee reservoir inflows for 5 recent years were used as proxies for the five hydrologic conditions: extremely low—1992; medium-low—1994; medium—1995; medium-high—1999; and extremely high—1997 (see section 3.3.1.1, *Surface Water*).

3.3.2.1 Proposed Operations

With one exception, Idaho Power proposes to operate all three developments under the same constraints as those that characterize current operations (section 2.2.2, *Proposed Project Operations)*. The exception relates to winter flood control requirements, whereby Idaho Power would provide flood storage at Brownlee reservoir equivalent to a maximum draft rate without spill of 3 feet per day over a 2- or 3-day period, not to exceed a total of 9 feet. This provision would apply only in December and January, and it would occur only on a case-by-case request from the Corps. In light of the occasional nature of this operational constraint, it is not separately modeled in CHEOPS. Refer to this document's appendix D, *Modeled Constraints for Idaho Power Company's Proposed Operations and Operational Alternatives*, for the constraints used in simulating Idaho Power's Proposed Operations.

At the request of Commission staff, Idaho Power evaluated differences between modeled Proposed Operations and actual historical flow and reservoir data reflective of Current Operations (Bowling, 2004). Because of the complex nature of simulation modeling of a multi-development hydroelectric project, there will always be differences between simulated operations and actual historical operations, since modeling constraints cannot replicate the real-time decisions of the project operators. Although there are some differences between simulated and historical operations, we conclude that such differences result from the limitations of modeling, not from any substantive differences between Proposed and Current Operations. Accordingly, we consider the effects of Idaho Power's Proposed Operations to be indistinguishable from the ongoing effects of Current Operations.

3.3.2.2 Operational Recommendations and Alternative Evaluation Scenarios

In response to Commission staff's Ready for Environmental Analysis notice, we received 40 operation-related recommendations from resource agencies, tribes and other interested parties (table 9). The recommendations fall into several categories as to their primary purpose: flood control; flow augmentation/shaping; navigation; recreational access; warmwater fish spawning; fall Chinook flow program flows; Oxbow minimum flows; ramping rates; and fish stranding. Because these recommendations are directed at project operations, they could potentially affect reservoir levels and river flows.

Table 9. Operational recommendations. (Source: Staff)

Recommending Entity[a]	Recommendation Category	Recommendation
Corps-1	Flood control	The flood control draft for Brownlee in preparation of the spring runoff should be determined consistent with the November 1998 Procedure for Determining Flood Control Draft at Brownlee reservoir.
Corps-2	Flood control	For winter flood control operations, the Corps and Idaho Power would handle future winter flood control operations for Brownlee reservoir on a case-by-case basis. In the event flood control operations are necessary to control winter flood events, Idaho Power would comply with a Corps' request for storage at Brownlee reservoir equivalent to a maximum draft rate without spill of 3 feet per day over a 2- or 3-day period, not to exceed a total of 9 feet, for the months of December and January only.
CTUIR-8, NPT-6	Flood control	Idaho Power, in consultation and collaboration with the Corps, other appropriate agencies, and interested tribes, should revise flood control operations so as to shift a minimum of 110,000 acre-feet in flood control space from Brownlee reservoir to Lake Roosevelt reservoir in March-through-May period during low to average flow years, defined as water years when the January-through-July unregulated runoff is less than or equal to 28 million acre-feet at Lower Granite dam.
NMFS-18	Flood control	Idaho Power should provide shifts in flood control from Brownlee reservoir to Grand Coulee reservoir if requested by the Corps based on a determination that flood control will not be compromised. The Corps would determine the appropriate timing and amount of flood control space to accommodate the shift.
NMFS-8	Flow augmentation	Idaho Power should refill Brownlee reservoir to within 1 foot of the April 15 and April 30 minimum elevations necessary to meet the Corps' flood control requirements. After April 30, Idaho Power should coordinate the refill of Brownlee reservoir with NMFS to ensure that the refill of Brownlee reservoir does not result in any drastic reductions of spring flows as measured at Lower Granite dam.
NMFS-9	Flow augmentation	Idaho Power should refill Brownlee reservoir to full pool (elevation 2077 feet msl) by June 20 of each year, unless otherwise initially agreed to by NMFS, and subsequently agreed to by the Commission. Idaho Power should, to enhance migration conditions for juvenile fall Chinook salmon, release 237 kaf (1,000 cfs) of stored water from Brownlee reservoir (draft to elevation 2,059 feet msl) between June 21 and July 31. Idaho Power should release at least 150 kaf (draft to elevation 2,066 feet msl) of this water no later than July 15 of each year, but may maintain Brownlee elevations through the three-day Fourth of July weekend to enhance recreational use of the reservoir. Idaho Power should not refill Brownlee reservoir at any time between June 21 and August 31. Deviations from these operations may be allowed with the written consent of NMFS and subsequent approval by the Commission, or in emergency situations (e.g., regional energy related emergency or the need to protect human life).

Recommending Entity[a]	Recommendation Category	Recommendation
CTUIR-9	Flow augmentation/ fall Chinook flow program	Idaho Power, in consultation with tribal, state, and federal fisheries agencies, should investigate and implement actions to make the most efficient use of Brownlee reservoir storage to meet anadromous fish needs on an annual basis. Specifically, Idaho Power should: (1) manage Brownlee operations to draft Brownlee reservoir by May 15 for spring flows; (2) refill Brownlee reservoir by June 15 to elevation 2077 feet msl for summer flow storage for fish flows and pass remaining inflows during this period; and (3) draft Brownlee reservoir for summer flow augmentation by August 1 and then refill to a level necessary to provide minimum flows of 9,000 cfs for fall Chinook spawning and incubation downstream of the project. Such Brownlee reservoir operations should be managed annually based on a sliding scale determined by the National Weather Service's January to July runoff forecast at Lower Granite dam to provide flow augmentation for downstream anadromous fish spawning, incubation, rearing, and migration.
NPT-7	Flow augmentation/ fall Chinook flow program	Idaho Power, in consultation with state and federal fisheries agencies and tribes, should investigate and make the most efficient use of Brownlee storage to meet anadromous fish needs on an annual basis. Specifically, Idaho Power should (1) manage Brownlee reservoir operations to draft Brownlee reservoir by May 15 for spring flows; (2) refill Brownlee reservoir by June 15 to elevation 2077 feet msl for summer flow storage for fish flows and pass remaining inflows during this period; and (3) draft Brownlee for summer flow augmentation by August 1 and then refill to a level necessary to provide minimum flow of 8,500 cfs for fall Chinook spawning and incubation downstream of the project. These Brownlee reservoir operations should be managed annually based on a sliding scale determined by the National Weather Services' January-to-July runoff forecast at Lower Granite dam to provide flow augmentation for downstream anadromous fish spawning, incubation, rearing, and migration.
CTUIR-7, NPT-5	Flow augmentation	Idaho Power should maintain Brownlee reservoir at its upper flood control rule curve elevation from February 28 through April 15 each year so as to accrue additional storage to assist in meeting spring target flows for anadromous fish required by Biological Opinions for the Federal Columbia River Power System. The new license should reflect the modified flood control requirements in the most recent Corps' review of flood control and should allow for future modification of flood control requirements as determined by subsequent flood control reviews and the ongoing effects of global warming and climate change.

Recommending Entity[a]	Recommendation Category	Recommendation
AR/IRU-22	Flow augmentation/ shaping	Idaho Power should pass and shape flushing flows to aid anadromous fish outmigration. This includes the following measures: 1. Cooperate with BOR in leasing water rights for flow augmentation purposes. 2. Timely pass all upper Snake River water through the project to provide benefits to fisheries resources downstream of the project. Such pass through should take place in consultation with and subject to the approval of the appropriate tribes and state and federal agencies. 3. Use best efforts to hold Brownlee reservoir at or near full elevation through June 20, and, thereafter, draft Brownlee reservoir to elevation 2059 feet msl, releasing up to 237,000 acre-feet by August 7. 4. Cooperate with the BOR in shaping BOR storage water releases from upstream of Milner dam that cannot be delivered to Brownlee reservoir by August 31 by releasing up to 100,000 acre-feet of storage water from Brownlee reservoir from June 21 to August 31.
ODFW-32	Flow augmentation/ shaping	Idaho Power should cooperate with the BOR in leasing water rights, funded by the BOR, for flow augmentation purposes. Idaho Power should also make appropriate arrangements for passing of BOR flow augmentation water through the project. Idaho Power should shape BOR flow augmentation storage water releases from upstream of Milner dam that cannot be delivered to Brownlee reservoir by August 31, by releasing up to 100 kaf of storage water from Brownlee reservoir from June 21 to August 31 and refilling Brownlee reservoir with an equivalent amount of BOR water released for flow augmentation when that water reaches Brownlee reservoir. Idaho Power should attempt to hold Brownlee reservoir full through July 4 and thereafter coordinate releases from Brownlee reservoir, up to 237 kaf, by August 7. Idaho Power should consult with the Corps for a Brownlee reservoir target refill date of June 20, once the project is released from flood control requirements.
CTUIR-6	Flow shaping	Idaho Power should timely pass all Upper Snake River water through the project to provide benefits to fisheries resources downstream of the project, in consultation with, and subject to the approval of, the Umatilla Tribes and other appropriate tribes and state and federal agencies.
Interior-22	Flow shaping	Idaho Power should pass BOR flow augmentation water releases that reach Brownlee reservoir prior to August 29 (which assumes a 2-day routing time to Lower Granite reservoir) and shape all BOR flow augmentation water releases that do not reach Brownlee reservoir prior to August 29 (which assumes a 2-day routing time to Lower Granite reservoir).
NPT-2	Flow shaping	Idaho Power should provide timely pass through of all water released from BOR reservoirs for flow augmentation for salmon downstream of the Hells Canyon Complex (up to 427,000 acre-feet) and all natural flow rights acquired (up to 60,000 acre-feet) in the upper Snake River water through the Hells Canyon Complex by August 31 of each year. If any portion of the upper Snake River water dedicated for flow augmentation for salmon downstream of the Hells Canyon Complex in any given year is not passed through the Hells Canyon Complex, Idaho Power should release the amount not delivered in July.

Recommending Entity[a]	Recommendation Category	Recommendation
Interior-26	Recreation	Idaho Power, to the maximum extent practical, should maximize use of recreation access sites by holding Brownlee reservoir, at or near full elevation (approximately 2,077 feet msl) through June 20. The flow augmentation draft from Brownlee should stop during the Fourth of July holiday or begin after the Fourth of July holiday, if at all possible.
ODFW-51	Warmwater fish spawning	Idaho Power should operate the project for a Brownlee reservoir target refill date of June 30. Beginning on May 21, a 30-day period should be protected, during which time Brownlee reservoir should not be drafted more than 1 foot from the highest elevation reached during the 30-day period. From the end of the 30-day period through July 4, the Brownlee reservoir may be drafted more than 1 foot, but an elevation of at least 2,069 feet above mean sea level should be maintained through July 4, unless initiation of flow augmentation occurs before July 4.
NMFS-1	Fall Chinook flow program	Idaho Power should provide stable flows (i.e., no load following) downstream of Hells Canyon dam of between 8,500 and 13,500 cfs (dependent upon runoff forecasts) throughout the spawning season to ensure that spawning fall Chinook salmon redds are created at elevations that are protected during the winter peak load period. These flow restrictions should commence after the weekly spawning surveys in early October indicate that fall Chinook salmon are spawning between RM 146.8 (head of Lower Granite reservoir) and RM 247.6 (Hells Canyon dam) and continue until spawning surveys indicate that spawning is complete (typically early December). Idaho Power should monitor redds weekly and coordinate redd monitoring and project operations with NMFS and FWS to ensure that this operation remains effective for fish protection for the duration of the new license.
NMFS-2	Fall Chinook flow program	Idaho Power should provide instantaneous minimum flows downstream of Hells Canyon dam that are equal to or greater than the stable flows provided during the preceding fall Chinook salmon spawning period throughout the incubation period to protect fall Chinook salmon redds, unless NMFS agrees that shallow water redds, as identified by weekly spawning surveys and ground truthing, can be fully protected with a lower minimum flow. These flow restrictions should commence after weekly spawning surveys indicate that fall Chinook salmon spawning is complete (typically by early December) and continue through the winter and spring until the end of fry emergence, typically mid- to late May in the upper Hells Canyon reach. Idaho Power should coordinate redd monitoring and project operations with NMFS and FWS to ensure that this operation remains effective for the duration of the new license.
NPT-1	Fall Chinook flow program	Idaho Power should continue its fall Chinook flow program operation over the term of the license. This includes providing stable flows between 8,500 cfs and 13,000 cfs from Hells Canyon dam during the fall Chinook spawning period (October 1 through December 31) to protect redds from becoming dewatered. During the spawning season, Idaho Power should monitor the shallowest redds to ensure they do not become dewatered. In the event that spawning flows need to be altered, Idaho Power should report to tribal, federal, and state fisheries managers of any operational change necessary to protect redds.

Recommending Entity[a]	Recommendation Category	Recommendation
CTUIR-14, NPT-14	Flow augmentation	Idaho Power should maintain a minimum flow of 6,500 cfs immediately downstream of Hells Canyon dam and 13,000 cfs at Lime Point.
Corps-3, NPPVA-1	Navigation	Idaho Power should operate the project in the interest of navigation to maintain the following flow targets continuously throughout the year: (1) an instantaneous minimum of 8,500 cfs upstream of the mouth of the Salmon River, as measured at the Hells Canyon dam gaging station (RM 247.0); and (2) an instantaneous minimum of 11,500 cfs downstream of the mouth of the Salmon River as measured at the Snake River below McDuff Rapids gaging station (RM 175.5). If daily inflows into Brownlee reservoir drop below 8,500 cfs, Idaho Power should not be required to meet these minimum flows. When the 3-day moving average for Brownlee reservoir inflow is less than 8,500 cfs, the instantaneous minimum release required from Hells Canyon dam for the current day will be equal to the previous 3-day moving average for Brownlee reservoir inflow. When the 3-day moving average for Brownlee reservoir inflow is less than 8,500 cfs between July 1 and September 30, Idaho Power can seek a temporary variance from the Corps for the flow requirements.
FS-29	Navigation	Idaho Power should maintain a year-round minimum flow downstream of Hells Canyon dam of 8,500 cfs or project inflow (whichever is less) to provide for safe navigation for the duration of the license.
Interior-43	Oxbow minimum flows	Idaho Power should provide a conservation flow in the Oxbow bypass reach sufficient to meet state water quality standards and life history requirements for bull trout. The determination of the flow should employ state-of-the-art methodologies to determine the duration, timing, and quantity of the flow necessary to protect bull trout and provide for the movement, foraging, and rearing of adult and sub-adult bull trout in the Oxbow bypass reach between Hells Canyon reservoir and Oxbow dam, including unrestricted access to Pine and Indian creeks.
Interior-63	Oxbow minimum flows	Idaho Power should provide adequate flows and oxygen supplementation to maintain water quality parameters in the Oxbow bypass reach.
NMFS-15	Flow measurement location	Idaho Power should measure flows and ramping rates (stage height) within 1 mile downstream of Hells Canyon dam, or at the first location downstream where consistent and accurate information can be collected. At a minimum, this information should be collected at 15-minute intervals. Idaho Power should provide access to this information (both "real-time" and historical information) via the Internet.
FS-30	Ramping rate adaptive management plan	Implement a 12-year adaptive management plan to determine ramping rates based on monitoring sequential modification of: (1) the minimum flow monitoring location; (2) DO augmentation; and (3) seasonal run-of-river operation.

Recommending Entity[a]	Recommendation Category	Recommendation
Interior-66	Ramping rate adaptive management plan	Idaho Power should work with FWS to determine what operations support conservation of aquatic species downstream of the Hells Canyon dam. Toward that objective, Idaho Power should modify the operation of Hells Canyon dam to include experimental periods of various operating regimes and seasonal enhancement of DO, while assessing the effects of these changes on the lotic ecosystem and sensitive species in the Snake River of Hells Canyon. Idaho Power should, in cooperation with FWS, design and conduct monitoring programs for selected species and ecosystem processes under the current peak-loading mode of operation. Operations would be modified sequentially to assess changes in the benthic community and aquatic habitats in the Snake River downstream of Hells Canyon dam. Study design would be based on an adaptive approach where study results of the first scenario provide the basis for whether and how to evaluate the next operational scenario.
AR/IRU-25	Ramping rates	Idaho Power, in coordination with a Technical Advisory Committee, should identify and implement restrictions on a range of changes in daily maximum discharge to protect biological and other resource values in the Snake River downstream of Hells Canyon dam. The studies should be designed and evaluated by the Technical Advisory Committee. Based on the study results and the recommendation of the Technical Advisory Committee, Idaho Power should modify project operations with respect to maximum daily change in discharge at Hells Canyon dam to provide an optimal range of benefits and effects across resource values.
Corps-6	Ramping rates	The maximum variation in river stage should not exceed 1 foot per hour as measured at the Snake River at Johnson Bar gaging station (RM 230).
NPT-4	Ramping rates/effects on fish migration through Lower Granite reservoir due to Seiche (wave effect on velocities)	If flows at Lower Granite dam fall below 30,000 cfs at anytime during the juvenile fall Chinook salmon outmigration through Lower Granite dam, including fall Chinook salmon outmigrating from Clearwater River, Idaho Power should minimize ramping rates to 2 inches per hour to prevent flow fluctuations from backflow effects caused by power peaking.
AR/IRU-24	Ramping rates/fish stranding	Idaho Power, in coordination with the Technical Advisory Committee, should identify and implement a minimum flow that maintains connection to main river flow for most of the important entrapment pools identified in Idaho Power's analysis. This flow would be implemented during the fall Chinook rearing/outmigration period, which extends from late winter into the early summer.
CTUIR-10	Ramping rates/fish stranding	Idaho Power, in consultation with tribal, state, and federal fish and wildlife agencies, should restrict load following (i.e., "power peaking") during fall Chinook spawning and emergence and early rearing and when flows reach 30,000 cfs and below at Lower Granite dam. Flow fluctuations (ramping rate) from the project during these periods should vary by no more than 2 inches per hour. Idaho Power, in consultation with tribal, state, and federal fish and wildlife agencies, should establish critical flow levels for the protection of juvenile fall Chinook salmon downstream of the project to protect them from stranding and entrapment.

Recommending Entity[a]	Recommendation Category	Recommendation
AR/IRU-23	Ramping rates/fish stranding/measurement location	Idaho Power should operate under the following requirements for ramping rates in the Snake River downstream of Hells Canyon dam: 1. From October 20 to December 7, Idaho Power should continue the fall Chinook flow program (no ramping). 2. From December 8 to October 19, ramping rates should vary by no more than 2 inches per hour. 3. From March 1 to May 31, Idaho Power should monitor and identify potential stranding sites in the Snake River downstream of the project to the confluence with the Salmon River and operate the project, and/or take such other measures as may be necessary, to minimize the potential for stranding of juvenile fall Chinook salmon. Idaho Power should work with the Technical Advisory Committee to craft and implement operations to minimize stranding, including identifying and implementing minimum flows. 4. Ramping rate compliance should be measured at Hells Canyon dam, rather than 17.6 miles downstream at Johnson Bar. 5. Idaho Power, in cooperation with the Technical Advisory Committee, should develop and implement a monitoring and reporting protocol.
ODFW-33	Ramping rates/flow measurement location	Idaho Power should implement the ramping rates and minimum flows as described below. The ramping rate should be enforced below each of the three dams and apply to load following operations, as well as to project start-up and planned project shutdowns. – From December 12 through March 20, Idaho Power should use a 6-inches-per-hour ramping rate. – From March 21 through June 21, Idaho Power should use a ramping rate of 4 inches per hour and maintain a minimum flow of 11,500 cfs. – From June 22 through September 30, Idaho Power should use a 6-inches-per-hour ramping rate with a 10,000 cfs daily flow change limit. – From October 1 through October 20, Idaho Power should use a 6-inches-per-hour ramping rate. – From October 21 through December 11, Idaho Power should implement the fall Chinook flow program including no ramping. – Idaho Power should measure compliance of project operations within 1 mile of Hells Canyon dam.

Recommending Entity[a]	Recommendation Category	Recommendation
NMFS-6	Ramping rates/stranding	Idaho Power should release flows sufficient to ensure that the largest juvenile entrapment areas are reconnected with the mainstem Snake River for at least 2 hours on a daily basis, to the extent that spring flow conditions allow. In addition, when the daily average temperature in any entrapment pool exceeds 16°C for more than 3 days or when peak water temperatures in any entrapment pool exceed 18°C for more than 4 hours, Idaho Power should release stable flows of at least 11,500 cfs (unless otherwise agreed to by NMFS, and subsequently by the Commission) through the remainder of the rearing period to ensure that fish in the largest entrapment pools can readily move to the main river channel and avoid these stressful temperatures. These measures may be modified after NMFS initially approves, and the Commission subsequently approves, new operations to protect juvenile fall Chinook salmon rearing in shallow water areas downstream of the project.
NPT-3	Ramping rates/stranding	During fall Chinook rearing (April to May), Idaho Power should limit load following operations to no more than 2 inches per hour to minimize or eliminate stranding and entrapment by project operations. Idaho Power should monitor the formation of entrapment pools under this operation and if the sites form, and stranding occurs under the 2-inches-per-hour ramping rate operation, Idaho Power should reconnect the entrapment sites to the river channel twice in a 24-hour period through releases of water at Hells Canyon dam.

Notes: AR/IRU – American Rivers and Idaho Rivers United
BOR – Bureau of Reclamation
cfs – cubic feet per second
C – Celsius
Corps – U.S. Army Corps of Engineers
CTUIR – Confederated Tribes of the Umatilla Indian Reservation
DO – dissolved oxygen
FS – U.S. Forest Service
FWS – U.S. Fish and Wildlife Service
Interior – U.S. Department of the Interior
kaf – thousand acre-feet
msl – mean sea level
NMFS – National Marine Fisheries Service
NPPVA – Northwest Professional Power Vessel Association
NPT – Nez Perce Tribe
ODFW – Oregon Department of Fish and Wildlife
RM – river mile

[a] Appendix A provides a crosswalk between the alpha-numeric identifiers used throughout the EIS and the identifying numbers used by the recommending parties to identify their terms, conditions, recommendations, and prescriptions.

At the direction of Commission staff, Idaho Power simulated a set of operational scenarios, upon which the staff relied in assessing the effects of the various operation-related recommendations. We developed these scenarios based on our evaluation of comments received during the scoping process. In this final EIS, we make use of 3 alternative operational scenarios, which are as follows:

- **Scenario 1, Stabilized Hells Canyon Release**—This scenario uses the Hells Canyon reservoir to reregulate the load-following operations of the two upstream developments, thereby stabilizing the project's downstream releases. Operational flexibility to meet fluctuating load demands would be maintained at the Brownlee and Oxbow developments. We examine a range of potential downstream release stabilization levels under this scenario:
  - (a) instantaneous outflow from Hells Canyon dam equals the average inflow to the Hells Canyon reservoir during the previous 24 hours;
  - (b) maximum ramping rate of 2 inches per hour (year-round) with compliance measured at the Hells Canyon gage, located 0.6 mile downstream of Hells Canyon dam; and
  - (c) maximum ramping rate of 6 inches per hour (year-round) with compliance measured at the Hells Canyon gage, located 0.6 mile downstream of Hells Canyon dam.
- **Scenario 2, Flow Augmentation with Stabilized Release**—This scenario involves the augmentation of downstream flows using 350,000 acre-feet of Brownlee reservoir storage between June 21 and July 31 each year. The intent of this scenario is to improve anadromous fish smolt outmigration in the lower Snake River. The Brownlee reservoir target elevation would be 2,049 feet msl, and no additional water would be stored (i.e., the water surface elevation would not be raised) prior to August 31. This scenario also includes a maximum ramping rate of 2 inches per hour from March 1 through May 31) with compliance measured at the Hells Canyon gage, located 0.6 mile downstream of Hells Canyon dam. [37]
- **Scenario 3, Navigation Target Flow**—Under this scenario, Idaho Power would operate the project to maintain downstream flow targets helpful to boating. It includes: (1) an instantaneous year-round minimum flow of 8,500 cfs above the mouth of the Salmon River measured at RM 247.0, and (2) an instantaneous year-round minimum flow of 11,500 cfs downstream of the mouth of the Salmon River measured at RM 175.5. When daily flows into Brownlee reservoir drop below 8,500 cfs, the instantaneous minimum release required from Hells Canyon dam for the current day would equal the previous 3-day moving average for Brownlee reservoir inflow. At all times, the maximum variation in river stage at RM 230 would not exceed 1 foot per hour.

For further detail on how these operating scenarios were specified for evaluation purposes, refer to appendix D.

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[37] In response to our additional information request, Idaho Power submitted three related scenarios to the Commission on March 30, 2007. Scenario 7 evaluates the effect of a maximum ramping rate of 4 inches per hour from March 15 through June 15 with compliance measured at Johnson Bar. Scenario 8 evaluates the effect of downstream flow augmentation using 237,000 acre-feet of Brownlee reservoir storage. Scenario 9 combines scenarios 7 and 8. Idaho Power filed revisions to this response on April 25, 2007. The information provided by Idaho Power was primarily related to economic effects; water resources effects would be expected to follow trends similar to earlier scenarios. See appendix D for a description of all scenarios.

3.3.2.3 Flood Storage

Starting in January and through the spring, Brownlee reservoir is operated under the direction of the Corps to provide storage space for springtime flood waters. The Corps recommends that Brownlee reservoir continue to be operated in accordance with the Corps' November 1998 *Procedure for Determining Flood Control Draft at Brownlee Reservoir* (table 9, recommendation Corps-1), which requires a drawdown sufficient to provide up to 1 million acre-feet of flood storage. In addition, the Corps recommends handling winter flood control operations on a case-by-case basis, subject to certain specified maximum draft rates (table 9, Corps-2). Idaho Power's Proposed Operations incorporates these two recommendations from the Corps. The only effect relative to current operations would be occasional drawdown associated with the winter flood control operation. When requested by the Corps, Idaho Power would draft Brownlee reservoir to create flood storage. The maximum draft rate would be 3 feet per day over a 2- or 3-day period, not to exceed a total of 9 feet. This request would occur only during the months of December and January, and Idaho Power would not be required to spill to meet the Corps request. During these months, Brownlee is normally at, or near, full reservoir level (2077 feet msl). The drawdown, when requested, would lower the reservoir up to 9 feet. There are no competing reservoir uses at this time of year that would be affected by this occasional mid-winter drawdown.

NMFS (table 9, NMFS-8) recommends that Idaho Power control the level of Brownlee reservoir so as to be within 1 foot of the Corps' April 15 and April 30 target flood control elevations and then, after April 30, coordinate the refill of Brownlee reservoir with NMFS to ensure that the refill does not result in any drastic reductions of spring flows as measured at Lower Granite dam. Similarly, the Umatilla Tribes and the Nez Perce Tribe (table 9, CTUIR-7 and NPT-5, respectively) recommend that Idaho Power maintain Brownlee reservoir at its upper flood control rule curve elevation from February 28 through April 15 each year, so as to accrue additional storage to assist in meeting spring target flows for anadromous fish. The effect of these recommendations would be to somewhat limit Idaho Power's operational flexibility by requiring that Idaho Power not provide more storage capacity in Brownlee reservoir than that required by the Corps.

We address these recommendations and other recommendations that are directed at meeting spring and summer target flows for anadromous fish more fully in *Anadromous Fish Migration* in section 3.6.2.1, but we note here that a certain degree of operational flexibility is required by Idaho Power operators to ensure that the Corps' target flood control elevations are met. Further, during medium to high flow years, Brownlee reservoir is typically filling after April 30, capturing inflows as part of the springtime flood control operation. Under these circumstances, the Corps controls the rate of Brownlee reservoir's refill.

The Umatilla Tribes and the Nez Perce Tribe recommend that Idaho Power, in consultation with the Corps, interested tribes, and other appropriate agencies, revise flood control operations so as to shift a minimum of 110,000 acre-feet of flood storage space from Brownlee reservoir to Lake Roosevelt reservoir on the Columbia River in the March-through-May period during low to average flow years (table 9, CTUIR-8 and NPT-6). NMFS (table 9, NMFS-18) makes a similar recommendation but specifies that the timing and amount of the flood storage shift be determined by the Corps. In section 5.2.2.1, *Flood Storage*, we discuss the issue of agency jurisdiction over flood control operations.

3.3.2.4 Brownlee Reservoir Levels

Operational constraints imposed on the Hells Canyon Project result in substantial seasonal variation in modeled Brownlee reservoir levels. The modeled reservoir levels are also greatly affected by hydrologic conditions. Refer to figures 12 through 16 for simulated daily average Brownlee reservoir levels.

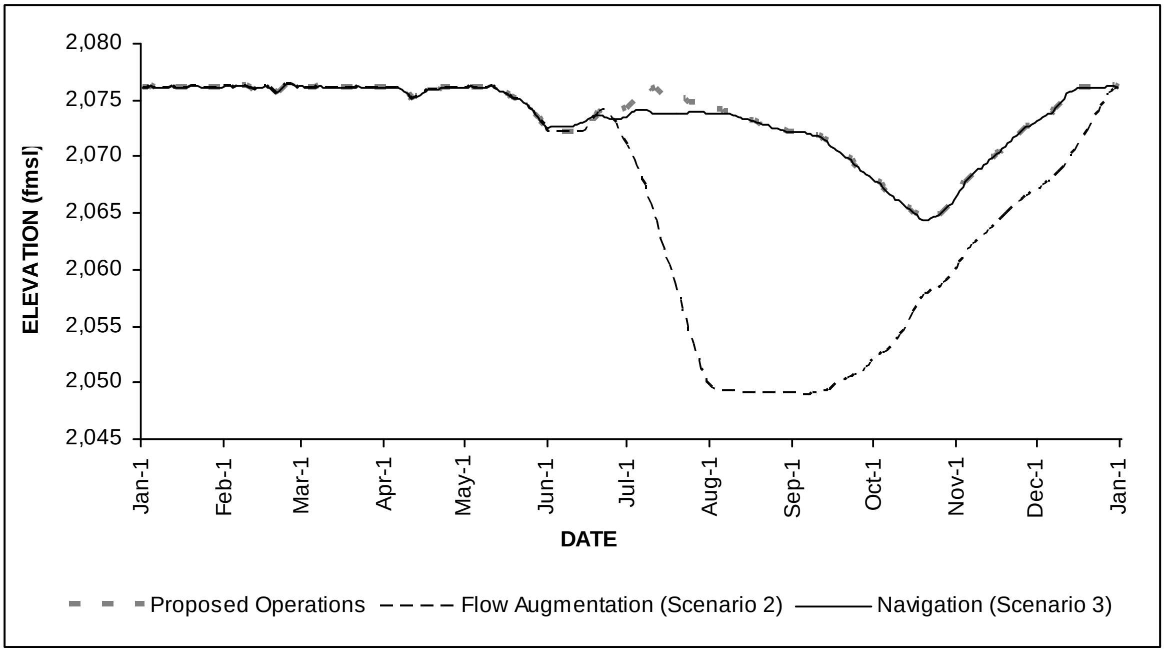
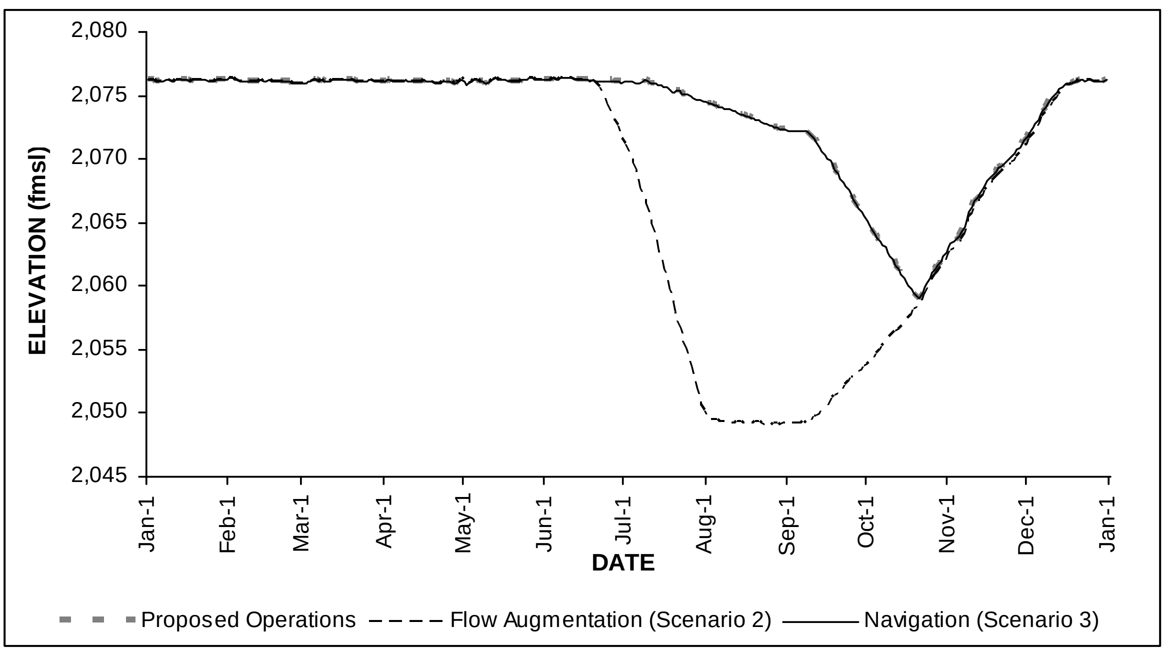


Figure 12. Simulated Brownlee reservoir levels for extremely low water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)



[a] Simulation based on 1994. Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Figure 13. Simulated Brownlee reservoir levels for medium-low water conditions.[a] (Source: Bowling and Whittaker, 2005, as modified by staff

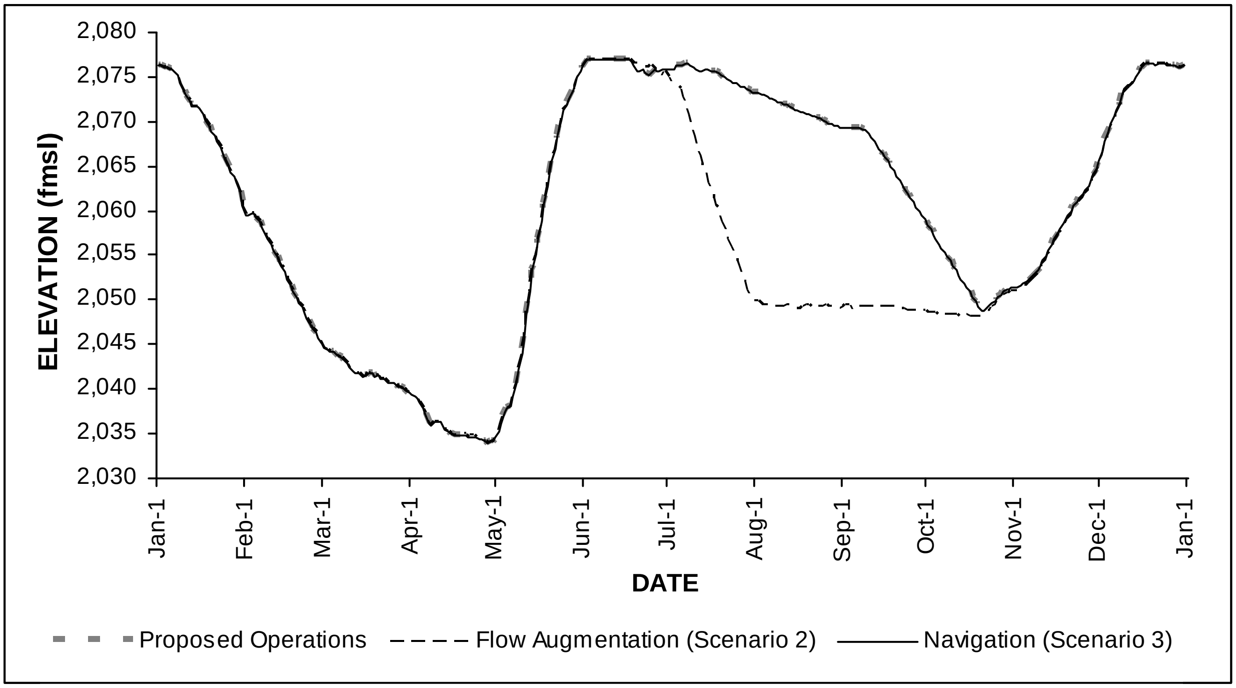


Figure 14. Simulated Brownlee reservoir levels for medium water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

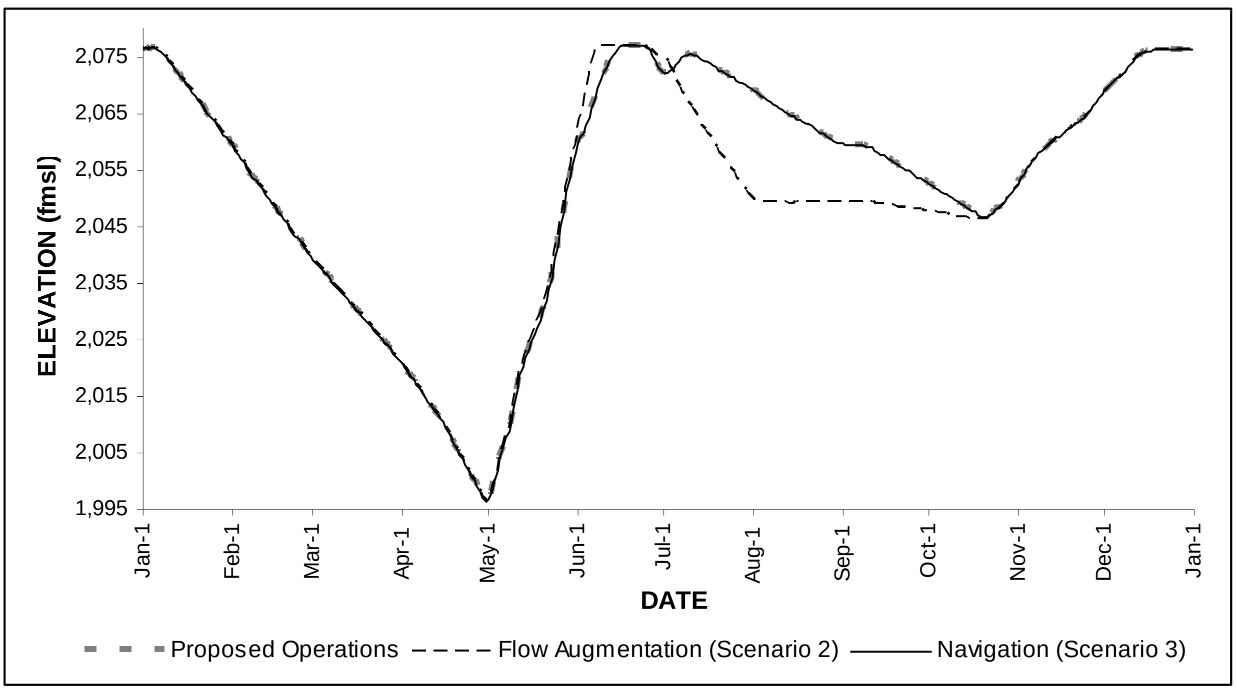


Figure 15. Simulated Brownlee reservoir levels for medium-high water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

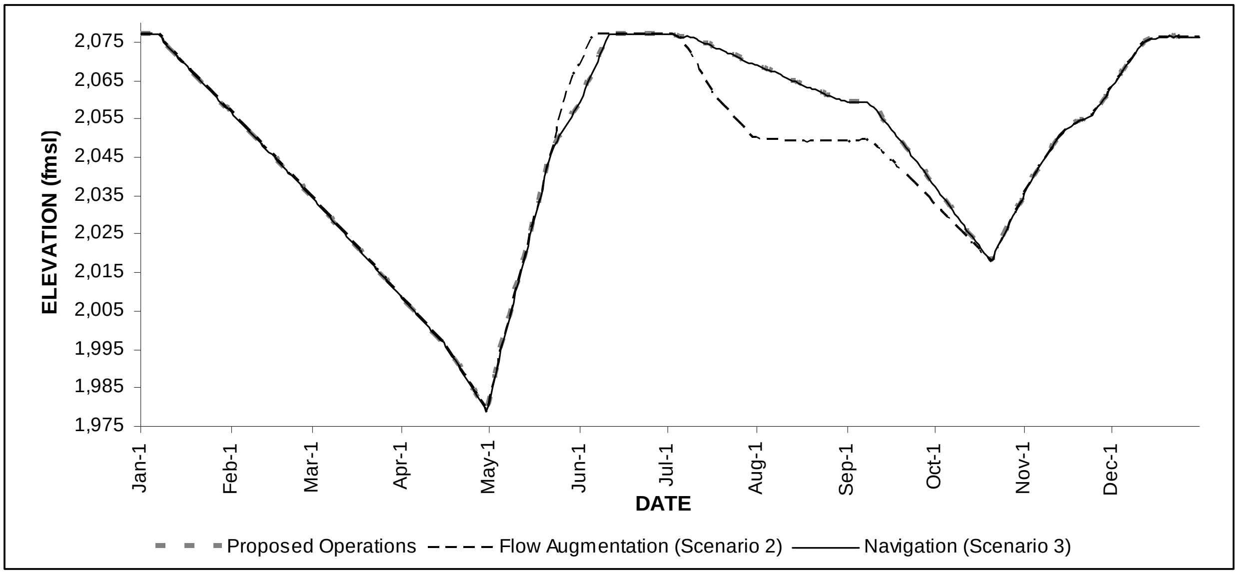


Figure 16. Simulated Brownlee reservoir levels for extremely high water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

Under Idaho Power's Proposed Operations, the modeled Brownlee reservoir level in a medium hydrologic year (figure 14) begins to fall in early January as the reservoir is drafted to meet target elevations for flood storage purposes. The reservoir elevation falls from an elevation of 2,077 feet msl (full reservoir) in the first week of January to about 2,035 feet msl by April 30. Starting May 1, the reservoir begins to refill to reach a target elevation of 2,069 feet msl by the first week of June and is full by the latter part of June. Under medium-high or extremely high water conditions (figures 15 and 16), greater flood storage capacity is required and the April 30 reservoir level falls to about 2,000 feet and 1,980 feet, respectively. Under extremely low or medium-to-low water conditions (figures 12 and 13), the flood storage capacity of Brownlee reservoir is not needed, and the reservoir level remains at or near full through May.

After the Fourth of July holiday, under Idaho Power's Proposed Operations, modeled reservoir levels gradually fall as Idaho Power operates to meet system power needs during July and August. During late August and through September, under all hydrologic conditions, Idaho Power continues to draft Brownlee reservoir so as to be in a position to implement the fall Chinook flow program of stable downstream spawning flows. Beginning in mid-October and lasting through early December, Brownlee reservoir refills so as to maintain a constant outflow downstream of Hells Canyon dam. The reservoir returns to full by the first week of December under all modeled conditions and remains full until any flood control drawdown is again called for in early January.

Operational recommendations directed at flow augmentation and flow shaping have the greatest potential for affecting seasonal reservoir levels at Brownlee. For a listing of these recommendations, refer to table 9. Our Scenario 2, Flow Augmentation, (described above) is representative of the recommendations calling for flow augmentation and flow shaping, and we graphically display the effects of the Flow Augmentation Scenario on Brownlee reservoir levels in figures 12 through 16.

Under the Flow Augmentation Scenario, modeled Brownlee reservoir levels are unchanged during the first half of the year compared to Proposed Operations, since the Corps' flood control rule curve is common to both scenarios. Beginning in late June, however, the modeled reservoir levels differ substantially as the flow augmentation program is implemented. In all hydrologic year types, the Flow Augmentation Scenario results in an earlier and more rapid drafting of Brownlee reservoir. In the medium water year, for example, the 2,050-foot-msl reservoir elevation is reached by the end of July under the Flow Augmentation Scenario, in contrast to mid-October for Proposed Operations (figure 14).

Operational recommendations related to navigation target flow levels also can affect Brownlee reservoir levels, but only under extremely low water conditions. Refer to table 9 for a listing of navigation-related recommendations. Our Scenario 3 (Navigation, described above) is consistent with the navigation recommendations (Corps-3, NPPVA-1, and FS-29).

For extremely low water conditions, modeled Brownlee reservoir levels during June and July under the Navigation Scenario differ from those under the Proposed Operations (figure 12). Whereas the reservoir refills under Proposed Operations as inflow spikes are captured and stored, under the Navigation Scenario most of the inflow spikes are passed through the project to meet the navigation target flows. As a result, little reservoir refill occurs. For the other hydrologic conditions, there are no distinguishable differences between these scenarios.

3.3.2.5 Oxbow and Hells Canyon Reservoir Levels

Under current conditions, both Oxbow and Hells Canyon reservoirs fluctuate within a 5-foot band from maximum reservoir levels year-round (section 3.3.1.1, *Surface Water*, above). Idaho Power's Proposed Operations would maintain this same regime under normal operating conditions, but would allow fluctuation up to 10 feet under certain atypical conditions. As defined by Idaho Power, atypical conditions would be conditions when Idaho Power determines that operation of the project (which operation may occur automatically or manually) is needed to: (1) protect the performance, integrity, reliability, or stability of Idaho Power's electrical system or any electrical system with which it is interconnected; (2) compensate for any unscheduled loss of generation; (3) provide generation during severe weather or extreme market conditions; (4) inspect, maintain, repair, replace, or improve Idaho Power's electrical systems or facilities related to the project; (5) prevent injury to people or damage to property; or (6) assist in search-and-rescue activities.

Commission licenses typically include a license article that allows departures from licensed operating procedures in circumstances involving potential harm to life or property. Idaho Power's proposed conditions for atypical operations include market factors, which go beyond the Commission's standard license article. Idaho Power has not specified the exact nature of these extreme market conditions nor has it explicitly modeled any such events in their CHEOPS simulations. Therefore, we cannot estimate the frequency of greater than normal reservoir drawdowns that would be associated with such market conditions.

None of the 40 operation-related recommendations made by the parties (table 9) are directed at the Oxbow and Hells Canyon reservoir levels, and Idaho Power's CHEOPS modeling shows little or no effect of the alternative operational scenarios on the levels of these reservoirs (refer to Idaho Power response to additional information request (AIR) OP-1(f), tables 1 through 117).

3.3.2.6 Project Outflows

Constraints on operation of the project affect the pattern of modeled outflows from the Hells Canyon dam. The pattern of modeled project outflows, in turn, has the potential for affecting sediment movement (section 3.4.2), aquatic resources (section 3.6.2), navigation (section 3.10.2), and other downstream resource values. Refer to figures 17 through 21 for Brownlee reservoir inflows and simulated daily average project outflows.

On a seasonal basis, under Proposed Operations, modeled outflows in a medium hydrologic year (figure 19) tend to exceed inflows during the late winter and early spring as the reservoir is being drawn down to create flood storage; be less than inflows after April 30 as the reservoir refills; closely match inflows from early June through mid-July; slightly exceed inflows from mid-July to early September;

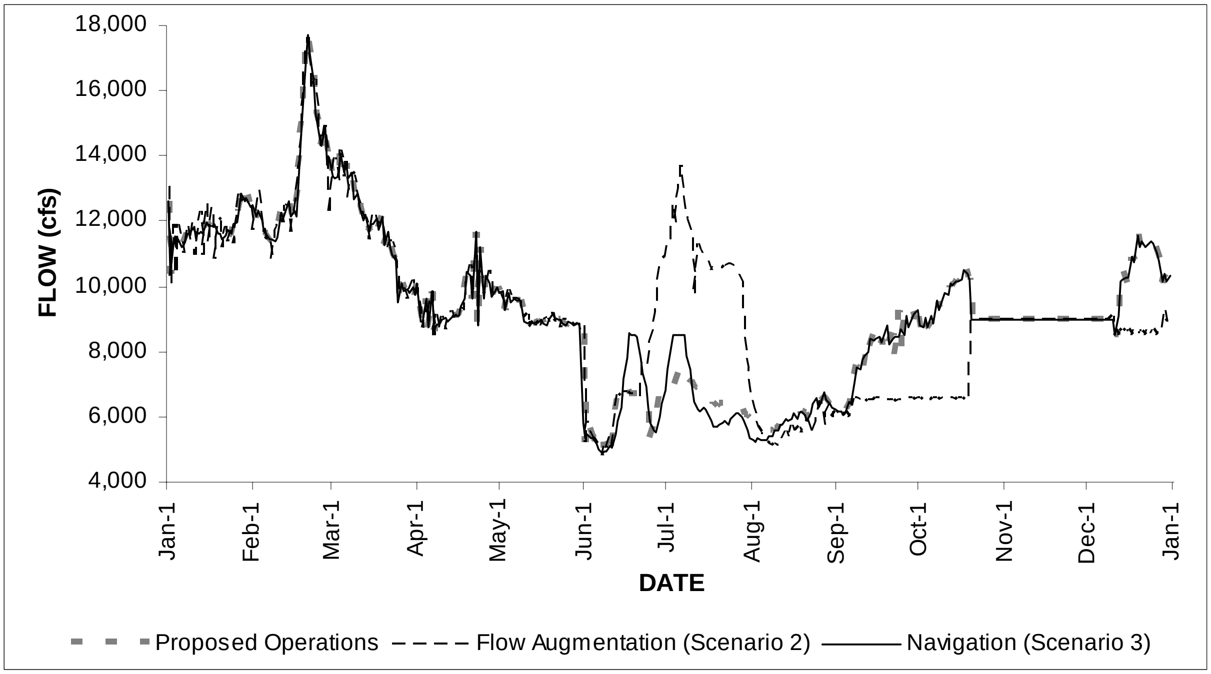
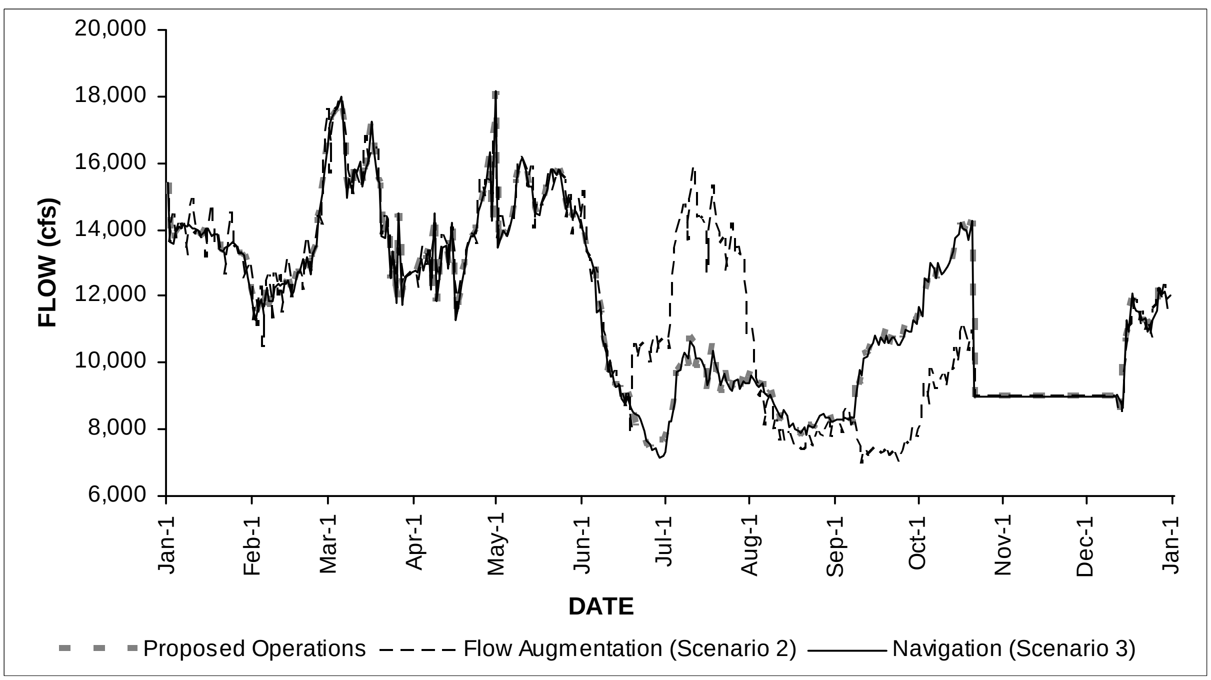


Figure 17. Simulated project outflows for extremely low water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)



[a] Simulation based on 1994. Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Figure 18. Simulated project outflows for medium-low water conditions.[a] (Source: Bowling and Whittaker, 2005, as modified by staff)

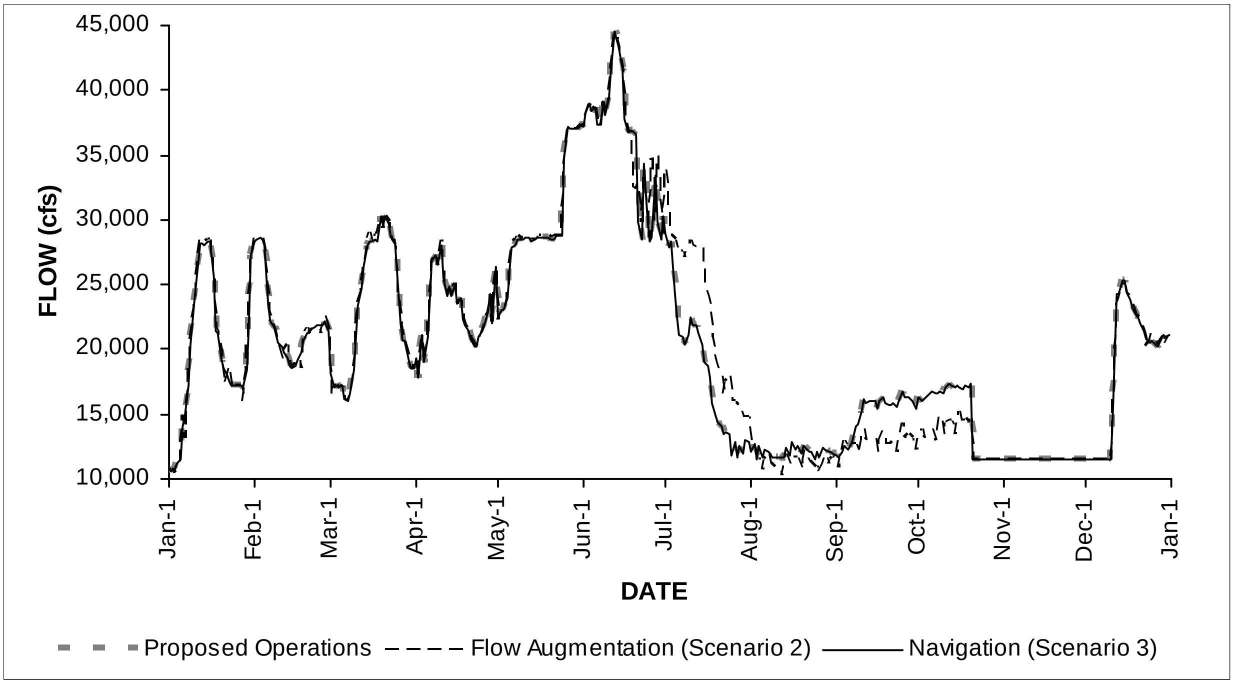


Figure 19. Simulated project outflows for medium water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

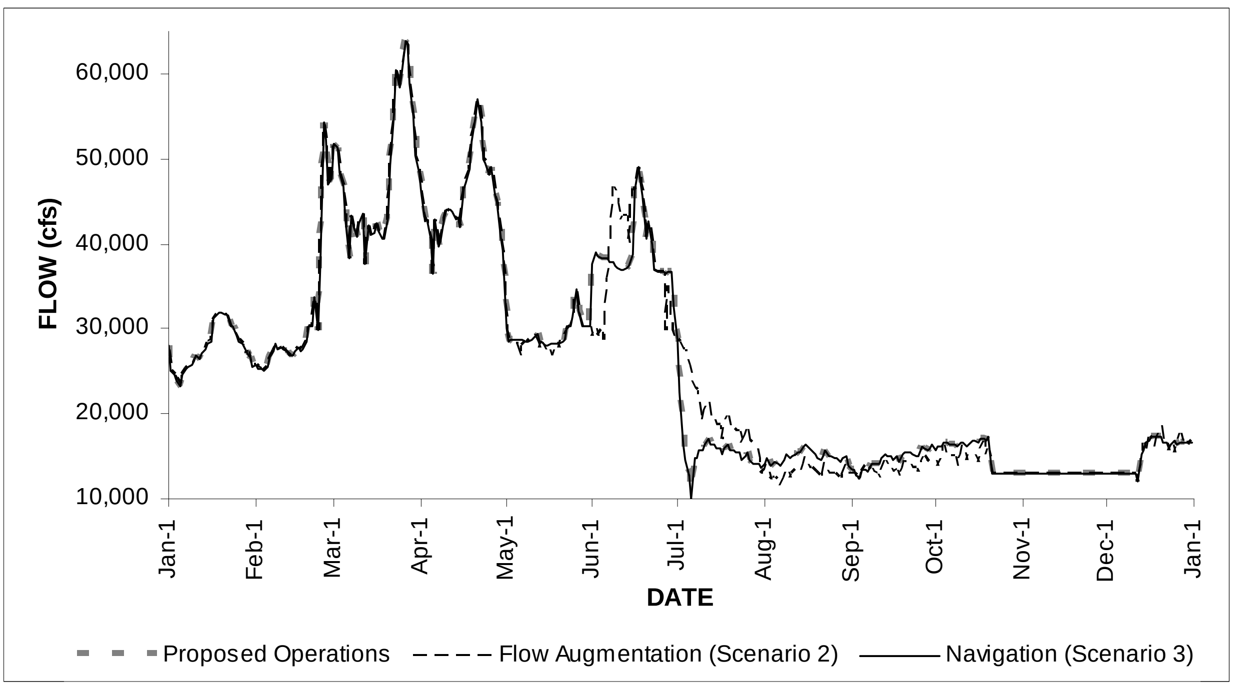


Figure 20. Simulated project outflows for medium-high water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

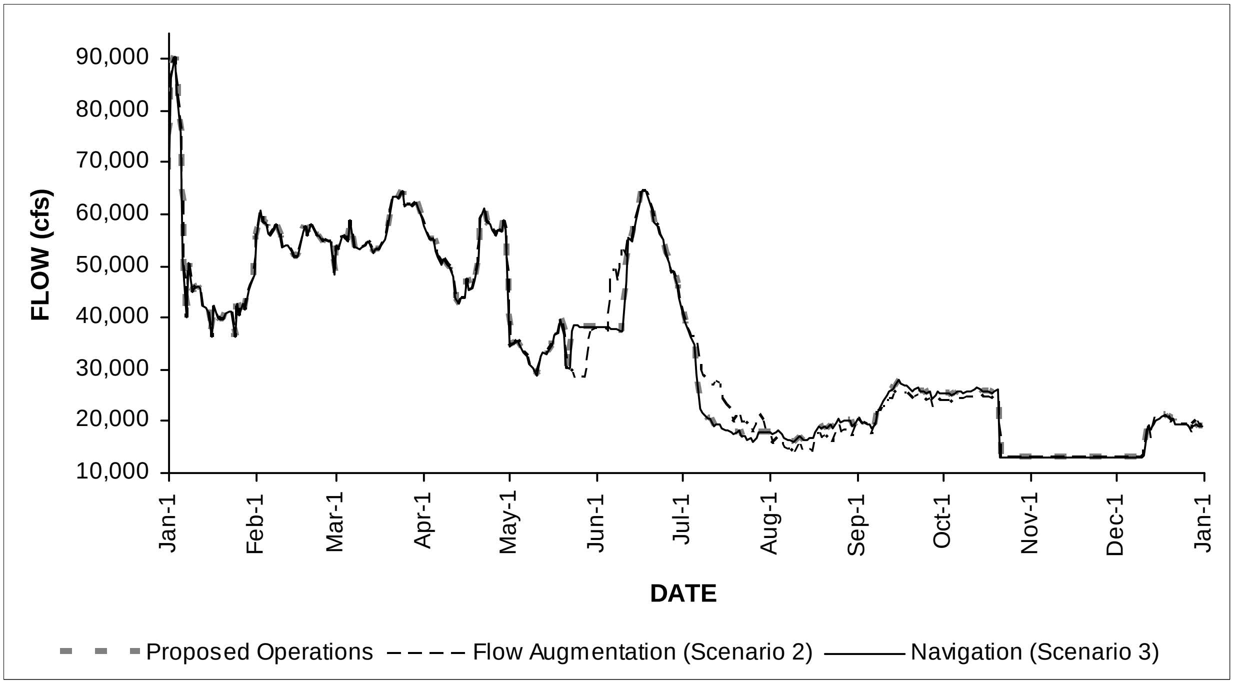


Figure 21. Simulated project outflows for extremely high water conditions. (Source: Bowling and Whittaker, 2005, as modified by staff)

appreciably exceed inflows from early September through mid-October; and then stabilize at levels below inflow during the fall Chinook salmon spawning period from mid-October to early December. The seasonal pattern is similar under other conditions, except in extremely low and medium-to-low water years when project outflows closely match inflows during the late winter and early spring because Brownlee reservoir is not being called upon to provide flood storage under these low-water conditions (figures 17, 18, 20, and 21).

Under Scenario 2 (Flow Augmentation), modeled project outflows differ from Proposed Operations during two periods (figure 19). The first is during July when project outflows exceed inflows as the project releases water for flow augmentation. The second is later in the year, from early September through mid-October, when outflows under the Flow Augmentation Scenario match inflows since Brownlee reservoir has already been drawn down due to the flow augmentation releases and no further drawdown is necessary to prepare for the fall Chinook flow program.

Under Scenario 3 (Navigation), project outflows differ from Proposed Operations during summer periods in low water conditions (figure 17). During June and July of the extremely low water year, for example, outflows rise coincident with spikes in Brownlee reservoir inflow because the Navigation Scenario calls for releasing water to meet the target whenever inflows to the project allow.

3.3.2.7 Downstream Flows Important to Navigation

Project operations affect minimum river flow levels in the Snake River downstream of Hells Canyon dam, which can affect the conditions under which boats can safely navigate this reach. Of particular importance for navigation are flows measured at the Hells Canyon dam gage and China Gardens Rapids gage (also known as the Snake River below McDuff Rapids gage; see figure 8). The latter gage is downstream of the confluence of the Snake and Salmon rivers. In the interest of navigation, the Corps identified 8,500 cfs downstream of Hells Canyon dam and 11,500 cfs downstream of the mouth of the Salmon River as minimum flow targets (Corps-3). We use the relative frequency of achieving these target levels to compare operational scenarios.

Under Proposed Operations, Idaho Power would continue to operate the project for navigation purposes by maintaining 13,000 cfs in the Snake River at Lime Point[38] at least 95 percent of the time. Flows of less than 13,000 cfs would be limited to the months of July, August, and September, and Idaho Power would not be required to use reservoir storage to meet the 13,000-cfs requirement. Idaho Power modeled this restriction for June 1 through October 20 by providing a 6,500-cfs release from the Hells Canyon dam, or project inflow if inflow was less than 6,500 cfs. The Umatilla and Nez Perce Tribes recommend that Idaho Power maintain a minimum flow of 6,500 cfs immediately downstream of Hells Canyon dam and 13,000 cfs at Lime Point (CTUIR-14 and NPT-14 in table 9). These tribes are concerned that higher minimum flows would jeopardize fish flows during low water years.

Under Proposed Operations and the 6,500-cfs minimum flow recommendations, modeled flows at the Hells Canyon dam gage routinely fall below the Corps' 8,500-cfs navigation target from early June through mid-October under the extremely low and medium-to-low water conditions. The causes of the lower flows are low inflow to Brownlee reservoir, power peaking operations at Hells Canyon dam, or a combination of the two. At the China Gardens Rapids gage, modeled flows for these low water conditions similarly fall below the 11,500-cfs target for much of the summer and fall period.[39] Under medium water conditions, modeled flows under Proposed Operations routinely fall below the navigation target for the Hells Canyon dam gage from late July through early September, while at China Gardens Rapids, Proposed Operations meet or exceed the target year-round. Modeled Proposed Operations flows below the targets occur only once for medium-to-high water conditions (a couple of days in early July at the Hells Canyon dam gage) and never for extremely high water conditions.

The Corps recommends that Idaho Power operate the project to maintain a year-round instantaneous minimum flow of 8,500 cfs, as measured at the Hells Canyon dam gage and 11,500 cfs as measured at the Snake River below McDuff Rapids (China Gardens Rapids) gage. If daily inflows to Brownlee reservoir fall below 8,500 cfs, however, Idaho Power would not have to meet these minimum flows. Instead, Idaho Power would be required to release from Hells Canyon dam a flow equal to the previous 3-day moving average Brownlee reservoir inflow. From July 1 through September 30, if the 3-day moving average Brownlee reservoir inflow drops below 8,500 cfs, Idaho Power could seek a temporary variance from the Corps for the flow requirements. NPPVA (NPPVA-1 from table 9) concurs with the Corps' recommendation. The Forest Service provides a similar recommendation for a year-round minimum flow downstream of Hells Canyon dam of 8,500 cfs, or project inflow (whichever is less), but does not include the opportunity for the variance (see table 9, FS-29). Scenario 3, Navigation, is representative of these recommendations.

Under the Navigation Scenario, the modeled flows meet the navigation target flows more frequently than under Idaho Power's Proposed Operations. In extremely low water conditions, the Navigation Scenario results in about 18 fewer days during the summer and fall when modeled flows measured at the Snake River at Hells Canyon gage fall below the 8,500-cfs target. For medium-to-low water conditions, there is a much reduced duration of flows below target; the duration of such flows decreases from longer than 4 months under Proposed Operations to about 6 weeks under the Navigation

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[38] Idaho Power does not explicitly propose 13,000 cfs at Lime Point, but this value is consistent with the flow releases from Hells Canyon dam assumed by Idaho Power for modeling purposes. In the absence of an explicit alternative proposal, we consider it part of Idaho Power's proposed operation. Idaho Power proposes that any navigation flow requirement for the Snake River reach from the Salmon River confluence to Lewiston be measured at McDuff Rapids (RM 175.5), 4 miles upstream of Lime Point.

[39] The observations in this subsection are based on staff's analysis of Idaho Power's response to AIR OP-1(c) (Bowling, 2005b).

Scenario. For modeled medium water conditions, below-target flows are eliminated, and the same is true for medium-to-high and extremely high water conditions.

Relative to Proposed Operations, the frequency with which navigation target flow levels are reached is also higher under the Flow Augmentation Scenario (350 kaf) because the augmented release during July for anadromous fish also improves Snake River navigation conditions. At the Hells Canyon dam gage, modeling shows about 25 fewer days below the 8,500-cfs target for extremely low water conditions, about 30 fewer days for medium-to-low conditions, and about 21 fewer days for medium water conditions[40].

3.3.2.8 Flow Fluctuations Downstream of Hells Canyon Dam

The extent of diurnal flow fluctuations downstream of the project can affect aquatic resources, riparian habitats, recreation usage, and other resource values. We briefly discuss flow fluctuations here, but assess their resource effects in the appropriate resource sections later in this final EIS. Refer to appendix E figures E-1 through E-15 for simulated river flows at 15-minute intervals at two locations: (1) immediately downstream of Hells Canyon dam; and (2) at Anatone, which is downstream of the confluence with the Grande Ronde River at RM 167.2.

Under Proposed Operations, Idaho Power would limit the daily range of the Hells Canyon dam release to 10,000 cfs from June 1 through September 30, and no load following would occur during late fall and early winter (approximately October 21 through December 11), in keeping with the fall Chinook flow program. Further, throughout the year, Idaho Power would continue to manage project releases to meet a 1-foot-per-hour ramping rate restriction at Johnson Bar. The effect of this operation is apparent in figures E-1, E-2, and E-3 in appendix E, for extremely low water conditions, medium water conditions, and extremely high water conditions, respectively. For extremely low water conditions, there is a substantial modeled flow fluctuation immediately downstream of Hells Canyon dam from mid-December through June, occasional periods of modest fluctuation during the summer, substantial fluctuation in the early fall, and no fluctuation during the fall Chinook salmon spawning period. For medium water conditions, the extent of flow fluctuation is similar, with two exceptions. The first is in the early summer when flows are sufficiently high that the project operates continually at full capacity. The second is during the late summer when there is sufficient flow to support a load following operation. For extremely high water conditions, there is substantially less modeled fluctuation because the project is running at full capacity for much of the year. The flow fluctuations farther downstream at Anatone (lower portion of each figure) mirror those at Hells Canyon dam, but are much reduced due to the inflow from tributaries entering the Snake River between the two locations.

The Stabilized Hells Canyon Release scenarios are specifically designed to reduce the extent of flow fluctuation. The model results for Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate) and for Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate) are displayed in figures E-4 through E-6 and in E-7 through E-9, respectively. These scenarios are representative of the various recommendations for ramping rate restrictions (see table 9). Both of these ramping rate restriction scenarios follow the same seasonal pattern of diurnal fluctuations as Proposed Operations, but the magnitude of fluctuation is much reduced.

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[40] In comments on the draft EIS (Idaho Power, November 23, 2006, page 19), Idaho Power provided the results of additional operational modeling based on the operational scenario included in the draft EIS Staff Alternative, specifically a 237-kaf flow augmentation scenario. The incremental effect of adding the Corps' minimum flow recommendation to the 237-kaf flow augmentation scenario would be to reduce the below-target days from 116 to 100 under extremely low water conditions, from 120 to 32 under medium-low water conditions, and from 40 to zero under medium water conditions.

Scenario 2 (Flow Augmentation [figures E-10 through E-12]) results in substantially less diurnal fluctuation than under Proposed Operations in the March 1 through May 31 period (as specified in the scenario).

Meaningful differences between modeled flow fluctuations under Scenario 3 (Navigation [figures E-13 through E-15]) and Proposed Operations occur only under extremely low water conditions (compare figures E-1 and E-13). Under the Navigation Scenario, flows would fluctuate less in June and July for extremely low water conditions, and greater fluctuations would occur during August.

3.3.2.9 Operations Compliance Measurement Location

Currently, compliance with minimum flow and ramping rate restrictions is measured at the Johnson Bar gage. This gage is downstream of Hells Canyon dam, but upstream of major tributaries such as the Imnaha, Salmon and Grande Ronde rivers (refer to table 4). Idaho Power proposes to continue using Johnson Bar as the compliance monitoring location, and the Corps concurs (table 9, Corps-6). The Corps proposes to monitor minimum navigation flows downstream of the Salmon River confluence at the Snake River below McDuff Rapid Gage. The 8,500-cfs minimum flow downstream of the Hells Canyon Project would be measured at the Hells Canyon Dam Gage (USGS Gage No. 13290450)

NMFS, with respect to biologically based flows and ramping rates, recommends that Idaho Power measure flows and stage heights within 1 mile downstream of Hells Canyon dam, or at the first location downstream where consistent and accurate information can be collected (table 9, NMFS-15). At a minimum, NMFS recommends that this information should be collected at 15-minute intervals and that Idaho Power should provide access to this information (both “real-time” and historical information) via the Internet. ODFW and AR/IRU concur with NMFS on an upstream location for compliance monitoring (ODFW-13 and AR/IRU-23, respectively, in table 9).

The various compliance locations serve different purposes. Ramping rate compliance at Johnson Bar and flow rate compliance at the Snake River below McDuff Rapids gaging station are designed to address navigation issues. Flow monitoring below Hells Canyon dam serves both a navigation and biologically based purpose. Ramping rate monitoring below Hells Canyon dam is designed to address biologically based ramping rates. Staff does not see any conflict between having different types of monitoring occurring at different locations. Idaho Power would have a greater degree of control at the base of Hells Canyon dam, since except for spill conditions, they can control the release and limit changes in release in accordance with the stage-discharge rating curve for that gage.

Ramping rates can be estimated by using the latest USGS rating curves below Hells Canyon dam and at Johnson Bar. Minimum flows at McDuff Rapids can be monitored by that USGS gage, however information from several tributary gages may provide useful information to Idaho Power in terms of regulating release from Hells Canyon dam to meet flow objectives at McDuff Rapids and ramping rate objectives at Johnson Bar. In addition to the gages on the main stem Snake River, these gages include:

- Salmon River at White Bird, Idaho (USGS Gage No. 13317000);
- Imnaha River at Imnaha, Oregon (USGS Gage No. 13292000); and
- Grande Ronde River at Troy, Oregon (USGS Gage No. 13333000).

Because Idaho Power has varying levels of control at the different monitoring locations, it would be advisable to develop a plan to measure compliance with both minimum flows and ramping rates. Such a plan would usually be developed in consultation with the USGS, fish and wildlife agencies and the Corps of Engineers. Typically minimum flow and ramping rate monitoring plans specify under which conditions compliance is enforceable and set a reasonable basis for evaluating compliance. For example if the Hells Canyon dam is spilling, Idaho Power does not have control and cannot be expected to meet ramping rate objectives. Compliance with ramping rates immediately downstream of Hells Canyon dam would likely have a higher standard than at Johnson Bar. The basis for compliance should include the frequency of required compliance and what percentage deviation from the targeted ramping rate is permissible over what period. Such a basis should take into account the ability to measure and forecast both flow and stage.

3.3.2.10 Water Uses and Water Rights

Although operational changes have the potential to affect existing water rights, we have no information to suggest that existing water rights would be inconsistent with proposed or alternative operating regimes considered in this final EIS.

Idaho Power is in the process of reconciling discrepancies between its water rights for hydroelectric diversion in the state of Oregon via the Oregon Hydropower Application Review Team (HART) Process. The HART Process is Oregon's certification process that combines all state authorities into single entity for providing comments and includes primarily ODEQ, OWRD, and ODFW. Idaho Power would enlarge its water right to match the maximum diversion capacities of the as-built Hells Canyon Project.

Several processes are underway that could affect water rights and streamflow hydrology in the Snake River, including potential clarification of the Swan Falls Agreement, the SRBA, and the Snake River Aquifer recharge program. Idaho Power would be required to revise or supplement its water rights based on the outcome of these processes.

Lower Valley Energy (LVE) recommends that Idaho Power compensate the state of Wyoming and the Wyoming public in the upper Snake River watershed in Wyoming, as represented by LVE, for the use of Wyoming's unused allocation under the Snake River Compact. In section 5.2.2.4, *Water Rights,* we discuss the issue of agency jurisdiction over this issue.

3.3.3 Unavoidable Adverse Effects

None.

3.4 SEDIMENT SUPPLY AND TRANSPORT

3.4.1 Affected Environment

The supply and movement of sediment in the free-flowing section of the Snake River downstream of Hells Canyon dam provide habitat for aquatic life, support recreational activities, and maintain important cultural resources. For example, fall Chinook salmon depend on the availability of suitable gravel for spawning habitat, and juvenile fall Chinook favor areas with gently sloping shorelines that are often associated with beach areas. Beaches used for recreational purposes, such as camping, hiking, rafting, and boating, depend heavily on the availability and movement of sediment because sand beaches are typically preferred by recreation users over gravel or cobble beaches. Terraces located above beaches contain important archeological sites that could be affected by beach and terrace erosion.

Idaho Power's sediment studies primarily addressed the reach of the Snake River extending from Weiser, Idaho (RM 351.3) to just upstream of the confluence with the Salmon River (RM 188.2) (see figure 1). Idaho Power focused its study of sediment supply and transport on the Hells Canyon reach because it: (1) includes the majority of the Hells Canyon National Recreational Area (HCNRA) and sections of the Snake River designated as wild and scenic; (2) contains most of the spawning habitat for anadromous fish (Groves, 2001); and (3) is most sensitive to the effects of Hells Canyon Project operations because there are no major streamflow or sediment inputs to the Snake River between the project and the river's confluence with the Salmon and Grande Ronde rivers (Parkinson et al., 2003a).

The Hells Canyon reach is confined within a deep, narrow bedrock canyon, which restricts substantial floodplain development. Portions of the bedrock walls are mantled with fine- to coarse-grained sediment derived from debris flows and landslides. Incision of the canyon began about 2.5 million years ago in response to the draining of Lake Idaho (a large lake covering much of the western Snake River Plain) into the headwaters of the pre-canyon Salmon River basin at the present location of Oxbow dam (O'Connor, 2002). The catastrophic Bonneville Floods released large volumes of glacial water approximately 14,500 years ago and formed numerous terraces up to 600 feet above the current channel bed (Miller et al., 2003a).

Numerous dams constructed upstream of the project trap sediment originating from the upper Snake River basin. The nearest (and also the oldest) upstream dam on the Snake River was constructed in 1901 at Swan Falls. The Swan Falls dam was a major barrier to sediment movement on the mainstem Snake River for approximately 60 years before construction of the Hells Canyon Project and attenuated any anthropogenic sediment pulses associated with twentieth-century land development in the upper Snake River basin (Vincent and Andrews, 2002; Wilcock et al., 2002). Sediment from widespread development of irrigation farming in the basin was also trapped behind other mainstem dams and numerous tributary dams constructed during this era.

The average slope of the Snake River downstream of Hells Canyon dam varies from 0.002 to 0.0007 (10.5 to 3.7 feet per mile) and decreases in the downstream direction. Local variations in slope are associated with debris fans and bar features at tributary junctions. Between Hells Canyon dam and the Salmon River confluence, debris fans and gravel bars maintain a pool-riffle morphology in the river (Parkinson et al., 2003a). Relict debris fans at the mouths of tributaries along the river banks reflect the strong coupling between the river and the many small tributary basins that deliver sediment to the project reach.

3.4.1.1 Sediment Budget

Idaho Power completed numerous studies to quantify the components of a sediment budget for the Hells Canyon reach (Miller et al., 2003a; Parkinson et al., 2003a; Parkinson et al., 2005a,b). The sediment budget is an accounting of all sediment sources entering the project reach via the mainstem of the Snake River and sediment supplied by tributaries. The sediment budget also accounts for sediment leaving the reach and changes in sediment storage within the reservoirs and along the banks and bed of the Snake River. The sum of all sediment inputs and outputs is balanced by the net change in storage:

$$S_i + S_t - S_o = \Delta S_r$$

where

S_i = rate of sediment entering the project reach at Weiser,

S_t = rate of tributary additions for either a single basin or a group of basins,

S_o = rate of sediment leaving a specified river segment, and

ΔS_r = rate of change in sediment storage for various storage elements.

We use these components in the following discussion to describe the transfer of sediment within individual basins, specified reaches, and various sediment storage elements (i.e., reservoirs, sandbars, and gravel bars). The sediment budget is summarized in table 10.

Sediment Supply at Weiser, S_i

Of the four terms in the sediment budget, S_i (the average rate of sediment entering the reach from upstream) is the only term for which long-term measurements of sediment transport are available. This term implicitly accounts for sediment trapped behind the 13 mainstem dams on the Snake River upstream of the project and sediment trapped behind many tributary dams in smaller basins upstream of the project. All of the sediment entering the three project reservoirs is trapped (i.e., sediment output, $S_o = 0$ at Hells Canyon dam), which simplifies the calculation of sediment storage in the three reservoirs to $\Delta S_r = S_i + S_t$, where S_t in this case is all tributary inputs to the three reservoirs below Weiser.

Idaho Power estimated S_i using sediment rating curves (relations between discharge and sediment transport rate) developed by the USGS from suspended sediment load measurements in the Snake River near Weiser. The sediment sampling technique excluded the fraction of sediment transported as bedload, which is defined as sand and gravel with a grain diameter larger than 0.063 mm. Idaho Power calculated an average sediment yield of 1.47 million tons per year for S_i, which includes approximately 220,000 tons per year of unmeasured sand and gravel estimated by assuming 15 percent of the total suspended load is transported as bedload (Parkinson et al., 2003a), a reasonable assumption based on the range of bedload (5 to 15 percent) measured for rivers of this size (Reid and Dunne, 1996). Wilcock et al. (2002) performed a similar calculation and reported 978,000 tons per year for suspended sediment, which includes 214,000 tons per year of suspended sand (22 percent of the suspended load >0.062 mm) based on sediment analyses performed by the USGS on the suspended sediment samples collected at Weiser. Wilcock et al.'s (2002) calculations do not include the unmeasured bedload component, which would bring the total sediment yield to 1.15 million tons per year using Idaho Power's bedload estimate of 15 percent. Mussetter (2006) re-interpreted the rating curves for Weiser and calculated a greater yield for sand of 384,000 tons per year. Based on the assumptions reported by Mussetter (2006), including the assumption that bedload (gravel and sand) is 15 percent of total suspended load (fine sand, silt, and clay), we calculated a total suspended load of 1.17 tons per year and a total sediment load of 1.38 million tons per year for comparison with other estimates.

Based on the foregoing interpretations of suspended sediment records at Weiser, the total sediment load entering the project reach (S_i) is estimated to range from 1.15 to 1.47 million tons per year. The sand and gravel component of S_i is estimated to range from 220,000 to 384,000 tons per year, with most of this sediment likely falling in the size range of sand. The remaining sediment at Weiser (an estimated 764,000 to 1.25 million tons per year) is classified as clay and silt.

Table 10. Sediment budget. (Source: Wilcock et al., 2002; Miller et al., 2003a; Parkinson et al., 2003a, 2005b; Mussetter, 2006; as modified by staff)

Reach Segment	Contributing Basin Area (square mile)	Estimated Sediment Yield (tons/year)		
		Total	Clay and Silt (<0.063 mm)	Sand and Gravel (>0.063 mm)
Sediment gage at Weiser (S_i)[a]	9,260	1,150,000–1,470,000	764,000–1,250,000	220,000–384,000
Tributary inputs to Brownlee reservoir (S_t)[b]	2,230	277,000–825,000	207,000–701,000	41,500–206,000
Tributary inputs to Oxbow reservoir (S_t)[b]	218	27,100–80,700	20,300–68,600	4,050–20,200
Tributary inputs to Hells Canyon reservoir (S_t)[b]	447	55,500–165,000	41,600–141,000	8,310–41,300
Total sediment yield to reservoirs (ΔS_r)[b]	12,160	1,510,000–2,540,000	1,030,000–2,160,000	274,000–652,000
Tributary inputs (S_t)				
Hells Canyon dam to Pine Bar[b]	207	25,700–76,600	19,300–65,100	3,850–19,100
Pine Bar to Tin Shed[b]	91	11,300–33,700	8,460–28,600	1,690–8,420
Tin Shed to Salmon River (excluding Imnaha River)[b]	242	30,000–89,500	22,500–76,100	4,500–22,400
Total Hells Canyon dam to Salmon River (excluding Imnaha River)	540	67,100–200,000	50,200–170,000	10,000–50,000

Notes: Values are limited to three significant figures.

[a] Sediment yield based on gage data at Weiser and various techniques. See text for explanation.

[b] Range in total sediment yield based on 124 to 370 tons per square mile per year and the contributing basin area for each tributary. Range in sediment yield for the fine and coarse fractions is based on 75 and 15 percent of the minimum total and 85 and 25 percent of the maximum total, respectively (sum of ranges may not equal totals). See text for explanation.

As part of its license application and AIR responses, Idaho Power collected deep sediment cores from the bottom of Brownlee reservoir and collected shallow sediment samples from the bottom of Oxbow and Hells Canyon reservoirs to evaluate the relative fractions of fine sediment, sand, and gravel entering the Hells Canyon Project from upstream and from tributaries draining into the reservoirs. Due to the 20-mile shift in pool extent corresponding to the operational 100-foot fluctuation in water elevation and the reworking of sediment during reservoir drawdown, the depositional environment at the inlet to Brownlee reservoir is extremely complex and heterogeneous (Wilcock et al., 2002). Consequently, the three sediment cores taken within the draw-down reach may not provide an adequate characterization of the sediment composition delivered to the reservoir.

We divided the sediment yield estimated at Weiser by the contributing basin area (9,260 square miles) for comparison with the range in sediment yield calculated for four other reservoirs in the region. Based on the range in sediment yield estimated at Weiser, S_i is estimated to range from 124 to 159 tons per square mile per year (figure 22), which is about one-half the sediment yield (240 to 370 tons per square mile per year) measured from sedimentation surveys at other reservoirs in the region (Miller et al., 2003a). The lower estimates at Weiser may reflect sediment retention behind numerous upstream dams.

Changes in Reservoir Storage, ΔS_r

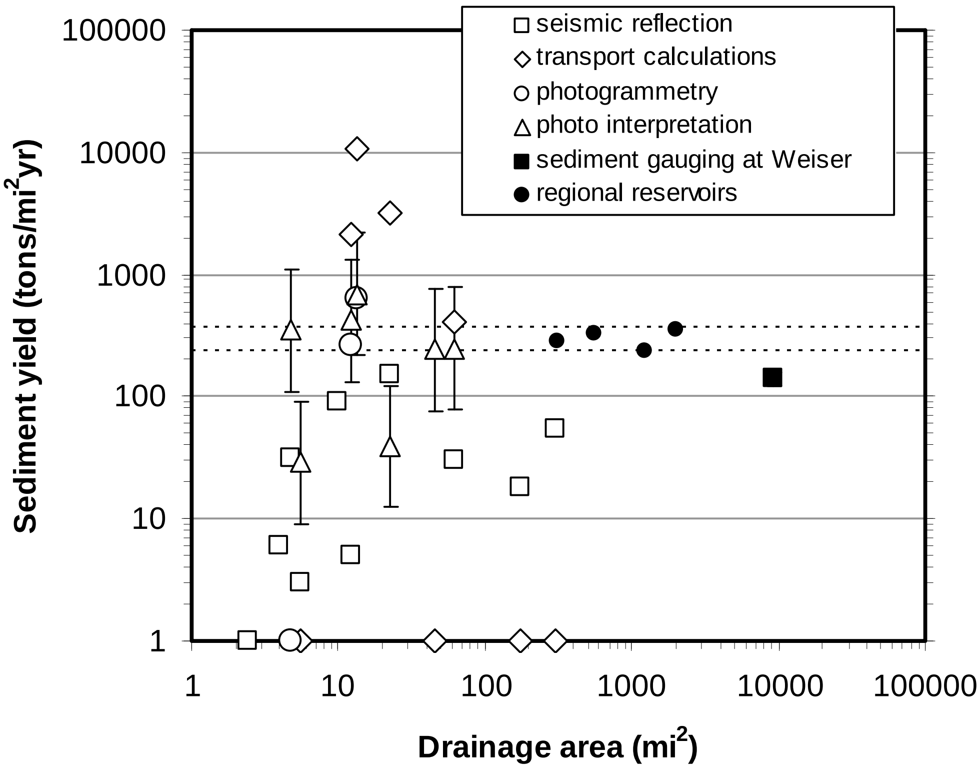
Idaho Power used a variety of techniques to evaluate the other components of the sediment budget. In its license application and AIR responses, Idaho Power attempted to estimate the volume of sediment trapped in the three reservoirs (ΔS_r) using the difference between pre-impoundment topography and recent bathymetric data. Parkinson et al. (2005b) found that the precision of the pre-impoundment topographic maps produced volumetric errors that exceeded the likely sediment volumes they set out to quantify. Therefore, reliable estimates of ΔS_r in the three reservoirs based on bathymetry are not available.

Sediment Supplied from Tributaries, S_t

In its license application, Idaho Power estimated S_t for 17 tributaries below Hells Canyon dam and 12 of the tributaries draining directly into the three reservoirs. Sediment yield for these selected tributaries was calculated using a sediment transport equation and field surveys of channel dimensions and bed material (Parkinson et al., 2003a). Results ranged from 0 to 59,000 tons per square mile per year, which Parkinson et al. (2003a) acknowledge are more than two orders of magnitude greater than regional sediment yields calculated by other methods (figure 22). The wide variability in the calculated values of S_t is likely due to the uncertainty of the assumptions used in the sediment transport model (Wilcock et al., 2002). Hence, a reasonable estimate of S_t, as measured from the transport calculations, cannot be determined for use in the sediment budget.

Idaho Power (Parkinson et al., 2005b) employed three additional techniques to quantify S_t. The methods included analyses of several tributary fans using photogrammetry, geomorphic interpretation of aerial photography and topographic maps, and geophysical profiling. For each technique, the volume of sediment stored in the tributary fans was measured at the point of entry to the reservoirs. Some tributary volumes were measured using more than one method.

Idaho Power (Parkinson et al., 2005b) used photogrammetry developed from historical aerial photographs to reconstruct the pre-impoundment topography of three tributary fans at a greater resolution than was previously available on the earlier pre-impoundment maps. The volumes of the three tributary fans were calculated from the difference between the high-resolution, pre-impoundment topography and the recent bathymetry. Measurable differences in the topography of two of the fans resulted in sediment yields of 268 and 640 tons per square mile per year (figure 22), which are two orders of magnitude lower than earlier estimates of S_t but twice the sediment yield measured at Weiser and from sediment trapping in the four regional reservoirs.



[a] Results of transport calculations are shown only for basins evaluated by other techniques. Error bars show the estimated range of values. Sediment yields from seismic reflection are minimum estimates. Calculations that did not result in a sediment yield are shown at S_t = 1 on the log axis. The dashed lines designate the range in sediment yield for the four regional reservoirs used in the sediment budget.

Figure 22. Summary of estimated sediment yield from tributaries using various techniques, sediment gaging at Weiser, and the four regional reservoirs.[a] (Source: Wilcock et al., 2002; Miller et al., 2003a; Parkinson et al., 2003a, 2005b; Mussetter, 2006; as modified by staff)

Idaho Power (Parkinson et al., 2005b) used the geomorphic interpretation of pre-impoundment aerial photographs, low-resolution pre-impoundment topography, and recent high-resolution bathymetry to estimate sediment volumes at the mouths of seven tributaries. Results ranged from 29 to 352 tons per square mile per year (figure 22) with an order-of-magnitude margin of error reported by Parkinson et al. (2005b). Values agree with the average sediment yield for Weiser and the four regional reservoirs to within the relatively large margin of error reported for these results.

Idaho Power (Parkinson et al., 2005b) conducted seismic reflection surveys and subbottom profiling at eleven tributary fans. Because sonar is unable to penetrate coarse sediment, only the thickness of the uppermost fine- to medium-grained sediment could be measured, and results are reported as a possible lower estimate of S_t. Additionally, bathymetry indicated that some post-impoundment sediment fans may have been deposited on pre-impoundment fans. Excluding the one tributary fan for which there was no measurable difference in topography, sediment yield ranged from 3 to 152 tons per square mile per year (figure 22).

The range in tributary sediment yield illustrated in figure 22 using the various analytical techniques shows considerable scatter over more than four orders of magnitude for the smaller basins but encompasses the narrow range calculated from sediment gaging at Weiser and values reported by Parkinson et al. (2003a) for the four reservoirs in the region. The wide variability in sediment yield decreases in larger basins due to the averaging of widely varying sediment yields from many small basins. Since the actual sediment yield in each tributary cannot be measured accurately, we estimated an average yield from tributaries of 124 to 370 tons per square mile per year based on a consideration of the range of rates reported for Weiser and the regional reservoirs. Based on this range, the average tributary input (S_t) to the three reservoirs from the approximately 2,900-square-mile drainage area is 359,000 to 1.07 million tons per year. Adding S_i to this range yields an average of 1.51 to 3.63 million tons of sediment trapped each year in the three reservoirs, of which 274,000 to 652,000 tons per year is likely sand and gravel (table 10).

Sediment Leaving the Reach, S_o

The project reach downstream of Hells Canyon dam is ungaged for sediment, such as it is at Weiser; therefore, direct measurements of sediment leaving the downstream project reach (S_o) and the rate of change in sediment storage in beaches and gravel bars within this reach (ΔS_r) are not readily available for use in the sediment budget. Tributaries draining to the Snake River downstream of Hells Canyon dam currently provide the only substantial source of sediment input for sandbars and spawning gravel. We calculated average sediment yields for the reach segments downstream of Hells Canyon dam using the range of average sediment yields established above for the tributaries (S_t) and the contributing basin areas for each reach (table 10). The results indicate that an estimated average of 67,000 to 200,000 tons per year of sediment is supplied by tributaries to the Snake River between Hells Canyon dam and the confluence with the Salmon River, which by comparison represents only 7 percent of the annual sediment trapped in the three reservoirs. In the absence of any changes in sediment storage below Hells Canyon dam (such as from beach erosion or bed incision), S_o in this reach should be equivalent to S_t. However, substantial changes in historical sediment storage have occurred downstream of Hells Canyon dam and are addressed in the following sections.

3.4.1.2 Beaches and Terraces

Beaches

Sandbars comprised of particles between 0.062 and 2 mm and connected to the Snake River shoreline are referred to as beaches. Beaches form by deposition of suspended sand in zones of recirculating flow or eddies along the channel margin. Studies of the 1996 controlled flood on the Grand Canyon indicate that large floods that transport sediment from the bed to the channel margin and the continuous supply of sand-size sediment from upstream are both necessary to maintain river beaches (Webb et al., 1999). Beaches occupy a small proportion of the total river bank and represent an important resource in Hells Canyon for fish rearing and recreational use (e.g., camping, boating, and hiking).

Idaho Power conducted a study to evaluate potential sources of the sand and coarse sediment found upstream, within, and downstream of the Hells Canyon Project (Miller et al., 2003b; Parkinson et al., 2003b). Idaho Power collected sediment from the Snake River upstream of Weiser (RM 449), sediment trapped in the reservoirs, sediment within tributaries, and sediment in sand and gravel bars in the Snake River downstream of Hells Canyon dam to below the confluence with the Salmon River (RM 152). Visual analyses of coarse sediment (>4 mm) indicated a mixture of both local and upstream host rocks, with a trend of increasing supply from local host rocks (mostly basalt) downstream of Hells Canyon dam.

Idaho Power evaluated the source of fine sediment (<4 mm) collected from the mainstem, tributaries, and sandbars using X-ray diffraction (XRD)[41] (Miller et al., 2003b; Parkinson et al., 2003b; CH2M HILL, 2006). The analyses measured the relative fractions of three minerals: plagioclase, quartz, and potassium feldspar (or K-spar). Quartz and K-spar are common to calc-alkaline intrusive rocks (such as granite, which is most common in the Payette and Boise River basins), but they are largely absent in mafic, volcanic rocks (such as basalt, which is common in tributary basins downstream of Weiser). Plagioclase occurs both in granite and basalt, but plagioclase (predominantly calcium-rich plagioclase) is found in greater proportions in basalt. For sediment collected from the mainstem Snake River between RM 152 and RM 149, CH2M HILL (2006) reported that the river mile where each sample was taken explained 67 percent of the total variance in the fraction of plagioclase, but that river mile explained only 56 percent of the variance in the fraction of quartz and only 13 percent of the variance in the fraction of K-spar in mainstem sediment. The downstream increase in plagioclase content supports mixing with sediment derived from more mafic source rocks (basalt) located downstream of Hells Canyon dam; however, the lack of a significant downstream trend in either quartz or K-spar suggests a homogenous sediment composition consistent with a host rock that includes basalt, calc-alkaline intrusive rocks, and metamorphic rocks. These results also indicate that local sources of calc-alkaline intrusive rocks are a significant source of mainstem sediments.

Historical aerial photographs indicate that the number and size of sandbars between Hells Canyon dam and the Salmon River declined substantially during the decade immediately following construction of the Hells Canyon Project (Grams, 1991; Grams and Schmidt, 1999b; Miller et al., 2003a.). The magnitude of this reduction declined with increasing distance downstream of Hells Canyon dam (Grams and Schmidt, 1999b). For the 9 years between 1964 and 1973, Grams (1991) and Grams and Schmidt (1999b) measured a 57 percent reduction in the number and cumulative area of sandbars. In a complementary inventory compiled by Idaho Power, Miller et al. (2003a) reported a 37 percent reduction in the number of sandbars for the same time period and noted an 11 percent increase in the number of sandbars in their inventory between 1955 (prior to dam construction) and 1964.

The rate of sand loss has declined substantially since the 1970s. Grams (1991) measured a roughly 30 percent reduction in the number and cumulative area of sandbars during the nine years between 1973 and 1982. Grams (1991) reported a 2 percent reduction in the number of sandbars from 1982 to 1990 and a 4 percent decrease in the total area of sandbars for this same period, but noted these changes were within the margin of error for the analysis. In contrast, Miller et al. (2003a) calculated a 19 percent increase in the number of sandbars between 1982 and 1997. Miller et al. (2003a) did not report any change in sandbar area for comparison with the results of Grams (1991).

Based on the work of Grams (1991) and Grams and Schmidt (1999b), Wilcock et al. (2002) calculated 10,500 to 35,000 tons per year for the average annual rate of sand loss from sandbars below Hells Canyon dam between 1964 and 1990, which encompasses the decade of rapid sand export after dam construction. Based on values presented in the sediment budget, the annual rate of sand loss between 1964 and 1990 would represents 1 to 15 percent of possible sand- to gravel-size sediment sequestered in the three reservoirs each year, and is roughly equal to the estimated sand and gravel component supplied by all of the tributaries downstream of Hells Canyon dam.

In addition to analyzing aerial photographs for the sandbar inventory, Idaho Power conducted transect surveys at four sandbars between 1997 and 2000: Pine Bar, Salt Creek Bar, Fish Trap Bar, and China Bar (figure 23). In general, Parkinson et al. (2003a) reported that all monitored sandbars except Salt Creek Bar experienced both erosion and aggradation (buildup through sediment deposition) during the monitoring period. Salt Creek Bar experienced only erosion. Results of sandbar stability analyses

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41 XRD is a laboratory method used to determine the mineralogical signature of a material by analyzing the crystalline structure at the atomic level.

conducted at Fish Trap Bar indicated instability for some transects during drawdown from load-following flows and during the recession of a major flood (Parkinson et al., 2003c). Stability analyses for Pine Bar found that all eight transects were unstable during the recession of a major flood. Idaho Power updated the stability analyses using an instantaneous drawdown from 20,000 cfs to 10,000 cfs to conservatively model a 2-hour drawdown. Results indicated a similar level of sandbar instability under load-following flows at Fish Trap Bar, some instability at Pine Bar, and marginal to stable conditions at Tin Shed Bar (Parkinson et al., 2005b).

Idaho Power (Parkinson et al., 2005a) modeled sand mobilization and measured active sand transport at the four sandbars to determine the minimum flows capable of mobilizing sand. The results indicated that sand is transported at flows lower and higher than those predicted by the model. Based on available information, there are no estimates of S_o for the reach below Hells Canyon dam, except for the volume of historical sand loss estimated by Wilcock et al. (2002).

Terraces

Terraces are generally considered ancient fluvial surfaces located at an elevation above the current floodplain sufficient to isolate them from current channel processes. Terraces may be erosional or depositional in nature and form in response to channel incision caused by a lowering of the base level (such as a drop in sea level), tectonic uplift, or a change in hydrologic regime. Two sets of terraces have been identified within the Hells Canyon reach. High terraces located 100 to 600 feet above the current channel bed are interpreted to have formed by rapid incision and high water during the Bonneville Flood and subsequent Holocene flooding (Miller et al., 2003a). Lower terraces and river bars, located approximately 10 to 15 feet above the current channel, may have been formed by natural flows prior to basin regulation (that is, more than 100 years ago) (Parkinson et al., 2003a).

Many terraces below Hells Canyon dam contain valuable archaeological resources that may be threatened by the loss of beaches (see section 3.9.2.1, *Effects of Project Operations on Cultural Resources*). Many of the remaining beaches provide a buffer against erosion of these terraces. Bank stability analyses performed by Idaho Power found that portions of terraces may become unstable when subjected to rapid water drawdown during non-operational flood events (Parkinson et al., 2003a). The pre-dam flood flows would have delivered greater quantities of sand that would have maintained sandbar buffers adjacent to some terraces. Grams and Schmidt (1999b) documented high flows reaching terrace cut banks, which could contribute to bank retreat.

3.4.1.3 Spawning Gravel

Gravel beds with sediment ranging in size from 25 to 150 mm are used for spawning by fall Chinook salmon (Groves and Chandler, 2001). Based on spawning surveys conducted by Idaho Power between 1991 and 1993, the majority of redds (salmon spawning sites) were located downstream of the Snake River confluence with the Grande Ronde River (RM 169), an area with abundant sediment supply from the Imnaha River (RM 191.7), Salmon River (RM 187.5) and the Grande Ronde River (figure 1). However, since 1994, most observed redds have been located upstream of the confluence with the Salmon River.

Bedload transport rates for gravel have not been measured and thus are unknown. Idaho Power concludes from spawning-gravel size reported by Groves and Chandler (2001), assumptions for incipient motion, and MIKE 11 hydrodynamic modeling[42] that 11 to 30 percent of the bed surface in the Snake River between Hells Canyon dam and Salmon River (primarily downstream of tributaries) is mobilized at

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[42] MIKE 11 is a one-dimensional hydrodynamic model that includes add-on modules capable of simulating unsteady flows, sediment transport, flood forecasting, and water quality in open channels.

a flow of 30,000 cfs (the lowest modeled flow) (Parkinson et al., 2003a). Scour chains installed by Idaho Power in spawning beds downstream of Hells Canyon dam showed gravel mobilization during the monitoring period that included a peak flow of 30,800 cfs (Parkinson et al., 2003a). The location of scour chains in spawning beds implies that gravel mobilization in those areas could partly be due to spawning activity. Boat wakes are unlikely to contribute to gravel mobilization because wake influence is limited to disturbance of the armor layer in the near-shore environment.

3.4.2 Environmental Effects

3.4.2.1 Effects of Project Operations on Sediment Transport

We describe Idaho Power's Proposed Operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on reservoir levels and project outflows in section 3.3.2, *Effects of Project Operations on Water Quantity*. In section 3.3.2.2, we identify operation-related recommendations filed by agencies, tribes, and other parties (table 9), and we describe five alternative operational scenarios that we use to assess the effects of the various operation-related recommendations. At our request (AIR OP-1), Idaho Power simulated project operations for these representative scenarios under various hydrologic conditions. Refer to section 3.3.2.2 for additional discussion of the scenarios and the modeling process used for the simulations. We use the results of these simulations to assess the effects of the operation-related recommendations on: (1) beach erosion; (2) terrace stability; and (3) quality of spawning gravel.

Beach and Terrace Erosion

Sediment trapping within Idaho Power's mainstem reservoirs and flow fluctuations caused by project operations may contribute to the erosion of beaches and terraces downstream of Hells Canyon dam. The loss of beaches and sandbars may adversely affect aquatic resources by reducing the availability of gently sloping shorelines favored by rearing juvenile fall Chinook salmon (Kondolf, 1997; Wissmar, 2004). Because beaches add to the aesthetic appeal of the riverscape and provide locations for boat landing, swimming, and camping, beach erosion reduces the aesthetic appeal of the river and reduces the extent of beaches available for recreation. Beach and terrace erosion may also affect important archaeological sites. In this section, we evaluate the effects that proposed and alternative operations would have on beach and terrace erosion based on changes in sand mobility and terrace stability.

Our Analysis

Numerous studies in the Colorado River downstream of Glen Canyon dam have found that sediment-replenishing floods are required for the maintenance of sandbars and deposition of sand on high-stage terraces (e.g., Bennett, 1993; Schmidt, 1993; Webb et al., 1999). Investigations of the effects of flow regulation have found that lower flows and fluctuating flows with low suspended-sand concentrations can erode sandbars and redistribute sand to lower channel elevations (e.g., Schmidt and Graf, 1990; Beus and Avery, 1993; Schmidt, 1993; Melis, 1997; Webb et al., 1999). Budhu and Gobin (1994) documented seepage erosion of sandbars during downramping of load-following operations. Grams and Schmidt (1999b) observed the erosion of terraces in areas where beaches that had provided a buffer between the water and the terraces were substantially eroded or completely lost. Bauer and Schmidt (1993) demonstrated sandbar erosion by wave action. Based on an Idaho Power wave impact study performed on Hells Canyon sandbars, Mussetter (2006) found that waves created by powerboats are another important factor in mobilizing sediment from beach shorelines and may cause beach erosion during low to intermediate flow conditions.

To assess sandbar areas subject to erosion, we examined annual flow-duration curves, hydrodynamic model results of sand mobilization at four sandbars, field measurements of sand transport rates at four sandbars, and the simulated stability of three sandbars under instantaneous (conservative) drawdown conditions (Parkinson et al., 2005a,b). Areas of sand mobilization and inundation were simulated for each hour of the year and were then summed over the entire year. Areas of sand mobilization measured in the field were both higher and lower than those predicted by the hydrodynamic model; however, the estimates are suitable for our purposes in differentiating among the relative effects of various operational scenarios. The cumulative annual area of sandbars that would be subject to inundation and sand mobilization under Proposed Operations and the five alternative scenarios are presented in tables 11 and 12. The area of sandbars that would be subject to sand mobilization is illustrated graphically in figures 23 through 25. The percent change in area of sandbars that would be subject to sand mobilization under the five alternative scenarios relative to the area of sand mobilization for Proposed Operations are presented in table 13.

Table 11. Estimated cumulative annual area of sandbars that would be subject to inundation under Proposed Operations and five alternative scenarios. (Source: Parkinson et al., 2005a, as modified by staff)

		Inundated Area of Sandbars (m^2)			
Scenario	**Water Year Type[a]**	**Pine Bar (RM 227.5)**	**Salt Creek (RM 222.4)**	**Fish Trap (RM 216.4)**	**China Bar (RM 192.3)**
Proposed Operations	Extremely low	10,795	5,120	1,828	869
	Medium	12,486	5,739	3,243	1,309
	Extremely high	13,064	5,942	3,969	1,538
Scenario 1a (Reregulating)	Extremely low	10,800	5,136	1,769	859
	Medium	12,437	5,725	3,181	1,291
	Extremely high	13,076	5,944	3,991	1,537
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	10,827	5,144	1,779	863
	Medium	12,484	5,739	3,215	1,300
	Extremely high	13,074	5,944	3,987	1,537
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	10,821	5,137	1,789	863
	Medium	12,493	5,742	3,237	1,307
	Extremely high	13,074	5,943	3,979	1,540
Scenario 2 (Flow Augmentation)	Extremely low	10,835	5,144	1,814	869
	Medium	12,446	5,729	3,249	1,311
	Extremely high	13,052	5,938	3,970	1,537
Scenario 3 (Navigation)	Extremely low	10,896	5,168	1,847	880
	Medium	12,469	5,735	3,255	1,310
	Extremely high	13,059	5,942	3,981	1,541

[a] Water year types and corresponding flow years include extremely low (1992), medium (1995), and extremely high (1997).

Table 12. Estimated cumulative annual area of sandbars that would be subject to sand mobilization under Proposed Operations and five alternative scenarios. (Source: Parkinson et al., 2005a, as modified by staff)

Scenario	Water Year Type[a]	Mobile Area of Sandbars (m^2) Pine Bar (RM 227.5)	Salt Creek (RM 222.4)	Fish Trap (RM 216.4)	China Bar (RM 192.3)
Proposed Operations	Extremely low	147	1	49	591
	Medium	716	35	490	789
	Extremely high	1,062	74	796	861
Scenario 1a (Reregulating)	Extremely low	109	0	26	600
	Medium	649	33	464	781
	Extremely high	1,012	70	786	856
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	131	0	30	602
	Medium	667	33	473	783
	Extremely high	1,018	71	786	856
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	148	0	35	598
	Medium	683	33	481	786
	Extremely high	1,070	73	796	861
Scenario 2 (Flow Augmentation)	Extremely low	131	1	40	599
	Medium	677	38	498	787
	Extremely high	1,058	75	797	861
Scenario 3 (Navigation)	Extremely low	140	1	47	607
	Medium	671	35	491	787
	Extremely high	1,053	76	803	861

[a] Water year types and corresponding flow years include extremely low (1992), medium (1995), and extremely high (1997).

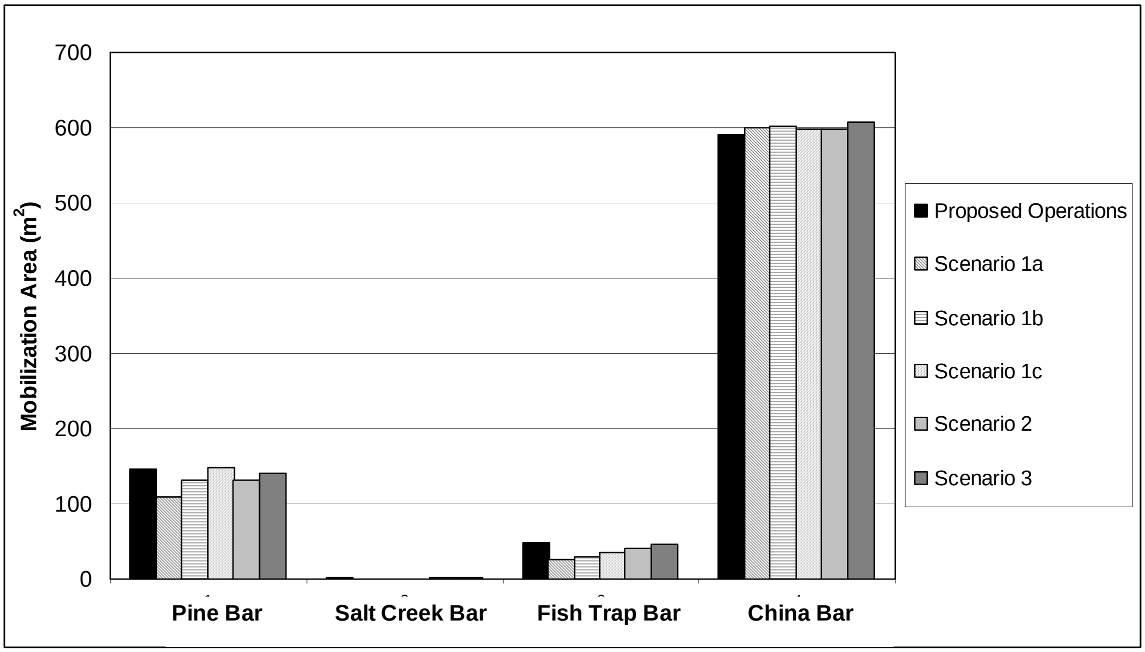

Figure 23. Estimated cumulative annual area of sandbars that would be subject to sand mobilization under Proposed Operations and five alternative scenarios for an extremely low water year. (Source: Parkinson et al., 2005a, as modified by staff)

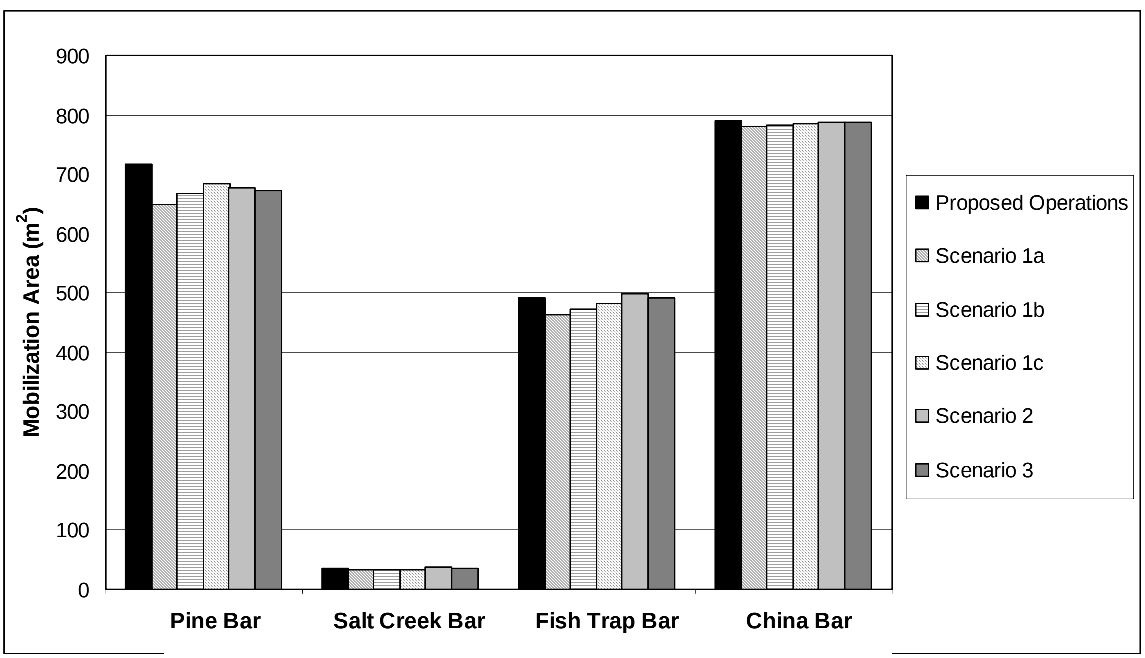

Figure 24. Estimated cumulative annual area of sandbars that would be subject to sand mobilization under Proposed Operations and five alternative scenarios for a medium water year. (Source: Parkinson et al., 2005a, as modified by staff)

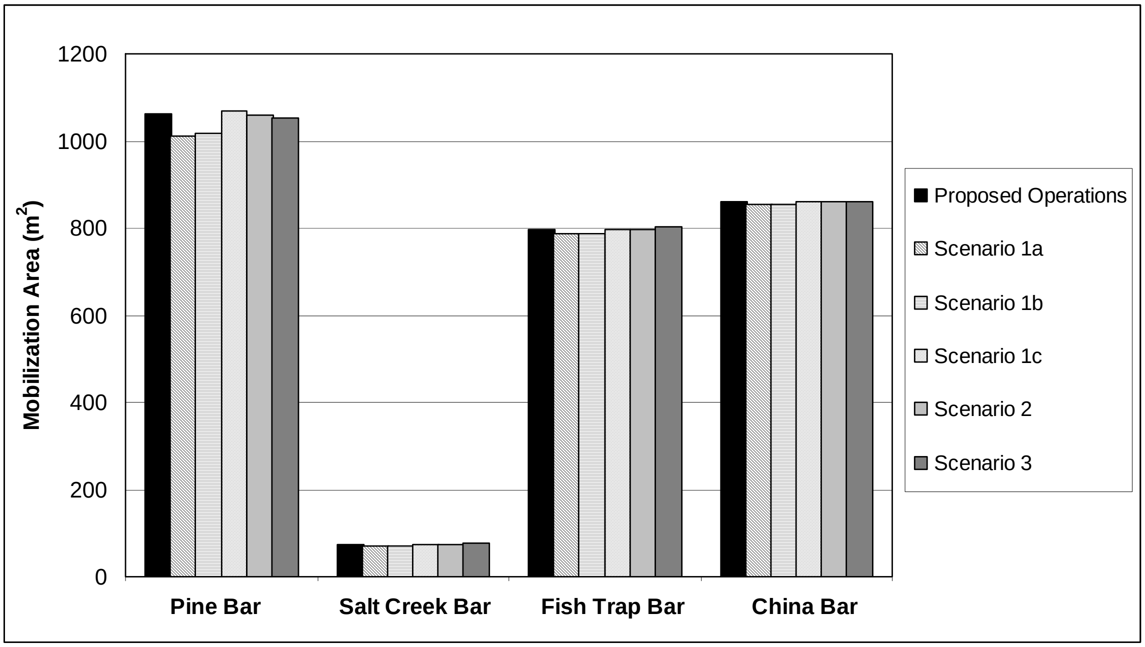

Figure 25. Estimated cumulative annual area of sandbars that would be subject to sand mobilization under Proposed Operations and five alternative scenarios for an extremely high water year. (Source: Parkinson et al., 2005a, as modified by staff)

Table 13. Estimated percent change in cumulative annual area of sandbars that would be subject to sand mobilization under five alternative scenarios. Percentages are given relative to the area of sand mobilization for Proposed Operations. (Source: Parkinson et al., 2005a, as modified by staff)

		Percent Change in Mobile Area of Sandbars Relative to Proposed Operations			
Scenario	**Water Year Type**[a]	**Pine Bar (RM 227.5)**	**Salt Creek (RM 222.4)**	**Fish Trap (RM 216.4)**	**China Bar (RM 192.3)**
Scenario 1a (Reregulating)	Extremely low	–25.9	Ind.[b]	–46.9	1.5
	Medium	–9.4	–5.7	–5.3	–1.0
	Extremely high	–4.7	–5.4	–1.3	–0.6
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	–10.9	Ind.	–38.8	1.9
	Medium	–6.8	–5.7	–3.5	–0.8
	Extremely high	–4.1	–4.1	–1.3	–0.6
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	0.7	Ind.	–28.6	1.2
	Medium	–4.6	–5.7	–1.8	–0.4
	Extremely high	0.8	–1.4	0.0	0.0

Scenario	Water Year Type[a]	Percent Change in Mobile Area of Sandbars Relative to Proposed Operations: Pine Bar (RM 227.5)	Salt Creek (RM 222.4)	Fish Trap (RM 216.4)	China Bar (RM 192.3)
Scenario 2 (Flow Augmentation)	Extremely low	–10.9	Ind.	–18.4	1.4
	Medium	–5.4	8.6	1.6	–0.3
	Extremely high	–0.4	1.4	0.1	0.0
Scenario 3 (Navigation)	Extremely low	–4.8	Ind.	–4.1	2.7
	Medium	–6.3	0.0	0.2	–0.3
	Extremely high	–0.8	2.7	0.9	0.0

[a] Water year types and corresponding flow years include extremely low (1992), medium (1995), and extremely high (1997).

[b] Ind. = indeterminate change due to the relatively small area for Proposed Operations (see table 12).

Results show that the estimated area of sandbar inundation varies more among sandbar locations and water year types than among Proposed Operations and the alternative scenarios. For instance, the area of sandbars subject to inundation varies by more than one order of magnitude between Pine Bar and China Bar (table 11), whereas the total area of sandbars that would be subject to inundation under any one of the five alternative scenarios differs by no more than about ±2 percent of the area inundated under Proposed Operations. Based on results of the analysis, the alternative scenarios would not cause a measurable change in the area of annual sandbar inundation.

The estimated area of sandbar mobilization also exhibits the greatest variability among sandbar locations and water year types, but in this case, the factor does vary considerably among flow scenarios and is correlated with ramping rate (table 12). The area of sand mobilization could be reduced by 26 to 47 percent for the extremely low water year under alternative Scenario 1a (Reregulating) for some sandbars (i.e., Pine Bar and Fish Trap Bar) but could increase modestly by 1.5 percent for other sandbars (i.e., China Bar). With the exception of China Bar, the 2-inches-per-hour ramping rate restriction would also yield a measurable reduction in the area of sandbar mobilization, and the other scenarios would provide little or no reduction.

The influence of drawdown rate on the stability of sloping portions of sandbars during load-following operations has not been evaluated. Nonetheless, slopes would be more prone to failure if the drawdown rate exceeds the rate at which the slope is able to drain. Under this condition, failure risk by seepage would increase as the range of fluctuation increases, the period in which peak discharge is held constant decreases, and the ramping rate increases (Parkinson et al., 2005b, appendix C). Based solely on ramping rates, the alternative scenarios with a 2-inches-per-hour ramping rate (Scenarios 1b, 1d, and 1f) or less (i.e., Reregulating) would carry the greatest reduction in risk of beach failure, followed by scenarios with a year-round 6-inches-per-hour ramping rate.

The results of these comparisons indicate that, in general, the area of sand mobilization would decline under the alternative scenarios compared to Proposed Operations, and the degree of reduction would vary considerably between sandbar locations. The area of beach inundation, which is causally linked to beach and terrace erosion, would not change measurably under the alternative scenarios; however, based on slope stability analyses, implementing the Year-round 6-Inches-Per-Hour Ramping Rate Scenario would cause greater seepage failure of sandbar slopes during drawdown than the other alternatives compared to Proposed Operations. Model results show that the area of sand mobilization at all of the model locations except China Bar would decline under alternative Scenario 1a (Reregulating). The area of sand mobilization would decline the least under the Year-round 6-Inches-Per-Hour Ramping

Rate and Navigation scenarios, with minor increases in mobilization area depending on sandbar location and water year type.

Spawning Gravel

Trapping of sand and gravel within the project's mainstem reservoirs and flow fluctuations caused by project operations may contribute to a reduction in the quality and quantity of spawning habitat downstream of Hells Canyon dam that is available for fall Chinook salmon. In this section, we evaluate the effects that proposed and alternative operations would have on the quality and quantity of spawning gravel.

Our Analysis

Numerous studies of the effects of dams show that the combination of a reduced sediment supply from sediment trapping in reservoirs and the elimination of large-magnitude floods that typically mobilize gravel can cause scouring and armoring of the stream bed downstream of dams (e.g., Gilbert, 1917; Leopold and Maddock, 1953; Galay, 1983). Armoring and the associated increase in roughness can diminish the quality of spawning habitat by increasing the threshold shear stress necessary for the transport and supply of gravel to spawning sites (Buffington and Montgomery, 1999). This increased stability can result in greater retention of finer sediments and reduce the permeability of spawning substrates (Wilcock, 1998; Wilcock et al., 2001; Wilcock and Kenworthy, 2002), which can lead to reductions in the survival of incubating salmon and steelhead eggs.

To assess the potential for gravel mobilization, we examined annual flow-duration curves and the minimum discharge required for gravel mobilization. As discussed in section 3.4.1.3, flows less than 30,000 cfs are sufficient to mobilize a portion of the bed containing sediment within the size range of spawning gravel (Parkinson et al., 2003a). Therefore, we used the percent exceedance reported for 22,200 cfs (the maximum peak flow in the historical period of record with an annual recurrence) to compare the change in potential for gravel mobilization under Proposed Operations, under Reregulating, Year-round 2-Inches-Per-Hour and Year-round 6-Inches-Per-Hour Ramping Rate restrictions, and under the Flow Augmentation and Navigation scenarios. Table 14 presents the percent exceedance for selected flows based on flow-duration curves for Proposed Operations and the five alternative scenarios.

Table 14. Percent exceedance for selected flows based on flow-duration curves for Proposed Operations and five alternative scenarios. (Source: Parkinson et al., 2005a, as modified by staff)

		Percent Exceedance for the Indicated Flow[b]		
Scenario	**Water Year Type**[a]	**10,000 cfs**	**22,200 cfs**	**39,621 cfs**
Proposed Operations	Extremely low	23	1	0
	Medium	95	39	3
	Extremely high	100	65	38
Scenario 1a (Reregulating)	Extremely low	35	0	0
	Medium	100	35	3
	Extremely high	100	63	38

Scenario	Water Year Type[a]	Percent Exceedance for the Indicated Flow[b] 10,000 cfs	22,200 cfs	39,621 cfs
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	34	0	0
	Medium	100	35	2
	Extremely high	100	63	37
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	31	0	0
	Medium	99	36	2
	Extremely high	100	65	37
Scenario 2 (Flow Augmentation)	Extremely low	28	1	0
	Medium	93	40	2
	Extremely high	100	65	38
Scenario 3 (Navigation)	Extremely low	24	1	0
	Medium	95	40	2
	Extremely high	100	65	38

[a] Water year types and corresponding flow years include extremely low (1992), medium (1995), and extremely high (1997).

[b] Indicated flows correspond to the simulated flow for incipient motion of 1 mm sand (10,000 cfs), the maximum peak flow with an annual recurrence (22,200 cfs), and the flow with a 1.5-year recurrence (39,621 cfs), as indicated in the AIRs.

Results of these comparisons indicate that the occurrence of potential gravel-mobilizing flows of 22,200 cfs would be reduced by as much as 4 percent under alternative Scenarios 1a, 1b, and 1c during medium water years. Gravel mobilization at 22,200 cfs would remain about the same or increase slightly under the Flow Augmentation and Navigation scenarios.

3.4.2.2 Sediment Augmentation and Monitoring

Idaho Power proposes to stabilize terraces containing culturally important sites and has also agreed to implement Forest Service condition no. FS-4, which includes measures to stabilize or restore sandbars. Idaho Power also proposes to implement a gravel monitoring plan, which it describes in appendix B of its comments on the draft EIS. The monitoring plan would include the following measures downstream of Hells Canyon dam: (1) continuation of aerial redd surveys from Asotin, WA (RM 145) to Hells Canyon dam and deep-water redd surveys at approximately 35 sites; (2) high resolution bathymetry monitoring to estimate bed scour or deposition at selected reaches every 3 to 5 years; (3) ground surveys in shallow areas where bathymetric monitoring is infeasible; (4) reach-scale mapping of spawning substrate in potential high-use spawning index sites upstream of the Salmon River every 5 years; (5) substrate classification by photography at approximately 650 locations between Hells Canyon dam and the Salmon River every 3 to 5 years and after high runoff events; (6) assessment of gravel quality by monitoring incubation and emergence at four sites between Hells Canyon dam and the Salmon River at 5-year intervals; and (7) the use of scour chains or sliding bead monitors to assess bed scour or gravel deposition at selected known and potential spawning areas. Idaho Power also states in its comments on the draft EIS that if monitoring indicates that gravel augmentation may be necessary or appropriate, the Commission could then instruct Idaho Power to develop a plan to address the issue.

Resource agencies, tribes, and other parties recommend measures for sediment augmentation and monitoring to address beach erosion, terrace instability, and the effects on spawning gravel as a result of ongoing project effects. We evaluate the effectiveness of the various measures below.

Forest Service condition FS-4 specifies that Idaho Power fund a sandbar maintenance and restoration program consisting of sand augmentation and monitoring. To fund the program, Idaho Power would establish and maintain an interest-bearing account, with the Forest Service as the beneficiary. Under this condition, the Forest Service would use the fund to restore 14 acres of sandbars on or adjacent to National Forest System lands. Sand would be placed at restoration sites between the levels of the 50,000 cfs and 100,000 cfs flows, which is equivalent to flows with recurrence frequencies of approximately 2.3 and 30 years, respectively, as measured immediately downstream of Hells Canyon dam.

Under measure AR/IRU-21, Idaho Power would be required to replenish an appropriate portion of the sediments (sand and gravel) to the Snake River downstream of Hells Canyon dam that have been diminished due to project operations. The quantity and composition of the sediment to be added would be determined based on specific habitat needs of anadromous and resident fish species and benthic organisms affected by the disruption of fine sediment and gravel supplies. Idaho Power would be required to develop a plan to identify a source and means of material excavation, propose methods and costs for sediment delivery, estimate sediment volumes and water energy available for sediment transport, address monitoring and reporting, and develop an adaptive management protocol for sediment augmentation.

The Forest Service (FS-31) recommends that Idaho Power prepare a gravel monitoring plan. The plan would include weekly aerial redd surveys, mapping of reach-scale spawning substrate, identification of representative reaches for intensive annual substrate monitoring (riverbed elevations, bed scour and deposition, and bedload sampling), and provide the Forest Service with an annual report of results.

Under Interior-68, Interior recommends that Idaho Power monitor selected beaches and gravel bars to determine rates of sediment depletion on exposed and submerged sediment deposits. Under Interior-69, Interior also recommends that Idaho Power monitor the quantity and quality of gravel material used by aquatic species in the Snake River below Hells Canyon dam. NMFS-6 recommends that Idaho Power, in cooperation with various resource agencies, design and carry out monitoring of fall Chinook salmon spawning gravel between Hells Canyon dam and its confluence with the Salmon River. The recommendation calls for the study to be repeated every 5 years and to employ high-resolution, multi-beam bathymetry, reach-scale substrate mapping using the Idaho Power's GIS database, and substrate monitoring using scour chains or sliding bead monitors. NMFS-7 recommends the evaluation of fall Chinook salmon egg-to-fry survival in at least two representative spawning areas in the Snake River downstream of Hells Canyon dam in 2015 and every 5 years thereafter. NMFS further recommends that the location of these specific monitoring locations be approved by NMFS and that Idaho Power provide a report of Chinook salmon egg-to-fry survival to NMFS and file it with FERC by December 31 of the same year.

The Nez Perce Tribe (NPT-20) recommends that Idaho Power be required to monitor the movement of sand, silt, and gravel from above, through, and downstream of the Hells Canyon Project to accurately quantify the composition and rate of movement of sediment. The Nez Perce Tribe (NPT-21) also recommends that Idaho Power be required to restore sandbars to their pre-project number and size through the use of sand augmentation practices to be developed in consultation with resource agencies. The purpose of sand augmentation would be to protect tribal cultural sites at risk of degradation from the erosion of sandbars and terraces.

ODFW-53 recommends that Idaho Power implement a gravel monitoring program to assess spawning gravel for fall Chinook salmon downstream of Hells Canyon dam. ODFW-53 also recommends that Idaho Power develop a bedload augmentation program if monitoring indicates project operations are adversely affecting the quantity and quality of spawning gravel.

Our Analysis

Based on the unit costs for sand procurement, trucking, transport by barge, and placement, we estimate that the funding specified by the Forest Service (FS-4; $937,000 per year for 10 years) would provide sand augmentation at selected beaches of about 2,500 cubic yards per year, which is roughly 7 to 24 percent of the average annual rate of sand loss estimated by Wilcock et al. (2002) for all sandbars below Hells Canyon dam between 1964 and 1990. The sand augmentation program, which would involve material placement above the annual flow level, would help maintain some current beaches and provide a buffer against terrace erosion. This could help reduce the loss of cultural resources, provide recreational benefits, and help maintain the scenic and recreational values of the Hells Canyon wild and scenic river. Restoring sandbars would also provide some benefits to aquatic resources because the augmented sand would be engaged and redistributed by flows with recurrence frequencies ranging from approximately 2.3 to 30 years. Such a program would also have some adverse environmental effects, due to the quantity of sand required and the effects of sediment procurement and delivery. Barges delivering sediment could interfere with recreation traffic and possibly disturb wildlife, particularly eagles.

Sand augmentation to restore beaches to their pre-dam number and size, as recommended by the Nez Perce Tribe (NPT-21) and AR/IRU-21, could restore rearing habitat for juvenile fall Chinook salmon by increasing the availability of near-shore habitat, maintain beaches used for recreation, and reduce potential losses to archaeological resources from beach erosion. However, the volumes of sand required to restore beaches to their pre-dam condition would be considerably larger than the amounts needed for partial restoration of selected sandbars, as called for in FS-4. Consequently, there would be a proportionate increase in adverse environmental effects associated with sediment procurement and delivery to restore beaches to their pre-dam number and size.

Monitoring the movement of sand and gravel and changes in the volume of sand and gravel bars, as recommended by Interior-68 and NPT-20, along with monitoring the use of sand and gravel by Chinook salmon, as recommended under FS-31, Interior-69, ODFW-53, and NMFS-6 would help quantify any changes in sediment storage (ΔS) downstream of Hells Canyon dam, a critical component currently missing from the sediment budget and necessary for the assessment of the effects of ongoing project operations on the spawning and rearing habitat of fall Chinook salmon. Monitoring salmon egg-to-fry survival, as described in NMFS-7, would help to determine whether the quality of incubation habitat has declined and thereby guide any corrective measures in a manner consistent with Idaho Power's proposed gravel monitoring plan. Results from sandbar monitoring would establish current conditions, provide an evaluation of the effectiveness of ramping rate restrictions on the stability of beaches, allow assessment of near-shore beach erosion from boat wakes relative to other recreational, project-related, and natural processes, and help determine if the documented increase in the use of floodplains and culturally significant terraces by recreation users is linked to a decline in sandbars. If significant changes in the number and volume of sandbars are detected, monitoring results could be used to test reasonable alternatives for sand augmentation. Our analysis indicates that conventional sand procurement and delivery methods are not economically or environmentally feasible at this time; however, adaptive measures other than sand augmentation could be proposed to maintain baseline sandbar conditions and protect aquatic habitat. Adaptive measures could include the restriction of various recreational activities (such as powerboat use, camping, and beach access) that are linked to beach and terrace erosion and the loss of fall Chinook rearing habitat.

Substrate monitoring with the use of scour chains and the sampling of bedload over a range of flows would help calibrate future sediment transport models for both sand and gravel. Bedload sampling may not be feasible in some remote locations. Results would fill data gaps in the current sediment budget and quantify the supply rate of sand and gravel from tributary sources to sandbars and spawning sites.

Gravel monitoring, in conjunction with spawning surveys, could determine whether spawning gravel is limiting fall Chinook production. The potential benefits of augmenting spawning gravel could be evaluated by conducting a pilot study consisting of adding gravel and monitoring any effects on the quantity of available spawning habitat. We provide further analysis of a pilot spawning gravel augmentation study in Aquatic Resources section 3.6.2.14, *Sediment Augmentation*.

3.4.3 Cumulative Effects

Alteration of the processes and conditions influencing sediment supply and transport contribute to cumulative effects that can adversely affect ecological, cultural, and recreational resources. The dramatic reduction in sediment supply downstream of dams directly affects the morphology and substrate of the river by reducing the number and size of sand and gravel bars and coarsening the river bed. These effects can be further compounded by flow regulation associated with impoundments.

Historical land use and water resource management have resulted in substantial changes to the sediment budget of the Snake River basin. Land use practices such as deforestation, grazing, land cultivation and irrigation, hydraulic and dredge mining, road construction, land development, channel clearing, and channel straightening, as well as the increased frequency of wildfires, all contributed to higher erosion rates and sediment yield to the drainage network. During the same period of historical development, numerous small and large dams were constructed throughout the drainage network. Between 1901 and 1957, 13 dams were constructed on the main stem Snake River upstream of the Hells Canyon Project. Swan Falls dam, the first dam on the mainstem Snake River upstream of Brownlee dam, was constructed in 1901 and would have trapped much of the increased sediment resulting from historical land use practices upstream of Swan Falls. Mainstem and tributary dams upstream of Brownlee dam have effectively trapped most of the sediment entering the Hells Canyon reach of the Snake River, dramatically reducing the amount of sediment delivered to the free-flowing Hells Canyon Reach downstream of Hells Canyon dam. With respect to sediment supply to the Snake River downstream of Hells Canyon dam, sediment retention by dams has more than offset any increase in sediment supply from land development.

Dam operations reducing the frequency of large magnitude floods can lead to downstream bed armoring, which diminishes the extent and quality of spawning sites and increases the flow threshold necessary to transport gravel. The downstream effects of a dam on sediment supply increase with time because of the cumulative effects of trapping sediment. The impact of sediment trapping by dams is most pronounced immediately downstream of the dams, diminishing with increasing distance downstream as the number of tributary inputs increases.

Cumulative adverse effects on the Snake River downstream of Hells Canyon dam will continue as a result of additional sediment trapping by the Hells Canyon Project. Most of the coarse sediment trapped by the dams is sand. The loss of sand increases the threshold flow for mobilizing gravel, decreasing the frequency of flow events capable of moving spawning gravels.

Idaho Power proposes to address the project's cumulative effects on sediment transport by implementing FS-4, which includes measures to stabilize or restore sandbars.

3.4.4 Unavoidable Adverse Effects

The Snake River annually delivers between 220,000 and 384,000 tons of coarse sediment (>0.063 mm) to Brownlee reservoir. Tributaries deliver an additional 54,000 to 268,000 tons per year of coarse sediment to the Brownlee, Oxbow and Hells Canyon reservoirs. The total load of coarse sediment trapped above Hells Canyon dam is estimated to be 274,000 to 652,500 tons per year. Based on these estimates, the three reservoirs would trap between 13,700,000 and 32,600,000 tons of sand and gravel over the next 50 years that would otherwise be delivered downstream of Hells Canyon dam. This would equate to 274,000 to 652,000 tons of sand and gravel annually. The coarse sediment delivered to the Hells Canyon Reach increases from zero at Hells Canyon dam to 3,850–19,100 tons per year at Pine Bar, to 5,540–27,520 tons per year at Tin Shed, to 10,000–49,900 tons per year at the Salmon River confluence (excluding the Imnaha River). The total flux of coarse sediment within the Snake River at its confluence with the Salmon River is between 3 and 7 percent of what it would be without the three dams of the Hells Canyon Project. This assumes the Swan Falls dam and upstream tributary dams remain intact. Without augmentation of coarse grained sediment downstream of Hells Canyon dam, the loss of sand and gravel bars would continue to adversely affect aquatic and riparian habitat.

3.5 WATER QUALITY

3.5.1 Affected Environment

3.5.1.1 Water Quality Standards

The Snake River within the project area is an interstate water body with the Idaho/Oregon State boundary described as the centerline of the river. Since the waters from each side of the Snake River can mix with the other side, waters of the entire river cross-section must be of a quality to protect the beneficial uses designated by the states of Idaho and Oregon. Beneficial uses designated by Idaho and Oregon for Snake River reaches in the project area are presented in tables 15 and 16, respectively.

As required under section 303(d) of the federal CWA, Idaho and Oregon periodically review the status of water quality and develop a list of water-quality limited waterbodies referred to as the 303(d) list. Both states have listed segments of the Snake River in the project area on their respective 303(d) list. The most recent U.S. Environmental Protection Agency (EPA)-approved 303(d) listings are presented in tables 15 and 16. IDEQ and ODEQ have cooperatively developed a total maximum daily load (TMDL) to address these listings.

Table 15. Idaho designated beneficial uses and most recent EPA-approved 303(d) listings for the Snake River. (Sources: IDEQ, 2005a; IDEQ and ODEQ, 2004, as modified by staff)

Segment	Designated Beneficial Uses[a]	303(d) Listed Pollutants
Brownlee reservoir, Scott Creek to Brownlee dam (RM 347–285)	Coldwater aquatic life, primary contact recreation, domestic water supply, special resource water[b]	DO, mercury, nutrients, pH,[c] sediment
Oxbow reservoir (RM 285–272.5)	Coldwater aquatic life, primary contact recreation, domestic water supply, special resource water[b]	Nutrients, sediment, pesticides,
Hells Canyon reservoir (RM 272.5–247)	Coldwater aquatic life, primary contact recreation, domestic water supply, special resource water[b]	Not listed
Downstream Snake River, Hells Canyon dam to Salmon River inflow (RM 247–188)	Coldwater aquatic life, salmonid spawning, primary contact recreation, domestic water supply, special resource water[b]	Temperature

Notes: DO – dissolved oxygen
EPA – Environmental Protection Agency
IDEQ – Idaho Department of Environmental Quality
ODEQ – Oregon Department of Environmental Quality
pH – potential hydrogen
RM – river mile
TMDL – total maximum daily load

[a] The designation of salmonid spawning for both Idaho and Oregon specifies that this designation applies only when and where salmonids are present and spawning.

[b] Idaho's designation of special resource water is applied where there are unique or outstanding characteristics or where intensive protection of water quality is needed to maintain a current designated beneficial use.

[c] Based on results of analyzing pH values for the TMDL process, IDEQ and ODEQ (2004) recommended that the state of Idaho delist Brownlee reservoir for pH.

Table 16. Oregon designated beneficial uses and most recent EPA-approved 303(d) listings for the Snake River. (Sources: IDEQ and ODEQ, 2004; ODEQ, 2005, as modified by staff)

Segment	Designated Beneficial Uses	303(d) Listed Pollutants
Upstream Snake River to Farewell bend (RM 395–335)	Public/private domestic water supply, industrial water supply, irrigation water, livestock watering, salmonid rearing and spawning[a] (trout), resident fish (warm water) and aquatic life, water-contact recreation, wildlife and hunting, fishing, boating, aesthetics	Mercury, temperature
Brownlee reservoir, Oxbow reservoir, and upper half of Hells Canyon reservoir (RM 335–260)	Public/private domestic water supply, industrial water supply, irrigation water, livestock watering, salmonid rearing and spawning,[a] resident fish and aquatic life, water-contact recreation, wildlife and hunting, fishing, boating, aesthetics, hydropower	Mercury, temperature
Lower half of Hells Canyon reservoir and downstream Snake River (RM 260–188)	Public/private domestic water supply, industrial water supply, irrigation water, livestock watering, salmonid rearing and spawning[a] (downstream), resident fish and aquatic life, water-contact recreation, wildlife and hunting, fishing, boating, aesthetics, anadromous fish passage, commercial navigation and transport	Mercury, temperature

Note: RM – river mile

[a] The designation of salmonid spawning for both Idaho and Oregon specifies that this designation applies only when and where salmonids are present and spawning.

Each state has its own water quality criteria developed specifically to protect the designated beneficial uses. Idaho’s criteria are in the Idaho Administrative Code (IDAPA 58.01.02) and Oregon’s criteria are in the Oregon Administrative Rules (OAR 340-41). The interstate nature of the Snake River in the project area requires that the more stringent of the two states’ water quality criteria be applied to the river. Because Idaho and Oregon use different methods to establish water quality criteria, it is not immediately obvious which state’s criteria are most stringent. Therefore, IDEQ and ODEQ conducted a direct calculation of the criteria to determine which state’s criteria were most stringent (Glass et al., 2001) prior to development of the TMDL. The resulting water quality targets are listed in table 17.

Table 17. TMDL water quality targets for the Snake River–Hells Canyon and applicable Idaho and Oregon water quality criteria. (Source: IDEQ and ODEQ, 2004; Idaho Administrative Procedures Act 58 Title 01 Chapter 02; OAR Chapter 340, Division 041, as modified by staff)

Parameter	TMDL Selected Target	Water Quality Criteria [a]
Temperature		
Full Snake River to Hells Canyon reach (RM 409 to 188), year-round	For coldwater aquatic life and salmonid rearing, a maximum 7-day average maximum temperature of 17.8ºC if and when the site potential is less than a 7-day average maximum temperature of 17.8ºC. If and when the site potential is greater than a 7-day average maximum temperature of 17.8ºC, the target is no more than a 0.14ºC increase from anthropogenic sources. When aquatic species listed under the ESA are present, and if a temperature increase would impair the biological integrity of the threatened or endangered species' population, the target is no greater than a 0.14ºC increase from anthropogenic sources.	Idaho: For aquatic life, 22°C or less with a maximum daily average of no greater than 19°C. Oregon: For salmon/steelhead migration corridor, a 7-day average maximum temperature of 20ºC at times and places where the salmonid spawning standard does not apply. Where the department determines that the natural thermal potential of all or a portion of a waterbody exceeds this, the natural thermal potential temperatures supersede the biologically-based criteria, and are deemed to be the applicable temperature criteria for that water body. [b]
Downstream Snake River (RM 247 to 188), October 23 to April 15	For salmonid spawning, when and where it occurs, a maximum weekly maximum temperature of 13ºC (when and where salmonid spawning occurs) if and when the site potential is less than a weekly maximum temperature of 13ºC. If and when the site potential is greater than a weekly maximum temperature of 13ºC, the target is no more than a 0.14ºC increase from anthropogenic sources. When aquatic species listed under the ESA are present, and if a temperature increase would impair the biological integrity of the threatened or endangered species' population, the target is no greater than a 0.14ºC increase from anthropogenic sources. These targets apply only to from October 23 to April 15 for fall Chinook salmon and from November 1 to March 30 for mountain whitefish.	Idaho: For salmonid spawning and incubation, 13°C or less with a maximum daily average of no greater than 9°C. Oregon: For salmon/steelhead spawning to fry emergence, a 7-day average maximum temperature of 13ºC from October 23 to April 15. Where ODEQ determines that the natural thermal potential of all or a portion of a water body exceeds this, the natural thermal potential temperatures supersede the biologically-based criteria, and are deemed to be the applicable temperature criteria for that water body.[b]

Parameter	TMDL Selected Target	Water Quality Criteria [a]
Dissolved Oxygen		
Downstream Snake River (RM 247 to 188), year-round	For coldwater aquatic life and salmonid rearing, 8 mg/L water column DO as an absolute minimum, or (where conditions of barometric pressure, altitude, and temperature preclude attainment of 8 mg/L) DO levels not less than 90% of saturation; unless adequate (i.e., continuous monitoring) data are collected to allow assessment of the multiple criteria section in the standards.	Idaho: For aquatic life, greater than 6.0 mg/L at all times with the exceptions of the bottom 20% of reservoir water depths that are 35 meters or less, bottom 7 meters of reservoir water depths that are greater than 35 meters, and the hypolimnion in stratified reservoirs. [c] Oregon: For cold water aquatic life, 8 mg/L water column DO as an absolute minimum, or (where conditions of barometric pressure, altitude, and temperature preclude attainment of 8 mg/L) DO levels not less than 90% of saturation; unless the Department determines that adequate information exists to use 8.0 mg/L as a 30-day mean minimum, 6.5 mg/L as a 7-day minimum mean, and 6.0 mg/L as an absolute minimum. Applicable at times and places in the Snake River where the salmonid spawning standard does not apply.
Downstream Snake River (RM 247 to 188), October 23 to April 15	For salmonid spawning, when and where it occurs: 11 mg/L water column DO as an absolute minimum or (where conditions of barometric pressure, altitude, and temperature preclude attainment of 11 mg/L) DO levels not less than 95% of saturation; with intergravel DO not lower than 8 mg/L, unless adequate (i.e., continuous monitoring) data are collected to allow assessment of the multiple criteria section in the standards. These targets will apply only to that portion of the Snake River to Hells Canyon TMDL reach downstream of Hells Canyon dam (RM 247–188) from October 23 to April 15 for fall Chinook salmon and from November 1 to March 30 for mountain whitefish.	Idaho: For salmonid spawning and incubation, intergravel DO of not less than 5.0 mg/L or 7-day average mean of less than 6.0 mg/L. Water column DO of not less than 6.0 mg/L or 90% of saturation, whichever is greater. [c] Oregon: For active salmonid spawning through fry emergence use, water column DO of 11.0 mg/L as an absolute minimum unless minimum intergravel DO measured as a spatial median is 8.0 mg/L or greater, then the water column DO criterion is 9.0 mg/L. Where conditions of barometric pressure, altitude, and temperature preclude attainment of 11 or 9 mg/L, DO levels must not be less than 95% of saturation. Spatial median intergravel DO must not fall below 8.0 mg/L. Applicable October 23 to April 15 from Hells Canyon dam to Oregon/Washington border.

Parameter	TMDL Selected Target	Water Quality Criteria [a]
Full Snake River to Hells Canyon reach (RM 409 to 188), year-round	For coolwater aquatic life, 6.5 mg/L water column DO as an absolute minimum, unless adequate (i.e., continuous monitoring) data are collected to allow assessment of the multiple criteria section in the standards.	Idaho: For aquatic life, greater than 6.0 mg/L at all times with the exceptions of the bottom 20% of reservoir water depths that are 35 meters or less, bottom 7 meters of reservoir water depths that are greater than 35 meters, and the hypolimnion in stratified reservoirs. [c] Oregon: For cold water aquatic life, 8 mg/L water column DO as an absolute minimum, or (where conditions of barometric pressure, altitude, and temperature preclude attainment of 8 mg/L) DO levels not less than 90% of saturation; unless the Department determines that adequate information exists to use 8.0 mg/L as a 30-day mean minimum, 6.5 mg/L as a 7-day minimum mean, and 6.0 mg/L as an absolute minimum. Applicable at times and places in the Snake River where the salmonid spawning standard does not apply.
Total dissolved gas, Oxbow reservoir to the Salmon River inflow (RM 285 to 188)	Less than 110% of saturation, except when stream flow exceeds the 10-year, 7-day average flood flow.	Idaho: Less than 110% of saturation. Oregon: Except when streamflow exceeds the 10-year, 7-day average flood flow, 105% of saturation or less in hatchery-receiving waters or waters less than 2 feet deep, 110% of saturation or less elsewhere.
Nutrients, Full Snake River to Hells Canyon reach (RM 409 to 188), May through September	Less than or equal to 0.07 mg/L total phosphorus.	Idaho: No phosphorus criteria specified. Oregon: No phosphorus criteria specified.
Nuisance algae, Full Snake River to Hells Canyon reach (RM 409 to 188)	14 µg/L mean growing season limit (nuisance threshold of 30 µg/L with exceedance threshold of no greater than 25%). [d]	Idaho: None specified. Oregon: 15 µg/L as average chlorophyll-a concentration used to identify reservoirs and rivers where phytoplankton may impair the recognized beneficial uses.
Bacteria, Full Snake River to Hells Canyon reach (RM 409 to 188)	Less than 126 *E. coli* organisms per 100 mL as a 30 day log mean with a minimum of 5 samples and no sample greater than 406 *E. coli* organisms per 100 mL.	Idaho: Same as TMDL target with addition of 235 *E. coli* organisms per 100 mL for public swimming areas. Oregon: Same as TMDL target.
pH, Full Snake River to Hells Canyon TMDL reach (RM 409 to 188)	7 to 9 pH units.	Idaho: 6.5 to 9.0 units. Oregon: 7.0 to 9.0 units from RM 260 to 335, 6.5 to 8.5 elsewhere.

Parameter	TMDL Selected Target	Water Quality Criteria [a]
Sediment (turbidity), Full Snake River to Hells Canyon TMDL reach (RM 409 to 188)	Less than or equal to 80 mg TSS/L for acute events lasting no more than 14 days, and less than or equal to 50 mg TSS/L monthly average.	Idaho: Shall not exceed background turbidity by more than 50 NTU instantaneously or more than 25 NTU for more than 10 consecutive days. Oregon: No more than 10% cumulative increase in natural stream turbidity.
Mercury, Full Snake River to Hells Canyon reach (RM 409 to 188)	Less than 0.012 µg/L water column concentration (total). Less than 0.35 mg/kg in fish tissue.	Idaho: Less than water column concentration of 0.14 µg/L for drinking water, 2.1 µg/L as a criterion maximum concentration and 0.012 µg/L as a criterion continuous concentration. Oregon: Not to exceed 2.4 µg/L for acute protection of aquatic life, 0.012 µg/L for chronic protection of aquatic life, 0.144 µg/L for protection of human health from ingestion of water and fish, 0.146 µg/L for protection of human health from ingestion of fish, and 2.0 µg/L for drinking water..
Pesticides, Oxbow reservoir segment and upstream waters (RM 409 to 272.5)	Less than 0.024 ng/L water column concentration DDT. Less than 0.83 ng/L water column concentration DDD. Less than 0.59 ng/L water column concentration DDE. Less than 0.07 ng/L water column concentration dieldrin.	Idaho: Less than water column DDT of 0.59 ng/L, DDD of 0.83 ng, DDE of 0.59 ng/L, and dieldrin of 0.14 ng/L. Oregon: For acute protection of aquatic life, not to exceed 1.1 µg/L as DDT and 2.5 µg/L as dieldrin. For chronic protection of aquatic life, not to exceed 1.0 ng/L as DDT and 1.9 ng/L as dieldrin. For human protection from ingestion of water and fish, not to exceed 0.24 ng/L as DDT and 0.071 ng/L as dieldrin. For human protection from ingestion of fish, not to exceed 0.24 ng/L as DDT and 0.076 ng/L as dieldrin.

Notes: C – Celsius
DO – dissolved oxygen
ESA – Endangered Species Act
mg/kg – milligram per kilogram
mg/L – milligram per liter
ng/L – nanogram per liter
pH – potential hydrogen
TMDL – total maximum daily load
TSS/L – total suspended solids per liter
µg/L – microgram per liter

[a] Idaho Power proposes site-specific criteria. However, EPA (letter from Christine Psyk, Associate Director, Office of Water and Watersheds, EPA, Seattle, Washington, to Barry Burnell, Administrator, Water Quality Division, Idaho Department of Environmental Quality, Boise, Idaho, dated September 27, 2006) states that Idaho Power's proposed site-specific temperature criteria would likely not protect salmon spawning and egg incubation. In its comments on the draft EIS, the Nez Perce Tribe objects to Idaho Power's proposal.

[b] Oregon's revised standards allow a cumulative increase from anthropogenic sources of no more than 0.3°C above the applicable criterion.

[c] Waters discharged from dams, reservoirs, and hydroelectric facilities are not subject to these criteria, but instead a 30-day mean of 6.0 mg/L, 7-day mean minimum of 4.7 mg/L, and an instantaneous minimum of 3.5 mg/L from June 15 through October 15.

[d] Algae concentrations exceeding one or both TMDL selected targets are indicative of nuisance levels.

3.5.1.2 Temperature

Inflows to the project area and the Snake River both upstream and downstream of the project are generally very warm during the summer. Although some tributaries with dams a short distance upstream of their confluence with the Snake River (e.g., the Owyhee and Malheur rivers) are relatively cool (table 18), a short distance downstream of the dam, spot measurements of temperature, provided by Idaho Power in its comments on the draft EIS, indicate that these streams warm considerably prior to entering the Snake River. For the most part, maximum summertime water temperatures in the Snake River and its tributaries exceed 20 degrees Celsius (°C).

Brownlee reservoir, which has an average hydraulic retention time of about one month, substantially alters Snake River temperatures. Storage of water in the reservoir and the depth of the powerhouse intake have delayed seasonal warming and cooling of water downstream of the Brownlee dam compared to conditions that occurred prior to project construction (figure 26). The reservoir has three zones with different general thermal characteristics (figure 27). Temperatures are nearly uniform throughout the water column in the uppermost zone referred to as the riverine zone, which extends down to about RM 325. Farther downstream the water is deeper, slower, and less turbulent, and thermal stratification begins to become evident in a zone referred to as the transition zone, which extends down to approximately RM 308, depending on the season. In the deepest portion of the reservoir, the lacustrine zone, strong summer stratification is evident. This zone consists of three classic strata: (1) the warm upper layer referred to as the epilimnion, (2) the metalimnion, which has a strong thermal gradient, and (3) the cold, deep hypolimnion. Figure 28 displays water temperatures and DO concentrations reported for mid-July and late September of 1995, a year with average hydrologic conditions. Summertime temperatures generally range from 18 to 25°C in the epilimnion, 8 to 17°C in the metalimnion, and cooler than 10°C in the hypolimnion. However, the extent of thermal stratification in Brownlee reservoir can be substantially different in wet years.

Table 18. Summary of Snake River tributary flows, water temperatures, and total phosphorus loadings, 1980–2003. (Sources: USGS, 2005e; StreamNet, 2005; IDEQ and ODEQ, 2004; IDEQ, 2005b; EPA, 2005; Hoelscher and Myers, 2003; WDOE, 2005b; NPCC, 2005, as modified by staff)

Stream or Discharge Source	Drainage Area[a] (square mile)	Snake River Mile	USGS Gage No.	Trib. RM	Mean Annual Flow[b] (cfs)	Mean May–Sept. Flow[b] (cfs)	Mean August Flow[b] (cfs)	Max Water Temp[c] (°C)	Total Phosphorus Load (kg/day)
Salmon Falls Creek	2,106	587	13108150 near Hagerman, ID	1.9	158	140	106	23.0	--
Bruneau River	3,372	494	13168500 near Hot Spring, ID	22.0	356	497	86	29.5	56[d]
Owyhee River	11,108	396.7	13183000 below Owyhee dam, OR	27.3	512	418	200	10.0[e]	265[f]
Boise River	4,031	396.4	13213000 near Parma, ID	3.8	1,564	1,605	800	24.0	1,114[f]
City of Nyssa	NA	385	NA	NA	[g]	--	--	--	11[h]
Amalgamated Sugar	NA	385	NA	NA	[g]	--	--	--	50[h]
City of Fruitland	NA	373	NA	NA	[g]	--	--	--	5.5[h]
Heinz Frozen Foods	NA	370	NA	NA	[g]	--	--	--	412[h]
Malheur River	4,719	368.5	13233300 below Nevada dam, OR	--[i]	243	146	92	16.0[e]	461[f]
Payette River	3,309	365.6	13251000 near Payette, ID	4.1	2,861	3,202	1,172	24.5	710[f]
City of Weiser, ID, WWTP	NA	352		NA	[g]	--	--	--	32[h]
City of Weiser, ID, WTP	NA	352		NA	[g]	--	--	--	5.5[h]

Stream or Discharge Source	Drainage Area[a] (square mile)	Snake River Mile	USGS Gage No.	Trib. RM	Mean Annual Flow[b] (cfs)	Mean May–Sept. Flow[b] (cfs)	Mean August Flow[b] (cfs)	Max Water Temp[c] (ºC)	Total Phosphorus Load (kg/day)
Weiser River	1,686	351.6	13266000 near Weiser, ID	14.9	1,069	878	268	33.0	392[f]
Burnt River	1,100	327.5	13275000 at Huntington, OR	--	148[j]	149[j]	74[j]	26.8	52[f]
Powder River	1,705	296	13286700 near Richland, OR	--	255	223	51	27.5	126[i]
Brownlee Creek	61	288	13289650 near Heath, ID	--	--	--	--	--	--
Wildhorse River	177	283.3	13289960 at Brownlee dam, ID	0.25	135	141	31	24.0	32[k]
Indian Creek	40	271.3	13290060 near Oxbow, OR	--	--	--	--	--	--
Pine Creek	301	271	13290190 near Oxbow, OR	1.9	334	340	46	26.5	114[k]
Granite Creek	33	239	--	--	--	--	--	--	--
Sheep Creek	41	229	--	--	--	--	--	--	--
Imnaha River	871	191.6	13292000 at Imnaha, OR	19.3	513	732	211	25.5	--
Salmon River	13,923	188.2	13317000 at White Bird, ID	53.7	10,744	17,390	5,278	25.2	--
Grande Ronde River	4,000	168.7	13333000 at Troy, OR	45.3	2,968	3,065	777	31.3	--
Asotin Creek	320	145.3	13335050 AT Asotin, WA	0.1	103	93	36	23.8	--
Clearwater River	9,645	140	13342500 at Spalding, ID	11.6	14,530	18,870	8,795	26.5	--

Stream or Discharge Source	Drainage Area[a] (square mile)	Snake River Mile	USGS Gage No.	Trib. RM	Mean Annual Flow[b] (cfs)	Mean May–Sept. Flow[b] (cfs)	Mean August Flow[b] (cfs)	Max Water Temp[c] (°C)	Total Phosphorus Load (kg/day)
Tucannon River	503	62	13344500 near Starbuck, WA	7.9	164	133	59	25.4	--
Palouse River	3,303	59.5	13351000 at Hooper, WA	19.6	590	212	41	31.1	--
Snake River	41,900	453.5	13172500 near Murphy, ID	NA	10,784	9,738	7,120	29.0	1,912[f]
Snake River	58,700	385.2	13213100 at Nyssa, OR	NA	13,702	12,738	8,651	28.0	--
Snake River	69,200	351.3	13269000 at Weiser, ID	NA	17,978	16,801	10,338	27.5	--
Snake River	73,300	247.0	13290450 at Hells Canyon dam, ID-OR state line	NA	19,768	18,682	11,817	24.0	--
Snake River	92,960	167.2	13334300 at Anatone, WA	NA	34,639	40,527	17,984	22.5	--

Notes: -- – no data
NA – not applicable
WTP – water treatment plant
WWTP – wastewater treatment plant

[a] Basin areas for streams upstream of Hells Canyon dam are from Chandler and Chapman (2003-E.3.1-2, Ch. 4), basin areas for Granite and Sheep creeks are from Chandler et al. (2003a), and basin areas for downstream tributaries are from the NPCC (2005) subbasin plans.

[b] Mean flow values were supplied by a variety of sources that used different assessment periods and are thus not directly comparable between sites.

[c] Availability and the type of water temperature data varied by stream and were not always available for USGS gage locations. We compiled data for the lower portions of tributaries from various sources, and used the maximum of daily mean temperatures for continuous (hourly) data sets. This compilation was done to show general trends, and the results are not directly comparable since temperature data were recorded for different periods at the sites.

[d] Annual loading, based on 1997 through 2002.

[e] In its comments on the draft EIS, Idaho Power reported that spot measurement of water temperature made in 1995 reached as high as 19.4°C in the Owyhee River at its mouth and 23.2°C in the Malheur River at its mouth.

[f] May through September loading, based on data from 1995, 1996, and 2000.

[g] Current design flow of less than 3.5 million gallon per day (5.4 cfs).

[h] May through September loading, based on 1995 and 2000.

[i] 0.1 mile downstream of Nevada dam.

[j] Based on a single year of data, October 1979 through September 1980.

[k] May through September loading, based on 1999.

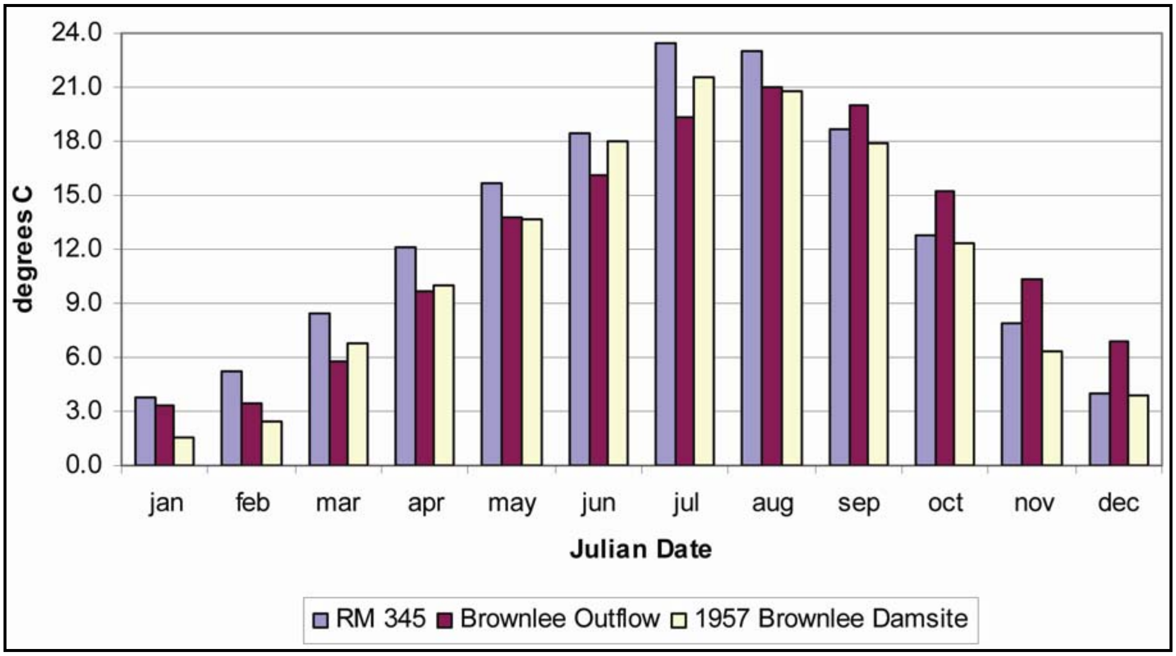

Figure 26. Recent (1990s) RM 345[a] and Brownlee reservoir outflow and pre-project (1957) Brownlee dam site mean monthly water temperatures for the Brownlee reservoir. (Source: IDEQ and ODEQ, 2004 [page 163, figure 2.3.23])

[a] RM 345 is plotted to show the temperature of Snake River inflow to Brownlee reservoir.

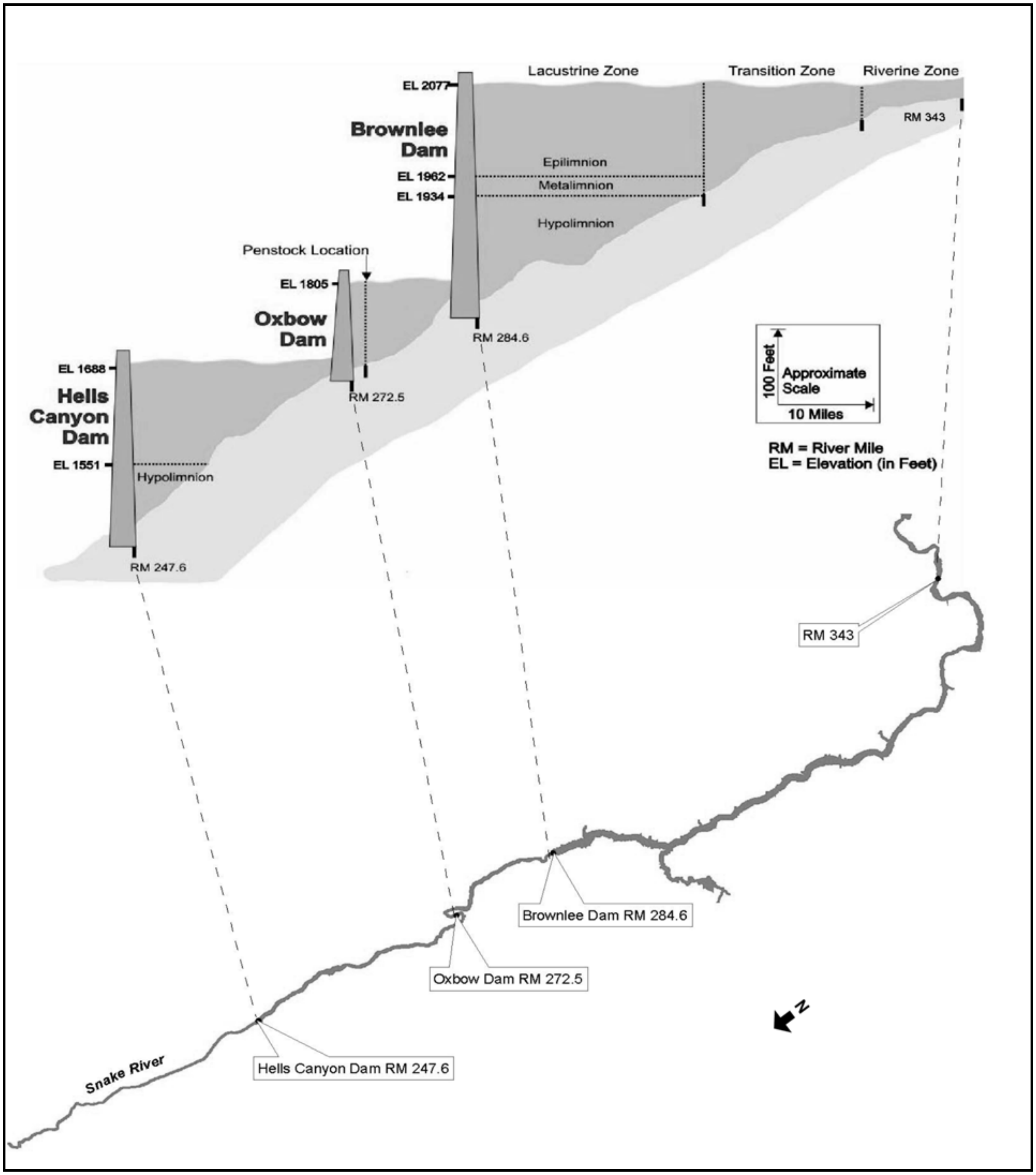

Figure 27. Reaches, zones, and strata of Brownlee, Oxbow, and Hells Canyon reservoirs. (Source: Myers et al., 2003a [page 117, figure 7])

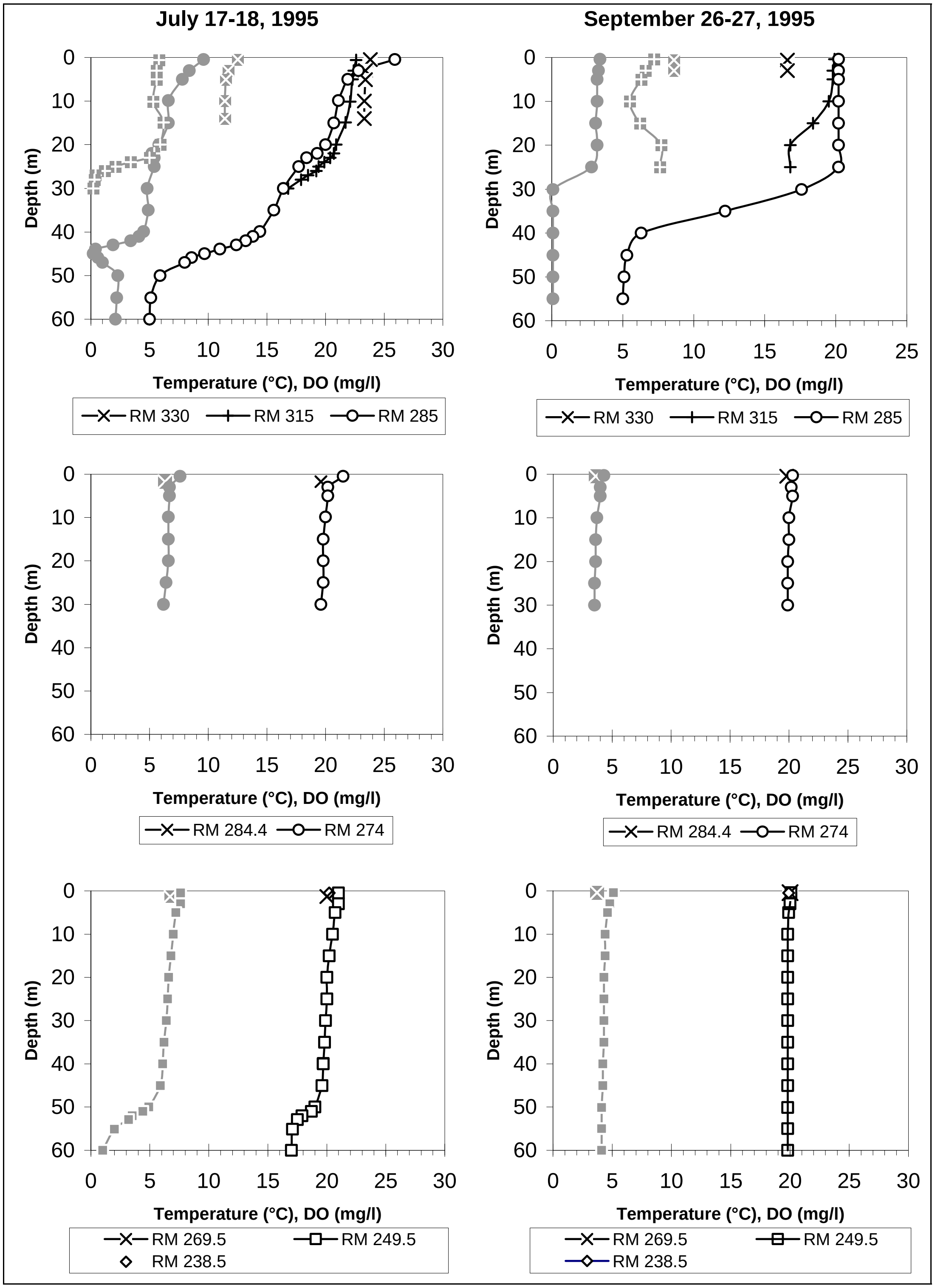

Figure 28. Vertical profiles of water temperature (open symbols) and DO concentrations (solid shaded symbols) in Brownlee reservoir (top), Oxbow reservoir (middle), and Hells Canyon reservoir (bottom), July and September 1995. (Sources: Myers et al., 2003b,c, as modified by staff)

For example, in early spring of the wet year of 1997, Brownlee reservoir was drawn down nearly 100 feet to an elevation of about 1,976 feet for flood-control purposes, which flushed the cold water from the reservoir. The water that was used to refill the reservoir had a temperature of about 12°C. Myers et al. (2003a) reported that the July water temperature at the centerline of the intake (1,948 feet) was 17°C in 1997 compared to 11°C in the dry year of 1992, but that the thermocline[43] was centered on the elevation of the powerhouse intake, as it was in other years.

Few data exist to describe the winter water temperatures in Brownlee reservoir. However, temperature data reported by Myers et al. (2003a) show that colder, less dense water sometimes occurs near the reservoir's surface rather than at depth in winter.

Water is routed rather quickly through the main body of Oxbow reservoir and Hells Canyon reservoir (refer to retention times in table 6), thus temperatures in these reservoir reaches are primarily determined by the temperature of releases from Brownlee dam. As can be seen in figure 28, the temperature generally remains relatively constant throughout the water column.

The portion of Oxbow reservoir that extends from the powerhouse intake (RM 272.8) to the dam (RM 272.5) typically receives little water compared to the rest of the reservoir. When the reservoir releases are less than 28,000 cfs, Idaho Power maintains a 100-cfs minimum flow release into the reach immediately downstream of the dam. This release water flows through the 0.3-mile-long portion of the reservoir and results in a longer hydraulic retention time for this part of the reservoir that averages 21.5 days. The combination of the slower routing of water through the reach and using three orifices in the spillway gate (with a centerline of approximately 1,776 feet) to provide the minimum flow releases into the reach downstream of the dam results in moderate thermal stratification in this portion of the reservoir during summer and into fall. During each of the profile measurements made in August 1998, temperature measurements ranged from about 23°C at the surface to about 14°C at the bottom. Even greater stratification was reported to occur during the summer of 1994, which was a dry year.

The Oxbow bypassed reach, which extends approximately 2.5 miles from the Oxbow dam (RM 272.5) to the Oxbow powerhouse (RM 270.0), receives a minimum flow of 100 cfs as described above. Water temperature in this bypassed reach is primarily determined by releases from the dam. Idaho Power's hourly monitoring results for the salmonid spawning period in 1997 and 1998 ranged from 17.2 to 24.3°C near the upper end of the reach (RM 272.2) and 20.2 to 24.8°C at the lower end of the bypassed reach (RM 270.2) (Myers and Chandler, 2003). Temperature measurements throughout the water column in the deep pool immediately upstream of the Indian Creek confluence showed that at flows of approximately 100 cfs, temperatures vary by about 1 to 3°C in August. Overall, temperatures in the Oxbow bypassed reach frequently exceed the 17.8°C coldwater target.

Based on an evaluation of temperature data collected during the 5-year period of 1996 through 2000, Myers and others (2003a) reported that both the 17.8°C-coldwater target and 13°C-spawning target were frequently exceeded in the project area. The Snake River inflows to Brownlee reservoir had annual exceedances of the 17.8°C target ranging from 37 to 47 percent of the days. Corresponding exceedance frequencies for the tailwaters of the Brownlee, Oxbow, and Hells Canyon developments were less than the inflow with one exception. In 1997, the 17.8°C target was exceeded 38 percent of the time in the inflow to Brownlee reservoir, but 57 percent of the time in the Oxbow tailwater. As discussed above, flood-control operations of Brownlee reservoir resulted in warmer temperatures during this high flow year. Annual exceedances of the 13°C target ranged from 40 to 47 percent of the days at the Snake River inflow to Brownlee reservoir and 31 to 38 percent of the days in the Hells Canyon tailwater.

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[43] The thermocline is the elevation within the metalimnion where the maximum rate of change in temperature occurs.

In its most recent application for water quality certification, Idaho Power (2007a) evaluated exceedance of the 7-day average maximum criterion of 20ºC and the 7-day average maximum salmonid spawning criterion of 13ºC for inflows to Brownlee reservoir and for outflows from Hells Canyon dam (figure 29). Table 19 presents the frequency that measured water temperatures exceeded these applicable water temperature criteria in each year between 1991 and 2004. In most years, the 7-day average maximum of 20°C was exceeded in the Snake River inflow to Brownlee reservoir and in outflows from each of the developments. Most of these exceedances occurred during the months of June through September. Exceedance of the 7-day average maximum criterion of 13°C was documented downstream of Hells Canyon dam in all years except 2001; however, measurements were made less than half the time during that year (table 19). Therefore, the evaluation suggests that Hells Canyon outflows exceed this criterion in all years. Idaho Power (2007a) reported that the elevated temperatures that exceed this criterion occurred during the first few weeks of the fall Chinook salmon spawning season, as can be seen in figure 29. The inflow to Brownlee reservoir also exceeded the 7-day average maximum criterion of 13ºC in some years, although in only 3 of the 9 years monitored. Exceedances of this criterion occurred during both fall and spring for the inflow to Brownlee reservoir.

Table 19. Percent of days that Hells Canyon Project water temperatures exceeded applicable numeric criteria, with the percent of applicable days monitored shown in parentheses. (Source: Idaho Power, 2007a)

	Resident Trout and Salmon/Steelhead Migration Corridor[a] (7-day average maximum of 20°C)				**Salmonid Spawning[b] (7-day average maximum salmonid spawning criterion of 13ºC)**	
Year	**Brownlee Reservoir Inflow**	**Downstream of Brownlee Reservoir**	**Downstream of Oxbow Reservoir**	**Downstream Hells Canyon Reservoir**	**Brownlee Reservoir Inflow**	**Downstream Hells Canyon Reservoir**
1991	---	---	---	26 (83)	---	8 (38)
1992	---	13 (60)	12 (47)	19 (90)	---	11 (100)
1993	---	0 (30)	0 (43)	17 (82)	---	2 (30)
1994	---	21 (85)	17 (78)	32 (71)	---	8 (70)
1995	---	19((78)	16 (77)	38 (91)	---	5 (80)
1996	19 (50)	7 (55)	0 (39)	27 (90)	0 (38)	5 (90)
1997	22 (80)	15 (76)	22 (55)	33 (86)	0 (100)	2 (79)
1998	23 (90)	24 (98)	16 (67)	45 (82)	0 (79)	4 (89)
1999	21 (63)	21 (90)	7 (72)	34 (95)	0 (49)	6 (92)
2000	25 (95)	12 (65)	1 (44)	24 (82	1 (100)	7 (86)
2001	0 (36)	18 (76)	8 (35)	31 (87)	0 (62)	0 (46)
2002	25 (76)	18 (94)	12 (74)	27 (84)	0 (69)	5 (93)
2003	24 (96)	19 (100)	0 (31)	37 (100)	2 (100)	9 (72)
2004	16 (71)	20 (98)	0 (1)	36 (100)	5 (75)	10 (82)

Notes: --- – data not available

[a] The 7-day average maximum temperature criterion of 20°C was applied year-round, except for downstream of Hells Canyon reservoir where it applies only from April 16 through October 22.

[b] The 13°C salmonid spawning criterion applies to the reach downstream of Hells Canyon reservoir from October 23 through April 15. This analysis evaluated exceedance of this criterion using 7-day averages for the designated period starting with October 23 through 29. Salmonid spawning criteria do not apply to the Brownlee reservoir inflow; evaluation for this site is for comparison purposes only.

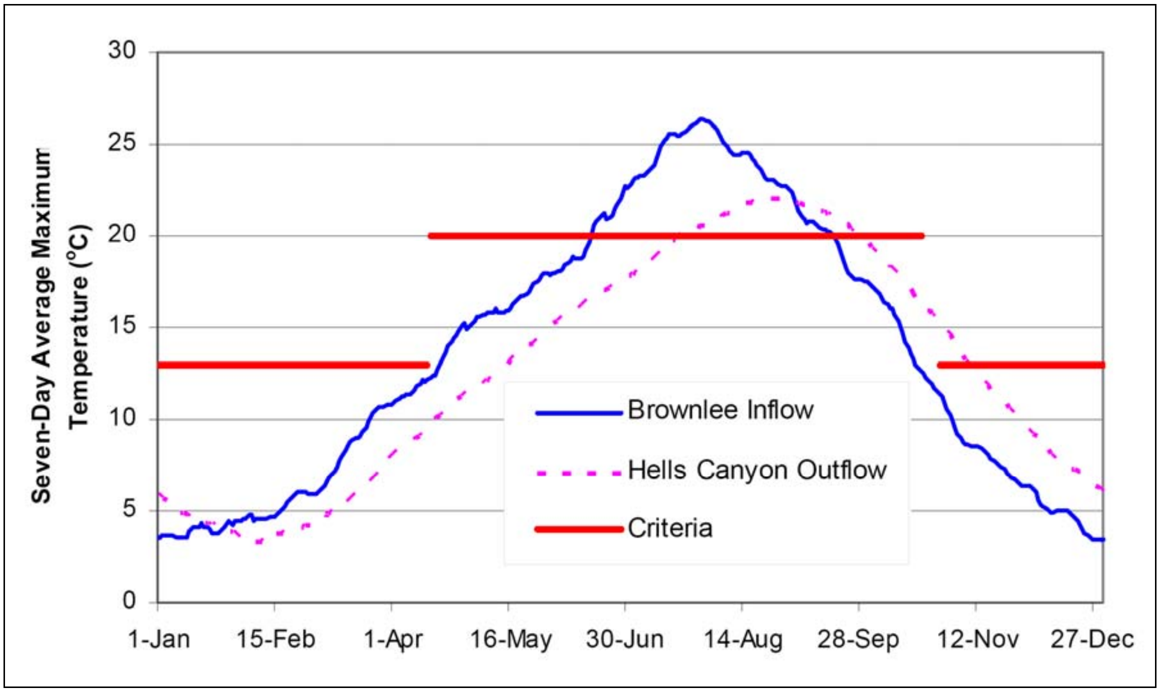

Figure 29. Average daily 7-day average maximum temperatures of Snake River inflow to Brownlee reservoir (1996–2004) and outflow from Hells Canyon dam (1991–2004). (Source: Idaho Power, 2007a)

The applicable water quality standards include a clause that allows temperature increases of 0.3°C over the site potential.[44] In the TMDL, IDEQ and ODEQ (2004) used Snake River inflow temperatures to Brownlee reservoir as an estimate of site potential for the Snake River downstream of Hells Canyon dam, although they acknowledged that this estimate should not be interpreted as natural conditions. In order to improve this estimate, Idaho Power (2007a) developed a flow-weighting model using the Corp's estimate of unregulated flow upstream of the project, a 1915 estimate of cumulative discharge from Thousand Springs (4,800 cfs), Salmon River temperatures measured near the confluence with the Snake River, and the median temperature of ground water inflows (14.5°C). They then determined the difference between simulated 7-day average maximum water temperatures for recent inflows and corresponding estimated historical temperatures, and subtracted these from corresponding measured 7-day average maximum temperatures. Figure 30 displays the resulting adjusted measured 7-day average maximum temperatures of outflow from Hells Canyon dam, which represent outflow temperatures based on Idaho Power's estimate of site potential, for the 7-day periods of October 23–29 through November 4–10. Temperatures above the 13.3°C line (i.e., the 13°C criterion plus the 0.3°C allowable increase) represent project exceedances of Oregon's water temperature standard for the fall spawning period. None of the values for representative high flow and medium-high flow years (1997 and 1999, respectively) exceeded the 13.3°C limit, and only one 7-day period exceeded this limit for the

[44] The site potential is generally considered natural conditions.

medium flow year (1995). In contrast, each of the representative low flow years (1992, 1994, and 2002) had exceedances of the 13.3°C limit. These exceedances occurred on 6 to 11 days per low flow year, and were as much as 1.6°C.

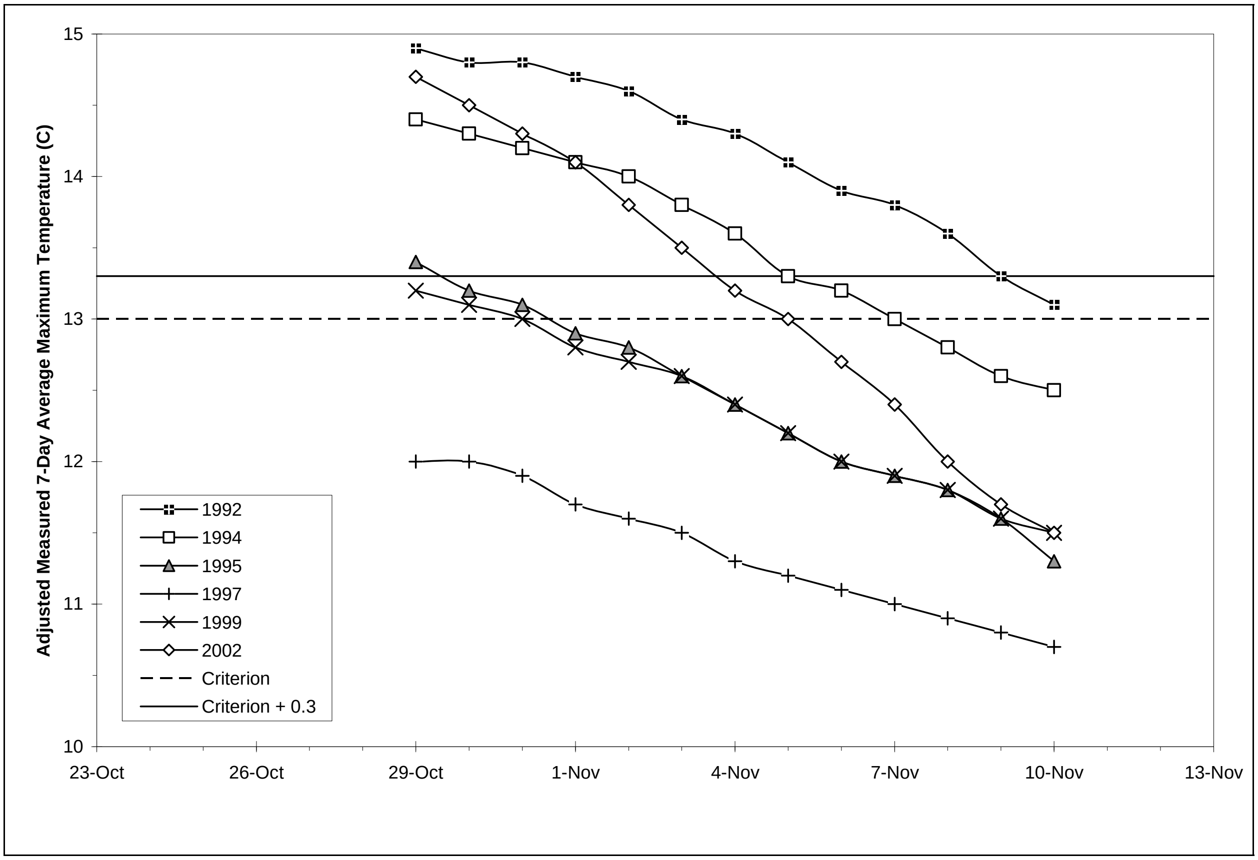

Figure 30. Adjusted measured 7-day average maximum temperatures of outflow from Hells Canyon dam for a portion of the fall Chinook spawning period. (Source: Idaho Power, 2007a, as modified by staff)

3.5.1.3 Biological Productivity

The project waters receive nutrients from numerous sources within the watershed. As part of an inventory of the nation's waters, EPA (1974, as cited by IDEQ and ODEQ, 2004) reported that the mountains along the southeastern border of the Snake River contain some of the world's richest phosphate deposits. In their comments on the draft EIS, AR/IRU emphasized that most of the phosphorus present in the Snake River derives from anthropogenic sources. Table 18 presents total phosphorus loadings of the Snake River and its tributaries, wastewater treatment plants, and industrial sources in the area. Median total phosphorus concentrations measured during 1992 through 1999 show that the TMDL total phosphorus target of 0.07 milligram per liter (mg/L) was exceeded more than half the time in all three of the project's reservoirs. The hypolimnion of Brownlee reservoir had the highest median total phosphorus and soluble reactive phosphorus concentrations of any of the project waters. Overall, the median concentrations of total phosphorus, total nitrogen, total Kjeldahl nitrogen (organic nitrogen and ammonia), and nitrate decreased through Brownlee reservoir, except in the hypolimnion. Median ammonia concentrations were also highest in Brownlee reservoir's hypolimnion. However, unlike the other nutrient parameters, ammonia increased through Brownlee reservoir. Median concentrations of each of the nutrient parameters measured were generally similar to one another in Oxbow reservoir, Hells Canyon reservoir, and Hells Canyon discharges. Summer of 1995 nitrogen to phosphorus ratios, which were based on biologically available forms of these nutrients (ammonia, nitrate, and soluble reactive phosphorus), were generally greater than 10 throughout Brownlee reservoir, with the exception of the hypolimnion.

Primary productivity in the project area was evaluated primarily using trophic state assessment tools developed by Carlson (1977). Carlson developed trophic state index formulas to predict algal biomass from chlorophyll-*a* concentrations, total phosphorus concentrations, and Secchi depths (Carlson, 1977). Using chlorophyll-*a* trophic state indices as a surrogate for primary productivity indicated that hypereutrophic (nutrient rich) conditions occurred in the riverine zone of Brownlee reservoir, while meso-eutrophic tending to eutrophic (middle of the continuum from nutrient rich to nutrient poor) conditions occurred in Oxbow and Hells Canyon reservoirs (Myers et al., 2003a).

The phytoplankton community of the three project reservoirs varies by season and location (Myers et al., 2003a). In the spring, the phylum of Chrysophyta (golden algae) was the dominant phytoplankton in all three reservoirs. In the summer, the phylum of Cyanophyta (blue-green algae) was dominant throughout most of the reservoir sections, although the phylum of Chlorophyta (green algae) was dominant in the riverine zone of Brownlee reservoir. A single species, *Aphanizomenon flos-aquae*, comprised most of the algal cells in the lacustrine zone of Brownlee reservoir and in the Oxbow and Hells Canyon reservoirs during the summer. In the fall, the phylum Chrysophyta was once again the dominant phytoplankton. Dense blooms of blue-green algae have frequently been observed in the transition zone of Brownlee reservoir in late spring and late summer. Algal blooms also have been observed in surface waters of Brownlee reservoir and Oxbow reservoir, although blooms were not as pronounced as they were in the transition zone of Brownlee reservoir (IDEQ and ODEQ, 2004).

Substantial temporal and spatial trends in DO concentrations have been monitored in the project area (figure 28). Monitoring results showed that lower DO concentrations generally occurred in summer and early fall than the rest of the year. Lower DO concentrations occurred downstream of Hells Canyon dam than in the uppermost section (riverine zone) of Brownlee reservoir during low- to high-flow years (figure 31).

Figure 28 indicates that DO concentrations vary substantially within Brownlee reservoir. In the reservoir's riverine zone, DO concentrations generally ranged from about 6 to 14 mg/L with high levels of algal photosynthesis resulting in supersaturation of water during the spring and summer. DO concentrations varied substantially throughout the water column in areas of the transition zone even though the thermal gradient was minimal. Hypoxic (DO <2 mg/L) and anoxic (DO <0.5 mg/L) conditions were regularly recorded in the transition zone during late spring and summer. In this zone, DO concentrations were generally lowest near the bottom, although hypoxic conditions have, on occasion, encompassed nearly the entire transition zone. Low DO concentrations occurred throughout much of the water column in July 1990, resulting in a fish kill that included at least 28 adult white sturgeon. Dead fish that were observed throughout the upper reach of the reservoir included white sturgeon, catfish, crappie, and suckers (Idaho Power, 2003a). Monitoring results indicate that the lacustrine zone of Brownlee reservoir had a clinograde (decreasing DO concentrations with depth) characteristic of eutrophic systems. During low- and average-flow years, hypoxic conditions first reached Brownlee dam in the metalimnion and then proceeded into the hypolimnion. In contrast, the lowest DO concentrations initially occurred in the hypolimnion during the wet year of 1997. Water in the epilimnion generally remained well oxygenated, although low DO concentrations have occasionally extended to the surface of the lacustrine zone.

DO concentrations reported for inflows to Oxbow reservoir were generally less than corresponding values for the riverine zone of Brownlee reservoir. Oxbow reservoir DO concentrations were similar throughout most of the water column with the exception of the reservoir reach between the Oxbow powerhouse intake and Oxbow dam. However, a clinograde developed in the main body of the reservoir during the dry summer of 1992, resulting in anoxic conditions at depths of more than 82 feet

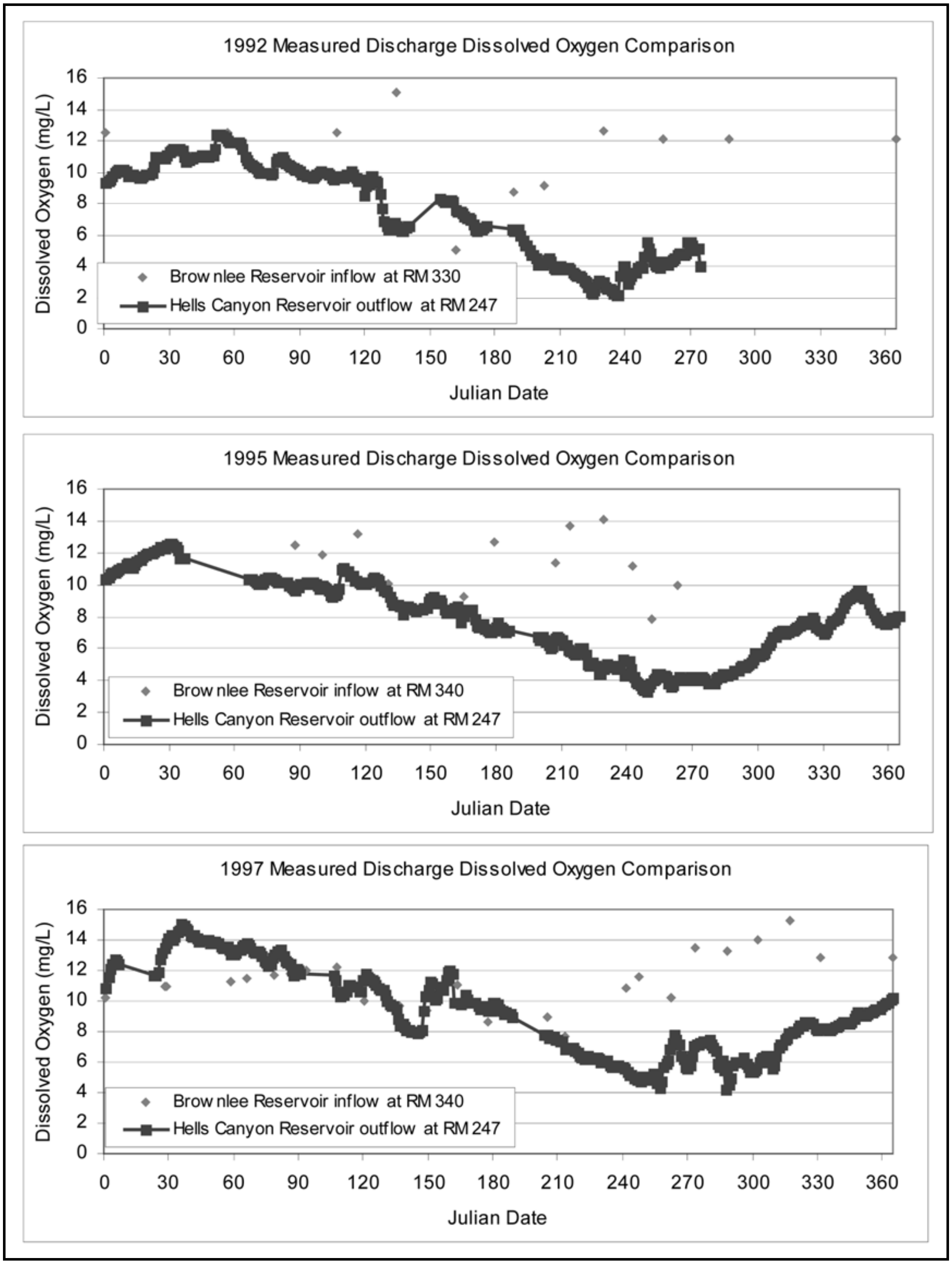

Figure 31. DO concentrations at the Brownlee reservoir inflow and downstream of Hells Canyon dam for 1992, 1995, and 1997 (low-, average-, and high-flow years). (Source: Myers et al., 2003a [page 135, figure 24])

near the Oxbow powerhouse intake. In the 0.3-mile-long reach between the powerhouse intake and Oxbow dam, development of a clinograde was more prevalent. This reach experienced relatively high DO concentrations near the surface and anoxic summer conditions near the bottom, even in the high-flow year of 1997.

Under current operations, the 2.5-mile-long bypassed reach that extends from immediately downstream of Oxbow dam down to Oxbow powerhouse receives inflow from the Oxbow dam via the spillway gates. Hourly DO measurements made during the summer of 1998 ranged from approximately 1.5 mg/L up to approximately 8.5 mg/L near the upper end of the bypassed reach and up to 11.5 mg/L near the lower end of the reach (Myers and Chandler, 2003). Vertical profiles of DO concentrations taken at a deep hole just upstream of Indian Creek (RM 272.4) showed considerable differences within the water column. Hypoxic/anoxic conditions occurred in the bottom 20 feet of the 49-foot-deep hole in August of 1997 and 1998, while near-surface values were about 6 mg/L.

In Hells Canyon reservoir, a clinograde developed with hypoxic conditions in deep water near the dam during dry, average, and wet years. During the dry year of 1992, a clinograde developed earlier in the season and anoxic conditions were more widespread for a longer period than in other years, as evidenced by anoxic conditions extending from the bottom to within 45 feet of the surface in September.

Discharges from Hells Canyon dam frequently had low DO concentrations. Results of monitoring DO concentrations at 10-minute intervals in the Hells Canyon dam tailwater showed that DO concentrations were less than the TMDL water quality targets (table 17) on more than half of the days in each of the years between 1991 and 2000. The DO targets were not met on 58 percent of the days in the high flow year of 1997 or on 98 percent of the days in the lower flow years of 1991 and 1993 (Myers et al., 2003). A breakdown of the timing of when the applicable targets were not met during each of the 10 years shows that the 11.0-mg/L spawning target was not met 100 percent of the time in the fall (October 24 through December 31) and 17 to 100 percent of the time in the spring (January 1 through May 10); at least one of the coldwater targets was not met 59 to 98 percent of the time during the remainder of the year (Myers et al., 2003c).

Idaho Power (2007a) reports that the outflows from each reservoir typically have the lowest DO concentrations in August and September. The Brownlee outflows have DO concentrations that are typically lower than the applicable criteria from June through November, and the Oxbow outflows have slightly higher DO concentrations during this critical period, with values less than the applicable criteria occurring during July through October. In the Hells Canyon outflows, DO concentrations are frequently lower than the applicable criteria during June through December.

Figure 32 displays daily mean DO concentrations measured in the Snake River at four locations within approximately the first 20 miles downstream of Hells Canyon dam. These results show that daily mean DO concentrations reported for critical periods in September and October increased to greater than 6.0 mg/L as water passed through the first few rapids in the first 9.1 miles downstream of the dam.

Myers et al. (2003a) reported that more than 90 percent of the potential hydrogen (pH) values recorded in each of the reservoirs between 1991 and 2000 were within the pH criteria/target levels of 7.0 to 9.0 units. Values greater than 9.0 were more common than values less than 7.0, and the highest pH values were recorded for the riverine zone of Brownlee reservoir. As part of development of the TMDL, IDEQ and ODEQ compiled a database of values reported by Idaho Power and/or obtained from EPA's STORET database for a wide range of flow and water quality conditions. The pH of 529 measurements made in Brownlee reservoir ranged from 7.4 to 9.6 units with less than 5 percent of the values falling outside the allowable range of 7.0 to 9.0 (IDEQ and ODEQ, 2004). The riverine zone had the highest mean seasonal pH values for all seasons.

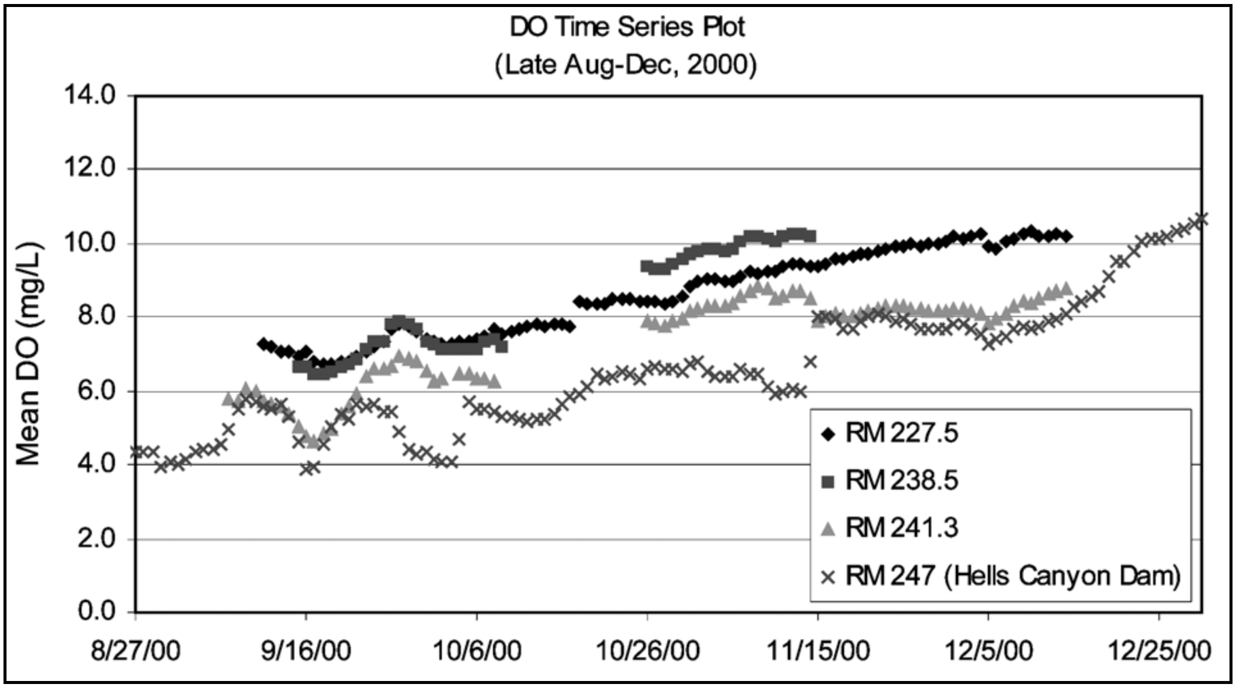

Figure 32. DO concentration time series for the Snake River downstream of Hells Canyon dam, late August through December 2000. (Source: Myers et al., 2003a [page 185, figure 75])

3.5.1.4 Total Dissolved Gas

Water flowing over and through dam spillways and plunging to depth in the pools below the spillways increases the hydrostatic pressure, causing air to be driven into solution and resulting in supersaturation of gasses in the water. Fish and other aquatic organisms that are exposed to excessive gas supersaturation can develop symptoms of Gas Bubble Trauma (GBT), a condition that can lead to a variety of abnormal physiological conditions, causing high levels of stress and mortality (Weitkamp and Katz, 1980; Ryan et al., 2000; Mesa et al., 2000).

Idaho Power evaluated the effects of routing water past the Brownlee, Oxbow, and Hells Canyon dams, along with dissipation rates downstream of Hells Canyon dam in 1997, 1998, and 1999 (Myers and Parkinson, 2003). In the spring of 1997 and 1998, Idaho Power routinely monitored TDG at eight sites (upstream of the spill gates at all three developments, in spilled water downstream of Brownlee and Oxbow dams, in turbine discharges of Brownlee Unit 5 and the Oxbow powerhouse, and at the Hells Canyon boat ramp located 0.8 mile downstream of Hells Canyon dam). Idaho Power did not consistently monitor TDG at any other locations downstream of Hells Canyon dam, but instead monitored TDG at target intervals of 5 to 10 miles down to near Lewiston. From March 3 to July 20, 1999, Idaho Power used a data logger to record hourly TDG levels at a depth of about 3.3 feet at RM 246, approximately 1.5 miles downstream of Hells Canyon dam. During the 2006 spill season, Idaho Power continuously monitored TDG along the left (spillway) and right (powerhouse) side of the channel at the bridge downstream of Brownlee dam, in the Oxbow forebay, and at the upper end of the Oxbow bypassed reach.

Results of these studies indicate that supersaturated TDG levels occurred in Brownlee reservoir immediately upstream of the dam, although levels remained lower than the 110-percent of saturation criterion. Maximum TDG levels recorded at this location were 108.1 percent of saturation in 1998 and 107.9 percent in 1997. Brownlee powerhouse discharges were found to have significantly ($p<0.005$) lower TDG levels than the reservoir. In contrast, TDG levels were significantly ($p<0.005$) higher immediately downstream of the Brownlee dam spillway than in the reservoir. All spill events of greater than 3,000 cfs that were measured had TDG levels, exceeding 110 percent of saturation. During 1997–1998, the maximum TDG level recorded immediately downstream of the Brownlee dam spillway was 128.0 percent, which occurred during a spill of 49,000 cfs. During 2006, hourly TDG reached as high as 143 percent of saturation along the left side of the channel when spill was greater than 55,000 cfs (Richter et al., 2006).

Elevated TDG levels continued through Oxbow reservoir all the way to Oxbow dam. Richter et al. (2006) reported that TDG measurements made during a Brownlee spill of between 35,000 and 42,000 cfs showed unmixed conditions (113 to 138 percent of saturation) at the bridge downstream of Brownlee dam, mixed conditions about four miles downstream of the dam (135 percent), and a dissipation of 5 percent of saturation throughout Oxbow reservoir with TDG levels of 130 percent of saturation measured near Oxbow dam (table 3). Myers and Parkinson (2003) reported that TDG levels in Oxbow reservoir varied substantially depending on the rate of spill at Brownlee dam. The maximum TDG recorded immediately upstream of the Oxbow dam spillway was 125.3 percent of saturation. Routing water through the Oxbow turbines and spillway had mixed effects on TDG. TDG levels in powerhouse discharges were as much as 7.2 percent of saturation greater than in the reservoir and 11.3 percent of saturation less than in the reservoir. Although powerhouse tailrace TDG levels varied compared to levels recorded for the reservoir, these differences could not be attributed to varied powerhouse flow rates. Myers and Parkinson (2003) suggest that these differences may be due to the timing of sampling and/or comparison to near-surface reservoir samples rather than TDG levels in water at the intake depth, which is about 45 feet below the full pool elevation. This conclusion is supported by Parametrix (1974, as cited in Myers and Parkinson, 2003) findings that dissolved nitrogen levels varied considerably throughout the water column of Oxbow reservoir. Comparison of TDG levels measured immediately downstream of the Oxbow dam spillway with levels for the Oxbow reservoir also indicate that both increases and decreases in TDG occurred. Spill rates of less than 2,000 cfs and greater than 24,000 cfs reduced TDG, whereas spills of 5,000 to 24,000 cfs increased TDG. The largest increase (20.5 percent of saturation) occurred during a spill of 12,000 cfs. Due to the configuration of the Oxbow development, elevated TDG levels from the Oxbow dam spillway continue downstream for 2.5 miles before mixing with the powerhouse discharges.

Idaho Power evaluated the effect of spills that occurred at Oxbow dam in 2006, independent of spills at Brownlee dam, by analyzing conditions that coincided with Oxbow forebay TDG levels of less than 110 percent of saturation. Under these conditions, the maximum TDG measured in the Oxbow bypassed reach was 128 percent of saturation, which occurred when the Oxbow spill rate was 22,000 to 26,000 cfs (Idaho Power, 2007a). The 2006 study showed that Oxbow dam spills ranging from about 14,000 to 33,000 cfs increased TDG from less than 110 percent of saturation in the Oxbow forebay to more than 120 percent of saturation in the Oxbow bypassed reach.

TDG levels in Hells Canyon reservoir are closely associated with spills at Brownlee dam, although the effect of spills at Brownlee and Oxbow dams is minor to moderate beyond Hells Canyon dam. However, spills at Hells Canyon dam caused TDG to be supersaturated in mixed water downstream of the spillway and powerhouse. In 1999, hourly TDG levels recorded 1.5 miles downstream of Hells Canyon dam reached as high as 136.3 percent of saturation and were clearly related to spill rates despite considerable variability in TDG at similar spill rates (figure 33). Nearly all spill rates resulted in TDG levels greater than 110 percent of saturation.

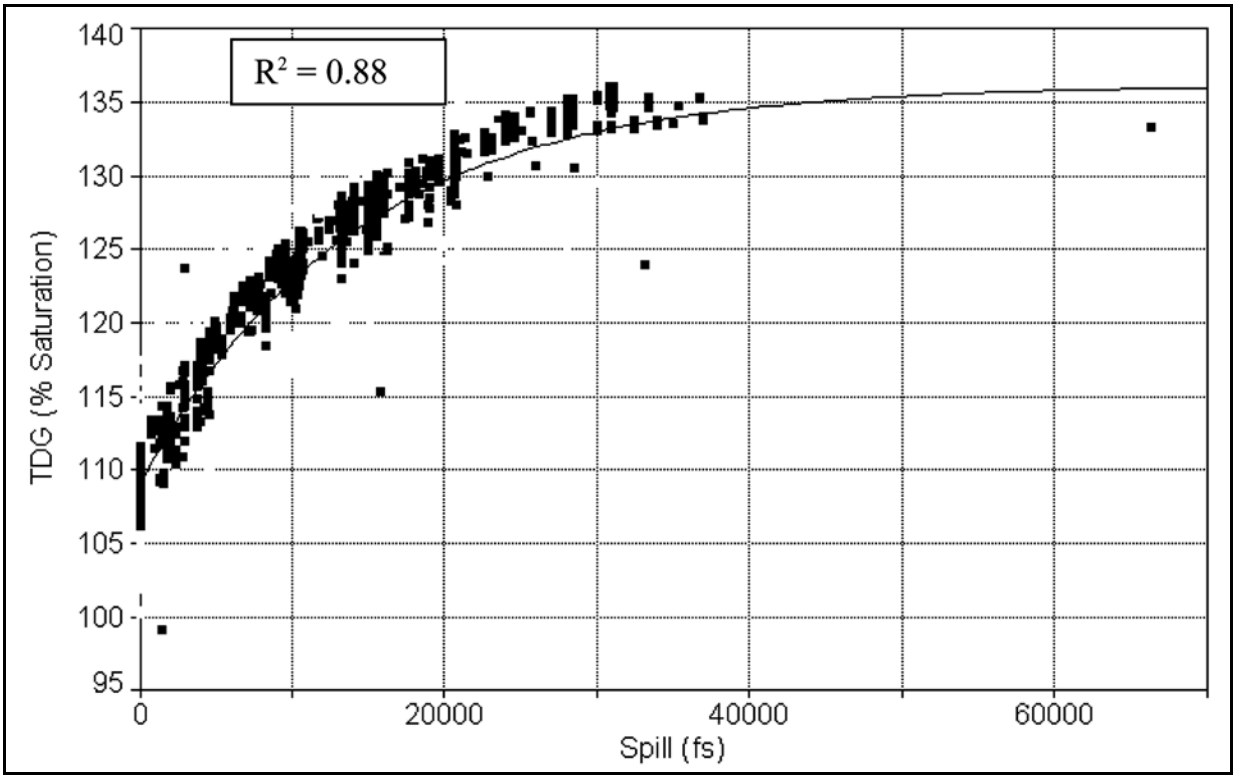

Figure 33. Relationship between spill rate at Hells Canyon dam and TDG approximately 1.5 miles downstream of the dam, 1997–1999. (Source: Idaho Power, 2007a)

The dissipation of elevated TDG downstream of Hells Canyon dam is displayed in figure 34. When TDG levels downstream of Hells Canyon dam exceeded 120 percent of saturation, it generally decreased approximately 0.3 percent of saturation per river mile. As TDG levels approached equilibrium with ambient air conditions (100 percent of saturation), dissipation rates decreased. Myers and Parkinson (2003) reported a direct relationship between the rate of spill and distance from the dam at which TDG levels exceeded 110 percent of saturation. For all measured spills of greater than 19,000 cfs, TDG levels exceeded the 110 percent of saturation criterion at all sites upstream of RM 180 (67 miles downstream of the Hells Canyon dam and about 8 miles downstream of the Salmon River confluence). Spills of 9,000 to 13,400 cfs resulted in exceedance of the 110 percent of saturation criterion down to RM 200 (47 miles downstream of the dam), and a spill rate of 2,400 cfs resulted in exceedance of the 110 percent criterion downstream to RM 230 (17 miles downstream of the dam). The results of the 1997–1999 TDG studies are consistent with Seattle Marine Laboratories' (1972, as cited in Myers and Parkinson, 2003) findings of maximum dissolved nitrogen levels of 125 percent of saturation immediately downstream of Hells Canyon dam, and reduction of these levels down to 107 percent of saturation nearly 60 miles downstream of the dam.

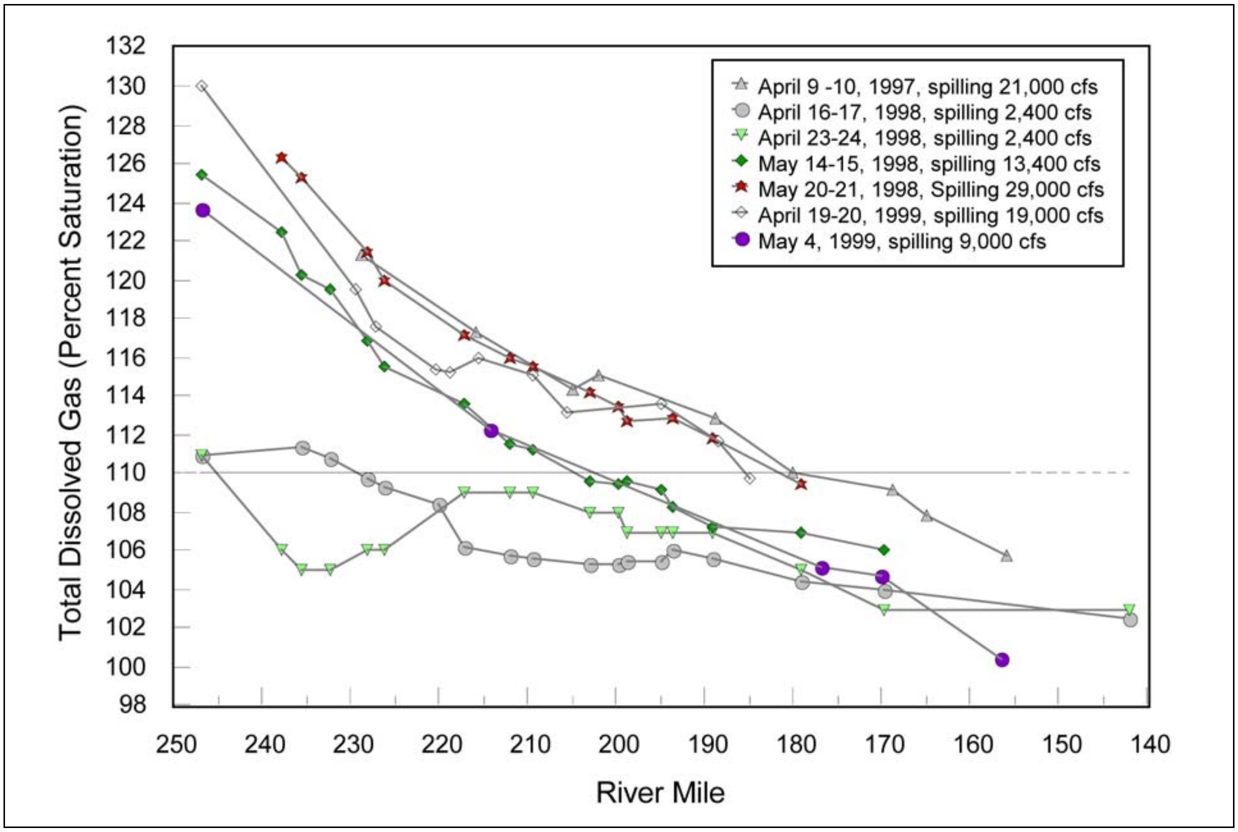

Figure 34. Dissipation of elevated TDG downstream of Hells Canyon dam relative to the 110 percent of saturation criterion, 1997–1999. (Source: Myers and Parkinson, 2003)

3.5.1.5 Turbidity

According to eyewitness accounts and personal photographs, the Snake River was described as being typically "murky" and "full of silt" between the 1920s and the early 1950s (personal communication, A. Barton, Barton Heights Homestead-Hells Canyon, and S. Zanelli, Idaho Power, on February 13, 2003, as cited by Miller et al., 2003c, App A; personal communication, V. Shirley, Wilson Homestead-Saddle Creek-Hells Canyon, and S. Zanelli, Idaho Power, on February 19, 2003, as cited by Miller et al., 2003c). Anecdotal information indicates that turbidity of the Snake River in Hells Canyon generally decreased in the early 1950s (Miller et al., 2003c). A summary of Snake River turbidity data reported for 1992 through 1997 is presented in table 20. These data indicate that turbidity generally decreases as water flows through Brownlee and Oxbow reservoir and remains low throughout Hells Canyon reservoir and its discharge.

Based on data collected from 1995 to 2000, total suspended solids (TSS) load supplied to the reach was estimated as being 76 percent from tributaries, 10 percent from drains, 12 percent from unmeasured sources, and the remainder from point sources (IDEQ and ODEQ, 2004). IDEQ and ODEQ estimates indicate that the majority (69 to 73 percent) of this loading generally occurred during the summer growing season of late April through October, followed by the spring period of February through early April (14 to 29 percent). Sediment loadings in November through January were relatively small (8 to 16 percent). During the growing season, approximately 15 to 25 percent of the total sediment load is organic matter in the Snake River upstream of Brownlee reservoir. This percentage increases in Brownlee reservoir.

Table 20. Summary of turbidity data for various reaches of the project, 1992–1997. (Source: Idaho Power, 2005d, as modified by staff)

Location	Snake River Miles	No. of Samples	Turbidity Minimum (NTU)	Turbidity Average (NTU)	Turbidity Maximum (NTU)
Snake River upstream of Brownlee reservoir	409–343.1	213	0.9	39.0	291
Brownlee reservoir	343–284.6	978	0.4	13.5	213
Oxbow reservoir	284.5–272.5	265	0.4	4.1	50.2
Hells Canyon reservoir	272.4–247.6	434	0.4	5.4	48.9
Snake River downstream of Hells Canyon dam	247.5–247	174	0.5	5.0	41.7

Note: NTU – nephelometric turbidity unit

Table 21 summarizes suspended sediment data reported for the Snake River and its tributaries for 1970 through 1997. Based on monthly averages of TSS data for 1990 through 2000, exceedances of the 50-mg/L target occurred in the Snake River at RM 409 in May, and in Brownlee reservoir in March and April (IDEQ and ODEQ, 2004).

Table 21. Summary of total suspended solids data available for the Snake River and its tributaries near their terminus, 1970–1997.[a] (Source: IDEQ and ODEQ, 2004, as modified by staff)

Location	Snake River Mile	Number of Samples	Total Suspended Solids Minimum (mg/L)	Total Suspended Solids Average (mg/L)	Total Suspended Solids Maximum (mg/L)
Snake River at Marsing	425	44	2	21.2	42
Owyhee River	396.7	169	7	65.2	562
Boise River	396.4	144	1	41.1	295
Malheur River	368.5	93	2	109.2	787
Payette River	365.6	98	3	36.5	406
Weiser River	351.6	59	2	27.5	117
Drains	NR	194	2	151.4	1,320
Snake River	409–335	304	1	38.3	685
Brownlee reservoir	335–285	147	1	21.1	411
Oxbow reservoir	285–272.5	113	1	7.8	215
Hells Canyon reservoir	272.5–247	58	1	9.4	116
Snake River downstream of Hells Canyon dam	247–188	69	1	6.9	24

Note: NR – not reported

[a] Total suspended solids data included in this summary include measurements of suspended sediment concentrations and total residue measurements.

3.5.1.6 Hazardous Materials

Idaho Power conducted an evaluation of possible oil leakage from the project's three power plants for 1999 and 2000. Using project records, Wolfe (2003) estimated that the amount of oil discharged to the Snake River during the 2-year period was 600 gallons at Brownlee, 120 gallons at Oxbow, and 50 gallons at Hells Canyon. The estimate for the Brownlee power plant is equal to an average volume of 0.8 gallons per day. In comparison, sump discharges of water from the project were between 105,000 and 229,000 gallons per day. The turbine guide bearings for Brownlee units 1 and 2 were the largest contributors to oil leakage during the study. Wolfe (2003) concluded that new gasket material and ring design appeared to have stopped slinger ring leaks in the turbine guide bearings as of March 2001.

Results of analyzing sediment samples collected from 1998 to 2000 from the thalweg in Brownlee reservoir at intervals of 5 miles or less show that trace metal concentrations generally increased in a downstream direction in both the main body of Brownlee reservoir and the Powder River arm, coinciding with increased percentages of fine material (Myers et al, 2003a). Idaho Power and the USGS compared the sample results to the corresponding threshold effect level (TEL) established to represent the upper limit at which adverse effects rarely occur to benthic life (Canadian Council of Ministers of the Environment, 1995, as cited in Clark and Maret, 1998). In the upper reservoir (RM 312 to RM 336), the TEL was exceeded for arsenic, chromium, mercury, and nickel. In the lower reservoir (RM 285 to RM 310), the TEL was exceeded for each of these elements as well as cadmium, copper, and zinc. A sediment sample taken from an elevation to represent pre-impoundment conditions exceeded the TEL for arsenic, chromium, and nickel. None of the measured lead concentrations exceeded the corresponding TEL. IDEQ and ODEQ (2004) reported that little water column data for mercury in the project area is available, and that most of the data collected since 1990 had non-detectable mercury concentrations using various detection limits ranging from 0.01 to 0.5 microgram per liter (μg/L).

A reconnaissance-level assessment of organochlorine compounds in bed sediments was conducted in August 1997 by collecting bed samples from Brownlee reservoir at Burnt River (RM 327) and Mountain Man Lodge (about RM 300) and then analyzing them for 33 organochlorine compounds, including pesticides, pesticide breakdown products (metabolites), and total polychlorinated biphenyls (PCBs) (Clark and Maret, 1998). Concentrations of these compounds were generally higher at the Burnt River site than at the Mountain Man Lodge site. The TEL and probable effect level (PEL) were both exceeded for p,p′-DDE, a metabolite of dichlorodiphenyltrichloroethane (DDT), at the Burnt River site. In 1999, additional sampling was conducted with similar sample handling and detection limits. However, none of the 42 samples collected had detectable concentrations of any organochlorine compounds, even though much of the samples consisted of fine-grained materials (CH2M HILL, 2000, as cited by Myers et al, 2003). No water column data are available for total DDT or dieldrin concentrations in Brownlee reservoir, although all of the values reported for total DDT and dieldrin (four each) in the upstream Snake River segment exceeded their respective target levels presented in table 17 (IDEQ and ODEQ, 2004).

In August and September 1997, fish were collected from Brownlee reservoir at Burnt River (RM 327) and Pittsburg Landing (RM 215) for analysis of contaminants. Composite samples that were analyzed consisted of whole-body and liver samples for largescale sucker and common carp, and fillet samples from sport fish. This analysis resulted in detectable concentrations of 17 trace metals (Clark and Maret, 1998). Concentrations of most trace metals were generally higher in liver samples than in sport fish fillets, although mercury concentrations were generally higher in fillets. Total mercury concentrations ranged from 0.02 μg/g (wet weight) in largescale sucker liver samples from the Snake River at Pittsburg Landing to 0.32 μg/g in both common carp liver samples and channel catfish fillets from the Brownlee reservoir at Burnt River. None of the fillet samples exceeded the FDA (2000) 1.0-μg/g action level, although the total mercury concentration in both channel catfish fillets and common carp liver samples from the Brownlee reservoir at Burnt River were greater than 0.3 µg/g, which is the EPA (2001a) recommended concentration of methylmercury set to protect human health.[45] IDEQ and ODEQ (2004) reported that 3 percent of the fish tissue samples from Brownlee reservoir exceeded the FDA's 1.0-milligram per kilogram action level, and that 80 percent of all the data for the reach from RM 409 to RM 188 exceeded the 0.35-µg/g target. Due to elevated concentrations of mercury in fish, a fish consumption advisory has been in place for the Snake River, including the project area, since 1997 (ODHS, 2005, 1997; Idaho Department of Health and Welfare, 2004).

Detectable concentrations of 12 organochlorine compounds or metabolites were reported. All fish-tissue samples were found to contain DDT or a DDT metabolite; concentrations of total DDT ranged from approximately 96 µg/kg in white crappie fillets to 3,633 µg/kg in whole-body samples of common carp (Myers et al, 2003a). The 200-µg/kg protection level set for fish-eating wildlife (Newell et al., 1987, as cited by Clark and Maret, 1998) was exceeded in whole-body composite samples of largescale sucker and common carp and fillets of channel catfish. Whole-body samples of common carp had total PCB concentrations that exceeded the 110-µg/kg level set to protect fish-eating wildlife. None of the reported organochlorine compound concentrations exceeded FDA action levels, although DDT exceeded a cancer risk screening value of 10^{-6} established by the EPA (Nowell and Resek, 1994, as cited by Clark and Maret, 1998).

3.5.1.7 Coliform Bacteria

IDEQ and ODEQ (2004) indicate that the upper Snake River segment (RM 409 to RM 347) was included on the 303(d) list for bacteria; in the same document, they recommend that this reach be delisted for bacteria, based on analysis of fecal coliform and *E. coli* data collected in the summer of 1999. Weekly measurements of fecal coliform concentrations at three locations in the Oxbow bypassed reach in July to September of 1997 and 1998 ranged from less than 1 to 110 most probable number (MPN) (Myers and Chandler, 2003). Hardy et al. (2005) reported that measurement of fecal coliform indicated that the E. coli criterion for primary contact recreation was exceeded in three of 26 samples from the Snake River at Weiser, which is about 11 miles upstream of Brownlee reservoir. In the Final 2002 Integrated Report, ODEQ (2005) reported that the Snake River was attaining the fecal coliform criteria from RM 244.2 to RM 268.8 in the summer, and from RM 280.5 to RM 404 throughout the year.

3.5.2 Environmental Effects

3.5.2.1 Effects of Project Operations on Water Quality

We describe Idaho Power's proposed operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on reservoir levels and project outflows in section 3.3.2, *Effects of Project Operations on Water Quantity*. We identify operation-related recommendations filed by agencies, tribes, and other parties (table 9), and we describe three alternative operational scenarios that we use to assess the effects of the various operation-related recommendations. At our request (AIR OP-1), Idaho Power simulated project operations for these representative scenarios under various hydrologic conditions. Refer to section 3.3.2.2 for additional discussion of the scenarios and the modeling process used for the simulations. We use the results of these simulations to assess the effects of the operation-related recommendations.

As provided below, we evaluate the effects of Idaho Power's Proposed Operations and of operation-related recommendations received from agencies, tribes, and other parties on the following

[45] This 0.3-µg/g criterion is based on a total fish and shellfish consumption of 17.5 g per day for a 70-kg (154-pound) human, which is the estimated average consumption rate for recreational fishers (EPA, 2000).

resources: (1) temperature; (2) biological productivity (nutrients, DO, and pH); (3) TDG; and (4) hazardous materials.

Temperature

Changes in the seasonal flow regime caused by project operations and recommended changes to project operations made by agencies, tribes, and NGOs can affect water temperature. As we discuss later in section 3.5.1.2 *Temperature*, construction and operation of the project has altered the thermal regime of the Snake River within and downstream of the project. These alterations include a seasonal temperature shift downstream of Brownlee dam that is primarily due to the combination of thermal stratification in Brownlee reservoir and water being released from the reservoir's deep layers. Compared to without project conditions, the end result of these operations has been cooler conditions in spring and summer, and warmer conditions in fall.

Our Analysis

Idaho Power used the CE-QUAL-W2 model to simulate the effects of various project operations and potential measures on water temperatures (Idaho Power, 2005b,e,f; Bowling, 2004). CE-QUAL-W2 is a two-dimensional (longitudinal/vertical) hydrodynamic and water quality model that is capable of modeling conditions in river/reservoir systems (Portland State University, 2006). Idaho Power's setup, calibration, and use of the CE-QUAL-W2 model is described by Zimmerman et al. (2002). Differences in CE-QUAL-W2 simulation results can be used to evaluate likely differences in water temperatures that would result from operating the project under a variety of operational regimes.

Idaho Power's Proposed Operations would be similar to current operations and result in similar thermal regimes within and downstream of the project.

Operational recommendations to limit ramping downstream of Hells Canyon dam (refer to table 9) would have little effect on water temperatures in project waters or the project's outflows, since they would result in minimal changes in the residence time within each of the project reservoirs.

Operational recommendations involving the Flow Augmentation Scenario, on the other hand, would result in modified water temperature conditions compared to existing and proposed operations. These changes would result from releasing more water from Brownlee reservoir during early summer and maintaining the reservoir at a lower level during summer and fall. We discuss the simulated temperatures for both Brownlee reservoir and Hells Canyon outflow below.

Our analysis of the effects of flow augmentation on water temperatures in Brownlee reservoir focused on the overall thermal regime of the reservoir, with emphasis on the simulated locations for temperatures of 17.8°C. Table 22 summarizes the simulated thermal regimes for each of the 5 representative flow years. Flow augmentation in early summer (June 21 through July 31) would result in lower Brownlee reservoir water levels and a thinner epilimnion during the summer of medium to extremely low flow years. During the summer of higher flow years, the simulated flow augmentation produced little difference from Proposed Operations.

Table 23 summarizes our comparison of the CE-QUAL-W2 simulation results for Hells Canyon outflow to the TMDL water temperature targets. This summary indicates that flow augmentation recommendations would increase the frequency of exceedances of the 17.8°C target in July of medium-low to extremely low flow years, but that they would not affect the frequency of exceedances of the 13.0°C target.

Table 22. Summary comparison of Brownlee reservoir simulated temperatures for Proposed Operations and Scenario 2 (Flow Augmentation). (Source: Idaho Power, 2005e, as modified by staff)

Year	Proposed Operations	Scenario 2 (Flow Augmentation)
1992 (extremely low flow)	Stratification is evident in spring and by the beginning of summer the uppermost 55 feet of the reservoir, extending down to an elevation of about 2,020 feet msl, generally exceed 17.8°C while below 1,950 feet msl the hypolimnion remains at 6°C or cooler. By mid-August, 17.8°C is exceeded down to an elevation of about 1,970 feet msl, and the hypolimnion extends from about 1,940 feet msl to the bottom. Water warmer than 17.8°C is fully evacuated from the reservoir by mid-October, but most of the cool hypolimnion still remains in the reservoir.	During spring, virtually the same thermal regime occurs as under Proposed Operations. During summertime, the water level surface elevation is lower and a thinner epilimnion occurs. By mid-August, the water surface elevation is about 25 feet lower and 17.8°C water is about 5 feet lower than under Proposed Operations. In fall, the epilimnion thickness becomes closer to Proposed Operations, but continues to be slightly thinner than under Proposed Operations.
1994 (medium-low flow)[a]	Stratification is evident in spring and by the beginning of summer the uppermost 55 feet of the reservoir, extending down to an elevation of about 2,020 feet msl, generally exceed 17.8°C while below 1,945 feet msl the hypolimnion remains at 6°C or cooler. By mid-August, 17.8°C is exceeded down to an elevation of about 1,980 feet msl, and the hypolimnion extends from about 1,930 feet msl to the bottom. Water warmer than 17.8°C is fully evacuated from the reservoir by mid-October, but most of the cool hypolimnion still remains in the reservoir.	During spring, virtually the same thermal regime occurs as under Proposed Operations. During summertime, the water surface elevation is lower and a slightly thinner epilimnion occurs. By mid-August, the water surface elevation is about 25 feet lower and the 17.8°C water is about 10 feet lower than under Proposed Operations. Although the water surface elevation is slightly lower than under Proposed Operations in mid-October, water temperatures are very similar to Proposed Operations.
1995 (medium flow)	Stratification is evident in spring and around the beginning of summer a longitudinal gradient is evident for 17.8°C water. Virtually all of the reservoir upstream of RM 320 exceeds 17.8°C, while exceedances of 17.8°C near the dam only occur down to an elevation of about 2,060 feet msl. A hypolimnion that is 7°C and cooler develops below an elevation of about 1,920 feet msl. By mid-August, 17.8°C is exceeded down to an elevation of about 1,965 feet msl, and the hypolimnion extends from about 1,920 feet msl to the bottom. Water warmer than 17.8°C is fully evacuated from the reservoir by mid-October, but much of the cool hypolimnion still remains in the reservoir.	During spring, virtually the same thermal regime occurs as under Proposed Operations. During summertime, the water surface elevation is lower and a slightly thinner epilimnion occurs. By mid-August, the water surface elevation is about 20 feet lower and the 17.8°C water is about 10 feet lower than under Proposed Operations, which moves the up-reservoir end of the metalimnion from RM 316 to RM 312. In the fall, the thermal regime is virtually the same as under Proposed Operations.

Year	Proposed Operations	Scenario 2 (Flow Augmentation)
1999 (medium-high flow)	Stratification is evident in spring and around the beginning of summer a longitudinal gradient is evident for 17.8°C water. All of the reservoir upstream of RM 322 exceeds 17.8°C, while exceedances of 17.8°C near the dam only occur down to an elevation of about 2,055 feet msl. A hypolimnion that is 11°C and cooler develops below an elevation of about 1,930 feet msl with 6°C or cooler water only occurring below an elevation of about 1,850 feet msl. By mid-August, 17.8°C is exceeded down to an elevation of about 1,950 feet msl, and the hypolimnion extends from about 1,920 feet msl to the bottom. Water warmer than 17.8°C is fully evacuated from the reservoir by mid-October, and the hypolimnion continues to have nearly the same characteristics as in mid-August.	During spring, virtually the same thermal regime occurs as under Proposed Operations. During summertime, the water surface elevation is lower and a slightly more distinct break occurs between the epi- and metalimnion. By mid-August, the water surface elevation is about 15 feet lower and the 17.8°C water is about 5 feet lower than under Proposed Operations. In the fall, the thermal regime is virtually the same as under Proposed Operations.
1997 (extremely high flow)	Stratification is evident in spring and by the beginning of summer the uppermost 100 feet of the reservoir, extending down to an elevation of about 1,975 feet msl, generally exceed 17.8°C and a hypolimnion that is 12°C and cooler develops below about 1,915 feet msl. By mid-August, 17.8°C is exceeded down to an elevation of about 1,940 feet msl, and the hypolimnion extends from about 1,910 feet msl to the bottom. Water warmer than 17.8°C is fully evacuated from the reservoir by mid-October, and the hypolimnion is a little smaller than in mid-August.	During spring, virtually the same thermal regime occurs as under Proposed Operations. During summertime, the water surface elevation is lower and there is a less distinct break between the epi- and metalimnion. By mid-August, the water surface elevation is about 15 feet lower and the 17.8°C water is at about the same elevation as under Proposed Operations. In fall, the thermal regime is virtually the same as under Proposed Operations.

[a] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Table 23. Summary comparison of simulated Hells Canyon outflow hourly water temperatures for Proposed Operations and Scenario 2 to TMDL water temperature targets.[a] (Source: Idaho Power, 2005e, as modified by staff)

Year	Proposed	Scenario 2 (Flow Augmentation)
1992 (extremely low flow)	Exceeds 13°C target in late October through early November, and exceeds 17.8°C target from mid-July through early October.	Generally about 1.0–1.7°C warmer in July, 0.5–1.0°C warmer in August, and up to about 0.5°C warmer in early September. Exceeds 17.8°C target for about 1 additional week in early July.
1994 (medium-low flow)[b]	Exceeds 13.0°C target for about 2 weeks in late October to early November, and exceeds 17.8°C target from early July through early October.	Generally about 0.5–1.0°C warmer in July through mid-August. Exceeds 17.8°C target for a couple of additional days in early July.
1995 (medium flow)	Exceeds 13°C target for about 1.5 weeks in late October to early November, and exceeds 17.8°C target from early July through early October.	Virtually the same as under Proposed Operations. Exceeds 13.0°C and 17.8°C targets during same periods as Proposed Operations.
1999 (medium-high flow)	Exceeds 13°C target for about 1.5 weeks in late October to early November, and exceeds 17.8°C target from mid-June through early October.	Virtually the same as under Proposed Operations. Exceeds 13°C and 17.8°C targets during same periods as Proposed Operations.
1997 (extremely high flow)	Exceeds 13°C target for a couple of days in late October, and exceeds 17.8°C target from late May through early October.	Virtually the same as under Proposed Operations. Exceeds 13°C and 17.8°C targets during same periods as Proposed Operations.

[a] We estimated compliance with the target water temperatures of 13°C for spawning for October 23 through April 15, and the 7-day mean maximum target of 17.8°C for the remainder of the year.

[b] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Operational recommendations related to navigation target flow levels (refer to table 9) would increase outflows during some low flow periods, generally in the months of June to October. The extent of increases in outflows and the resulting potential for changing the thermal regime would be determined by the specific recommendations implemented.

Idaho Power's simulation of project operations under the navigation target flow operation (Scenario 3) is representative of operations that would result from recommendations made by the Corps and NPPVA for a minimum flow of 8,500 cfs upstream of the mouth of the Salmon River and 11,500 cfs downstream of the Salmon River. Scenario 3 simulations indicate that Hells Canyon outflow rates would be most affected in medium-low flow years when Brownlee reservoir inflows exceed 8,500 cfs, but would be affected little in medium to extremely high flow years (Bowling, 2005b). Although Hells Canyon minimum outflows would increase, maximum outflows during these periods would be reduced, which would result in Brownlee reservoir levels similar to those under Proposed Operations. We anticipate that the temperature of the outflows would be only a little higher than under Proposed Operations. In contrast, operating the project under the Forest Service's navigation flow recommendation, which would not allow for lower minimum flows when inflows are low, would substantially draw down Brownlee reservoir in extremely low flow years. Drafting water from closer to the reservoir's surface would result in warmer water being discharged from the Brownlee, Oxbow, and Hells Canyon developments than would occur under Proposed Operations.

Biological Productivity (Nutrients, DO, pH)

Changes in the seasonal flow regime caused by project operations can affect DO levels and other water quality parameters associated with biological productivity. In addition, some of the operating scenarios recommended by agencies, tribes, and NGOs in this proceeding have the potential to affect water quality parameters associated with biological productivity.

Our Analysis

As discussed in section 3.5.1.3, *Biological Productivity*, current operations result in lower DO concentrations downstream of Hells Canyon dam than the Snake River inflow to Brownlee reservoir. Hypoxic and anoxic conditions regularly occur in the transition zone of Brownlee reservoir during late spring and summer, and in the hypolimnion layer of Brownlee reservoir's lacustrine zone in summer and fall. Low DO waters are drafted from Brownlee reservoir and routed downstream resulting in Hells Canyon outflows that have DO levels that are frequently lower than the TMDL targets for salmonid spawning and coldwater aquatic life/salmonid rearing. Evaluation of Hells Canyon outflow DO levels for the 10-year period of 1991 through 2000 showed that DO concentrations were lower than the 11.0-mg/L spawning criterion/target throughout the entire fall period of each year and between 17 and 100 percent of the time in spring, and lower than coldwater criteria/targets more than half of the time in each year. Idaho Power proposes to continue current operations, which would result in similar DO conditions.

Operational recommendations to limit ramping downstream of Hells Canyon dam (refer to table 24) would have negligible effects on DO levels in outflows from Brownlee reservoir. Although these ramping limitations would have short-term effects on water levels and outflows of Oxbow and Hells Canyon reservoirs, these shifts would be so short so as to have negligible effects on DO levels of Hells Canyon outflows.

We evaluated the effects of recommended flow augmentation measures (refer to table 9) on DO levels by comparing Idaho Power's CE-QUAL-W2 simulated values for Proposed Operations to those for the flow augmentation operation (Scenario 2). For Brownlee reservoir, we focused on the simulated locations of hypoxic and anoxic conditions. For Hells Canyon outflows, we focused on general characteristics of differences between the simulated Scenario 2 and Proposed Operations and comparison to the criteria/target levels of 11.0 and 8.0 mg/L.

Table 24 summarizes our comparison of CE-QUAL-W2 simulation results for Brownlee reservoir under Proposed Operations and Scenario 2. Flow augmentation recommendations would lower the Brownlee reservoir water levels. The primary effects of these operations would occur during the summer when hypoxic/anoxic conditions would occur closer to the reservoir's surface. Scenario 2 (Flow Augmentation) simulation results indicate that in mid-August hypoxic/anoxic conditions would occur about 15 feet closer to the surface in extremely low flow years, 10 feet closer to the surface in medium-low flow years, and about 5 feet closer to the surface in medium and higher flow years.

Table 25 summarizes our comparison of CE-QUAL-W2 simulation results for Hells Canyon outflow to one another and DO criteria and TMDL targets. Flow augmentation recommendations would increase Hells Canyon outflow DO concentrations between July and October to varying extents in different types of flow years. Generally, the largest and earliest increases in DO concentrations would occur in extremely low flow years, and increases in DO concentrations would generally be negligible in medium-high to extremely high flow years. The simulation results also indicate that changes in minimum DO concentrations would be negligible in most years and the largest increases in minimum DO concentrations would occur in extremely low flow years.

Table 24. Summary comparison of Brownlee reservoir simulated DO concentrations for Proposed Operations and Scenario 2 (Flow Augmentation). (Source: Idaho Power, 2005e,g, as modified by staff)

Year	Proposed	Scenario 2 (Flow Augmentation)
1992 (extremely low flow)	Hypoxic/anoxic conditions start in the spring at RM 326 to 318. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout most of the 1,950 to 2,020 feet msl band down to the dam, and most of the lacustrine zone within 50 feet of the bottom. As summer progresses, DO concentrations continue to decrease at elevations below 2,030 feet msl, resulting in anoxic conditions near the bottom of the transition and lacustrine zones. As fall progresses, hypoxic/anoxic water is flushed out of the transition zone and much of the lacustrine zone.	During summertime, lower water surface elevation with hypoxic/anoxic conditions at a lower elevation. In mid-August, the water surface elevation is about 25 feet lower and the top of the hypoxic/anoxic layer is about 10 feet lower than under Proposed Operations. There are no noticeable effects in spring, and minimal effects in the fall.
1994 (medium-low flow)[a]	Hypoxic/anoxic conditions start in the spring at RM 328 to 318. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout most of the 1,940 to 2,010 feet msl band in the transition zone and the upper end of the lacustrine zone, and most of the lacustrine zone within 30 feet of the bottom. As summer progresses, DO concentrations continue to decrease throughout the entire water column resulting in anoxic conditions near the bottom of the transition and lacustrine zones. As fall progresses, hypoxic/anoxic water is flushed out of the transition zone and most of the lacustrine zone.	During summertime, lower water surface elevation with hypoxic/anoxic conditions at a lower elevation. In mid-August, the water surface elevation is about 25 feet lower and the top of the hypoxic/anoxic layer is about 15 feet lower than under Proposed Operations. There are no noticeable effects in spring, and minimal effects in the fall.
1995 (medium flow)	Hypoxic/anoxic conditions start in the spring at RM 305 to 298. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout near bottom waters of the transition zone and just below the elevation of the powerhouse intake in the lacustrine zone. As summer progresses, the near bottom anoxic water is flushed out of the transition zone, but accumulates in the lacustrine zone even above the elevation of the powerhouse intake. As fall progresses, much of the hypoxic/anoxic water is flushed out of the lacustrine zone.	During summertime, lower water surface elevation with hypoxic/anoxic conditions at a lower elevation. In mid-August, the water surface elevation is about 20 feet lower and the top of the hypoxic/anoxic layer is about 15 feet lower than under Proposed Operations. There are no noticeable effects in spring, and minimal effects in the fall.

Year	Proposed	Scenario 2 (Flow Augmentation)
1999 (medium-high flow)	Hypoxic/anoxic conditions start in the spring at between RM 300 and the dam. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout near bottom waters of the transition zone and most of the water below 1,920 feet msl in the lacustrine zone. As summer progresses, anoxic water accumulates near the bottom of the transition zone and is then flushed out of the transition zone, and anoxic water accumulates in the lacustrine zone even above the elevation of the powerhouse intake. As fall progresses, most of the hypoxic/anoxic water is flushed out of the lacustrine zone.	During summertime, lower water surface elevation with hypoxic/anoxic conditions at a lower elevation. In mid-August, the water surface elevation is about 15 feet lower and the top of the hypoxic/anoxic layer is about 10 feet lower than under Proposed Operations. There are no noticeable effects in spring, and minimal effects in the fall.
1997 (extremely high flow)	Hypoxic/anoxic conditions start in the spring at between RM 302 and the dam. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout near bottom waters between the dam and RM 316, and in most of the lacustrine zone below 1,930 feet msl. As summer progresses, anoxic water accumulates near the bottom of much of the transition zone and in the lacustrine zone even slightly above the elevation of the powerhouse intake. As fall progresses, all of the hypoxic/anoxic water is flushed out of the lacustrine zone.	During summertime, lower water surface elevation with hypoxic/anoxic conditions at a lower elevation. In mid-August, the water surface elevation is about 15 feet lower and the top of the hypoxic/anoxic layer is about 10 feet lower than under Proposed Operations. There are no effects in spring and negligible effects in fall.

[a] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Table 25. Summary comparison of simulated Hells Canyon outflow hourly DO concentrations for Proposed Operations and Scenario 2 (Flow Augmentation) to applicable criteria and TMDL targets.[a] (Source: Idaho Power, 2005e, as modified by staff)

Year	Proposed Operations	Scenario 2 (Flow Augmentation)
1992 (extremely low flow)	Lowest in July and August with a minimum of about 2 mg/L. Lower than 8.0- and 11.0-mg/L criteria/targets from early March through mid-April and from early May through December.	Generally about 1.0–1.5 mg/L higher in July and August, 0.5 mg/L higher in late October, and very similar to Proposed Operations for the remainder of the year. Overall minimum of about 3 mg/L. Lower than the 8.0- and 11.0-mg/L criteria/targets during the same periods as Proposed Operations.
1994 (medium-low flow)[b]	Lowest in August and September, with a minimum of about 3 mg/L. Lower than 8.0- and 11.0-mg/L criteria/targets from mid-March through mid-April and from late May through December.	Generally about 0.5 mg/L higher in July, 0.5 mg/L lower in August, and virtually the same as under Proposed for the remainder of the year. Overall minimum of about 3 mg/L. Lower than the 8.0- and 11.0-mg/L criteria/targets during the same periods as Proposed Operations.
1995 (medium flow)	Lowest in August and September, with a minimum of about 2.5 mg/L. Lower than 8.0- and 11.0-mg/L criteria/targets from early February through mid-April and from late June through December.	Generally about 0.5 mg/L higher in September and early October, virtually the same as under Proposed for the remainder of the year. Overall minimum of about 2.5 mg/L. Lower than the 8.0- and 11.0-mg/L criteria/targets during the same periods as Proposed Operations.
1999 (medium-high flow)	Lowest in August and September, with a minimum of about 2 mg/L. Lower than 8.0- and 11.0-mg/L criteria/targets from late June through December.	Virtually the same as under Proposed except in June, which is about ±1.2 mg/L of Proposed Operations. Overall minimum of about 2 mg/L. Lower than the 8.0- and 11.0-mg/L criteria/ targets during the same periods as Proposed Operations.
1997 (extremely high flow)	Lowest in August and September, with a minimum of about 4 mg/L. Lower than 8.0- and 11.0-mg/L criteria/targets from early July through December.	Generally about the same as under Proposed except in late May to early June, which is about ±1.2 mg/L of Proposed Operations. Overall minimum of about 4.5 mg/L. Lower than the 8.0- and 11.0-mg/L criteria/targets during the same periods as Proposed Operations along with a couple of days in late May.

[a] We estimated compliance with the criterion/target DO concentrations of 11.0 mg/L for spawning for October 23 through April 15, and the coldwater criterion/target of 8.0 mg/L for the remainder of the year.

[b] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Idaho Power's simulation of project operations under navigation target flow levels (Scenario 3) is representative of operations that would result from recommendations made by the Corps and NPPVA for a minimum flow of 8,500 cfs upstream of the mouth of the Salmon River and 11,500 cfs downstream of the Salmon River. Based on Idaho Power's simulations of Scenario 3 (Bowling, 2005b), Hells Canyon outflow rates would be little affected in medium to extremely high flow years, and most affected in medium-low flow years when Brownlee reservoir inflows exceed 8,500 cfs. Although Hells Canyon minimum outflows would increase, maximum outflows during these periods would be reduced and thus

Brownlee reservoir levels would remain similar to Proposed Operations. We anticipate that DO concentrations in the Hells Canyon outflows under these circumstances would be a little higher than under Proposed Operations. Operating the project under the Forest Service's navigation flow recommendation, which would not allow for lower minimum flows when inflows are low, would substantially draw down Brownlee reservoir in extremely low flow years. We anticipate that this would result in somewhat higher DO concentrations being drafted from Brownlee reservoir and discharged from the Hells Canyon development than under Proposed Operations or the Corps/NPPVA navigation flow recommendations.

Total Dissolved Gas

Changes in the seasonal flow regime caused by project operations can affect the frequency of spill events at the project's dams and consequently affect gas super-saturation. In this section, we evaluate the effects that proposed and recommended operations would have on the frequency of spills that currently result in exceedance of the 110-percent of saturation TDG criterion. The effects of non-flow related issues that could influence the frequency and magnitude of exceedances of the TDG criterion are discussed in section 3.5.2.3, *Total Dissolved Gas*.

Our Analysis

As we discussed in section 3.5.1.4, *Total Dissolved Gas*, Brownlee dam spills of greater than 3,000 cfs increase TDG immediately downstream of the Brownlee dam spillway to levels above the 110-percent of saturation criterion. The effect of these spills is observed through both Oxbow and Hells Canyon reservoirs, but they have only a minor to moderate effect on TDG beyond Hells Canyon dam. Oxbow dam spills of 5,000 to 24,000 cfs increase TDG with the largest increases (about 20 percent of saturation) occurring at spills of 12,000 cfs. These elevated TDG levels continue through the 2.5-mile-long bypassed reach between the Oxbow dam and powerhouse. Nearly all spill rates at Hells Canyon dam result in exceedance of the 110-percent criterion at the monitoring station located approximately 1.5 miles downstream of the dam.

Idaho Power's Proposed Operations would be virtually the same as the current operations, with the exception of winter flood-control requirements that would apply only in December and January under a Corps request made on a case-by-case basis. Due to the occasional nature of this operational constraint, it was not separately modeled with the CHEOPS operations simulation model. As described in section 3.3.2.2, effects of Idaho Power's Proposed Operations were indistinguishable from the ongoing effects of Current Operations. This indicates that spills at each of the dams would result in negligible changes in the frequency of spills that would likely result in TDG exceedances of the 110-percent of saturation criterion.

We evaluated the effects of recommended project operations by comparing the frequency of spill events that would occur under Proposed Operations to the frequency occurring under the Flow Augmentation Scenario (Scenario 2) and the Navigation Scenario (Scenario 3) (see section 3.3.2.2).

Tables 26 and 27 summarize the CHEOPS modeling results for Brownlee outflows and the Hells Canyon dam gage that would likely result in TDG exceedances of the 110-percent of saturation criterion with the current spillway structures and operations.

Table 26. Summary of the occurrence of hourly modeled Brownlee outflows of greater than 38,000 cfs,[a] which likely would result in TDG exceeding the 110-percent of saturation criterion with current spillway structures and operations. (Source: Idaho Power, 2005b; Brink and Chandler, 2005, as modified by staff)

Year	Proposed	Scenario 1 (Stabilized Hells Canyon Release)	Scenario 2 (Flow Augmentation)	Scenario 3 (Navigation)
1992 (extremely low flow)	None	Virtually the same as proposed[b]	None	Virtually the same as proposed[b]
1994 (medium-low flow)[c]	None	NA	None	NA
1995 (medium flow)	A few days in mid-June	Virtually the same as proposed[b]	Virtually the same as proposed	Virtually the same as proposed[b]
1999 (medium-high flow)	Two-month period of late February through late April, and about 1 week in mid-June	NA	Slightly more frequent in mid-June	NA
1997 (extremely high flow)	Nearly 4-month period of January through April, and about 3 weeks in mid- to late June	Virtually the same as proposed[b]	Slightly more frequent in early June	Virtually the same as proposed[b]

Note: NA – indicates no CHEOPS model results, although there is no reason to believe Brownlee outflows would differ from Proposed Operations since this scenario uses Hells Canyon reservoir to reregulate Brownlee and Oxbow load-following operations.

[a] Flows of 38,000 cfs are equal to the Brownlee turbine hydraulic capacity of 35,000 cfs plus 3,000 cfs for spills that result in exceedance of the 110-percent criterion.

[b] Based on comparison of modeled Brownlee reservoir elevations plotted in Idaho Power's response to AIR OP-1(f).

[c] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Table 27. Summary of the occurrence of hourly modeled Hells Canyon dam gage (No. 13290450) flows of greater than 30,500 cfs, which likely would result in TDG exceeding the 110 percent of saturation criterion with current spillway structures and operations. (Source: Bowling, 2005b, as modified by staff)

Year	Proposed	Scenario 1 (Stabilized Hells Canyon Release)	Scenario 2 (Flow Augmentation)	Scenario 3 (Navigation)
1992 (extremely low flow)	None	None	None	None
1994 (medium-low flow)[b]	None	None	None	None

Year	Proposed	Scenario 1 (Stabilized Hells Canyon Release)	Scenario 2 (Flow Augmentation)	Scenario 3 (Navigation)
1995 (medium flow)	One-month period of late May through late June nearly continuously	Virtually the same as proposed	Slightly more frequent and higher spills in late June-early July	Virtually the same as proposed
1999 (medium-high flow)	Total of about 4 months ranging from mid-January to late June	Virtually the same as proposed	Slightly less frequent in June, but higher	Virtually the same as proposed
1997 (extremely high flow)	About 6-month period of January through June nearly continuously	Virtually the same as proposed	Slightly less frequent spills in late May, but higher in early June	Virtually the same as proposed

[a] Flows of 30,500 cfs are equal to the Hells Canyon turbine hydraulic capacity.

[b] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Under the Flow Augmentation Scenario, the frequency of modeled spills increased slightly, potentially resulting in TDG exceedances in early to mid-June of medium-high to extremely high flow years. A similar comparison for modeled Hells Canyon dam gage flows suggests that the frequency of spills could be affected in medium to extremely high flow years, but that the overall likelihood of Hells Canyon spills causing TDG exceedances would be about the same for the Flow Augmentation Scenario as Proposed Operations. In its comments on the draft EIS, NMFS states that the slight increases in the frequency of modeled discharges above the turbine hydraulic capacity at Brownlee and Hells Canyon dams are modeling artifacts likely caused by the model attempting to meet refill targets set by the program in every year, regardless of inflow. During high flow years, when aiming for a June 20 refill might incur unacceptable risk of involuntary spill, we anticipate that Idaho Power, NMFS, and FERC would confer and likely delay refill as appropriate; therefore, the increase in spill frequency predicted by the model would not occur.

Operational recommendations related to navigation target flow levels (Scenario 3) would not affect the outflows from any of the three developments during high-flow periods when spills are occurring. Thus, such recommendations would not result in a change in the frequency or magnitude of TDG exceedances of the 110-percent of saturation criterion.

Hazardous Materials

Changes in the seasonal flow regime caused by project operations can affect DO levels, which in turn can affect the formation and accumulation of hazardous water quality constituents (e.g., ammonia and methylmercury). In addition, some of the operating scenarios recommended by agencies, tribes, and NGOs in this proceeding have the potential to affect concentrations of hazardous materials. These scenarios include augmenting flows to improve outmigration survival of juvenile salmon and steelhead (Scenario 2, Flow Augmentation). Because the project needs to store and use petroleum products and other hazardous materials, there is a risk that these products could be discharged into the Snake River.

In addition to Idaho Power's proposed operations and operation-related recommendations received from agencies, tribes, and other parties (table 9), the ODFW, Umatilla Tribes, Nez Perce Tribe, and AR/IRU provide specific recommendations about hazardous materials. We discuss these recommendations below.

The Umatilla Tribes (CTUIR-23) and Nez Perce Tribe (NPT-17) recommend that Idaho Power prevent the discharge of point-source pollutants into the Snake River from the project as necessary to meet the applicable water quality standards. They recommend that Idaho Power develop a plan, in consultation with appropriate federal, state and tribal water quality and fish and wildlife agencies, to prevent discharge of pollutants from the project into the Snake River within 6 months of obtaining a new license, and implement measures to assure that point-source pollutants are not discharged from the project into the river within 1 year of issuance of a new license. If these measures do not meet applicable water quality standards, Idaho Power should re-consult with those agencies to develop and implement other means to meet standards within 2 years of the issuance of a new license.

AR/IRU (AR/IRU-20) recommend that Idaho Power obtain a permit under section 402 of the federal CWA for any discharges related to turbine operation from the Brownlee development. They indicate that this would include oil, grease, pH, cooling water, and any other pollutants created by the Brownlee powerhouse.

ODFW-43 recommends that Idaho Power, in consultation with ODFW and the White Sturgeon Technical Advisory Committee,[46] evaluate potential adverse effects on white sturgeon from the bioaccumulation of contaminants. Idaho Power would develop, fund, and implement a contaminant study for white sturgeon populations isolated within Hells Canyon and Oxbow reservoirs and the reach between Brownlee and Swan Falls dams. Under this recommendation, Idaho Power would provide ODFW and the White Sturgeon Technical Advisory Committee with annual updates and an annual plan, and allow a 30-day comment period for the draft annual plans. Idaho Power would also provide ODFW and the White Sturgeon Technical Advisory Committee a final report at the completion of the study. In addition, ODFW-57 recommends that Idaho Power consult with ODEQ and ODFW to develop and conduct a study to determine mercury, dieldrin, and DDT/DDE levels in fish in Brownlee reservoir. Such data would be used in modeling biomagnification of analytes for target species that include white sturgeon, bald eagles, and golden eagles.

Our Analysis

Operating the project would continue to require the storage, use, and potential spill of oil and other potentially hazardous materials. As discussed in section 3.5.1.6, *Hazardous Materials*, project power plants leaked/released oil at the rate of about 300 gallons per year at Brownlee, 60 gallons per year at Oxbow, and 25 gallons per year at Hells Canyon. To substantially reduce oil leakage from the Brownlee power plant, Idaho Power developed a new ring design and installed new gasket ring material at Brownlee units 1 and 2, which were the largest contributors to oil leakage.

The prevention and countermeasures for spills of the aforementioned hazardous materials is managed by Idaho Power through implementation of Spill Prevention Control and Countermeasure plans, which are approved by EPA and WDOE, in accordance with 40 CFR 112, EPA Oil Pollution Prevention Regulations. These plans describe management practices, procedures, structures, and equipment at project facilities to prevent spills and to mitigate or preclude any adverse effects on the environment. The plans provide: (1) the locations, quantities, and contents of oil products stored at the project; (2) a description of potential spill situations and control systems; (3) a detailed list of spill prevention measures associated with specific runoff and other drainage systems; (4) storage locations; (5) oil-containing equipment; (6) maintenance activities; (7) personnel training; and (8) reporting procedures. The existing Spill Prevention Control and Countermeasure plans fulfill the requirements of 40 CFR 112. To comply with 40 CFR 112, Idaho Power periodically reviews and revises the plans for the project at least every

[46] The White Sturgeon Technical Advisory Committee is an interagency group that was established by Idaho Power to identify and develop measures to protect or enhance white sturgeon in the Snake River from Shoshone Falls (RM 615) to the mouth of the Salmon River (RM 188.2).

3 years or within 60 days of a spill. Continued implementation of practices implemented as components of these plans (e.g., training personnel in appropriate notification and cleanup procedures), would continue to ensure that project spills would be identified before they could enter project waters or cause much biological harm, and appropriate cleanup procedures would be done.

The only other considerable project point sources of pollutants are discharges of warm cooling and sump water from the project's power plants. Idaho Power has National Pollutant Discharge Elimination System (NPDES) permits that limit the temperature of these discharges from each of the project power plants. Meeting the requirements of these NPDES permits and the Spill Prevention Control and Countermeasure plans would ensure that the project does not discharge point-source pollutants into the Snake River, as recommended by the Umatilla Tribes and Nez Perce Tribe, and is consistent with section 402 of the federal CWA as recommended by AR/IRU.

Although these actions would limit the project's supply of point-source pollutants, operation of the project would still result in the production, accumulation, and discharge of ammonia and trace metals (including mercury) that form in the anoxic reservoir waters; and bioaccumulation of methylmercury and organochlorine compounds (including dieldrin, DDT/DDE, and PCBs) in fish in the project area. Operating the project under Idaho Power's Proposed Operations would result in essentially the same flow regime as current conditions, and thus would result in virtually the same production, accumulation, and discharge of ammonia and trace metals; and bioaccumulation of contaminants in fish and wildlife.

Because operational recommendations to limit ramping downstream of Hells Canyon dam (refer to table 9) would result in minimal changes in the water residence time within each of the project reservoirs, they would have negligible effects on ammonia and trace metal concentrations in water, as well as bioaccumulation of contaminants in fish and wildlife.

Operational recommendations related to flow augmentation (refer to table 9) would result in earlier drawdown of Brownlee reservoir, and greater drawdown of the reservoir in low to medium-low flow years. Because the near-bottom anoxic conditions would change little, the amount of ammonia produced and the amount of trace metals transferred from the sediments to the water column are expected to be similar to under Proposed Operations. However, increasing summertime discharges from Brownlee reservoir would tend to expedite discharge of ammonia and trace metals from Brownlee reservoir, and routing of them through the other two reservoirs and the lower Snake River. Consequently, accumulation of ammonia and trace metals would tend to be reduced in the meta- and hypolimnion of Brownlee reservoir during summer and early fall; hence, fall discharges would have lower concentrations of ammonia and trace metals. We anticipate that fish in the project area would bioaccumulate methylmercury and organochlorine compounds at roughly the same rate as under Proposed Operations.

Operational recommendations related to navigation target flow levels (refer to table 9) would have little effect on the seasonal outflows from Brownlee reservoir and is therefore expected to have negligible effects on the production, accumulation, and discharge of ammonia and trace metals; and bioaccumulation of methylmercury and organochlorine compounds in fish in the project area.

Data obtained for fish collected from Brownlee reservoir and the Snake River at Pittsburg Landing indicate that bottom dwelling fish (channel catfish, common carp, and largescale sucker) have concentrations of total mercury, total DDT, and/or total PCBs that indicate excessive contamination (refer to section 3.5.1.6, *Hazardous Materials*). No sampling of white sturgeon was done during this study, so the extent of contamination of this species is unknown. However, white sturgeon are particularly susceptible to bioaccumulation of contaminants due to their long life span, benthic feeding habits, and position at the top of the food chain. In section 3.7.2.1, *Effects of Project Operations on Terrestrial Resources*, we indicate that evidence suggests that fish-eating (piscivorous) wildlife would likely be adversely affected by some contaminants. DDT/DDE concentrations are at levels that adversely affect great blue heron and river otter, and mercury concentration are at levels that likely adversely affect bald eagle.

Monitoring the bioaccumulation of methylmercury and organochlorine compounds (particularly DDT/DDE) in fish from the project area, as recommended by ODFW, would provide data to refine estimates of the level of risk to fish and piscivorous wildlife, including bald eagles, golden eagles, and river otters. Additional monitoring of contaminant levels in the ODFW-recommended reaches upstream of Brownlee reservoir would provide added data for a more widespread evaluation of risks to fish and piscivorous wildlife. However, such reaches are beyond the hydrologic influence of the project. In the draft EIS, we stated that water quality conditions would likely improve through TMDL implementation before new year classes of white sturgeon attain reproductive age in 10 to 20 years, and ODFW's recommended monitoring of contaminants in white sturgeon would provide limited value if a sturgeon conservation aquaculture program is implemented. After re-evaluating these issues, we conclude that implementing the TMDL would take decades to attain substantial water quality improvements and even longer to reduce the effects of legacy contaminants. Therefore, we conclude that there would be a negligible change in bioaccumulation rates for toxic contaminants within the first 20 years (period for white sturgeon to reach sexual maturity) of a license, and that monitoring bioaccumulation in white sturgeon in a non-lethal manner would aid in determining the effects of bioaccumulation of contaminants on reproductive success and recruitment.

3.5.2.2 Dissolved Oxygen

Low DO levels greatly reduce habitat suitability for both cold and warmwater species in the project reservoirs during the summer months, and DO levels in the first 6 to 7 river miles downstream of Hells Canyon dam are below optimal during the first month of the fall Chinook salmon spawning season. Increasing DO levels in project reservoirs and downstream of Hells Canyon dam could greatly increase the usable habitat in the project reservoirs, reduce the incidence of fish kills, and improve conditions for fall Chinook salmon spawning downstream of Hells Canyon dam.

In its license application, Idaho Power proposed two measures to improve DO conditions. To improve DO conditions within the Hells Canyon Project, Idaho Power proposed to supplement DO in Brownlee reservoir at a rate consistent with the draft TMDL (average annual rate of 1,450 tons oxygen per year). Idaho Power also proposed to install and operate turbine-venting systems in Brownlee powerhouse units 1 through 4 and to investigate, and install and operate if practical, a turbine-venting system in Brownlee powerhouse unit 5 to enhance oxygen concentrations in the waters downstream of Hells Canyon dam. Following revision of the project's DO TMDL load allocation in the final TMDL, Idaho Power revised its proposed supplementation rate to 1,125 tons of oxygen per year, which is consistent with the final TMDL. Idaho Power also withdrew its proposals to vent the Brownlee turbines.

In a filing with the Commission on April 26, 2007, Idaho Power superseded its original proposal with the measures proposed in its January 31, 2007, application for water quality certification (Idaho Power (2007a). In this new proposal, Idaho Power proposes to fulfill its responsibility for the TMDL load allocation of 1,125 tons of oxygen per year for Brownlee reservoir either through implementing a Brownlee reservoir aeration system or through upstream phosphorus trading. Idaho Power proposes to implement aeration options using an adaptive management approach. However, phosphorus trading offers the potential for enhanced resource benefits over mechanical aeration. Therefore, Idaho Power proposes to devote a limited period (i.e., up to 1 year after license issuance) to identifying appropriate trading partner(s) first and, if that fails, to then proceed with design and installation of the reservoir diffuser system.

In addition to the DO load assigned to Idaho Power in the TMDL, Idaho Power (2007a) has estimated the project's responsibility for lowering DO concentrations downstream of Hells Canyon dam at a maximum of 637 tons of oxygen per year and developed measures to satisfy this responsibility. Idaho Power proposes to offset the project's contribution to low DO downstream of Hells Canyon dam by using a forced-air (blower) system at the Hells Canyon power plant to add 1,500 tons of oxygen annually or alternatively using a turbine aeration system at Brownlee power plant. Idaho Power proposes to work with IDEQ and ODEQ to develop a monitoring plan for DO that would document the injection of 1,125 tons of oxygen per year into Brownlee reservoir or the removal of an equivalent phosphorus load upstream, and the addition of 1,500 tons of oxygen per year at Hells Canyon dam or Brownlee dam to augment DO levels downstream of the project. Idaho Power would monitor TDG in Hells Canyon turbine discharges whenever turbine aeration is occurring to ensure that its aeration does not cause TDG to exceed the 110 percent of saturation criterion. In addition, Idaho Power proposes to install and operate a destratification system in the Oxbow bypassed reach, and conduct monitoring to evaluate the effectiveness of this system. We discuss Idaho Power's proposed Oxbow bypassed reach DO measures in section 3.5.2.5, *Oxbow Bypassed Reach Flows.*

ODFW-55 recommends that Idaho Power consult with ODEQ to develop and implement a plan, approved by ODEQ in a water quality certification, to ensure that the project does not contribute to violation of Oregon's DO standard within or downstream of the project. This plan would include appropriate implementation measures, a timeframe, and an effectiveness monitoring plan. In addition, ODFW-58 recommends that Idaho Power consult with ODEQ and ODFW to develop appropriate water quality monitoring, including DO, and that the monitoring measures be approved by ODEQ in a water quality certification.

NMFS-12 recommends that Idaho Power, in cooperation with NMFS, IDEQ, ODEQ, and other interested agencies and tribes, evaluate and design the most effective means (blowers, aerating runners, or other technologies) of increasing late summer and fall DO levels in outflows of the Hells Canyon Project developments, with the goal of increasing DO levels downstream of Hells Canyon dam to at least 6 mg/L (an increase of roughly 2 mg/L over typical conditions at present). The initial evaluation would be completed within 2 years of issuance of a new license, with final design and construction completed within 5 years of license issuance. NMFS-14 also recommends that Idaho Power fund and maintain 6 permanent water quality monitoring stations in the mainstem Snake River to document trends in water quality (temperature, DO, TDG, and pH) and collect additional water quality samples twice each month to assess progress in reducing nutrient and fine sediment loads in the Snake River. Water quality monitoring stations would be located downstream of Hells Canyon, Brownlee, Swan Falls, C.J. Strike, and Bliss dams as well as between Brownlee reservoir and the Weiser River confluence. The specific location of each monitoring station would be determined by the Aquatic Resources Committee. Idaho Power would make this water quality information available to members of the Aquatic Resources Committee and FERC. In the 10(j) meeting, NMFS emphasized that funding water quality monitoring stations is a critical step toward re-establishment of a second population of fall Chinook salmon.

The Umatilla and Nez Perce Tribes (CTUIR-21 and NPT-16) recommend that Idaho Power construct structures on Hells Canyon dam, within 2 years of the issuance of a new license, to add DO to the Snake River downstream of the project. If these structures do not result in meeting the applicable DO standards, Idaho Power would re-consult with those agencies to develop and implement other structural approaches to increase the discharge of DO within 5 years of the issuance of a new license. In addition, the Nez Perce Tribe recommends including injecting oxygen in Brownlee reservoir to meet the 6.5-mg/L DO target, as designated by the load allocation in the Snake River-Hells Canyon TMDL (IDEQ and ODEQ, 2004).

Interior-42 recommends that Idaho Power implement measures to improve water quality conditions in Oxbow and Hells Canyon reservoirs, to the point that they meet all water quality standards for designated beneficial uses for the states of Idaho and Oregon. In more specific recommendations, Interior-61 recommends that Idaho Power, in consultation with ODEQ and IDEQ, install and operate a turbine-venting system on units 1 through 4, and potentially on unit 5, at the Brownlee development and the units at Hells Canyon dam. If any of the evaluated turbine venting systems for the units were found to be feasible, Idaho Power would coordinate with ODEQ and IDEQ to develop a design and operations plan, and an effectiveness monitoring plan, for turbine-venting system(s) on any of the feasible units. Interior-67 recommends that Idaho Power monitor water quality, including DO, TDG, temperature, dissolved constituents, organic pesticides, mercury, and other heavy metals at numerous locations downstream of Hells Canyon dam. At least three replicate samples/readings would be taken from mid-channel in runs or pools at or near the following locations:[47] Hells Canyon Boat Ramp (RM 247), Stud Creek (RM 246), Warm Springs Bar (RM 243), Rocky Bar (RM 240.5), Granite Rapids (RM 239), and additional downstream locations or similar locations. Sampling would be conducted twice per month for the term of any new license, with more frequent sampling during low DO periods and when DO enhancement mitigation is being implemented.

AR/IRU-16 recommend that the Commission require Idaho Power to locate, fund, construct, and oversee operations of projects to reduce nutrient and suspended particle delivery from on-land sources to the Snake River and its tributaries above, and within, the project. These entities state that the purpose of this program would be to address unmitigated project impacts to DO, as well as improve tributary habitats and upstream mainstem habitat sufficiently to support white sturgeon and fall Chinook salmon under a future reintroduction program. They recommend that this program be implemented instead of Idaho Power's DO supplementation proposal for Brownlee reservoir.

AR/IRU-17 recommend that the Commission require Idaho Power to take steps to increase DO levels in flowing reaches within, and below, the project to meet applicable water quality standards. They recommend that this be done with an adaptive management approach using real-time monitoring results to trigger aeration/oxygenation of reservoir outflows. They recommend that these efforts start at the Brownlee development with sequential evaluation at the other two dams, and that this effort be overseen by a Technical Advisory Committee. These efforts would include the following elements:

- monitor DO on a real-time basis in deep water at the Brownlee forebay near the outlet structure and Brownlee outflows at the dam, and at Hells Canyon and Oxbow dams, if needed to measure project-caused low DO levels at these dams; and
- aerate or oxygenate the outflows (not including spill) and/or the forebay waters to address low DO levels in the project reservoirs. Idaho Power would start with aeration or oxygenation of reservoir outflows, and subsequently aerate or oxygenate deep waters in the forebay, if needed to satisfy the applicable water quality standards. Any system to bubble air or molecular oxygen in the forebay would be designed to avoid re-suspension of sediments and associated contaminants.

AR/IRU-26 recommend that Idaho Power locate and develop new water quality monitoring stations immediately downstream of Hells Canyon dam, upstream of Brownlee reservoir, and downstream of Brownlee dam. The two stations downstream of project dams would be designed for real-time monitoring of stage, discharge, water temperature, TDG, DO, pH, turbidity, and ammonia. Parameters that would be measured above Brownlee reservoir include total discharge, water temperature, DO, pH, nutrients, turbidity, and community production to respiration ratios.

Our Analysis

Currently, low DO levels regularly occur in the transition zone and much of the lacustrine zone of Brownlee reservoir during late spring and summer, and downstream of Hells Canyon dam in spring through fall. These DO conditions are primarily a result of the high nutrient (phosphorus) loads to the project, and the reduction in assimilative capacity caused by converting the riverine system into a reservoir system. As described in section 3.5.2.1, *Effects of Project Operations on Water Quality*, operating the project under any of the proposed and recommended operational regimes would not

[47] Interior indicates that sample locations are to emphasize numerous locations within the first 10 miles downstream of Hells Canyon dam and states that this is the area most affected by operations and low DO levels.

substantially alter the DO regime in the project's reservoirs or Hells Canyon outflows. Measures that increase DO levels would provide direct benefits to aquatic habitat and indirect benefits to aquatic resources by expediting the degradation of organochlorine contaminants and reducing the availability of methylmercury (the biologically available form of mercury) in reservoir sediments.

We present our analysis in four parts: upstream watershed phosphorus trading, reservoir supplementation, aeration of downstream waters, and planning and monitoring.

Upstream Watershed Phosphorus Trading

In developing the Snake River-Hells Canyon TMDL for nutrients and DO, IDEQ and ODEQ (2004) represented the water quality narrative standards that were applicable at the time by setting a chlorophyll-*a* mean growing season (May through September) target at 14 μg/L and a total phosphorus target at no greater than 0.07 mg/L. Subsequent computations showed that reducing the nutrient loadings to the target level would not in itself satisfy the 6.5 mg/L DO target in Brownlee reservoir's transition zone and metalimnion during parts of July and August. Furthermore, IDEQ and ODEQ (2004) indicate that they anticipate it will take up to 70 years to reduce nutrient levels to the target levels. Based on modeling the reduction in assimilative capacity caused by converting the riverine system into a reservoir system, IDEQ and ODEQ (2004) assigned Idaho Power a load allocation equivalent to the addition of 1,125 tons of oxygen during a 65-day-long period per season. Although the calculated time period when exceedances occurred in the metalimnion of Brownlee reservoir was between Julian days 182 and 247 (July 1 through September 4[48]), IDEQ and ODEQ (2004) state that the timing of oxygen addition or other equivalent implementation measures should coincide with the actual periods when DO sags occur and where it would be the most effective in improving aquatic life habitat and supporting designated beneficial uses. IDEQ and ODEQ (2004) specifically stated that improvements in DO concentrations can be accomplished through equivalent reductions in total phosphorus or organic matter upstream, or by using other appropriate mechanism that can be shown to result in the required improvement of DO in the metalimnion and transition zones to the extent required. They also indicate that they expect water column DO monitoring to be undertaken as part of this scheduling effort.

In its January 31, 2007, application for water quality certification, Idaho Power (2007a) proposes to implement one of two measures (upstream phosphorus trading or Brownlee reservoir supplementation) to address the TMDL load allocation equal to 1,125 tons of oxygen per year. Idaho Power would try to identify an appropriate upstream phosphorus trading partner(s), and if that is unsuccessful within a limited period, it would proceed with Brownlee reservoir aeration to fulfill its obligation for the TMDL load allocation. Identifying one or more appropriate trading partners would be the first step to developing a legal agreement (trade) with another party under which the trading partner would reduce its phosphorus load to the Snake River more than required under regulations or established in the TMDL. This surplus phosphorous reduction (credit) would be in lieu of Idaho Power's supplementing oxygen at its TMDL allocation of 1,125 tons of oxygen per year. The intent of the trade would be to achieve an equivalent improvement in Snake River water quality, but at a lower cost. For the trade(s) to be successful, several factors would need to be addressed to ensure that the reductions in phosphorous loading provided a water quality improvement that would be functionally equivalent to supplementing oxygen at the TMDL allocation. A key component of any phosphorus trading would be identifying trading ratios for converting the required oxygen load to equivalent phosphorus loads. In its application for water quality certification, Idaho Power (2007a) provides ratios as a starting point for evaluating upstream trades. The total phosphorus to organic matter ratios presented range from 0.005 to 0.02, and the total phosphorus to oxygen ratios range from 0.0036 to 0.0143. Prior to arranging a trade, it would be important to determine acceptable ratio(s) to be used for upstream trading by consulting with IDEQ and ODEQ. In addition to

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[48] In a non-leap year.

determining the magnitude of any trade(s), it would be important to address the timing of the actual action so that it increases DO levels during the critical period. Reducing phosphorus loading to the reservoir would decrease the potential for algae growth, and over time would lower internal cycling of phosphorus, which would add to the overall benefits of source reduction. Implementing phosphorus reduction measures in tributaries also would enhance the DO regime, thereby improving fish habitat. Currently, it is impossible to quantify benefits that are likely to occur from an upstream phosphorus trade (or trades) since the location and nature of the trade(s) has yet to be identified.

Reservoir Supplementation

In the event that it does not locate an upstream phosphorus-trading partner(s), Idaho Power proposes to provide reservoir supplementation at an average annual rate of 1,125 tons oxygen per year, which would be consistent with the allocation in the final TMDL. Idaho Power provided a conceptual design of its proposed reservoir aeration system and described its proposed operations, along with CE-QUAL-W2 simulation results for each of the five representative flow years, in its final report on DO augmentation (Idaho Power, 2005g). In order to maximize the benefits of the aeration system, Idaho Power designed it with the goal of extending adequate DO levels for fish into the upstream end of the transition zone and preventing extreme hypoxic conditions from developing in this area.

Idaho Power's conceptual design of the reservoir aeration system includes an on-shore oxygen supply facility, supply piping from the facility to the reservoir, and two porous hose line diffusers. The oxygen supply facility would be located on flat terrain near the distribution site, and would include a storage tank for liquid oxygen, vaporizers, a pressure-regulating assembly, control valves, distribution piping, and truck access. The system is designed so that it could be used to deliver between 17.3 tons of oxygen per day (equivalent to 1,125 tons per year when applied for 65 days) and 34.6 tons of oxygen per day (equivalent to 2,250 tons per year when applied for 65 days). The amount of liquid oxygen needed for aeration at these rates, with an oxygen transfer efficiency of 85 percent and a safety factor of 1.15, would be 23.4 to 46.8 tons/day. This quantity could be delivered to the facility with three trucks every two days or three trucks every day, respectively. In order to provide an adequate storage volume and a flexible schedule for delivery of liquid oxygen, Idaho Power proposes installing a 50,000-gallon tank for storing liquid oxygen at the facility. Supply lines from the oxygen supply facility to the diffuser system would be routed in a trench under the road and then underwater to the deepest part of the reservoir. Then oxygen would be supplied to two porous-hose line diffusers in about a 2-mile-long reach of the reservoir centered around RM 325. The porous-hose diffusers would be maintained slightly off the bottom of the reservoir with several anchors and a buoyancy pipe, which could be used to re-float the porous hose for maintenance. MEI (2004a) estimates that the porous hose would need to be replaced about every 10 years.

Constructing the proposed reservoir aeration system would require clearing and grading the upland site for the oxygen supply facility, trenching for the supply lines, placing anchors for the diffuser system, and assembling the diffuser system at a site along the reservoir. Each of these activities has the potential to increase the turbidity in the nearby area. However, implementing reasonable management practices that are commonly employed for such activities would limit the magnitude and duration of these events to minor short-term events primarily within the construction period.

DO concentrations exhibit substantial interannual variability in Brownlee reservoir. Evaluation of vertical profiles for RM 325 collected in July of 1991 through 2003 shows that hypoxic conditions are common in low flow years, sometimes occur in medium-low flow years, and seldom if ever occur in years with higher flows (Idaho Power, 2005g). Simulations of DO concentrations indicate that reservoir aeration at 1,125 tons of oxygen per year (17.3 tons per day over the 65-day period of Julian day 182 to 247) would increase DO in the vicinity of the diffusers, but have little effect down-reservoir (table 28) and negligible effects farther downstream.

Table 28. Summary comparison of Brownlee reservoir simulated DO concentrations for Proposed Operations with and without proposed reservoir DO supplementation. (Source: Idaho Power, 2005g, as modified by staff)

Year	Without Proposed Reservoir DO Supplementation	With Proposed Reservoir DO Supplementation
1992 (extremely low flow)	Hypoxic/anoxic conditions start in the spring at RM 326 to 318. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout most of the 1,950 to 2,020 feet band down to the dam, and most of the lacustrine zone within 50 feet of the bottom. As summer progresses, DO concentrations continue to decrease at elevations below 2,030 feet, resulting in anoxic conditions near the bottom of the transition and lacustrine zones. As fall progresses, hypoxic/anoxic water is flushed out of the transition zone and much of the lacustrine zone.	During summertime, near-bottom DO concentrations substantially increase between RM 327 and 324, and minor increases in DO concentrations occur in the upper layers of the transition zone. Hypoxic/anoxic conditions occur near the bottom for several miles just upstream of the oxygenated water. In addition, anoxic conditions continue to occur near the bottom of most of the transition zone and the entire lacustrine zone, and near the powerhouse intake. There are no noticeable effects in the fall.
1994 (medium-low flow)[a]	Hypoxic/anoxic conditions start in the spring at RM 328 to 318. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout most of the 1,940 to 2,010 feet band in the transition zone and the upper end of the lacustrine zone, and most of the lacustrine zone within 30 feet of the bottom. As summer progresses, DO concentrations continue to decrease throughout the entire water column resulting in anoxic conditions near the bottom of the transition and lacustrine zones. As fall progresses, hypoxic/anoxic water is flushed out of the transition zone and most of the lacustrine zone.	During summertime, near bottom DO concentrations substantially increase between RM 328 and 322, and minor increases in DO concentrations occur in the upper layers of the transition zone. Hypoxic conditions occur near the bottom for about 2 miles just upstream of the oxygenated water. In addition, anoxic conditions continue to occur near the bottom of most of the transition zone and the entire lacustrine zone, and near the powerhouse intake. There are no noticeable effects in fall.
1995 (medium flow)	Hypoxic/anoxic conditions start in the spring at RM 305 to 298. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout near bottom waters of the transition zone and just below the elevation of the powerhouse intake in the lacustrine zone. As summer progresses, the near bottom anoxic water is flushed out of the transition zone, but accumulates in the lacustrine zone even above the elevation of the powerhouse intake. As fall progresses, much of the hypoxic/anoxic water is flushed out of the lacustrine zone.	During summertime, near bottom DO concentrations substantially increase between RM 328 and 324, and minor increases in DO concentrations occur in the upper layers of the transition and lacustrine zones. Anoxic conditions continue to occur near the bottom in much of the transition zone and the entire lacustrine zone, and near the powerhouse intake. There are virtually no effects in fall.

Year	Without Proposed Reservoir DO Supplementation	With Proposed Reservoir DO Supplementation
1999 (medium to high flow)	Hypoxic/anoxic conditions start in the spring at between RM 300 and the dam. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout near bottom waters of the transition zone and most of the water below 1,920 feet in the lacustrine zone. As summer progresses, anoxic water accumulates near the bottom of the transition zone and is then flushed out of the transition zone, and anoxic water accumulates in the lacustrine zone even above the elevation of the powerhouse intake. As fall progresses, most of the hypoxic/anoxic water is flushed out of the lacustrine zone.	During summertime, near bottom DO concentrations substantially increase between RM 326 and 324, and minor increases in DO concentrations occur in the upper layers of the transition zone. Anoxic conditions continue to occur near the bottom in varied amounts of the transition zone and the entire lacustrine zone, and near the powerhouse intake. There are no noticeable effects in fall.
1997 (extremely high flow)	Hypoxic/anoxic conditions start in the spring at between RM 302 and the dam. By the beginning of summer, hypoxic/anoxic conditions have progressed throughout near bottom waters up to RM 316, and most of the water below 1,930 feet in the lacustrine zone. As summer progresses, anoxic water accumulates near the bottom of much of the transition zone and in the lacustrine zone even slightly above the elevation of the powerhouse intake. As fall progresses, all of the hypoxic/anoxic water is flushed out of the lacustrine zone.	During summertime, near bottom DO concentrations substantially increase between RM 326 and 323, and minor increases in DO concentrations occur in the upper layers of the transition and lacustrine zones. Anoxic conditions continue to occur near the bottom in varied amounts of the transition zone and the entire lacustrine zone, and near the powerhouse intake. There are no noticeable effects in fall.

[a] Prior to issuance of the draft EIS, 1994 was identified as a representative medium-low flow year, based on analysis of the 1928 to 1999 flow record. However, Idaho Power's (2007a) subsequent analysis of the 1911 to 2005 flow record resulted in reclassifying 1994 to a low flow year.

Using the aeration system to provide 1,125 tons of oxygen per year in years when DO levels are not low in the vicinity of the aeration system (e.g., high flow years) would provide minimal increases to DO concentrations. In addition, simulation results indicate that aerating at the rate of 1,125 tons of oxygen per year could create an isolated area of oxygenated water surrounded by hypoxic conditions in low flow years (table 28). Placing the reservoir aeration system farther upstream would be undesirable due to the shallower depths that would reduce the efficiency of aerating the water.

Idaho Power's conceptual operational plan for the aeration system includes adaptively adjusting the rate of aeration based on potential benefit, and satisfying its TMDL load allocation on a long-term average period instead of an annual basis. Using this strategy, Idaho Power would inject more oxygen in years when there is a higher likelihood of formation of a hypoxic barrier surrounding the highly oxygenated area, and would inject less oxygen when this situation is unlikely to occur. Idaho Power suggests meeting the TMDL allocation of 1,125 tons per year using a 10-year average and providing aeration rates of 2,250 tons per year in low and medium-low flow years, 1,125 tons per year in medium flow years, and no aeration in higher flow years. Idaho Power also indicates that adjusting the aeration period to begin earlier may be warranted based on historical data and model results.

Providing higher aeration rates in low and medium-low flow years would provide an incremental increase in DO concentrations, although there is a possibility that the aerated water would be surrounded by hypoxic conditions that would form a barrier to aquatic organisms. The resulting conditions would be dependent on many factors including the flow conditions, nutrient loading, and oxygen demand. Recently collected data in Brownlee reservoir's transition zone suggests that there may be a significant oxygen demand near the sediment resulting from chemical products of anoxic conditions (including sulfide, ferrous iron, and methane), which are not specifically included in the CE-QUAL-W2 model. Currently, it is not clear how extensive oxygen demand from these materials would be upon initiation of aeration and ongoing aeration. This uncertainty, along with the potential for hypoxic water to surround aerated water, show the importance of adaptively managing any reservoir aeration process implemented to maximize its benefit in a cost-effective manner. Monitoring water quality in Brownlee reservoir would be essential for providing information to assist in making decisions about when to initiate aeration and the aeration rate to be used.

Idaho Power's proposed reservoir aeration system was designed for the current level of nutrient loading. As long-term improvements in upstream sources result from implementing the TMDL, the location of low DO levels would move down-reservoir and it may be beneficial to relocate the diffusers to the new low DO area. Idaho Power has designed the diffusers to facilitate this relocation, although it would not be practical to relocate the diffusers annually.

IDEQ and ODEQ (2004) state that "[i]mprovements in DO concentrations can be accomplished through equivalent reductions in total phosphorus or organic matter upstream, or other appropriate mechanism that can be shown to result in the required improvement of DO in the metalimnion and transition zones to the extent required." Since Idaho Power's proposed reservoir supplementation efforts would typically provide negligible benefit in most of Brownlee reservoir and downstream of Brownlee dam, there is reason to explore the potential to reduce nutrient and organic matter loadings from tributaries. In addition to reducing loadings to Brownlee reservoir, tributary restoration is likely to improve water quality in the tributaries, themselves, and aid in tributary fish restoration efforts. We discuss potential effects of tributary restoration efforts in section 3.6.2.10, *Tributary Habitat Improvements*.

TDG

In the immediate vicinity of the diffusers, DO could be increased to supersaturated levels, and thereby elevate TDG. Under current organic matter loadings, the resulting oxygen demand would result in the injected oxygen being used quickly. Simulations of reservoir aeration show that, under current conditions, the oxygen plume from aeration in the transition zone would not affect the DO levels of Brownlee discharges. Likewise, TDG levels in discharges from the Brownlee development would not likely be affected by reservoir aeration under current levels of nutrient and organic matter loadings.

Temperature

The oxygen bubbles from aerating the reservoir may promote some mixing of water layers in the vicinity of the diffusers, and thus affect water temperature in the area. However, Mobley and Brock (1996) report that minimal mixing has resulted from porous-hose line diffusers at other sites. We anticipate, therefore, that any effect on water temperatures would likely be minimal. While water temperatures would be affected in the immediate vicinity of the diffusers, we expect negligible temperature effects in discharges from the Brownlee and Hells Canyon dams.

pH and Ammonia

In eutrophic waters similar to Brownlee reservoir, photosynthesis raises pH in the photic zone, and CO_2 generation from heterotrophic decay of organic matter, nitrification of ammonia, and oxidation of sulfide lowers pH in deep waters (Wetzel, 1975). Elimination of anoxic conditions in portions of the reservoir likely would increase the pH and reduce the production and accumulation of ammonia in those areas. When water stored in the transition zone is discharged during drawdown, Brownlee and Hells Canyon discharges may have elevated pH levels and lower ammonia concentrations as a result of reservoir aeration.

Mercury and Organochlorine Compounds

Mercury and organochlorine compounds (including pesticides and their break down products, along with PCBs) are strongly associated with sediments. There is the potential for suspending sediments and their associated toxic contaminants while constructing the porous hose system and by operating the system if the porous hose is installed too close to the reservoir's bottom. Therefore, it would be important to (1) avoid disturbing sediments while constructing reservoir aeration system, and (2) install the porous hose line at a level that would minimize disturbance of the reservoir's sediments during operation. Based on the conceptual design of the aeration system and the proven means of floating the porous hose diffusers, we anticipate that any disturbance of sediments would be minimal.

Under anoxic conditions, contaminated sediments can act as a source for mercury, and organochlorine contaminants degrade at a slower rate. Therefore, elimination of anoxic conditions near the bottom of the reservoir would reduce the availability of methylmercury (the biologically available form of mercury) and organochlorine contaminants. The extent of these reductions would primarily be a function of the extent and location of sediment contamination, and the extent and duration of shifting from anoxic to higher DO concentrations. Any ongoing adverse effects of these contaminants on aquatic organisms and their predators (including bald eagles) would be reduced accordingly.

Aeration of Downstream Waters

Although Idaho Power's proposed reservoir supplementation would not increase DO concentrations of Brownlee or Hells Canyon discharges to above the 6.5-mg/L target, it would fulfill the intent of the TMDL load allocation (IDEQ and ODEQ, 2004) and would be responsive to the Nez Perce Tribe's recommendation for reservoir supplementation. High levels of nutrient and organic matter loading would be the primary cause of these low DO concentrations, and would continue until implementation of the TMDL resulted in substantial reductions in the loadings to project waters. Nutrient loads to the project would be reduced at a faster rate if Idaho Power identified a trading partner and successfully implemented an upstream phosphorus trade. However, we anticipate that substantial reduction in the overall nutrient and organic matter loadings from non-point sources would not occur for decades.

At the time that Idaho Power filed its license application (Idaho Power, 2003a), there was little evidence as to the extent that the project contributes to the low DO concentrations downstream of Hells Canyon dam, other than the reduction in assimilative capacity caused by Brownlee and Oxbow reservoirs. Nonetheless, Idaho Power initially proposed additional aeration measures in its license application. Idaho Power proposed to install and operate turbine venting systems in Brownlee units 1 through 4 and to evaluate the feasibility of implementing turbine-venting technology at Brownlee unit 5 with the goal of increasing DO levels downstream of Hells Canyon dam. This proposal, which Idaho Power subsequently withdrew after further study, was consistent with Interior's recommendation for turbine-venting measures.

The Brownlee development's turbine units 1 through 4 have the centerline of their runners above the tailwater elevation, while unit 5 has a lower runner elevation that is below the normal tailwater elevation. In August 2000, Idaho Power installed 4-inch hub baffles on Brownlee unit 4 and conducted tests to investigate the potential for turbine venting to increase DO concentrations in units 1 through 4. Initial evaluation of the 2000 tests suggested that the baffles may increase DO uptake by 1.0 to 1.5 mg/L (MEI et al., 2000). However, further evaluation indicates that changes in air flow were largely driven by tailwater elevations, which were different during the pre- and post-modification tests. Re-evaluation of the August 2000 data, along with another study conducted by Idaho Power in September 2004, indicates that the baffles have negligible effects on airflow and DO uptake in units 1 through 4 (Idaho Power, 2005g). Idaho Power examined the turbine drawings and found that the vacuum breaker air enters the head cover and exits the runner cone and, therefore, the baffles cannot induce additional airflow into the turbine.

The investigation indicated that normal aspiration of air without modification of the units varies by wicket gate openings and tailwater elevations. DO uptake for units 1 through 4 is about 1.0 mg/L at low tailwater elevations (1,800 to 1,801.9 feet) and about 0.7 mg/L at high tailwater elevations (1,804 to 1,805.1 feet). Therefore an estimated DO uptake of 0.5 mg/L is a conservative estimate of the effects of aspiration under normal operations without any modifications. Based on a mass balance approach, normal aspiration increases DO concentrations of Brownlee discharges by 0.33 mg/L when all of the units are being operated near their full capacity. Since unit 5 is located below the tailwater elevation, the pressure differential would not enable use of turbine-venting technology to aerate its discharges. Based on the results of these investigations, Idaho Power withdrew its proposal to implement turbine-venting technology in any of the units at the Brownlee facility.

Idaho Power (2007a) estimates that the project's contribution to downstream depressed DO levels is a maximum of 637 tons of oxygen per year, based on CE-QUAL-W2 simulations for the low flow year of 2002. Idaho Power indicates that it would use a forced-air system at Hells Canyon power plant to add 1,500 tons of oxygen annually to offset the project's contribution to low DO downstream of Hells Canyon dam (Idaho Power, 2007a). However, Idaho Power continues to evaluate turbine aeration measures for the Brownlee power plant. Consequently, additional information may be developed as to benefits, feasibility, or cost effectiveness of the power plant aeration measures that indicates the installation of a turbine aeration system at Brownlee may be preferable to one at Hells Canyon. In that case, Idaho Power plans to evaluate whether turbine aeration at the Brownlee powerhouse would provide reasonable assurance that the targets downstream of Hells Canyon dam would be met. Pending ODEQ and IDEQ approval, measures at Brownlee dam would be implemented within a specified time frame following license issuance.

To further evaluate the potential to increase DO levels downstream of Brownlee dam, Idaho Power analyzed the effects of implementing forced air blowers at Brownlee units 1 through 4 and unit 5. Conceptual designs of forced air systems were developed to meet the goal of attaining DO increases of between 1 and 2 mg/L (MEI, 2004b). A discrete bubble model was used to track oxygen and nitrogen transfer from bubbles and determine the air requirements to increase an incoming DO concentration of 4 mg/L by 1 mg/L and 2 mg/L. MEI estimated oxygen transfer efficiencies of about 40 percent for unit 5 and 20 percent for units 1 through 4.

Model results indicate that DO concentrations in the unit 5 tailrace would increase about 1 mg/L for every 107 cfs of air that is injected when the unit is operating near its maximum capacity of 11,800 cfs. Model results for units 1 through 4 indicate that each unit would have DO increases of about 1 mg/L for every 95 cfs of air that is injected when the respective unit is being operated near its maximum capacity of 5,675 cfs. Injecting atmospheric air would result in a substantial amount of nitrogen also being dissolved in the water and would, thus, increase TDG levels substantially. Model results indicate that injecting enough air into any of the five Brownlee units to increase the DO concentration from 4 mg/L to 6 mg/L would increase TDG levels to above the 110 percent of saturation criterion; whereas, the model predicted that injecting air at levels that would increase DO by 1 mg/L would maintain TDG levels below the 110 percent of saturation criterion. By injecting oxygen instead of atmospheric air, Idaho Power could avoid producing TDG in excess of 110 percent of saturation while substantially increasing DO.

Idaho Power has continued evaluating forced-air systems and aerating runners for the Brownlee and Hells Canyon power plants. Idaho Power (2007a) reported that preliminary evaluations indicate that various combinations of turbine aeration measures at Brownlee are feasible to meet the 1,500 tons of oxygen per year load downstream of Hells Canyon dam, but model simulations indicate that additional DO may need to be added at the Brownlee power plant to account for processes in the Oxbow and Hells Canyon reservoirs. Preliminary evaluations indicate that turbine aeration at Brownlee dam could provide the 1,500 tons per year and 440 tons for 37 days to compensate for adverse DO conditions caused by a Brownlee reservoir bubble upwelling system (see section 3.5.2.4, *Water Temperature*). However, further evaluation is necessary to verify both the adverse effects from implementing a Brownlee reservoir upwelling system, as well as the capability of the Brownlee turbine aeration measures to increase DO. Turbine aeration at Brownlee would have the added benefit of enhancing DO conditions within Oxbow and Hells Canyon reservoirs. Idaho Power (2007a) reported that numerical simulations of a Hells Canyon blower system delivering atmospheric air at a rate of 2,000 standard cubic feet per minute during July through November could provide 1,654 tons of oxygen, which is about 150 tons more than the required load allocation. Simulation results indicate that the DO concentration would increase an average of 0.4 mg/L, and that it was unlikely that the blower system would cause TDG to exceed the 110-percent of saturation criterion. Based on their evaluations, Idaho Power states that a forced-air system for Hells Canyon power plant would be the most cost-effective technology to implement.

Planning and Monitoring

The study results summarized in the preceding sections provide a basis for Idaho Power to develop a DO enhancement plan, in consultation with IDEQ, ODEQ, and other federal, state, and tribal agencies responsible for managing fish and wildlife, to compensate for the project's adverse effects on DO levels. Developing this plan and implementing appropriate measures to compensate for the project's adverse effects on DO would be consistent with ODFW's recommendation (ODFW-55). The plan would help outline a process to identify appropriate upstream phosphorus trading partner(s), refine the proposed reservoir DO supplementation measure and the need for additional aeration measures, and confirm whether reservoir supplementation is cost effective. This plan would provide a vehicle to evaluate the effectiveness and feasibility of alternative measures including reducing nutrient and organic matter loadings from tributaries, injecting oxygen or air into forebay waters or turbines, and using aerating runners to increase DO in turbine flows. We anticipate that consultation would include finalizing trading ratios to be applied in the event of implementing upstream phosphorus trading.

Regardless of what methods are implemented to increase DO levels, monitoring of nutrients, TSS, DO, and pH would provide data to confirm their effectiveness. In addition, these data also would aid in adaptively implementing measures so as to maximize the benefit. Monitoring the quality of Snake River inflows to Brownlee reservoir would provide data that could be used to determine long-term reduction of nutrients and suspended sediment loads as the TMDL and other restoration efforts are implemented. If reservoir supplementation is selected for implementation, this information could be used to determine when (both which years and the timing within selected years) supplementation would occur and the rate at which it would occur. Monitoring the quality of inflows and outflows of Brownlee reservoir would provide data that could be used to select the appropriate time in the season to begin reservoir supplementation and document the effectiveness of the supplementation. A long-term assessment of inflowing water quality also could aid in determining if upstream conditions have sufficiently improved to warrant relocating the diffuser system to a down-reservoir location. Monitoring water quality at the three sites recommended by NMFS that are about 120 to 220 miles upstream of Brownlee reservoir (i.e., downstream of Swan Falls, C.J. Strike, and Bliss dams) would not provide any incremental information to aid in selecting control measures for the project or determining their effectiveness. However, monitoring at these sites would facilitate assessment of whether upstream water quality would likely support restoring fall Chinook in these areas.

During development of the plan, Idaho Power would consult with IDEQ and ODEQ to confirm agreement with Idaho Power's estimate of project effects that contribute to low DO levels in the Snake River downstream of Hells Canyon dam. Once the appropriate DO load allocation is set for the project, the feasibility of implementing Idaho Power's proposed Hells Canyon forced-air system and other measures to meet this load allocation, including oxygen injection at the Hells Canyon turbines and Brownlee powerhouse forced-air and aerating runner systems, would be evaluated. A monitoring plan would be used to: (1) confirm that Idaho Power is meeting their obligations for improving the DO regime; and (2) evaluate the effectiveness of the measures implemented, as well as any adverse effects on TDG downstream of the turbine aeration measures implemented. To accurately document the effectiveness of increasing DO downstream of Hells Canyon dam, monitoring would need to be conducted near the dam. Sampling water quality at a single downstream site would provide insight into the level of discharges from the project, including the effects of aeration measures implemented at the project.

Sampling water quality at numerous locations within the first 10 miles downstream of Hells Canyon dam at least twice per month, as recommended by Interior, would provide information on the reaeration rate and changes in other water quality parameters in this reach. However, we anticipate that sampling at this intensity would provide little incremental value over monitoring at just one site, since reaeration rates are relatively predictable and there are no primary sources of contaminants in this reach. At the 10(j) meeting, FWS expressed some flexibility regarding the frequency and number of water quality measurements that would be needed downstream of Hells Canyon dam to track changes in water quality associated with implementation of water quality improvement measures. As part of developing the DO enhancement plan, Idaho Power would consult with the appropriate federal and state agencies and the tribes to determine an appropriate level of monitoring downstream of Hells Canyon dam. The FWS's recommended level of monitoring effort would be addressed during these consultations.

3.5.2.3 Total Dissolved Gas

Spills occur at the project's dams when river flows exceed the capacity of the respective powerhouse. Spills are routed over the project spillways, which results in water plunging to depth in the pool below the dams. This can increase TDG to levels exceeding the applicable Idaho and Oregon state standards. The frequency and extent of these increases are dependent on the spillway structures and the flow of water routed through them. We discuss the frequency of flows routed through the spillways above in section 3.5.2.1, *Effects of Project Operations on Water Quality*. In this section, we discuss the effects of varied operational procedures, structural changes at the dams, and TDG monitoring.

In its license application, Idaho Power proposed to continue preferential use of crest (upper spillway) gates for passing spills at Brownlee dam and to install flow deflectors on the Hells Canyon dam spillway, consistent with the conceptual design presented in Technical Report E.2.2-4 (Myers and Parkinson, 2003). In an April 26, 2007, filing with the Commission and its January 31, 2007, application for water quality certification, Idaho Power (2007a) added several proposed measures to address spill-related TDG. Under Idaho Power's amended proposal, it would:

- Continue preferential use of crest gates for passing spills at Brownlee dam until spillway deflectors are constructed at Brownlee dam.
- Evaluate TDG reduction structures for Oxbow dam.
- Install Hells Canyon dam spillway flow deflectors.
- Install Brownlee dam spillway flow deflectors.
- Install the most effective, safe, and economically feasible measure designed to reduce TDG at Oxbow dam (Idaho Power did not specify the measures under consideration, and indicates that the final design cannot be completed until the Brownlee dam spillway flow deflectors are installed and TDG levels downstream are monitored. The monitoring data would provide a basis for more accurately estimating the dynamics of the effects of Brownlee dam on TDG levels at Oxbow dam).
- Work with ODEQ and IDEQ to develop a TDG monitoring plan that would include monitoring during spill to determine compliance with the TMDL load allocation assigned to Idaho Power and biological monitoring of fish communities during spill to determine the degree to which aquatic life is being protected; and
- If monitoring during spill indicates that these measures fail to meet the TDG criterion or protect aquatic life, Idaho Power would adaptively manage TDG at the project through evaluation and implementation of additional measures designed to further reduce TDG levels.

ODFW-54 recommends that Idaho Power develop and implement a plan, in consultation with and as approved by ODEQ, for satisfying Idaho Power's TDG allocation of less than 110 percent of saturation at the edge of the aerated zone below each dam. Under this plan, Idaho Power would develop measures to assure compliance with Oregon's 110-percent of saturation criterion below all three dams, and the plan would include a schedule and a monitoring component. ODFW-58 also recommends that Idaho Power consult with ODEQ and ODFW to develop appropriate monitoring of water quality parameters including TDG, and that the monitoring measures be approved by ODEQ in a water quality certification.

NMFS recommends that Idaho Power design, in consultation with NMFS, IDEQ, ODEQ, and other interested agencies and tribes, and construct a gas abatement structure at spillways of both Hells Canyon (NMFS-10) and Brownlee (NMFS-11) dams to reduce TDG levels in Oxbow and Hells Canyon reservoirs and the free-flowing Snake River downstream of Hells Canyon dam. It recommends that Idaho Power complete the designs and provide them for agency review no later than 1 year following issuance of a new license; the Hells Canyon structure would be built no later than 3 years after issuance of a new license, and the Brownlee structure no later than 4 years after license issuance. In addition, NMFS-14 recommends that Idaho Power fund and maintain six permanent water quality monitoring stations in the mainstem Snake River to document trends in water quality, including TDG (see section 3.5.2.2, *Dissolved Oxygen)*. Water quality monitoring stations would be located downstream of Hells Canyon, Brownlee, Swan Falls, C.J. Strike, and Bliss dams, as well as between Brownlee reservoir and the Weiser River confluence.

Interior-62 recommends that Idaho Power install flow deflectors on the spillways of Hells Canyon and Brownlee dams. The deflector at Hells Canyon would be as described in the license application (Idaho Power, 2003d; Myers and Parkinson, 2003), and Idaho Power would work with the IDEQ and ODEQ to design similar structures that are appropriate for the Brownlee dam spillway. Interior's recommendation includes an effectiveness monitoring plan. Interior-64 recommends that Idaho Power comply with the terms set forth by the IDEQ and ODEQ water quality certifications in a manner that is consistent with the implementation timelines described by IDEQ and ODEQ through the certification process.

The Umatilla and Nez Perce Tribes (CTUIR-20 and NPT-15) recommend that within 6 months of obtaining a new license Idaho Power, in consultation with appropriate federal, state and tribal water quality and fish and wildlife agencies, develop a plan to implement structural means and measures to abate TDG from the project, and implement such structures within 2 years of the issuance of a new license. If the resulting structures do not meet standards, Idaho Power would re-consult with those agencies to develop and implement other structural approaches to meet water quality standards within 5 years of the issuance of a new license.

AR/IRU-18 recommend that the Commission require Idaho Power to eliminate or minimize TDG levels in excess of 110 percent of saturation. This effort would include the following elements:

1. Implementation of a real-time monitoring program for TDG that would operate only during times of spill or consistent with Idaho Power's water quality certification, whichever is the most rigorous. This monitoring program should be designed to first detect TDG violations and then to quantify affected reach length downstream of project dams.
2. An adaptive-management approach beginning at Hells Canyon dam working upstream to the other two dams using measurements of TDG as an indicator of priority.
3. Installation of deflectors (flip-lip-like devices) to minimize the deep plunge of water immediately downstream of the dam face.[49]
4. Evaluation of whether non-plunging discharge should be horizontally separated from water plunging over the dam to prevent entrainment of those non-plunging flows that would take them to deep water.
5. An adaptive management approach, on a site-specific basis, to determine if horizontal separators are needed to prevent entrainment of otherwise non-plunging discharges.
6. A compensation program to address the losses of aquatic biota in those years when TDG attainment is not feasible. This would include a method to quantify losses and to determine the appropriate level and nature of compensation for those losses.

Our Analysis

Spills of greater than 3,000 cfs at Brownlee dam currently result in TDG levels exceeding the 110 percent of saturation criterion downstream of the Brownlee dam spillway and have substantial effects on TDG levels in the Oxbow and Hells Canyon reservoirs. Nearly all spills at Hells Canyon dam result in exceedance of the 110-percent of saturation criterion, and at spills of 19,000 cfs and greater, the entire Hells Canyon reach down to the Salmon River confluence exceeds the criterion. As described in section 3.5.2.1, *Effects of Project Operations on Water Quality*, operating the project under any of the proposed and recommended operational regimes would result in spill rates at Brownlee and Hells Canyon dams that exceed the 110 percent of saturation criterion at Brownlee and Hells Canyon dams. These spills would

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[49] AR/IRU do not specify the dams for which they recommend the installation of deflectors or how to make that decision.

occur for prolonged periods in medium-high to extremely high flow years, less frequently in medium flow years, and seldom, if ever, in low flow years.

Idaho Power's proposal and the recommendations of others to address TDG abatement cover a variety of approaches including operational changes at Brownlee dam, designing and constructing TDG abatement structures for Hells Canyon, Brownlee, and/or Oxbow dams, monitoring, adaptive management, and development of a compensation program for high TDG levels.

Idaho Power study results (Myers and Parkinson, 2003) indicate that spilling water through the Brownlee dam upper spillway gates and Hells Canyon dam lower spillway gates provide lower TDG levels than using the other gates at these dams. For example, TDG levels at Brownlee dam are reduced by 14 percent using the upper spill gates at spill releases of 39,000 cfs, and TDG levels at Hells Canyon dam are reduced by about 4 percent of saturation by using the lower spillway gates at spill releases of 28,000 cfs. Therefore, continued preferential use of the upper spillway gates at Brownlee dam, as proposed by Idaho Power, would aid in avoiding unnecessary elevation of TDG below the dam. Depending on the Brownlee spill rates, these beneficial effects could continue through Oxbow reservoir and down to Hells Canyon dam. After spillway deflectors are added to Brownlee dam, there would be less need to reduce TDG through operational measures. The deflectors would alter the hydraulics of the spillway and therefore the effectiveness of using the upper spillway gates to reduce TDG.

The benefit associated with preferential use of the lower gates at Hells Canyon dam appears to be much smaller than the benefit of using the Brownlee upper gates. However, it still would provide some benefit. Based on the study results, TDG reductions would occur with total flows of up to at least 74,000 cfs at Brownlee dam and 58,500 cfs at Hells Canyon dam if the turbines are operating at their full hydraulic capacity. Since the 110 percent of saturation criterion does not apply when flows exceed the 10-year 7-day average flood flow of approximately 67,900 cfs at Brownlee dam, these reductions would occur at Brownlee dam for the entire applicable range of the 110 percent of saturation criterion. However, this may not be the case at either Oxbow or Hells Canyon dams, where Idaho Power (2007a) estimates the 10-year 7-day average flood flows are approximately 69,060 cfs and 71,500 cfs, respectively.

In addition to evaluating operational procedures to reduce the project's elevation of TDG, Idaho Power funded development of physical models of both Brownlee and Hells Canyon dams to investigate the potential to reduce entrainment of air through structural changes at the dams (Lyons and Weber, 2005a,b; Myers and Parkinson, 2003). Initial use of the physical model for Hells Canyon dam indicated that deflectors for the upper spillways would not be effective at reducing TDG and could cause dam stability problems. Subsequently, the focus has been on developing an acceptable deflector design for the lower level sluiceways. The design for a total flow of up to 60,000 cfs includes 16-foot-long deflectors with a 5-degree upward lip angle located on the spillway face at an elevation of 1,468 feet msl. To quantitatively optimize the final Hells Canyon spillway flow deflector design to the 10-year 7-day average flood flow of approximately 71,500 cfs, Idaho Power (2007a) proposes to use a three-dimensional finite element computational fluid design model.

In its January 31, 2007, application for water quality certification, Idaho Power (2007a) proposes to construct deflectors on the Brownlee dam spillway. The qualitatively optimized design consists of 18-foot-long deflectors located on the spillway face at an elevation of 1,800 feet msl. Idaho Power proposes to further refine this design using a computational fluid dynamics model. The physical models indicate that flow characteristics of the proposed Hells Canyon lower level spillway deflectors and intended Brownlee dam spillway deflectors would provide the best hydraulic conditions for the greatest range of flows. Installation of Hells Canyon and Brownlee deflectors, with refined designs, would reduce the frequency and severity of supersaturation events related to flows up to the 10-year 7-day average flood flow.

At the time the draft EIS was issued, it was not evident whether spill at Oxbow dam independent of Brownlee dam spills elevate TDG to levels above the 110 percent of saturation criterion. In 2006, Idaho Power (2007a) conducted a study that showed that spill at Oxbow dam can elevate TDG to at least 128 percent of saturation in the Oxbow bypassed reach when TDG is less than 110 percent in the Oxbow forebay. This shows that effective TDG abatement at Brownlee dam would not resolve all TDG issues at the Oxbow dam. To address this, Idaho Power is currently evaluating TDG reduction structures for Oxbow dam. It intends to finalize its design of appropriate Oxbow dam TDG abatement measures after the Brownlee dam spillway deflectors are installed and their effectiveness is monitored, and implement the Oxbow TDG abatement measures once it has obtained required permits. Currently, the effectiveness of an Oxbow dam TDG abatement measure would be difficult to determine because of the effects of spills at Brownlee dam. Idaho Power's proposed approach for abating TDG at the Oxbow dam would help reduce TDG in the Oxbow bypassed reach and through Hells Canyon reservoir. Also, the proposed approach would be consistent with ODFW's recommendation (ODFW-54) to ensure compliance with TDG standards below each of the project dams.

In summary, Idaho Power's proposed operational changes and deflector installations at Hells Canyon and Brownlee dams would reduce the frequency of spill events that exceed the TDG criterion and reduce the magnitude of exceedances at flows up to the 10-year 7-day average flood flow at both Brownlee and Hells Canyon dams. Idaho Power's proposed implementation of an appropriate TDG abatement measure for Oxbow dam would reduce the magnitude of TDG exceedances of 110 percent of saturation in the Oxbow bypassed reach and Hells Canyon reservoir. However, we do not have sufficient information to accurately estimate the extent of these reductions in TDG.

Because it is not known whether the combination of Idaho Power's proposed operational changes, the installation of Brownlee and Hells Canyon spillway deflectors, and the selected Oxbow dam TDG abatement measure would satisfy the applicable TDG standards, additional abatement measures may be warranted. Development of a TDG abatement monitoring plan such as recommended by ODFW, the Nez Perce Tribe, and the Umatilla Tribes would provide an effective way of proceeding toward compliance with applicable TDG standards in an adaptive fashion that is consistent with Idaho Power's proposed approach to monitoring. Developing the plan through consultation with agencies and tribes responsible for managing water quality and fisheries would help to focus efforts on their concerns. Including an adaptive monitoring program as part of the overall plan would provide a means of documenting the effectiveness of TDG abatement measures and the need for any additional abatement measures to satisfy applicable TDG standards. If additional TDG abatement measures are deemed necessary, Idaho Power could evaluate the potential for additional operational and/or structural TDG abatement measures, as well as the feasibility of implementing these measures.[50] The plan also could provide an effective means to schedule the design and implementation of TDG abatement measures in a practical way that maximizes their benefits, monitor the effectiveness of these measures, document compliance with TMDL allocations and applicable TDG standards, and report these activities.

Water quality could be monitored downstream of Bliss, C.J. Strike, and Swan Falls dams to document conditions downstream of these dams. However, monitoring TDG at these sites, as recommended by NMFS, would not assist in determining the need for TDG-abatement measures at the Hells Canyon Project dams or in documenting their effectiveness.

Idaho Power (2007a) indicates that it proposes to work with IDEQ and ODEQ to develop a monitoring protocol that includes a specific methodology for monitoring TDG during spills, which may

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50 Potential abatement measures that could be evaluated include modifying the flow deflectors after installation, modifying the training walls to better separate turbine and spill flows, increasing the turbine capacity by refurbishing or adding units, modifying the stilling basin, building off-gassing structures, and constructing a bypass conveyance to pass spill flows.

include monitoring effects of TDG on aquatic organisms. We anticipate that this protocol would include collecting data on the timing and quantity of spill at each of the project dams, TDG measurements at the point of compliance, and data to determine whether the point of compliance was completely mixed and representative of conditions in the river. Near-field TDG studies also may be necessary to more closely evaluate mixing downstream of the spillways and potential measures to reduce entrainment of powerhouse flows into the stilling basins. Reporting this information annually along with any recommendations for relocation of the compliance site would provide valuable information to help determine the effectiveness of measures implemented, the need for any additional TDG abatement measures, and whether continued monitoring of TDG is warranted.

We anticipate that achieving applicable TDG standards would take several years to accomplish, even with implementation of the foregoing measures. AR and IRU recommend that a compensation program be developed to address losses of aquatic biota in years when attaining the TDG standards is not feasible. We discuss this recommendation along with the effects of TDG abatement measures on aquatic resources in section 3.6.2.3, *Total Dissolved Gas*.

3.5.2.4 Water Temperature

As a result of the large volume of water stored in the project reservoirs and the project's relatively deep intakes, the project substantially alters Snake River temperatures by delaying the seasonal warming and cooling of water downstream of the project. Compared to inflows, this thermal lag reduces exceedances of criteria for supporting coldwater aquatic life during the summer, but increases the exceedances of temperature criteria for salmonid spawning at the start of the spawning season for fall Chinook salmon. We evaluate the biological effects of altered water temperatures on fall Chinook salmon in section 3.5.3, *Aquatic Resources*, in the subsection 3.5.3.4, *Water Temperature*.

In its license application, Idaho Power did not propose any measures to control downstream water temperatures. However, in its January 31, 2007, submittals to IDEQ and ODEQ (Idaho Power, 2007a), Idaho Power proposes to follow an adaptive management approach in implementing appropriate measures to demonstrate compliance with the existing water temperature standards. Idaho Power's adaptive management approach would consist of:

- monitoring water temperature of the mainstem Snake River and three major tributaries downstream of Hells Canyon dam (i.e., the Imnaha, Salmon, and Grande Ronde rivers) to determine the thermal conditions under which fall Chinook salmon spawn, and when fry emerge from the gravels;
- continuing to monitor Snake River fall Chinook salmon redds[51] to provide a basis for evaluating the urgency and need for implementing specific measures for altering the thermal regime, and to assess the risks and benefits of these measures; and
- implementing Idaho Power's proposed Temperature Adaptive Management Plan, under which Idaho Power, in consultation with IDEQ and ODEQ, would: (1) define the extent and nature of the project's temperature responsibility; (2) evaluate potential measures and select the appropriate measure; and (3) implement the appropriate measure.

ODFW-56 recommends that Idaho Power consult with ODEQ to develop and implement a temperature management plan. This plan would include implementing measures, a timeframe, and an effectiveness monitoring plan. In addition, ODFW-58 recommends that Idaho Power consult with ODEQ

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[51] Redd monitoring is also used to establish protective flows for fall Chinook salmon redds during the incubation period.

and ODFW to develop appropriate monitoring protocols for water temperature and other water quality parameters.

The Nez Perce and Umatilla Tribes (NPT-13 and CTUIR-22) recommend that Idaho Power, in consultation with appropriate state and federal agencies and interested tribes, continue to investigate the installation of a temperature control structure at Brownlee reservoir to meet CWA numeric and narrative criteria to support the beneficial use of fisheries. The tribes also recommend that Idaho Power install a temperature control structure in a timely and expeditious manner should it be determined that installation of such a structure is appropriate.

AR/IRU-19 recommend that Idaho Power, in cooperation with a Technical Advisory Committee, continue to investigate the installation of a temperature control structure at Brownlee dam to meet CWA standards. They recommend that Idaho Power install the temperature control structure upon determination by the Technical Advisory Committee that installation of such a structure is appropriate. Idaho Power also would work with the Technical Advisory Committee to identify and implement other possible remedies for achieving temperature control of outflows at Brownlee, Oxbow, and Hells Canyon dams.

Interior does not make any recommendations specifically associated with a temperature control structure. However, Interior-42 recommends that Idaho Power implement measures to improve water quality conditions in Oxbow and Hells Canyon reservoirs to the point that they meet all water quality standards for designated beneficial uses for the states of Idaho and Oregon.

In commenting on the draft EIS, NMFS states that it worked extensively with Idaho Power during the relicensing process to investigate several temperature control measures for the project, as well as various strategies for using these structures. Based on these evaluations, NMFS concludes that these structures would not provide the substantial benefits to incubating, rearing, migrating, or spawning fall Chinook salmon that the agency had hoped would be attained with these structures. However, NMFS states that it does not object to further consideration or analysis of methods to improve discharge water temperatures, particularly if new or innovative approaches can be found.

Our Analysis

Operation of the project has delayed the seasonal pattern of the thermal regime downstream of Brownlee dam compared to without project conditions. Under Idaho Power's Proposed Operations, water temperatures would continue to be cooler than without project conditions in spring and summer and warmer than without project conditions in the fall (refer to section 3.5.1.2, *Temperature*, and section 3.5.2.1, *Effects of Project Operations on Water Quality*). This thermal shift would continue to adversely affect fall Chinook salmon downstream of Hells Canyon dam by: (1) causing high water temperatures in the fall that can adversely affect the survival of adult fall Chinook salmon until spawning and the viability of eggs after spawning; and (2) delayed warming in the spring, which can slow the growth of newly emerged fall Chinook salmon fry, which may adversely affect their survival during rearing and outmigration. In the following section, we describe several approaches that were evaluated by Idaho Power to address these effects, including several new elements that were included in its January 31, 2007, application for water quality certification. We then discuss the effects of these measures on water temperatures downstream from Hells Canyon dam and within the project reservoirs.

The Commission, as part of the relicensing, requested that Idaho Power conduct an evaluation of potential alternative Brownlee temperature control structures having capabilities ranging from using the existing Brownlee powerhouse intake channel to accessing full-depth control to a depth of about 250 feet below full pool for all units. In response, Idaho Power developed conceptual designs, provided a preliminary screening of those designs, and evaluated potential temperature control structures for the Brownlee development (Idaho Power, 2005e, 2005h, 2005i, 2005j). The general objectives for temperature control structures would be: (1) accelerating warming of Hells Canyon discharges in the spring to promote growth and early outmigration of fall Chinook salmon; and (2) providing cooler fall Hells Canyon discharges in the early part of the fall Chinook salmon spawning period.

Idaho Power evaluated the potential for using a temperature control structure at the Brownlee intake to meet the above objectives by drafting more warm water from closer to Brownlee reservoir's surface in the spring and early summer and then drafting cool water from deeper reservoir depths in the fall. The volume of cool water stored in Brownlee reservoir is controlled by several factors including the volume and timing of inflows, meteorological conditions, and project operations. During high flow years, flood control operations result in the reservoir being drafted to a lower level in the spring, resulting in less coolwater storage than in low and medium flow years. The volume of cool water available for release from Brownlee reservoir is also limited by the configuration of the intakes. The existing Brownlee intakes are located in a 500-foot-long channel that was excavated into the rock abutment on the Idaho side of the Snake River. The sill of the intake channel and the invert elevation of the intakes is approximately 1,930 feet msl, about 147 feet below full pool elevation, thereby limiting access to the reservoir's lowermost 180,000 acre-feet of cool-water storage.

Idaho Power initially developed conceptual designs of alternative temperature control structures that could be installed at the Brownlee intakes with the goals of providing control down to the depth of the intake channel, partial control of the reservoir's full depth, and full-depth control (Idaho Power, 2005h). Based on a preliminary evaluation of the most effective least-cost methods to achieve the downstream temperature and DO objectives, the following five alternatives were selected for further evaluation:

1. **Stop-log weir** consisting of an overflow stop-log weir in the existing intake channel, for which the crest elevation could be adjusted between 2,077 and 1,930 feet.
2. **Gated weir** consisting of a variable-height gate structure in the existing powerhouse intake channel.
3. **Gated weir and tunnel** consisting of a variable-height gate structure in the existing intake channel; re-opening the original, existing, plugged, diversion tunnel; and connecting it to the existing intake channel, with coldwater uplift provided by elevation control at the channel-gate structure and by pumping.
4. **12,000-cfs small tower** consisting of a new 10,000 to 12,000 cfs variable-height-gated intake tower with trashracks above the re-opened original diversion tunnel, a new vertical shaft with trashrack in the shaft, and tunnels from the old diversion tunnel directly to the unit 5 penstock.
5. **35,000-cfs tower** consisting of a new 35,000-cfs variable-height-gated intake tower above an enlarged old diversion tunnel to a vertical shaft to a new tunnel into the existing intake channel, and a concrete dam across existing intake channel.

Idaho Power provided detailed evaluations of three of the alternatives to show the likely range of potential effects of installing a temperature control structure (Idaho Power, 2005e). The alternatives include: (1) stop-log weir; (2) gated weir with tunnel; and (3) 35,000-cfs intake tower. The temperature modeling presented in this filing focused on meeting a fall spawning target of 13°C. At the request of Commission staff, Idaho Power performed a second set of simulations (Idaho Power, 2005f) that evaluated a withdrawal strategy focused on the objectives of promoting early emergence, enhanced growth, and early outmigration of juvenile fall Chinook salmon.

As discussed in section 3.5.1.2, *Temperature*, Idaho Power (2007a) conducted an evaluation of the project's effect on elevated fall temperatures. Based on the average of the three low flow years evaluated, Idaho Power believes the project's salmonid spawning temperature responsibility averages 0.8°C for 8 days in low flow years. [52] Although no model simulations were conducted for medium-low flow years, we concur that the project likely has some level of temperature responsibility during those years. In its application for water quality certification, Idaho Power (2007a) also accepts limited responsibility, in accordance with its estimated historical temperature analysis, for medium-low flow years. Idaho Power believes this is a conservative assumption because responsibility was estimated based only on low flow years and there was negligible modeled effect in higher flow years. However, Idaho Power (2007a) acknowledges the need for additional refinement of the appropriate project temperature responsibility through further study and assessment.

Under its proposed Temperature Adaptive Management Plan, Idaho Power would evaluate two potential approaches for meeting its temperature responsibility for the project: (1) a Brownlee reservoir bubble upwelling system; and (2) implementing watershed measures. The primary objective of a bubble upwelling system would be to cool the Brownlee reservoir outflows by lifting the cool water from the hypolimnion up to a higher elevation in the water column where it could be withdrawn from the reservoir through the existing turbine intakes. A successful upwelling system would create a bubble plume starting deep in the cold portion of the water column that would entrain the surrounding water as it rises through the water column toward the surface.

Idaho Power developed a preliminary design for an upwelling system for Brownlee reservoir. This design would consist of four 400-hp air compressors and piping connecting the compressors to the diffusers, which would extend approximately 3,800 feet from the compressor location to the forebay (MEI et al., 2006). The effects of upwelling plumes of atmospheric air within Brownlee reservoir, as well as the resulting turbine outflow temperatures, were simulated using a custom model that integrates a bubble plume model (BUBBLEP) into the standard CE-QUAL-W2 water quality model. MEI et al. (2006) used this model to simulate several different upwelling configurations to develop the optimal combination for providing the temperature decrease needed to address the project's estimated temperature responsibility. We discuss the modeling results in the subsections that follow.

Watershed measures, such as temperature trading, offer an alternative approach for meeting the project's temperature responsibility by implementing measures in the watershed upstream of the project that would act to cool inflows to and outflows from the project. Potential methods for reducing fall temperatures in upstream reaches include increasing shade by restoring/enhancing riparian vegetation, altering channel morphology to reduce warming, and altering the hydrologic regime by reducing the volume of warm agricultural return flows or by augmenting existing flows. These measures would tend to reduce water temperatures in and downstream of the tributaries where they are implemented for a prolonged period in the summer and fall. In addition to reducing water temperatures, some watershed measures have the potential to enhance water quality and aquatic habitat by reducing sediment/nutrient loads and improving the quantity and quality of instream and riparian habitat. Implementing watershed measures within a watershed trading framework is an approach that has proven acceptable to IDEQ and ODEQ for meeting a project's temperature responsibility in other TMDLs (Idaho Power, 2007a).

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[52] We conclude that Idaho Power's estimate under-represents its responsibility based on the increases in the adjusted measured 7-day average maximum temperatures compared to 13°C and the allowable human use allowance of 0.3°C (refer to table 6.1-12 in Idaho Power, 2007a) by not taking into account that each of the 7-day values represents more than a single day. Eight 7-day periods extending from October 23 through November 5 had average values starting at 1.4°C and decreasing to 0.2°C, and the average for just the first eight days of the spawning period (October 23 through October 30) is 1.3°C. Based on this method, we estimate an average project responsibility of approximately 0.8°C for 14 days in low flow years.

Temperature Downstream of Hells Canyon Dam

Idaho Power's evaluations (Idaho Power, 2005e,f) show that each of the temperature control structures could be used to increase Hells Canyon outflow temperatures after approximately March 14, and that the warming effects would get larger as spring progresses. CE-QUAL-W2 simulations indicate that the most warming would occur in low flow years, with only minor warming (less than 0.5°C) in medium to extremely high flow years. For extremely low and medium-low flow years, simulated late May temperatures were about 2.0 to 2.5°C warmer than Idaho Power's Proposed Operations and Scenario 2 (Flow Augmentation), respectively, with the stop-log weir and gated weir with tunnel, and about 1.5 to 2.0°C warmer than the respective operations with the 35,000-cfs tower (Idaho Power, 2005e).

The summer/fall cooling effects of a temperature control structure would largely depend on its ability to access Brownlee reservoir's coolwater storage, as well as the amount of this storage that is used to provide cooling in summer versus the fall. The stop-log weir would be able to access water down to the existing sill elevation of 1,930 feet. In contrast, the gated weir and tunnel structure would provide limited access to the 180,000 acre-feet of low-level hypolimnion water that is below the existing sill, and the 35,000-cfs tower would provide full access to the 180,000 acre-feet of low-level hypolimnion water that is below the existing sill (Idaho Power, 2005i). Placing a high priority on cooling the river in the fall would reduce the extent and duration of any summertime cooling that could occur because the volume of coolwater storage would be limited in Brownlee reservoir. Similarly, fall cooling would be less likely if a higher priority were placed on cooling the river in summer. In addition to the tradeoff between summer and fall cooling, placing a high priority on cooling the river in the fall would add the complexity of needing to forecast the amount of cool water to reserve for fall cooling. Because the need for cool water could not be accurately forecast during the summer, Idaho Power would need to reserve more cool water than it might need for fall cooling and, thus, forego some of the summer cooling that could be accomplished otherwise.

Idaho Power reported temperatures that were simulated with the goal of maintaining Hells Canyon discharge temperatures at or below the higher of 13°C or the daily Snake River inflow temperature to Brownlee reservoir on and after October 23 (Idaho Power, 2005e). Simulated temperatures satisfied this target in all 5 representative years for both the gated weir and tunnel structure and 35,000-cfs tower, with either Proposed Operations or Scenario 2 (Flow Augmentation). The stop-log weir satisfied the fall temperature target in 4 of the 5 representative years, but did not satisfy the target in the representative medium-high flow year (1999). Simulated summer temperatures for Hells Canyon outflows without a temperature control structure exceeds Oregon's 20°C criterion nearly 100 percent of the time in the extreme high flow year (1997) and progressively less in relation to the overall flow condition, with exceedances of roughly 20 percent of the time in the extreme low flow year (1992). These simulations indicate that the installation of a temperature control structure has the potential to reduce exceedance of Oregon's 20°C criterion for medium to low flow years (1995, 1994, and 1992), but has little potential to reduce exceedance of the 20°C criterion in the high flow years (1999 and 1997). The greatest improvement from the temperature control structures was simulated for the 35,000-cfs tower, followed by the gated weir with tunnel and finally the stop-log weir. The stop-log weir actually increased exceedance of the 20°C criterion in the extreme low flow year (1992).

To evaluate the effects that Brownlee temperature control structures would have on lower Snake River temperatures, Idaho Power, in coordination with the Corps, assessed the thermal effects of the stop-log weir and gated weir with tunnel in the representative extremely low flow year (1992) and medium flow year (1995) (Idaho Power, 2005j). Simulated temperatures for the Anatone gage[53] and the Lower Granite tailwater,[54] without a temperature control structure, were warmer than the Hells Canyon outflow

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[53] The Anatone gage is located approximately 80 miles downstream of Hells Canyon dam.

[54] The Lower Granite tailwater is located just downstream of the Lower Granite dam, which is about

for most of the summer, especially in the low flow year (1992). Compared to the Hells Canyon outflow, these simulated temperatures exceeded the Oregon and Washington[55] 20°C criteria more frequently at the Anatone gage, but less frequently at the Lower Granite reservoir tailwater. Simulated temperatures for the Anatone gage and the Lower Granite tailwater show that the warmer summer Hells Canyon outflows caused by the stop-log weir and gated weir with tunnel would result in slightly warmer summer conditions at the Anatone gage and the tailwater of Lower Granite reservoir compared to Proposed Operations, but would have little effect on exceedance of the Oregon and Washington 20°C criteria at either of these locations. Similarly, the cooler fall Hells Canyon outflows would result in cooler fall conditions at the Anatone gage and the tailwater of Lower Granite reservoir. Considerable cool summertime inflow from the Clearwater River, which includes flows from Dworshak reservoir, would continue to moderate the effects of Hells Canyon outflows on temperatures in and downstream of Lower Granite reservoir.

In its comments on the draft EIS, EPA reported simulation results based on the RBM10 model (Yearsley et al., 2001), which EPA used to simulate lower river temperatures for the medium-low flow year of 1994 using historical flows. EPA's simulation results for the temperature control structure operations modeled by Idaho Power indicate that the two most effective temperature control structures (gated weir and tunnel and 35,000-cfs tower) would reduce Snake River temperatures upstream of the Clearwater River confluence by about 1.5 to 2°C during the summer and early October. Considerable cool summertime inflow from the Clearwater River, which includes flows from Dworshak reservoir, would continue to moderate the effects of Hells Canyon outflows on temperatures in and downstream of Lower Granite reservoir. EPA simulation results for the temperature control structure operations modeled by Idaho Power indicate that a temperature control structure would reduce Snake River temperatures downstream of Lower Granite reservoir by about 0.5 to 1°C during the summer and about 1.5°C in early October. EPA's simulation of the effects of short-term summer Hells Canyon dam releases of 15 to 16°C indicates that Snake River temperatures would be reduced by about 1.5 to 2.5°C upstream of the Clearwater River confluence and about 0.5 to 1.0°C downstream of Lower Granite reservoir. CRITFC and EPA also suggested that a temperature control structure could be used to access warmer water from deep in Brownlee reservoir during portions of the winter (McCullough, 2007). Based on our review of the limited winter temperature data for Brownlee reservoir, we conclude that there would be some potential to increase the temperature of Hells Canyon releases during a portion of at least some winters.

Idaho Power provides an evaluation of maintaining Hells Canyon discharges at 15°C in the summer, and maintaining the same temperature that would occur without a temperature control structure in the fall (Idaho Power, 2005f).[56] Simulated Hells Canyon outflow temperatures for the stop-log weir under Proposed Operations in an extremely low flow year were 15 to 16°C from late May through early July and then steadily increased to a maximum of nearly 20°C in early September. Compared to Proposed Operations without a temperature control structure, outflow temperatures were warmer between mid-March and late June, cooler from late June through early October, and virtually the same after early October. Idaho Power's qualitative analysis of the other structures and representative years indicates that there would be less ability to maintain cooler summer temperatures in years with higher flows, and that both the gated weir and tunnel, as well as the 35,000-cfs tower would be better able to maintain cooler summer temperatures than the stop-log weir (Idaho Power, 2005f).

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140 miles downstream of Hells Canyon dam and about 32.5 miles downstream of the Clearwater River confluence.

55 Washington's temperature criterion for the Snake River upstream of the Clearwater River is an absolute maximum of 20°C with an allowable increase of up to 0.3°C for a single source.

56 These targets emphasize the benefits of providing near optimal temperatures for fall Chinook salmon growth and rearing in the summertime over the Oregon and Idaho State numeric water temperature criteria for the fall.

As discussed above, Idaho Power also investigated the possibility of addressing the project's temperature responsibility through the use of a Brownlee reservoir bubble upwelling system or watershed measures. The bubble upwelling system would lift cool water from deep in Brownlee reservoir so that it could be withdrawn and provide cooler fall temperatures downstream of Hells Canyon dam. Idaho Power's preliminary CE-QUAL-W2 simulations indicate that it would take about 8 days for the cool, upwelled water discharged from Brownlee powerhouse to pass downstream through Hells Canyon dam. The simulation results also indicate that a Brownlee reservoir upwelling system could reduce fall Hells Canyon outflow temperatures by as much as 1.0°C compared to existing conditions, but would frequently reduce temperature by only 0.5°C or less (Idaho Power, 2007a). Based on these results, we conclude that the installation of a bubble upwelling system alone may not be sufficient to meet all of the project's temperature responsibility, which Idaho Power estimates to be 0.8°C for 8 days in low flow years.

Idaho Power did not undertake any modeling of watershed measures, or the extent to which watershed measures would need to be implemented to meet the project's temperature responsibility downstream of Hells Canyon dam. Rather, Idaho Power proposes to identify and evaluate measures for implementation through a stakeholder process that would include: (1) formation of a watershed stakeholder group; (2) defining goals and objectives; (3) screening trading opportunities by identifying potential trades and obstacles to trades; (4) selecting potential trading alternatives for further analysis; and (5) selecting the preferred trading alternative(s) for implementation. We conclude that this represents a logical approach for identifying and prioritizing watershed measures. Given the size of the watershed upstream of Hells Canyon dam and the extent of habitat degradation in many of the upstream tributaries, we consider it likely that there are sufficient opportunities to identify a suite of measures that would meet the temperature responsibility of the project.

Temperature of Brownlee Reservoir and Downstream to Hells Canyon Dam

Many factors, including the level at which water is withdrawn, control the thermal regime of Brownlee reservoir. Using any temperature control structure or a bubble upwelling system to regulate water quality conditions downstream of Hells Canyon dam also would affect the thermal regime of the reservoir. For a temperature control structure, the extent and timing of changes would primarily depend on the depths of seasonal withdrawals in spring, summer, and fall. Withdrawing water from closer to the reservoir's surface in spring and early summer would raise the thermocline resulting in a thinner epilimnion and additional cool-water storage in the reservoir. The extent of deep-water summer and fall withdrawals would control how much cool-water storage is used and any associated lowering of the thermocline.

Load-following operations at Brownlee development would have localized effects on temperatures near the intake(s) used but would have negligible effects in the rest of the reservoir. However, these operations would result in large reductions in Brownlee tailrace temperatures as cool water is released from Brownlee reservoir. Idaho Power (2005i) concludes that these temperature fluctuations could be as large as 10°C during the summer and fall cooling periods, and that these large temperature fluctuations would proceed through the Oxbow reservoir and into the Hells Canyon reservoir and could adversely affect aquatic resources in these waterbodies.

MEI et al. (2006) reported that a Brownlee reservoir upwelling system with eight 21.3-foot-diameter circular plume diffusers placed at an elevation of 1,788 feet, about 290 feet deep in the Brownlee reservoir forebay, would create eight independent bubble plumes to entrain and lift cool water. Simulation results indicate that the system could entrain and lift about 30,000 cfs of cool water. Because the cool water would not be lifted directly in front of the turbine intakes, not all of the cool, upwelled water would be immediately drafted through the turbine intakes. The simulations indicate that only a small fraction of the cool, upwelled water would be expected to travel directly into the Brownlee intakes. The hydrodynamic model results indicate that water in the hypolimnion of the upper portion of the reservoir would generally flow down-reservoir to replace the upwelled water, but the metalimnion would tend to flow up-reservoir to maintain an overall balance in the reservoir. Therefore, these reservoir currents would route much of the cool upwelled water a considerable distance up-reservoir, and would not be available for withdrawal. For a bubble upwelling system, simulated temperatures for Brownlee reservoir outflows were reduced by as much as 1.5°C. As water proceeds through the Oxbow development and Hells Canyon reservoir, the cooling effect would generally be reduced by about 0.4°C in late October.

As described above, implementing upstream watershed measures would reduce summer and fall water temperatures within and downstream of the tributaries where they are implemented. This would improve the thermal regime for native resident salmonids within and downstream of the project area, and for anadromous salmonids downstream from Hells Canyon dam.

Dissolved Oxygen

Based on simulated DO concentrations for Brownlee reservoir with temperature control, anoxic conditions could extend farther up-reservoir during some low flow years. For an extremely low flow year (1992), simulated mid-June anoxic conditions extended about 3 to 4 miles farther up-reservoir with the temperature control structures (i.e., RM 332 to 331 with the stop-log weir, gated weir with tunnel and 35,000-cfs tower compared to RM 328 without a temperature control structure). Another simulated effect for the extreme low flow year (1992) and low flow year (1994) was higher DO concentrations in much of the metalimnion, which became surrounded with hypoxic/anoxic water during the summer and fall, for each of the three temperature control evaluated. Simulation results for wetter years indicate varied results for the temperature control structures. The 35,000-cfs tower would result in anoxic conditions in less of the water column than existing conditions, but the stop-log weir, as well as gated weir and tunnel, would extend anoxic conditions further up in the water column. The effects of the three simulated temperature control structures on near-bottom fall anoxic conditions were not consistent among control structures or years. The overall trend was that simulated near-bottom anoxic conditions for the 35,000-cfs tower were typically slightly smaller than without a temperature control structure, but the gated weir and tunnel had a slightly larger area and the stop-log weir showed a much bigger area. In mid-October of the extreme low flow year (1992), simulated near-bottom anoxic conditions extended upstream to RM 325 for the stop-log weir in comparison to RM 308 for the 35,000-cfs tower. Differences in the extent of near-bottom anoxic conditions were more subtle in other water year types.

The temperature control structures would provide varied effects on DO concentrations in Hells Canyon outflows. These effects would vary considerably depending on the type of flow year, the temperature control structure used, and the overall goals for its operation. Simulation results indicate that using the 35,000-cfs tower to draft cool, deep water would tend to lower DO concentrations in discharges. In contrast, simulation results indicate that using the stop-log weir or gated-weir and tunnel would generally increase DO concentrations in discharges during summer. Simulation results for fall are much more variable, with both increases and decreases in discharge DO concentrations with the stop-log weir or gated weir and tunnel.

As discussed above, a Brownlee reservoir bubble upwelling system would change flow patterns in Brownlee reservoir, and thereby alter the complex physical, biological, and chemical processes in the reservoir, causing in-reservoir water quality effects. Simulation results indicate that, during operation of the upwelling system, the DO regime in Brownlee reservoir may be altered substantially, with regions of higher or lower DO concentrations extending nearly 25 miles upstream of the dam. Simulated DO concentrations indicate that changes in DO concentrations would happen rapidly and persist for some time following operation of the bubble upwelling system. Although simulation results show that operation of an upwelling system may change Brownlee outflow DO concentrations, additional study is needed to determine the extent of this effect.

As described above, implementing a nutrient (e.g., phosphorus) trading program has the potential to reduce nutrient loads within and downstream of the tributaries where the measures are implemented. This could incrementally enhance DO levels within and downstream of these tributaries, including the project reservoirs. Some measures, such as reducing the volume of agricultural return flows, could provide reductions in stream temperatures as well as phosphorus loads.

pH and Ammonia

In eutrophic waters similar to Brownlee reservoir, photosynthesis raises pH in the photic zone as well as carbon dioxide generation from heterotrophic decay of organic matter, nitrification of ammonia, and oxidation of sulfide lowers pH in deep waters (Wetzel, 1975). Alterations in the reservoir's thermal structure could alter pH within the reservoir. Simulated Brownlee reservoir DO concentrations suggest that production of ammonia would increase for the stop-log weir and gated weir and tunnel, but ammonia production would be somewhat reduced for the 35,000 cfs tower. The pH is expected to be somewhat lower in portions of the riverine reach of the reservoir for the stop-log weir and gated weir and tunnel, and is less influenced by the 35,000-cfs tower. Operation of the temperature control structures also is expected to influence pH levels in the metalimnion and some of the hypolimnion. The simulated DO concentrations suggest that the 35,000-cfs tower would have a larger influence on pH levels than either the stop-log weir or gated weir with tunnel. The 35,000-cfs tower would tend to increase pH in larger portions of the metalimnion and hypolimnion than the stop-log weir or gated weir with tunnel. The stop-log weir or gated weir with tunnel is expected to lower pH in areas of the metalimnion and hypolimnion closer to the water surface in some years.

The project currently accumulates ammonia in the hypolimnion and deeper areas of the transition zone. Idaho Power (2005e) reports that ammonia concentrations in discharges from Hells Canyon dam closely mirror concentrations in Brownlee discharges and show some seasonal patterns with peaks in spring and late fall. A raised and stronger thermocline would be expected to result in greater accumulation of ammonia in Brownlee reservoir that would occur earlier in the season. If the gated weir and tunnel or 35,000-cfs tower were used to directly draft hypolimnetic water, the discharges would have higher ammonia concentrations and lower pH. Using the gated weir and tunnel to draft water from the bottom of the hypolimnion would have the highest ammonia concentrations and could disturb and mobilize bed sediments. Although the stop-log weir would not directly access hypolimnetic water, it could be used to access cool water from the metalimnion and would have the potential to export water with elevated ammonia concentrations and lower pH. Installing and operating a bubble upwelling system in Brownlee reservoir would mix deep water in the reservoir with water in upper layers and likely increase ammonia concentrations in portions of the epilimnion and metalimnion, as well as the outflows from the reservoir.

Mercury and Organochlorine Compounds

Mercury and organochlorine compounds (including pesticides and their break down products, and PCBs) are strongly associated with sediments. Therefore, it would be important to avoid disturbing sediments while constructing and operating any temperature control structure or bubble upwelling system. With the construction of any temperature control facilities, we anticipate that sediment disturbance would generally be minimal. However, special attention would need to be applied to limit the disturbance of bed sediments by operation of the bubble upwelling system and the gated weir and tunnel that would make near-bottom withdrawals.

Under anoxic conditions, contaminated sediments can act as a source for mercury. Therefore, any changes to the anoxic conditions in the reservoir could affect its storage/release in reservoir sediments. Directly drafting water from deeper in the water column would be expected to increase concentrations of mercury and organochlorine compounds in discharges. We anticipate that operating the deeper intake structures (i.e., gated weir and tunnel and 35,000-cfs tower) to draft cool, near-bottom water would cause the largest increases in the discharge of these contaminants. A bubble upwelling system may result in substantial mixing of near-bottom anoxic water with the rest of the water column and, thereby, substantially increase the discharge of these contaminants. Any ongoing adverse effects of these contaminants on aquatic organisms and their predators (including bald eagles) would increase accordingly.

Planning and Monitoring

Idaho Power's completed evaluation of various potential alternative Brownlee temperature control structures shows that a temperature control structure could be used to increase Hells Canyon outflow spring and early summer temperatures and reduce Hells Canyon outflow late summer and/or fall temperatures. However, we conclude that the magnitude of spring increases would be limited in medium and high flow years and in the early spring in all years. Also, the volume of cool water stored in Brownlee reservoir would not be sufficient to reduce both late summer and fall temperatures to provide optimal thermal conditions for fall Chinook salmon growth and satisfy the 13°C spawning criteria (section 3.6.2.4, *Water Temperature*). Of the temperature control structures evaluated, the 35,000-cfs tower would provide the greatest potential to manage water temperatures and the stop-log weir would provide the least potential to manage water temperatures. Using a temperature control structure to provide a better thermal regime for fall Chinook salmon downstream of Hells Canyon dam, however, could potentially degrade water quality by reducing DO levels and increasing concentrations of ammonia, mercury, and organochlorine compounds.

Idaho Power's proposed Temperature Adaptive Management Plan includes a three-step planning and implementation process. In the first step, Idaho Power would determine the project's thermal load allocation in consultation with IDEQ and ODEQ. The second step includes evaluation of potential measures to address the project's thermal load allocation and selection of the appropriate measure for implementation. The evaluation would include conducting pilot testing of the upwelling system and forming a stakeholder group to develop watershed measures. In the third step, Idaho Power would develop a final design of the selected measure for approval by the Commission and all necessary regulatory agencies, and would implement the selected measure. Idaho Power estimates that step 1 would require 2 to 4 years, step 2 would require 4 to 5 years if watershed measures are selected and 4 to 10 years if a bubble upwelling system is selected. Completion of step 3 would require 3 to 10 years.

Idaho Power's proposed adaptive approach to temperature management is consistent with ODFW's recommendation (ODFW-56) to develop and implement a temperature management plan. This adaptive approach would facilitate Idaho Power's development of a program to monitor and address adverse effects of the project on water temperatures, and to report on the progress made towards addressing such effects. Following the implementation of any temperature control measures, it would be important to monitor water temperature and other water quality parameters to document the effectiveness and secondary effects of the measures. Because water quality conditions, including water temperatures, have strong influences on aquatic resources, we conclude that it would be beneficial for Idaho Power to consult annually with the state and federal fish management agencies and interested tribes to determine whether the measures implemented are sufficient or if additional measures are needed. Reporting the results of monitoring efforts and any changes in implemented measures each year would help to ensure that progress continues to be made towards addressing the project's temperature responsibility.

3.5.2.5 Oxbow Bypassed Reach Flows

Diversion of flow through the Oxbow powerhouse reduces flow in the lowermost portion of Oxbow reservoir and bypassed reach, affecting water quality in both of these reaches.

Idaho Power proposes to continue to release 100 cfs from the Oxbow dam spillway into the bypassed reach immediately downstream of the dam to help maintain water quality in the bypassed reach.

In its April 26, 2007, filing with the Commission and its January 31, 2007, application for water quality certification, Idaho Power (2007a) proposes to install and operate a destratification system for the deep pool in the Oxbow bypassed reach just upstream of the Indian Creek confluence.

Interior-43 recommends that Idaho Power develop and implement, within 1 year of license issuance, a plan to establish a conservation flow in the Oxbow bypassed reach sufficient to meet state water quality standards and life history requirements for bull trout. Following approval by FWS, Idaho Power would submit the plan to the Commission for its approval and implement the plan within 2 years of plan approval and continue for the remainder of the term of the new license. Interior-63 also recommends that Idaho Power provide adequate flows and oxygen supplementation to maintain water quality that supports native fishes in the Oxbow bypass reach.

Our Analysis

Operation of the Oxbow development results in bypassing water around the lowermost 0.3 mile of Oxbow reservoir and a 2.5-mile-long reach immediately downstream of Oxbow dam. Behind Oxbow dam, thermal stratification occurs during summer and into fall, and hypoxic/anoxic conditions occur in deep water. In the reach downstream of the Oxbow dam, frequent exceedances of the applicable water temperature criteria and minimum DO criteria occur during summer and fall, and occasionally a slimy growth is observed on the substrate. Idaho Power's proposal to continue to provide a 100-cfs minimum flow release from Oxbow dam would not affect water quality in either of these bypassed reaches compared to current conditions.

Water temperature and DO levels in the bypassed reach downstream of Oxbow dam are influenced primarily by the condition of water released from Oxbow reservoir and the backwaters from Hells Canyon reservoir. Oxbow reservoir is very warm throughout the summer and fall and tends to exhibit minimal thermal stratification (Myers, et. al., 2003a). Idaho Power conducted flow studies for this reach in August 1999 and 2000. During these studies, Idaho Power adjusted Oxbow dam flow releases to approximately 100, 500, 800, 1,350, and 1,850 cfs, while monitoring water quality in the bypassed reaches. Study results suggest that regardless of the rate of flow released into the reach downstream of the dam, the temperature and DO concentrations of water released from the dam would remain nearly the same as under the existing minimum flow release of 100 cfs. However, increased flows in the bypassed reach downstream of the dam would slightly reduce warming in the reach and may reduce diel fluctuations of DO concentrations at the lower end of the reach (Myers and Chandler, 2003). Increasing flow releases resulted in more uniform temperatures and DO concentrations in the upper layers of deep pools in the bypassed reach, but continued to result in the deepest layers of the deep pool at RM 271.3 having extremely low DO concentrations. At flows of 1,350 cfs and more, this entire pool's water column would have virtually the same temperature and DO concentrations.

The short duration of flow manipulation (i.e., less than 1 day for each target flow) did not allow monitoring of changes that would take longer to occur (e.g., the effect of reducing the average retention time in the reservoir's bypassed reach from 21.4 days at 100 cfs to 4.3 days at 500 cfs, and the long-term effects of mixing in the deep pool at RM 271.3). Maintaining increased flow releases from Oxbow dam would reduce warming of near surface water in the bypassed reach of the reservoir and, thereby, reduce stratification of both temperature and DO, although these changes would likely result in minimal changes in the temperature and DO concentration of water released from the dam. We anticipate that increasing flow releases from the dam would result in more mixing in the RM 271.3 pool than it appears based on the short period monitored, since the study was not long enough to capture the full effects of flushing through the pool.

Although Idaho Power's flow study (Myers and Chandler, 2003) does not provide conclusive results of the water quality effects associated with increasing flow releases from Oxbow dam, there is a strong indication that substantial increases in flow releases would be needed to satisfy the applicable DO criteria under current loadings of nutrients and organic matter. As indicated in the TMDL (IDEQ and ODEQ, 2004), water quality in the project area depends highly on the condition of source waters, which currently have high loadings of phosphorus and organic matter. These loadings would be slowly reduced as the TMDL is implemented and could be reduced at a faster rate by Idaho Power implementing upstream phosphorus trading measures, which could include restoring conditions in tributaries. All of these reductions in loadings of phosphorus and organic matter would have the potential to improve water quality in the project area, including the Oxbow bypassed reach.

Idaho Power proposes to increase mixing of water in the deep pool at RM 271.3 by installing and operating a destratification system. This measure would provide oxygen supplementation, as recommended by Interior. Based on Idaho Power's (2007a) preliminary design of this system, it would include an air compressor, 0.55-inch flexible PVC composite pipe that sinks in water, and two self-cleaning 9-inch diameter flexible membrane diffusers that produce 500 to 3,000 micron bubbles. The compressor would be powered with an electrical power line, and would be capable of running continuously without oil. Idaho Power (2007a) states that the system would be capable of exchanging all the water in the pool about three times each day, which it believes is sufficient to prevent thermal stratification. We would expect that mixing of the water in the pool would prevent anoxic conditions that currently occur deep in the pool. However, it is not clear whether it would fully satisfy the applicable DO criteria. Although this would improve the DO regime, the warm inflows to the Oxbow reservoir, which are passed through, would continue to prevent attainment of the water temperature criteria in the Oxbow bypassed reach during much of the year.

We discuss the effects of increasing Oxbow dam flow releases on aquatic resources in section 3.6.2.5, *Oxbow Bypassed Reach Flows*. Developing a plan to establish a conservation flow for the Oxbow bypassed reach, as recommended by Interior, would provide a way to consider any benefits to aquatic organisms and ensure that Idaho Power satisfies the water quality standards.

3.5.2.6 Effects of Other Measures on Water Quality

Below, we discuss the effects that measures developed to address other resources would have on water quality.

Sediment Transport Measures

In section 3.4.2.2, *Sediment Augmentation and Monitoring*, we discuss the effects that measures proposed and recommended to stabilize and restore sandbars would have on sediment transport. Sandbar maintenance and restoration has the potential to produce secondary effects on water quality. In the section 10(j) meeting, Idaho Power stated that Commission staff should consider implementation of Forest Service condition no. FS-4 as part of Idaho Power's proposal. The goal of this measure would be to restore and maintain 14 acres of sandbars on or adjacent to National Forest System lands, based on their distribution and area existing in 1975. In its justification of this 4(e) condition, the Forest Service indicated that this could be accomplished by using cargo boat(s) to transfer sand in batches of about 5 cubic yards to beaches outside the peak recreation season (mid-June through August), and then distribute the sand at elevations between the 50,000- and 100,000-cfs levels. Idaho Power would limit the potential for increasing turbidity by placing clean sand, with minimal silt and clay, at levels that would be reached at recurrence intervals of 2.3 to 30 years or more. Using cargo boats and other machinery to transport and distribute the sand would slightly increase the risk of spilling petroleum products in the river and on the beaches.

Terrestrial Resource Measures

In sections 3.7.2.2 through 3.7.2.8, we discuss the effects that proposed and recommended terrestrial resource measures would have on plants and wildlife. Some of these measures could potentially produce secondary effects on water quality. Increasing the extent of woody plants and other riparian plants along the shoreline of the project reservoirs, Snake River, and islands in the Snake River could result in a slight reduction in water temperatures in and around shaded areas along the shoreline. Idaho Power also indicates that this would probably increase DO levels, although we conclude that it is unlikely that measurable differences in DO concentrations would occur in most cases.

O&M activities for the transmission line have the potential to increase sediment loading and turbidity in surface waters. These risks would be limited by including best management practices (BMPs) in the transmission line O&M plan.

An integrated wildlife habitat management program is expected to include managing livestock grazing, which could reduce livestock access to the shoreline and thereby reduce contamination of surface waters from livestock fecal matter. Management of livestock grazing also likely would result in more stable banks along the shoreline, and thereby, reduce sediment loading and turbidity in these areas.

Cultural Resource Measures

The cultural resource effects of stabilizing archeological sites and doing data recovery of archeological sites are discussed in subsections *Stabilization* and *Mitigation*, respectively, in sections 3.9.2.2, *Site Treatment*. Since both of these actions would require movement of sediment and/or establishment of vegetation near the project reservoirs or Snake River downstream of Hells Canyon dam, they could result in localized short-term increases in turbidity during these activities. However, these effects could be minimized through the implementation of appropriate BMPs. Subsequently, there would be localized long-term reductions in turbidity associated with more stable conditions at the sites.

Recreation Measures

In section 3.10.2.3, *Recreation Site Improvements*, we discuss the effects that proposed and recommended recreation facility improvement measures (table 86) would have on recreation. Many of these measures also have the potential to produce secondary effects on water quality. Actions that would affect water quality can be broken into two categories: (1) ground-disturbing activities in upland areas, and (2) ground-disturbing activities below the normal high water level.

Construction and maintenance of recreation facilities (e.g., roads, trails, parking areas, campgrounds, day-use areas) that would require ground-disturbing activities in upland areas would increase the potential for erosion, loadings of sediments, and turbidity during and shortly after the construction period. Ground-disturbing activities below the normal high water level (e.g., constructing/improving boat launches and removing sediment buildup around docks and in-reservoir pumps) may require in-water construction, which would incrementally add to the potential to increase erosion, loadings of sediments, and turbidity. In addition, in-water work could re-suspend sediments and any contaminants associated with them into the water column. We anticipate that the largest risk of this effect would result from removal of sediments around docks and in-reservoir pumps, as recommended by the Oregon Parks and Recreation Department (OPRD) (OPRD-2 and -3). By implementing appropriate BMPs, adverse water quality effects of all of these upland and in-water ground-disturbing activities should be limited to reasonable levels and short periods that occur primarily during the construction period.

Recreation Waste Disposal

The recreational use of the project by thousands of visitors could potentially result in human feces contaminating waters in the project area. Recreational measures proposed by Idaho Power, including continuing its recreation waste disposal program to prevent waste from contaminating the river, continuing to fund the existing litter and sanitation program, and enhancing the program by providing additional portable and vault toilets at appropriate dispersed recreational sites would reduce the concentration of fecal coliform and disease-causing organisms in the near-shore environment and, thereby, reduce any associated contamination of project waters. Recommendations by the Oregon State Marine Board (OSMB), ODFW, Interior, and the Forest Service, including installation of toilet facilities at dispersed recreation sites, installation of floating toilets on each reservoir, installation of boat toilet dump stations in the project area, construction and maintenance of a gray water disposal system and a sanitary cleaning system capable of cleaning portable human waste carry out systems within the Hells Canyon reservoir area, and sanitation measures consistent with provisions of the Baker County Settlement Agreement, dated October 3, 2003, would likewise reduce possible sources of water contamination.

3.5.3 Cumulative Effects

Land management practices that have reduced shading of the Snake River and its tributaries have increased water temperature compared to what would occur under without-project conditions. Diverting water away from the river for irrigation and other uses causes the river to be more thermally sensitive to the river's inflows, whether cold or warm. Comparison of existing water temperatures to estimated historical water temperatures (Idaho Power, 2007a) shows that flow regulation upstream of Brownlee reservoir has increased the temperature of inflows to the reservoir throughout most of the year, but particularly in May through September. Large impoundments like Brownlee reservoir result in thermal stratification in the reservoirs and a delay in seasonal warming and cooling downstream. Operation of Dworshak dam, which is located on the North Fork Clearwater River, can alter the Snake River's thermal regime downstream of the confluence with the Clearwater River (RM 140). Since 1992, Dworshak dam has been operated for flow augmentation and cooling of the lower Snake River. Implementation of Proposed Operations would result in minor to negligible effects on temperatures in the lower Snake River. The cumulative effects of the aforementioned actions would result in continued thermal stratification in Brownlee reservoir and continued delay of spring and early summer warming and fall cooling downstream of Brownlee dam. With installation and operation of a thermal control structure, the thermal regime of Brownlee discharges and downstream reaches could be a little warmer in spring and early summer and cooler in the fall. Installation and operation of a Brownlee reservoir upwelling system could result in somewhat cooler Brownlee discharges in the fall.

IDEQ and ODEQ (2004) indicate that degradation of water quality in the project area is caused by numerous human-caused factors including mining, industrial activities, agricultural practices, municipal waste, urbanization, flood control, flow modifications, hydroelectric activities, and impoundments. Historical mining activity in the basin has increased loadings of sediments that are rich in metals and phosphorus. Although some mining still occurs, most of the mines have not been operational since the 1950s. Municipalities have historically and continue to contribute pollutants via sewage treated to varying standards, urban runoff, and residential and commercial sources. The Boise River, which flows primarily through Ada and Canyon counties (Boise metropolitan area), consistently had the highest phosphorus concentrations and fecal coliform population densities in a statewide study (Hardy et al., 2005). Industrial activities have historically and continue to discharge pollutants either directly or indirectly into the Snake River. However, the primary sources of pollutant loading are from nonpoint source loads to the mainstem Snake River and its tributaries. Cropland and range practices, as well as urbanization, increase loadings of sediments, nutrients, and legacy pesticides (e.g., DDT). Aquaculture and wastewater developments also contribute sediment and nutrient loadings. Most of these sediments are deposited in large reservoirs, including Brownlee reservoir. Motorized recreational boating on the Snake River and project reservoirs contributes antifreeze, gas, oil, and other pollutants to the water.

The combination of extremely nutrient-rich water flowing into Brownlee reservoir and the reservoir environment results in algae blooms in the transition zone of the reservoir. Decay of this material and other organic matter accumulated on the bottom of Brownlee reservoir has increased oxygen demand, which reduces DO concentrations to anoxic and hypoxic conditions in the hypolimnion, part of the metalimnion, and the transition zone. Anoxic conditions at the sediment/water interface increases concentrations of ammonia, metals, and phosphorus in the water. These conditions also lead to elevated bioaccumulation of mercury, DDT/DDE, and dieldrin in fish.

Implementation of TMDLs for the Snake River and its tributaries and any tributary restoration efforts conducted by Idaho Power would result in a slow, long-term decline in loadings of sediments and nutrients. This would gradually reduce the frequency and magnitude of algae blooms and result in less deposition of organic material in Brownlee reservoir, which would reduce the oxygen demand associated with the reservoir's sediments. The combination of these factors would result in corresponding higher DO concentrations and lower loadings of ammonia, metals, and phosphorus from the sediments. Implementation of Idaho Power's proposed reservoir DO supplementation would further increase DO concentrations around RM 325, but have little to no effect near and downstream of Brownlee dam. The extent of increases in DO concentrations downstream of the project dams would depend on which, if any, of the recommended aeration measures for project dams/power plants are implemented. Cumulative effects of the aforementioned actions would result in incremental improvements in DO levels following installation of aeration/oxygenation facilities, and a slow improvement in water quality in Brownlee reservoir and the Snake River downstream of Brownlee dam that is expected to continue through any license term.

Elevated TDG levels are caused by spill at the project dams. Spill at Brownlee dam currently results in TDG levels of up to at least 128 percent of saturation downstream of the dam. Oxbow and Hells Canyon dams reduce velocities and natural rates of degassing, which indirectly cause TDG levels to remain higher than if the impoundments did not exist. In some cases, this results in elevated TDG levels all the way through both Oxbow and Hells Canyon reservoirs. The resulting high TDG levels at the Hells Canyon forebay (greater than 120 percent of saturation in some cases) contribute to causing even higher TDG levels (up to at least 136 percent of saturation in some cases) downstream of Hells Canyon dam than would occur from spill at Hells Canyon dam alone.

Implementation of Idaho Power's proposed preferential use of the upper spillway gates at Brownlee dam and construction of deflectors on Hells Canyon and Brownlee dam spillways would reduce TDG levels downstream of these dams. We anticipate that Oxbow dam deflectors, if constructed, or other TDG abatement measures implemented at the Oxbow facility, would reduce TDG levels in the Oxbow bypassed reach, Hells Canyon reservoir, and potentially downstream of Hells Canyon dam. The cumulative effects of the aforementioned actions would be a long-term reduction in TDG levels downstream of Brownlee, Oxbow, and Hells Canyon dams, compared to current conditions.

3.5.4 Unavoidable Adverse Effects

Under Idaho Power's proposal, low DO concentrations would continue to occur in the three project reservoirs and downstream of Hells Canyon dam, trace metals (including methyl-mercury) and ammonia would continue to be created in the anoxic reservoir waters, and increases in TDG may occur at the dams under extremely high flows. However, the TDG abatement measures proposed by Idaho Power should reduce the frequency of high TDG levels under most spill conditions. Depending on the nature of DO measures that are ultimately implemented, the frequency and severity of anoxic conditions may be reduced as well.

3.6 AQUATIC RESOURCES

3.6.1 Affected Environment

3.6.1.1 Aquatic Habitat Conditions

The location and drainage area of the principal tributaries to the Snake River within the reach that was historically accessible to anadromous fish are listed in table 29. Our description of aquatic habitats will focus on the mainstem Snake River and its tributaries downstream from Swan Falls dam.

Swan Falls Dam to Brownlee Reservoir

This 118-mile segment of the Snake River extends from Swan Falls dam at RM 458 to the headwaters of Brownlee reservoir at RM 340 (figure 35). The uppermost 13.7 miles of this reach are relatively high gradient and the river is confined within a steep-walled canyon. After the river leaves the canyon, it becomes lower in gradient, and the remainder of the reach comprises primarily shallow, low-velocity run habitat, with numerous braided channels and island complexes. Several large tributaries enter this reach, including the Owyhee, Boise, Malheur, Payette, Weiser, and Burnt rivers. The quantity and quality of water that is delivered from these tributaries is heavily influenced by municipal development and by development to support irrigated agriculture, livestock grazing, and confined animal-feeding operations. Three large multi-purpose reservoirs control flows in the Boise River System, and five major municipal wastewater facilities discharge into the lower Boise River (Hoelscher and Myers, 2003).

Severely degraded water quality, primarily due to high nutrient loads delivered from the tributaries listed above, currently limits aquatic resources in this reach. In summer, algae blooms are common and phosphorus levels are typically double the target concentration identified in the Snake River-Hells Canyon TMDL (Idaho Power 2003b). Water temperatures in the Snake River upstream of Brownlee reservoir can reach 27°C during the late summer months. The Swan Falls-Brownlee reach contains a large amount of potential sturgeon habitat, but it is underused due to its poor water quality. It also includes about 40 percent of the most important historical production area for fall Chinook salmon. Evermann (1896) considered the reach extending from Huntington (RM 328) to Auger Falls (RM 606.7) to be the most important fall Chinook spawning area in Idaho.

Brownlee Reservoir

Brownlee dam impounds the Snake River from RM 284.6 to RM 340, forming a 55-mile-long reservoir (figure 35). The reservoir's average depth is 105 feet with a maximum depth of about 300 feet near the dam. Shoreline areas are typically steep and consist of bedrock or mixtures of boulders, sand, and gravel substrate. The reservoir has a surface area of 14,600 acres and a volume of 1,400,000 acre-feet at full pool. Reservoir levels fluctuate seasonally as a result of operations to provide flood control, to meet seasonal peaks in power demand, and to stabilize flows downstream of Hells Canyon dam during the fall Chinook spawning season. Flood control drawdowns of up to 100 feet occur during high flow years. Between 1995 and 2001, storage was also used to provide up to 237,000 acre-feet of water during the summer for flow augmentation to assist with the outmigration of juvenile salmon and steelhead from the lower Snake River under an energy exchange agreement with the Bonneville Power Administration. At the maximum drawdown of 100 feet, the reservoir's surface is 6,410 acres, a 56 percent reduction from the surface area at full pool. The volume at maximum drawdown is 444,744 acre-feet, a 68 percent reduction from the volume at full pool.

Table 29. Principal tributaries to the Snake River that historically supported anadromous fish, with the location of Brownlee, Oxbow and Hells Canyon dams shown for reference.

Snake River Mile	Tributary	Basin Area (square miles)[a]
615 to 550	Rock Creek basins (Clover, Billingsley, Cedar Draw, Rock, Deep, and Mud creeks)	2,208
587	Salmon Falls Creek	2,106
494	Bruneau River	3,372
396.7	Owyhee River	11,108
396.4	Boise River	4,031
368.5	Malheur River	4,719
365.6	Payette River	3,309
351.6	Weiser River	1,686
327.5	Burnt River	1,100
296	Powder River	1,705
288	Brownlee Creek	61
284.6	Brownlee dam	NA
283.3	Wildhorse River	177
273	Oxbow dam	NA
271.3	Indian Creek	40
271	Pine Creek	301
247.6	Hells Canyon dam	NA
239	Granite Creek	33
229	Sheep Creek	41
191.6	Imnaha River	871
188.2	Salmon River	13,923
168.7	Grande Ronde River	4,000
140	Clearwater River	9,645
62	Tucannon River	503
59.5	Palouse	3,303

[a] Basin areas for streams upstream of Hells Canyon dam are from Chandler and Chapman (2003a), basin areas for Granite and Sheep creeks are from Chandler et al. (2003a), and basin areas for downstream tributaries are from NPCC's (2005) subbasin plans.

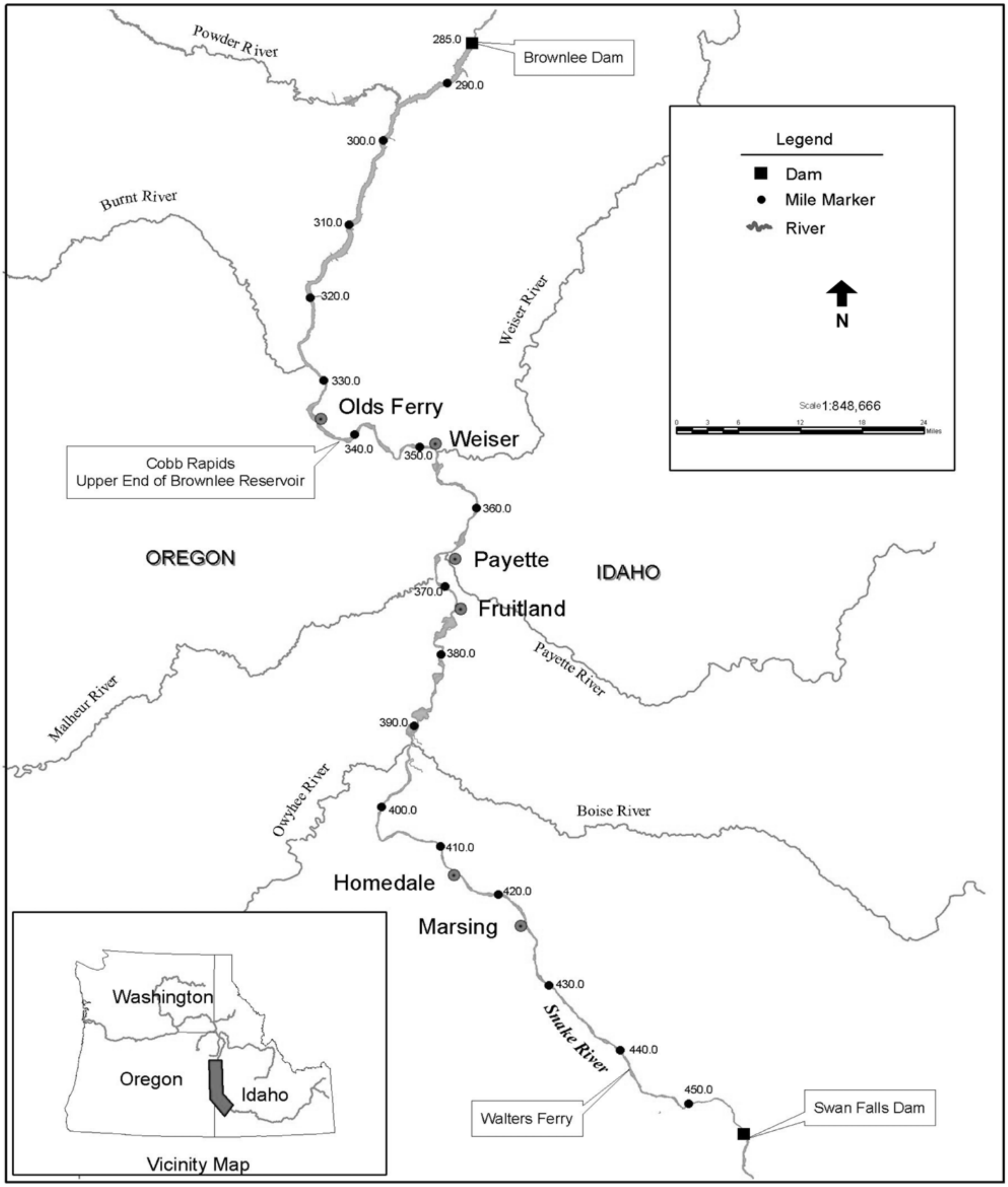

Figure 35. Map of the Swan Falls to Brownlee reach of the Snake River. (Source: (Idaho Power, 2003b)

The Powder River enters the reservoir on the Oregon side, approximately 11 miles upstream from Brownlee dam. Approximately 5 miles of the Powder River is inundated by Brownlee reservoir, forming the Powder River arm. The Burnt River enters Brownlee reservoir in the upper third of the reservoir. Both of these tributaries are heavily diverted to support irrigated agriculture (Hoelscher and Myers, 2003).

Water temperatures in the surface waters of Brownlee reservoir during July and August can range from 24 to 31°C (Idaho Power, 2003b). Because of the high nutrient load contributed primarily from tributaries upstream of the reservoir, algae blooms are common, and much of the reservoir's volume becomes anoxic during low water years, especially in the transition zone at the head of the reservoir. Isolated fish kills, typically of small fish during the summer, are periodically reported. A major anoxia event that occurred in 1990 killed at least 28 adult white sturgeon, and dead fish observed throughout the upper reach of the reservoir included white sturgeon, catfish, crappie, and suckers (Idaho Power, 2003b).

Brownlee reservoir supports an important recreational fishery that targets primarily warmwater species, including smallmouth bass, black crappie, white crappie, and channel catfish. It also supports a stocked fishery for rainbow trout, and limited numbers of wild rainbow trout. Additional information on the fishery in all three project reservoirs is provided in section 3.6.1.6, *Reservoir Fisheries*.

Oxbow Reservoir and Bypassed Reach

Oxbow dam impounds the Snake River from RM 272.5 upstream to Brownlee dam, forming a narrow, 12.1-mile-long reservoir with maximum depths approaching 100 feet (figure 36). Shoreline areas are primarily basalt outcrops and talus, except where small tributaries have deposited alluvium. The project passes flow through tunnels constructed through a natural rock ridge at a bend in the Snake River, creating a 2.5-mile-long bypassed reach. The reservoir has a surface area of 1,150 acres and a volume of 58,385 acre-feet at full pool. Reservoir levels fluctuate by about 5 feet during normal operations with a maximum drawdown of 10 feet. The Wildhorse River enters the Snake River in the upstream end of the reservoir, about a mile downstream of Brownlee dam. A smaller tributary, Indian Creek, enters the middle of the bypassed reach. In addition to flows contributed from Indian Creek, a minimum flow of 100 cfs is released from Oxbow dam into the head of the bypassed reach. Most of the bypassed reach is backwatered when the Hells Canyon reservoir is at full pool.

Oxbow reservoir supports a warmwater fishery similar to Brownlee reservoir, and it provides overwintering habitat for redband and bull trout that spawn in the Wildhorse River. The reservoir may contain a very small remnant population of white sturgeon. The bypassed reach provides overwintering habitat for redband and bull trout that spawn and rear in Pine and Indian creeks. During July and August of low flow years, most of the deeper water in the reservoir becomes anoxic as a result of water with low DO levels being discharged from Brownlee reservoir.

Hells Canyon Reservoir

Hells Canyon dam impounds the Snake River from RM 247.6 upstream to Oxbow dam, forming a narrow, 22-mile-long reservoir (figure 36). Shorelines in the reservoir are generally very steep, and substrates consist primarily of basalt outcrops and talus. The maximum depth approaches 240 feet near the dam. The reservoir has a surface area of 2,412 acres and a volume of 167,720 acre-feet at full pool. Reservoir levels typically fluctuate about 5 feet as a result of daily peaking operations, with a maximum drawdown of 10 feet. Pine Creek enters the Snake River near the head of the reservoir, about 1.5 miles downstream from Oxbow dam.

Hells Canyon reservoir supports a warmwater fishery similar to Brownlee reservoir, but it also provides overwintering habitat for redband and bull trout that spawn and rear in Pine and Indian creeks. The reservoir also contains a very small remnant population of white sturgeon. During July and August of low flow years, most of the deeper water in the reservoir becomes anoxic because of the persistence of low DO levels in waters discharged from Brownlee reservoir.

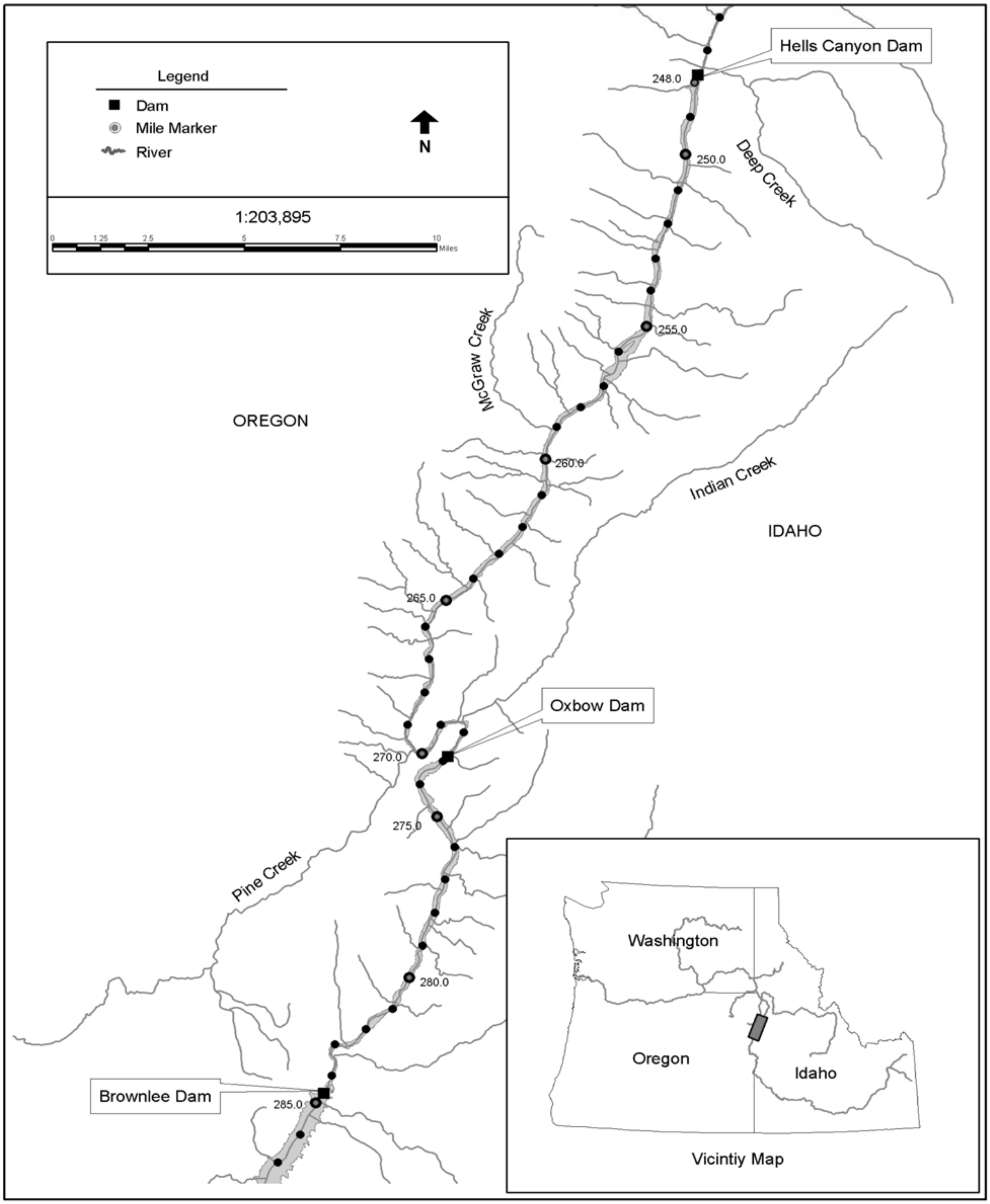

Figure 36. Map of the Brownlee to Hells Canyon reach of the Snake River. (Source: Idaho Power, 2003b)

Hells Canyon Dam to Lower Granite Reservoir

The Hells Canyon reach of the Snake River flows through a deep canyon, creating a series of turbulent rapids and runs intermixed with many deep pools. The Snake River in this reach flows freely for 107 miles. Lower Granite dam, located at RM 107.5, impounds the river for about 32 miles. Several major tributaries including the Imnaha, Salmon, and Grande Ronde rivers join the Snake River upstream of Lower Granite reservoir, and the Clearwater River enters the Snake River near the head of Lower Granite reservoir (figure 37). The Salmon and Clearwater River basins are relatively undeveloped and have a substantial influence on the flow and temperature regimes in the lower Snake River. The Salmon River, which enters the Snake River at RM 188.2 has a mean annual flow of 10,744 cfs and a mean August flow of 5,278 cfs (table 18). The Clearwater River, which enters the Snake River at RM 140, has a mean annual flow of 14,530 cfs and a mean August flow of 8,795 cfs. Together, these tributaries contribute more flow than the Snake River basin upstream of Hells Canyon dam, where the mean annual flow of the Snake River is 19,768 cfs and the mean flow during August is 11,817 cfs. Dworshak dam, a federal dam located at RM 1.9 on the North Fork Clearwater River, plays an important role in providing cool water to augment river flows during the smolt outmigration season. Dworshak reservoir has a usable storage capacity of 2,016,000 acre-feet.

The Hells Canyon reach provides the majority of the fall Chinook spawning habitat that is currently accessible to anadromous fish in the Snake River basin, and the lower part of the reach is part of the migration corridor for anadromous fish migrating to and from the Grande Ronde, Salmon, and Imnaha River basins, including salmon and steelhead produced by Idaho Power's hatcheries, which are released into the Salmon River basin and at Hells Canyon dam. Adult spring Chinook salmon and steelhead that migrate to Hells Canyon dam are collected in trapping facilities at the dam and are transported to Idaho Power's hatcheries, and releases of hatchery smolts from these facilities contribute to commercial and Tribal fisheries, as well as recreational fisheries in the Hells Canyon reach and in the Salmon River basin. Additional information about anadromous fish species, recreational fisheries in the Hells Canyon reach, and Idaho Power's hatchery system is provided in section 3.6.1.3, *Anadromous Fish*, section 3.6.1.7, *Hells Canyon Riverine Fishery*, and in 3.6.1.8, *Hatchery Operations*, respectively.

The Hells Canyon reach also provides overwintering habitat for redband and bull trout that spawn and rear in the Imnaha and Grande Ronde River basins, and in several of the smaller tributaries, including Granite and Sheep creeks (Chandler et al. 2003a). The reach contains a large population of white sturgeon, which supports both recreational catch-and-release and Tribal harvest fisheries. Additional information about these resources is provided in section 3.6.1.4, *Native Resident Salmonids*, and section 3.6.1.5, *White Sturgeon*.

3.6.1.2 Primary Production and Aquatic Macroinvertebrates

Idaho Power conducted two macroinvertebrate surveys: a general survey and a targeted survey focused on detecting listed, rare, or sensitive mollusks. Both surveys involved sampling in all three project reservoirs and in the Snake River between Hells Canyon dam and the confluence with the Salmon River. The general survey also included sampling upstream of the project, from Swan Falls dam to the headwaters of Brownlee reservoir. The results of the general survey indicate that Ephemeroptera (mayflies), Trichoptera (caddisflies), Diptera (true flies), Oligochaeta (worms) and Gastropoda (snails) dominate the invertebrate community upstream of Brownlee reservoir (Myers and Foster, 2003). Ephemeroptera were consistently the most abundant taxon in this reach, and the genus *Trichorythodes* composed 75 percent of this group on average. Within this reach, Oligochaetes increased from less than 1 percent in upstream areas to approximately 13 percent of the invertebrate community downstream of RM 360. Surveyors located the federally listed endangered Idaho springsnail (*Pyrogulopsis idahoensis*) in a single reach between RM 365 and RM 370, about 25 miles upstream from the headwaters of Brownlee reservoir. Surveyors also found the invasive New Zealand mudsnail (*Potamopyrgus antipodarum*) in several reaches upstream of Brownlee reservoir, including the reach where Idaho springsnails were found.

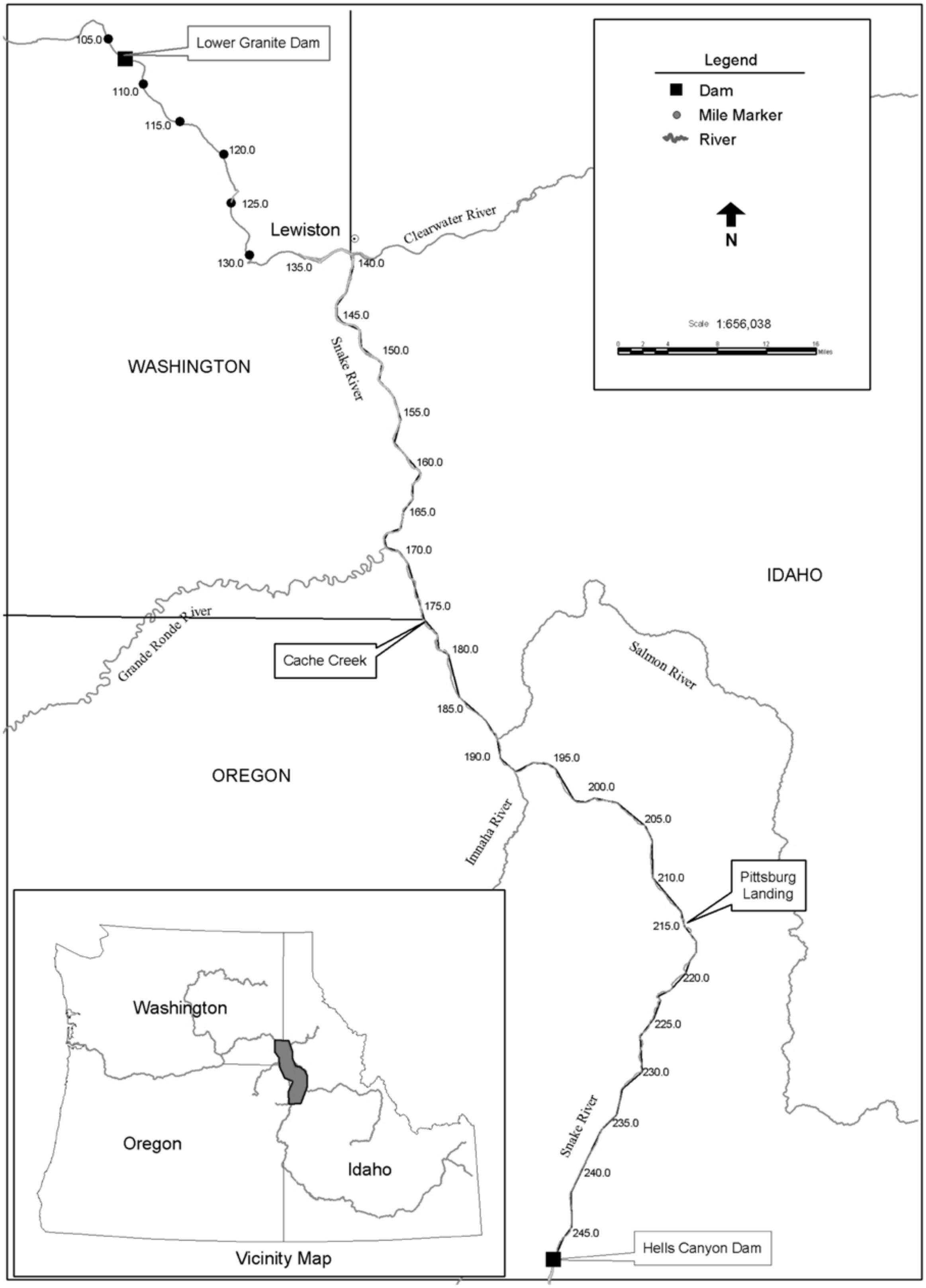

Figure 37. Map of the Hells Canyon to Lower Granite reach of the Snake River. (Source: Idaho Power, 2003b)

In the project reservoirs, the results of the general survey indicated that the abundance of Oligochaetes was relatively high, and surveyors detected no Trichoptera, Plecoptora (stoneflies), or *Tricorythodes*. Fewer taxa were found in Brownlee samples during all seasons compared to Oxbow and Hells Canyon reservoirs (Myers and Foster, 2003). Bivalves (clams and mussels) were present in Oxbow and Hells Canyon reservoirs, but none were found in Brownlee reservoir during the general survey. In the targeted mollusk survey, several California floater (*Anodonta californiensis*) shells, one of which still had a dead mussel inside, were found in the section of the Burnt River that is often inundated by the reservoir (Richards et al. 2005). Idaho Power concluded that a colony of this species, which is a federal species of concern (BLM Type 3-regional/state imperiled species), probably exists somewhere in the area.

In the reach downstream of Hells Canyon dam, Platyhelminthes (flatworms), bivalves (*Corbicula* sp.), and gastropods were found to be very common within the first 6 miles downstream of the dam during the general survey (Myers and Foster, 2003). Surveyors found New Zealand mudsnails in half (14) of the 1-mile subreaches that were sampled. In the general survey, one snail that was field-identified as a Bliss Rapids snail (*Taylorconcha serpenticola*), a federally listed threatened species, was collected near RM 227, about 20 miles downstream of Hells Canyon dam. A follow-up survey of this area conducted in 2002 resulted in the collection of three more individuals that were field-identified as Bliss Rapids snail, but efforts to verify their taxonomy were inconclusive. In the targeted mollusk survey, surveyors found a species of *Taylorconcha* to be fairly abundant in the reach downstream of RM 234 (Richards et al. 2005-AR-2). Genetic analysis of specimens collected during the targeted survey indicates that the *Taylorconcha* that inhabit the Hells Canyon reach may represent a new species that is distinct from the listed Bliss Rapids snail. Other special status species that were identified downstream of Hells Canyon dam during the targeted mollusk survey include the California floater and the great Columbia River limpet or shortface lanx (*Fisherola nuttalli*), which is a BLM Type 2 (rangewide/globally imperiled) species. Two invasive species, the New Zealand mudsnail and the Asiatic clam (*Corbicula fluminea*) were the most abundant and widespread species of mollusk observed downstream of Hells Canyon dam.

3.6.1.3 Anadromous Fish Species

This section provides an overview of the historical and current distribution of anadromous fish in the project vicinity and describes the life history of anadromous fish species that occur in the Snake River basin. Additional information on the listing status and recent trends in abundance of Endangered Species Act (ESA)-listed species, including fall and spring/summer Chinook salmon, sockeye salmon, and steelhead trout is provided in section 3.8, *Threatened and Endangered Species*.

Historical Distribution and Abundance

The historical production area of anadromous fish in the Snake River basin included 615 miles of the mainstem Snake River extending upstream to Shoshone Falls, and portions of 13 major tributary basins and many smaller basins (table 29). Major tributaries that historically produced anadromous fish upstream of the current site of Hells Canyon dam (RM 247.6) include Salmon Falls Creek and the Bruneau, Owyhee, Boise, Malheur, Payette, Weiser, Burnt, and Powder rivers. Smaller tributaries within this reach include the Wildhorse River, Indian Creek, and Pine Creek, as well as a group of small creeks that are referred to collectively as the Rock Creek basins. Major anadromous fish producing tributaries downstream of Hells Canyon dam include the Imnaha, Salmon, Grande Ronde, Clearwater, and Tucannon rivers.

Fall Chinook salmon historically used the entire mainstem of the Snake River downstream of Shoshone Falls, as well as the lower sections of several of the larger tributaries, for spawning and rearing. Evermann (1896) considered the spawning areas between Huntington (RM 328) and Auger Falls (RM 606.7) to be the most important in Idaho, although he did not explore areas downstream of Huntington. Historical accounts given in Pratt et al. (2003a–n) indicate that spring/summer Chinook salmon and steelhead probably spawned in every major tributary, and sockeye salmon spawned and reared in Payette Lake and in several small lakes in the headwaters of the Salmon River basin.

Idaho Power estimated that the Snake River basin upstream of Hells Canyon dam produced between 1 and 1.7 million adult salmon and steelhead annually in the pre-development era (prior to 1860). This estimate includes an estimated 0.76 to 1.19 million spring/summer Chinook salmon; 135,000 to 214,000 fall Chinook salmon; 117,000 to 225,700 steelhead; and 14,400 to 57,400 sockeye salmon (Chapman and Chandler, 2003). In an analysis appended to its January 20, 2006, filing, NMFS notes an apparent error in Idaho Power's estimate of the number of fall Chinook salmon produced upstream of Hells Canyon dam,[57] and provides its own estimate, which is considerably higher than the Idaho Power estimate. The NMFS estimate is based on the distribution of historical fall Chinook habitat described in Dauble et al. (2003), which estimates that 52 percent of the historical fall Chinook salmon spawning habitat in the Columbia basin occurred in the Snake River, and that 58 percent of the fall Chinook spawning habitat in the Snake River was located upstream of Hells Canyon dam. NMFS states that this assessment corroborates the statement made by Waple et al. (1991) that the great majority of fall Chinook salmon spawned in the mainstem Snake River upstream of the Hells Canyon Project. Applying these percentages to a historical estimate of 800,000 to 1,250,000 fall Chinook salmon returning to the Columbia River, NMFS estimates the historical return of adult fall Chinook salmon to the Snake River upstream of Hells Canyon was between 241,280 and 377,000 fish.

Over a period of approximately 70 years, anadromous fish above the present-day site of Hells Canyon dam were gradually extirpated from much of their historical range by the construction of federal and private dams and from habitats being degraded by multiple land uses. Habitat losses began primarily with placer mining, which took place throughout the entire basin, followed by development of the basin for agricultural production, timber harvest, and livestock production.

Idaho Power estimated that by the time that the Hells Canyon Project was constructed, anadromous fish runs to the area upstream of Hells Canyon dam had been reduced to approximately 16,000 fall Chinook salmon, 1,900 spring Chinook salmon, and 7,500 steelhead (Chapman and Chandler, 2003). Based on its review of historical records, Idaho Power concluded that the production of spring/summer Chinook salmon and steelhead upstream of the Hells Canyon dam site was primarily limited to the Weiser River, Eagle Creek (a tributary to the Powder River), the Wildhorse River, Pine Creek, and Indian Creek. Although large areas in the Malheur and Burnt rivers and the lower portion of the Boise were accessible to anadromous fish, Idaho Power concluded that these rivers no longer supported anadromous salmonids, with the exception of a few runs of steelhead remaining in the Burnt River (Idaho Power, 2003a, section E.3.1.1.2.2.1).

Historically, Pacific lamprey occurred throughout the Columbia and Snake River basins, mirroring the range of migrating salmon (Close et al. 1995). Pacific lamprey were documented in large numbers throughout the Snake River, and were harvested by Native Americans at traditional fishing areas within the Snake River basin, areas that included the Tucannon, Grande Ronde, and Powder rivers (Close and Bronson, 2001). Pacific lamprey were reported to ascend the Snake River upstream to Shoshone Falls, and probably occurred in nearly all of its tributaries. Within the project area, accounts given in Pratt et al. (2003a–n) indicate that they occurred in at least the Boise, Payette, Powder, and Wildhorse rivers.

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[57] NMFS states that Idaho Power's estimate was calculated assuming that 36 percent of fall Chinook salmon returning to the Columbia River spawned in the Snake River, and that 60 percent of the fish spawning in the Snake River spawned upstream of Hells Canyon dam.

Loss of Access from Dam Construction

The construction and operation of both private and federally owned dams have substantially reduced anadromous fish access to habitat in the Snake and Columbia River basins. The construction of 13 mainstem dams on the Snake River downstream from Shoshone Falls, 4 mainstem dams on the Lower Columbia River (figure 1 and table 3), and numerous tributary dams and diversions has affected access in the Snake River basin. Although the lowermost four dams on the Snake River and the four Lower Columbia River dams are equipped with fish passage facilities, migration losses associated with these dams and their reservoirs have contributed to the decline of Snake River salmon and steelhead, all of which are now protected under the ESA.

Swan Falls dam, which was constructed in 1901 at RM 458, was the first dam on the mainstem of the Snake River[58] to substantially reduce the distribution of anadromous fish in the Snake River basin. Although a fish ladder was installed during initial construction, it was not functional for salmon and blocked access to much of the spring-influenced habitat in the middle Snake River. The section of the river blocked by Swan Falls dam was probably the most productive habitat for fall Chinook salmon in the basin. Inflow of spring water near Thousand Springs (RM 584) created a thermal regime that was well suited for the production of fall Chinook salmon, with warm temperatures in the winter and early spring that promoted early emergence and rapid growth (Chandler et al., 2003b; Connor and Burge, 2003).

The next downstream barrier constructed on the Snake River was Brownlee dam, which was constructed at RM 284.6 in 1958. The diversion tunnel used during construction was completed in 1956, along with temporary fish passage facilities to move adult fish around the construction area. When Brownlee reservoir filled in May 1958, adult fish collection was moved downstream to the Oxbow dam construction site (RM 272.5) and then, in 1966, to below Hells Canyon dam (RM 247.6). In addition, Idaho Power deployed a large collection net in Brownlee reservoir in an attempt to collect downstream migrating smolts for transport to the river downstream of the project.

Although efforts to trap and transport adult salmon and steelhead around the dams were generally successful,[59] within several years it became clear that efforts to collect downstream migrating smolts were not successful enough to maintain anadromous fish runs upstream of the project.[60] In December 1963, the Federal Power Commission (predecessor to the Federal Energy Regulatory Commission) ordered Idaho Power to abandon the downstream collection efforts prior to the outmigration of 1964, which led to the development of hatchery mitigation efforts. Because of these events, Hells Canyon dam became the terminus for production of anadromous fish, eliminating access to 210 miles of mainstem habitat, as well as the tributaries that enter the Snake River between Hells Canyon and Swan Falls dams.

During the same general period as construction of the Hells Canyon Project, four federally owned dams were constructed on the lower Snake River. Ice Harbor dam was constructed in 1962, Lower

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58 Anadromous fish access to the Bruneau River was eliminated in 1890 when a dam was constructed 1.5 miles from its mouth. Historical accounts indicate that the dam was constructed without a fishway, and blocked access of anadromous fish into the basin (Pratt et al., 2001g). Although the dam washed out several times, it was rebuilt each time.

59 An exception occurred in the late summer of 1958, when failure of a cofferdam at the temporary fish collection facility downstream of Oxbow dam, allowed adult fall Chinook and steelhead to enter and become trapped in the bypassed reach. An estimated 3,497 fall Chinook and 771 steelhead were killed in the “Oxbow incident,” which constituted approximately 20 percent of the run of fall Chinook and 15 percent of the run of steelhead for that year.

60 Failure of the collection net was attributed to mechanical failures, fish passing under the net, and losses of smolts as they passed through approximately 54 miles of impounded water upstream of the net, which was deployed about 1 mile upstream of Brownlee dam.

Monumental and Little Goose dams were constructed in 1969 and 1970, respectively, and Lower Granite dam was constructed in 1975. Combined, these dams inundated 135 miles of the mainstem Snake River, 54 percent of the mainstem habitat downstream of Hells Canyon dam. Two of the four federally owned dams on the lower Columbia River—The Dalles and John Day dams—were also constructed in the same period. The date of construction and location of each of these dams is listed in table 3. Although all of the federal dams on the lower Snake and lower Columbia rivers are equipped with fish passage facilities, the cumulative losses of fish passing these dams are substantial, especially during the smolt outmigration. However, as the result of ongoing efforts to reduce mortality in the migration corridor, the overall rate of juvenile survival is, at present, reported to be equivalent to that observed in the 1960s when only four dams were present (Williams et al., 2005).

Current Distribution

Within the Snake River basin, the distribution of anadromous fish is currently limited to the mainstem Snake River and portions of its tributaries downstream of Hells Canyon dam. The 107-mile segment from Hells Canyon dam to the head of Lower Granite reservoir contains most of the fall Chinook spawning and rearing habitat that is still accessible, although fall Chinook spawning also occurs in the lower reaches of the Imnaha, Salmon, Grande Ronde, Clearwater, and the Tucannon rivers. All of these tributaries also continue to support limited numbers of spring/summer Chinook salmon and summer steelhead. Idaho Power operates two major hatcheries in the Salmon River basin and two hatcheries on the Snake River upstream of Hells Canyon dam that produce steelhead, spring Chinook salmon, summer Chinook salmon, and in the last few years, fall Chinook salmon. Most of the fish produced in the Idaho Power hatchery system are released into the Salmon River or its tributaries or into the Snake River downstream of Hells Canyon dam. Redfish Lake, in the headwaters of the Salmon River basin, supports the only remaining population of Snake River sockeye salmon, and this population is the subject of an intensive conservation hatchery supplementation program. A small number of adult Pacific lamprey continue to migrate past Lower Granite dam, and probably spawn in tributaries to the Hells Canyon reach. The number of adult lamprey that have been counted migrating past Lower Granite dam over the past decade have ranged from 27 fish in 2001 to 1,122 fish in 1997 (FPC, 2005).

Life History of Anadromous Fish in the Snake River[61]

Fall Chinook Salmon

Snake River fall Chinook salmon spawn in the mainstem Snake River and in the lower portions of some of its larger tributaries. Spawning generally occurs in October, November, and early December. Emergence timing varies and can extend from early March to June, depending on the location and spawn timing. Fall Chinook salmon rear in mainstem environments that are generally associated with low-gradient, low-velocity shorelines. Most fall Chinook salmon rear for a few months in freshwater environments before they migrate to the ocean as subyearlings. In the mid-1990s most juvenile fall Chinook salmon migrated past Lower Granite dam from June through August, but in recent years the migration has occurred earlier, with most juvenile fall Chinook salmon passing Lower Granite dam by the middle of July (figure 38). Williams (2005) reports that the average length of wild juvenile fall Chinook salmon passing Lower Granite dam has decreased from 140 mm in 1996 and 131 mm in 1997 to 113, 113, and 110 mm in 2002, 2003, and 2004, respectively. Because factors such as water temperatures and river flows have not changed substantially over this time period, NMFS concludes that the most plausible explanation for these recent changes in migration timing and fish size is that density-dependent mechanisms (e.g., competition for food and space) are beginning to manifest themselves because the number of juvenile fish is approaching the carrying capacity of the habitat.

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61 Information in this section comes from Idaho Power's license application (Idaho Power, 2003a) unless otherwise noted.

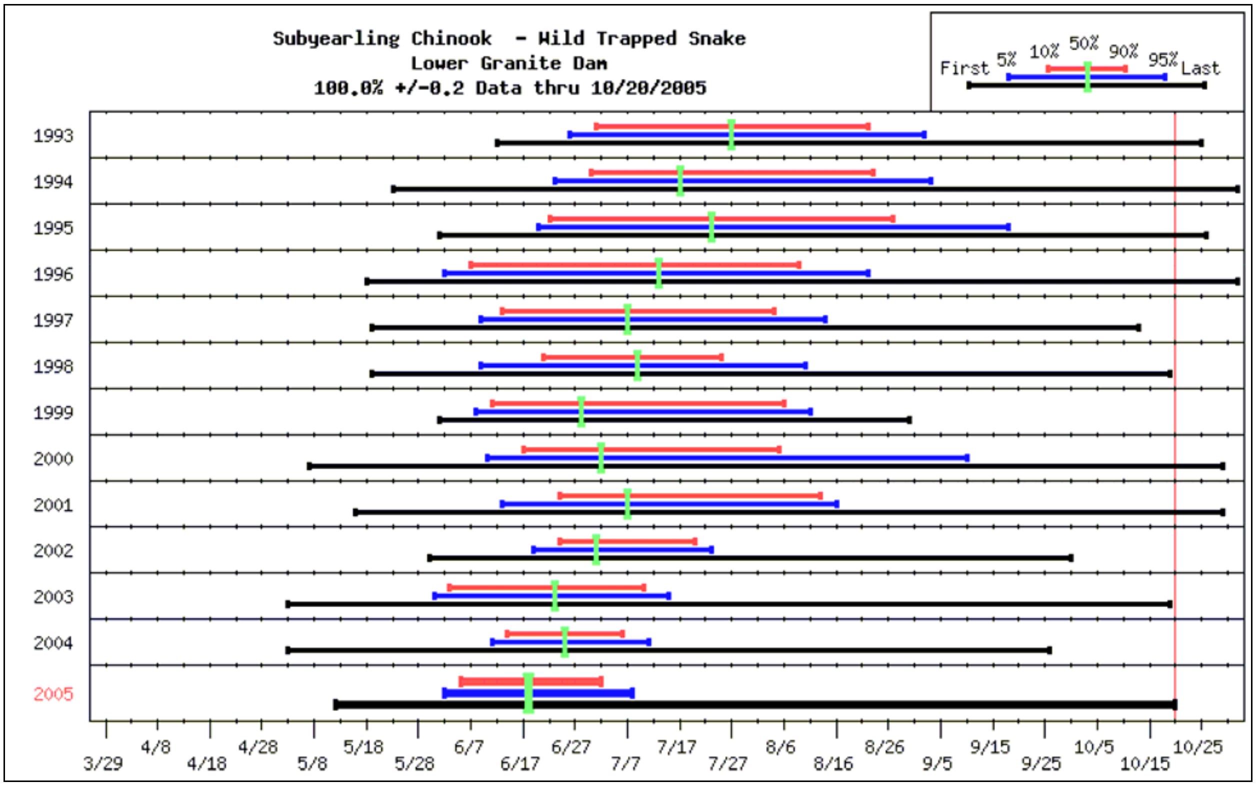

Figure 38. Passage timing of wild subyearling fall Chinook salmon smolts (PIT-tagged in the upper and lower Hells Canyon reaches) at Lower Granite dam. (Source: NMFS letter dated January 24, 2006.)

Adult fall Chinook salmon return to the Snake River at ages 2 to 5, although age 4 is the most common age for spawning. Adults generally arrive at the spawning areas from mid-August to November, with peak periods ranging from mid-September to the first week in October. Some fall Chinook salmon outmigrate through the lower Snake River as yearlings, but most of these fish originate from the Clearwater River.

Spring/Summer Chinook Salmon

Snake River spring/summer Chinook salmon spawn in tributary habitats from mid-August to mid-September. The distinction between spring and summer Chinook salmon is not always clear, and within the Snake River basin, NMFS has designated these fish as a single stock. Fry emerge in the spring and rear in freshwater for a year before they outmigrate in April, May, and June. Adults spend 2 to 3 years in the ocean and then return to fresh water. Adult spring/summer Chinook salmon return to the Snake River from May through July.

Steelhead Trout

Steelhead are the anadromous form of rainbow trout. The Snake River steelhead is a summer-run stock, which enters rivers earlier than winter runs, completing sexual maturation in the freshwater environment. The Snake River run is further divided into an A-run, which passes Bonneville dam between June and August 25, and a B-run, which enters fresh water from late August through October. A-run steelhead mostly spend 1 year in the ocean, while the B-run fish spend 2 years in the ocean environment. In the Snake River downstream of Hells Canyon dam, the A-run predominates. The composition of ocean-age returns to basins that historically produced steelhead upstream of Hells Canyon dam is unknown.

Steelhead enter the Snake River from September through November, and typically hold over during the winter months until they move into tributaries to spawn during March and April. Unlike the Pacific salmon species, steelhead are capable of repeat spawning, although the frequency of repeat spawning is probably low for inland stocks. Fry emerge from the gravel from the late spring to early summer, and most juveniles rear in freshwater for 1 to 3 years before outmigrating during the spring. Some degree of crossover between resident rainbow trout and steelhead populations is common, and hatchery steelhead smolts may fail to migrate and remain in the streams and rivers in which they are stocked.

Sockeye Salmon

Production areas of sockeye salmon are associated with lake environments. Although spawning occurs in both stream and lake habitats, juvenile rearing occurs almost exclusively in lake habitats. Some sockeye salmon, referred to as kokanee, may spend their entire life cycle within fresh water. As with steelhead, the resident form is capable of producing anadromous offspring and vice versa. Sockeye salmon generally spawn from late summer into the fall. Juvenile sockeye salmon rear in lake environments for 1 to 3 years before migrating to the sea, where they spend 2 to 4 years before returning to their natal lake system. Juvenile sockeye salmon generally migrate past Lower Granite dam from April through June. Adult sockeye pass Lower Granite dam between the end of June and the first part of August.

Pacific Lamprey

In the Columbia River basin, Pacific lamprey migrate upstream to spawn from May to September. Most lamprey hide under stones and overwinter until the following spring, after which they resume their migration into tributaries, where they spawn when temperatures reach between 10 and 15°C. Adult lamprey build nests in sandy gravel. Larvae (ammocoetes) hatch within 2 to 3 weeks and leave their natal substrate 2 to 3 weeks later, drifting downstream into slower pools and eddies. The larvae spend 4 to 6 years burrowing into fine sediments where they filter-feed on algae, diatoms, and detritus. Transformation from an ammocoete to a juvenile (macropthalmia) generally occurs from July through October, prior to a late fall to spring outmigration. Developing juvenile and young adult lamprey initially leave the substrate and migrate during the night in the lower portions of the water column. Lamprey generally spend between 1 and 3.5 years in the ocean, where they become parasitic feeders. Pacific lamprey are the only species of lamprey that are known to occur in the Snake River basin. The species is a federal species of concern and is classified as an endangered species by the state of Idaho.

3.6.1.4 Native Resident Salmonids

Native resident salmonids in the project area include bull trout, Columbia River redband trout, and mountain whitefish. Redband trout are classified as a species of special concern in Idaho, and as a vulnerable species in Oregon. Bull trout are federally listed as threatened, as a species of special concern by the state of Idaho, and as a critical species by the state of Oregon. Because of their special state and federal status, Idaho Power's studies and our analysis of project effects on native resident salmonids focuses on redband and bull trout.

Redband Trout

Redband trout are a poorly defined subspecies of inland rainbow trout (*Oncorhynchus mykiss*) that occurs in the Columbia, Fraser, and Sacramento River basins, as well as the ancient lake basins in the northern Great Basin (Behnke, 1992). Redband trout populations display a range of life history strategies, including anadromous (migrates to rear in the ocean), fluvial (migrates between large rivers and tributaries), adfluvial (migrates between a lake and tributaries), and resident (non-migratory) forms. The anadromous form (steelhead trout) is present in the Snake River and its tributaries downstream of Hells Canyon dam and is heavily supplemented through hatchery propagation (see section 3.6.1.8, *Hatchery Operations*).

Idaho Power used multiple techniques to assess the distribution and life history of redband trout in the project area, including electrofishing, gillnetting, hook and line sampling, the use of weir traps to collect trout emigrating from tributaries, genetics analysis, and radio telemetry studies (Chandler et al., 2003a). Idaho Power found that redband trout were distributed throughout the project reservoirs and in nearly every tributary that had adequate year-round discharge and no barrier preventing upstream movement. All of the major tributaries contained redband trout populations, although several streams also contained hybrids of redband trout with coastal rainbow trout. Sampling conducted at outmigrant traps installed on five tributaries in the project area[62] indicate that redband trout tended to move downstream from tributaries during the fall when water temperatures began to drop below 8 to 10°C. Radio-tagged adult redband trout made numerous and extensive movements into tributaries, presumably to spawn, primarily during April and May.

Within the project reservoirs and in the Snake River downstream of Hells Canyon dam, hatchery-produced rainbow trout (which are primarily from coastal rainbow stock) were 3 to 10 times more abundant than wild redband trout, yet wild redband trout were more abundant than hatchery rainbow trout in tributary streams throughout the study area. IDFG and ODFW stock large numbers of fingerling and smaller numbers of catchable rainbow trout in project reservoirs, especially in Brownlee reservoir and several of the tributaries in the project area (table 30). In addition, IDFG stocks surplus adult hatchery steelhead into Hells Canyon reservoir and into the Boise and Payette rivers when returns are sufficient (Abbott and Stute, 2003).

Bull Trout

Bull trout (*Salvelinus confluentus*) are a native species of char that is unique to western North America. Their historical range extends from the McCloud River in northern California and the Jarbridge River in Nevada north to the headwaters of the Yukon River in Canada (Haas and McPhail, 1991). Bull trout require colder water than most other salmonids for incubation, juvenile rearing, and spawning. Spawning and rearing areas are often associated with the coldest streams in a watershed. Throughout their lives, bull trout require complex forms of cover, including large woody debris, undercut banks, boulders, and pools.

Bull trout exhibit both resident and migratory life-history strategies. Resident bull trout complete their entire life cycle in the tributary streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear for 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form), or in certain coastal areas to saltwater (anadromous form). Resident and migratory forms may be found together, and either form may give rise to offspring exhibiting either resident or migratory behavior (Rieman and McIntyre, 1993).

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[62] Outmigrant weirs were installed at four sites upstream of Hells Canyon dam (Brownlee Creek, Wildhorse River, Pine Creek, and Indian Creek) and one site downstream of Hells Canyon dam (Sheep Creek). Redband trout were collected at each of these sites.

Table 30. Number of rainbow trout stocked by IDFG and ODFW at project reservoirs and at major tributaries from 1987 to 1997. (Source: Chandler et al., 2003a)

	Species/Strain									
	Rainbow			**Kamloops**		**Steelhead**		**Kamloops X Steelhead Hybrid**	**Rainbow X Cutthroat Hybrid**	
Location	**Catchable**	**Fingerling**	**Fry**	**Catchable**	**Fingerling**	**Adults**	**Fingerling**	**Fingerling**	**Fingerling**	**Grand Total**
Brownlee reservoir	388,364	4,009,642	--	155,840	745,745	--	373,140	441,460	--	6,114,191
Hells Canyon reservoir	45,772	368,780	48,000	--	30,140	3,761	--	--	139,380	635,833
Oxbow reservoir	154,687	653,631	--	--	30,140	--	--	--	60,600	899,058
Malheur River	66,552	2,152,229	88,839	--	--	--	--	--	--	2,307,620
Burnt River	53,081	1,203,214	--	--	--	--	--	--	--	1,256,295
Powder River	413,599	2,640,367	5,293	--	--	--	--	--	--	3,059,259
Wildhorse River	6,017	--	--	--	--	--	--	--	--	6,017
Pine Creek	55,542	12,000	13,130	--	--	--	--	--	--	80,672
Grand Total	1,183,614	11,039,863	155,262	155,840	806,025	3,761	373,140	441,460	199,980	14,358,945

Note: According to Behnke (1992), the Kamloops strain is the form of redband rainbow trout native to the upper Columbia and Frasier River basins.
IDFG – Idaho Department of Fish and Game
ODFW – Oregon Department of Fish and Game

The results of extensive fisheries surveys conducted by Idaho Power indicate that bull trout populations in the project area upstream of Hells Canyon dam were restricted to Indian Creek, Pine Creek, and the Wildhorse River drainages (Chandler et al., 2003a). All drainages upstream of Hells Canyon dam that contained bull trout also had resident brook trout and hybridized individuals between bull trout and brook trout. Hybrids were particularly abundant in Indian Creek and in the Wildhorse River. Surveyors found no bull trout or bull trout hybrids in Brownlee reservoir or its tributaries, although bull trout are known to occur in the headwaters of the Powder River Watershed. Downstream of Hells Canyon dam, only pure bull trout were present in the Snake River and in several of the major tributaries (Imnaha River, Grande Ronde River, Salmon River, Sheep Creek, and Granite Creek).

Brownlee, Oxbow, and Hells Canyon dams impede connectivity among bull trout populations in tributaries by blocking upstream migration past the dams and impeding migration within inundated habitat due to adverse water quality conditions that occur for extended time periods in the reservoirs, primarily during the summer and early fall. Idaho Power modeled seasonal trends in the suitability of water temperatures and DO levels in the project reservoirs for several fish species including bull trout. Suitability indices were calculated using suitability curves to rate the average water temperatures and DO levels throughout the entire volume of each reservoir. A composite index was also calculated by multiplying the temperature and DO suitability indices. The modeling effort was conducted for proposed and run-of-river full pool scenarios. The results generally indicate only minor differences between scenarios in terms of temperature and DO suitability.

For a representative extreme low flow year (1992), high water temperatures caused the temperature suitability index to diminish to levels less than 0.5 from mid-June through October in Brownlee reservoir, while the temperature suitability index in Oxbow and Hells Canyon reservoir dropped to levels below 0.5 from mid-July through October (figures 39 through 41). The DO suitability index diminished to levels below 0.5 from June through October in Brownlee reservoir, and dropped to levels below 0.5 from mid-June through November in Oxbow and Hells Canyon reservoirs. The composite (temperature x DO) index dropped to levels below 0.5 from June through mid-November in Brownlee reservoir, from mid-June through November in Oxbow and Hells Canyon reservoirs.

For a representative medium flow year (1995), high water temperatures caused the temperature suitability index to diminish to levels less than 0.5 from July through early October in Brownlee and Oxbow reservoirs, while the temperature suitability index in Hells Canyon reservoir dropped to less than 0.5 from early July through October (figures 42 through 44). The DO suitability index diminished to less than 0.5 from mid-August through early October in Brownlee reservoir, and from August through October in Oxbow and Hells Canyon reservoirs. The composite (temperature x DO) index dropped to levels less than 0.5 from early June through October in Brownlee reservoir, from July through October in Oxbow reservoir, and from July through mid-November in Hells Canyon reservoir.

For a representative extreme high flow year (1997), the temperature suitability index diminished to less than 0.5 from June though mid-October in all three reservoirs (figures 45 through 47). The DO suitability index dropped slightly below 0.5 from mid-August through early September in Brownlee reservoir, and dropped below 0.5 from August through early September in Oxbow and Hells Canyon reservoirs. The composite (temperature x DO) index dropped to levels near below 0.5 from June through early October in all three reservoirs.

Idaho Power also modeled DO and temperature suitability downstream of Hells Canyon dam for the 3 representative years. DO suitability for salmonids for the 3 years is shown in figures 48 through 50 and temperature suitability for bull trout is shown in figures 51 through 53. The modeling results indicate that sub-optimal DO levels extend for a considerable distance downstream from Hells Canyon dam, especially in the extreme low flow year of 1992. However, these periods of low DO suitability coincide with periods in which water temperatures are also sub-optimal for bull trout.

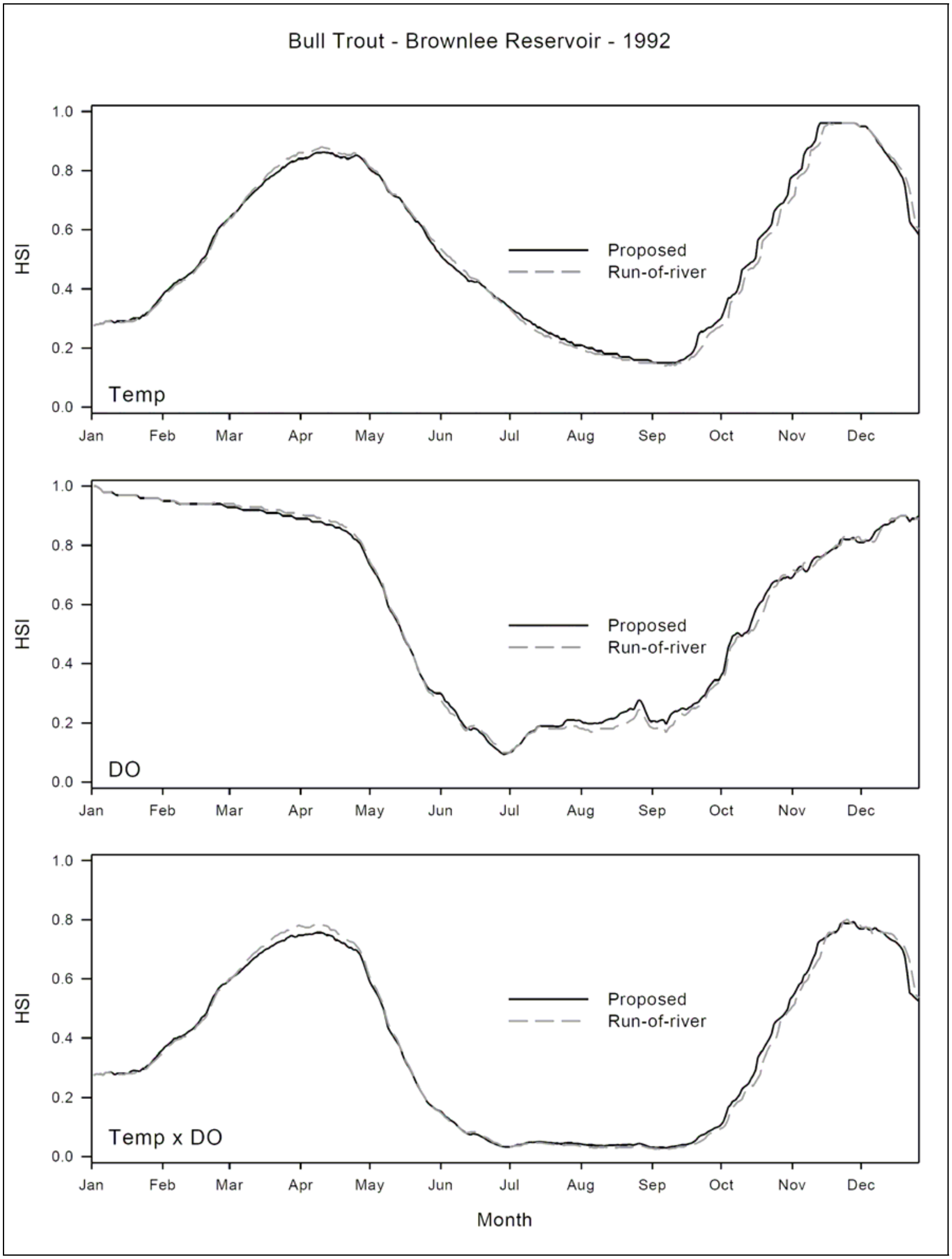


Figure 39. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Brownlee reservoir during an extreme low flow hydrologic year (1992) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

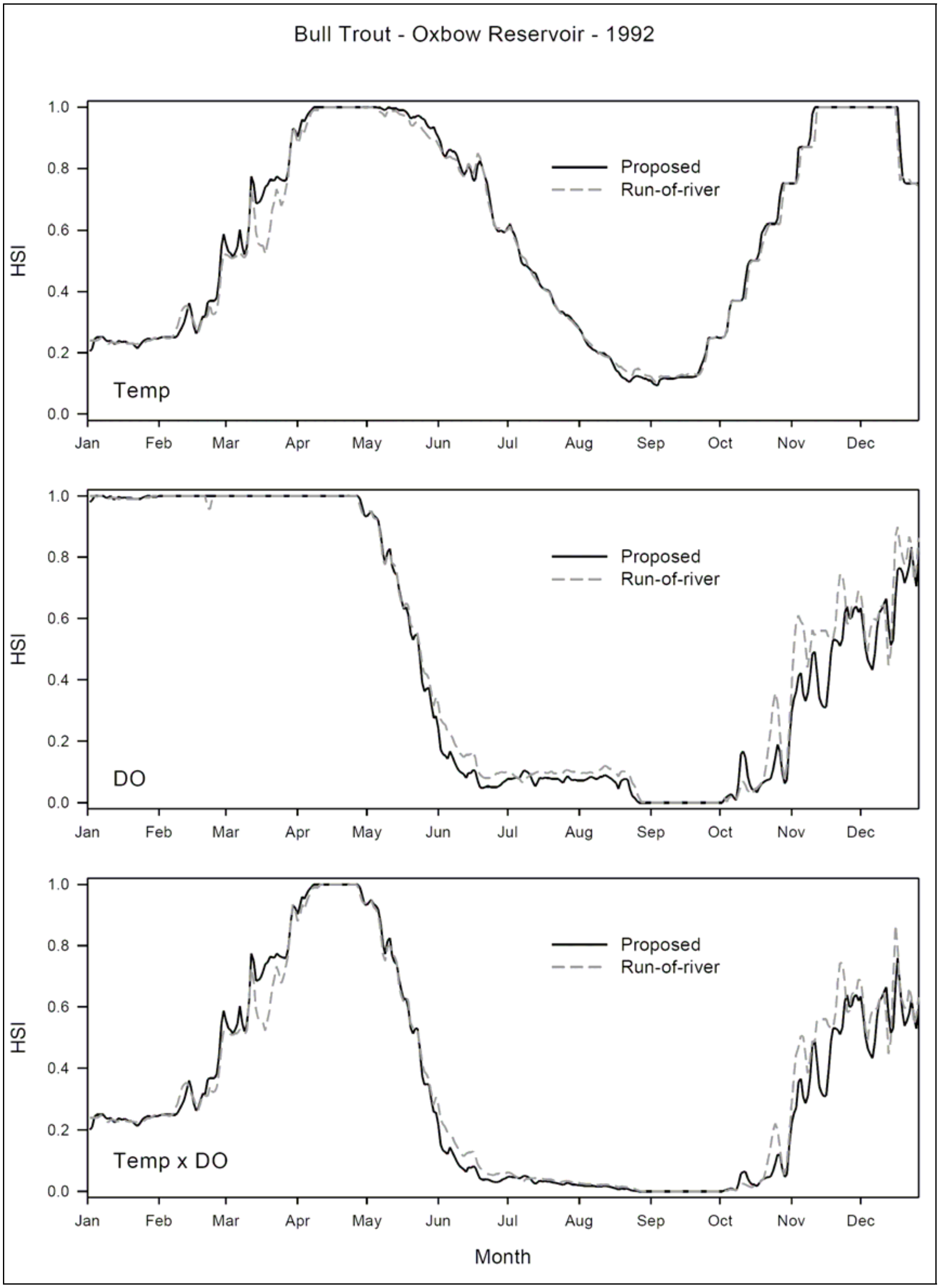


Figure 40. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Oxbow reservoir during an extreme low flow hydrologic year (1992) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

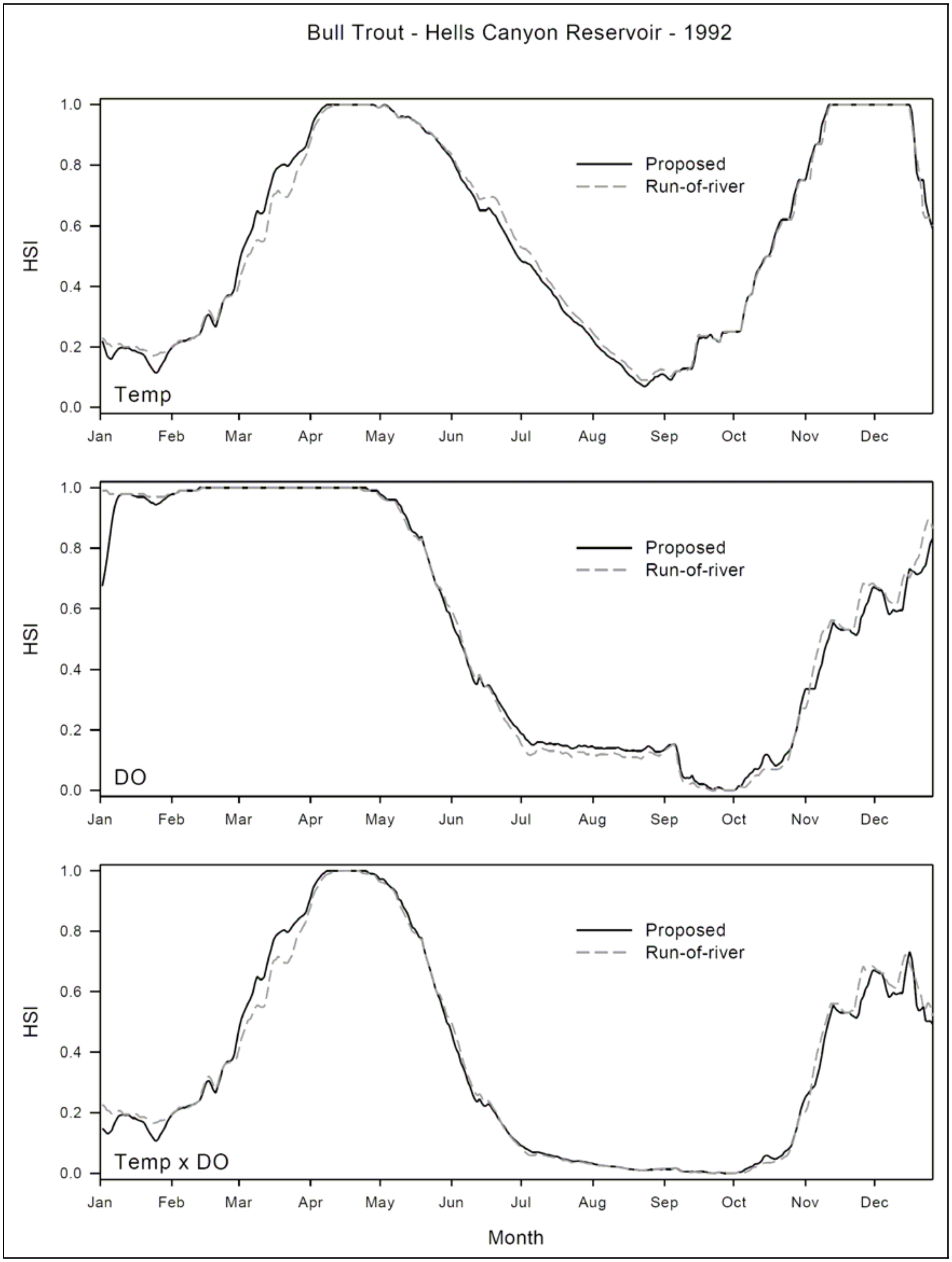


Figure 41. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Hells Canyon reservoir during an extreme low flow hydrologic year (1992) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

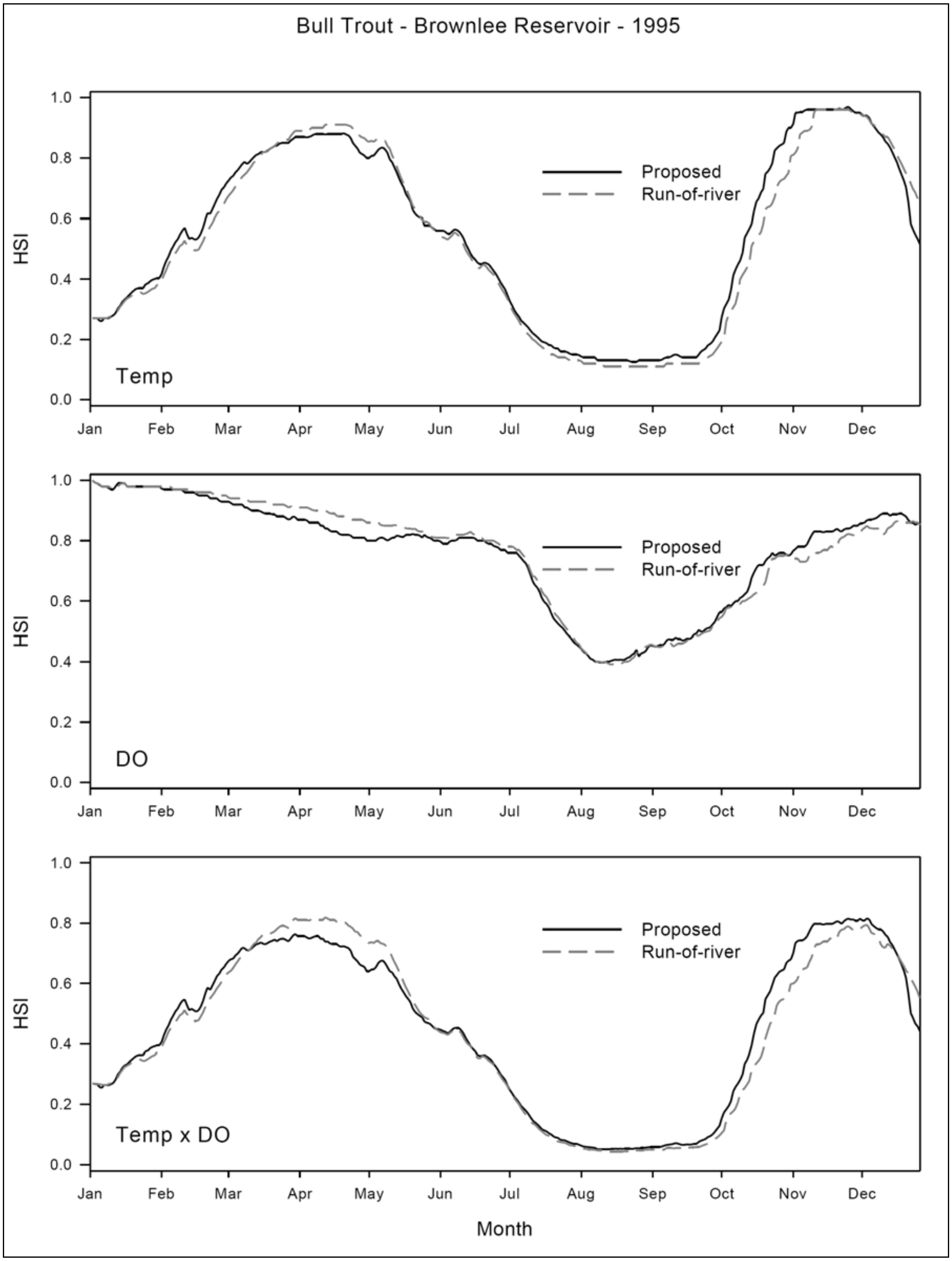


Figure 42 Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Brownlee reservoir during a medium flow hydrologic year (1995) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

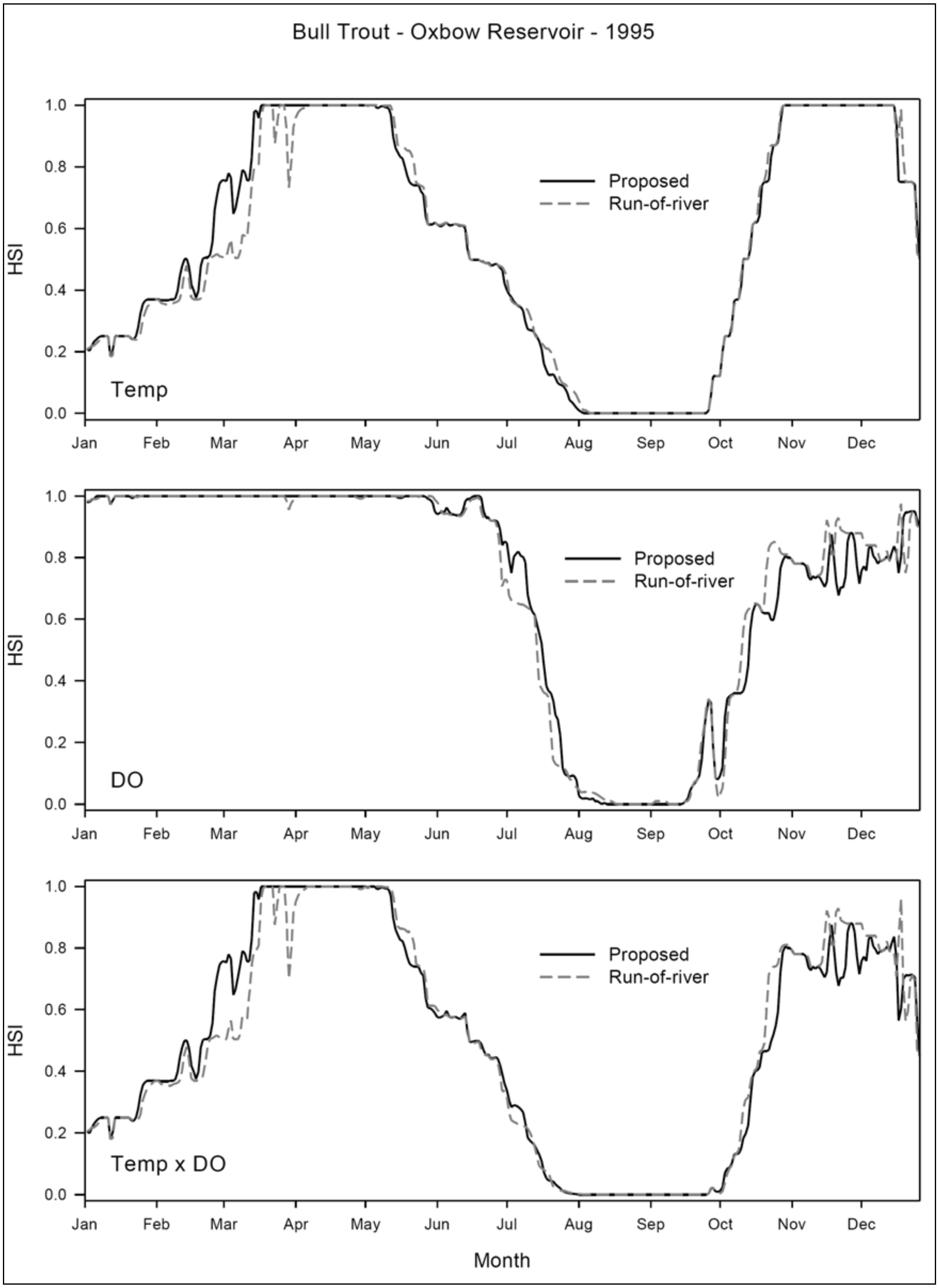


Figure 43. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Oxbow reservoir during a medium flow hydrologic year (1995) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

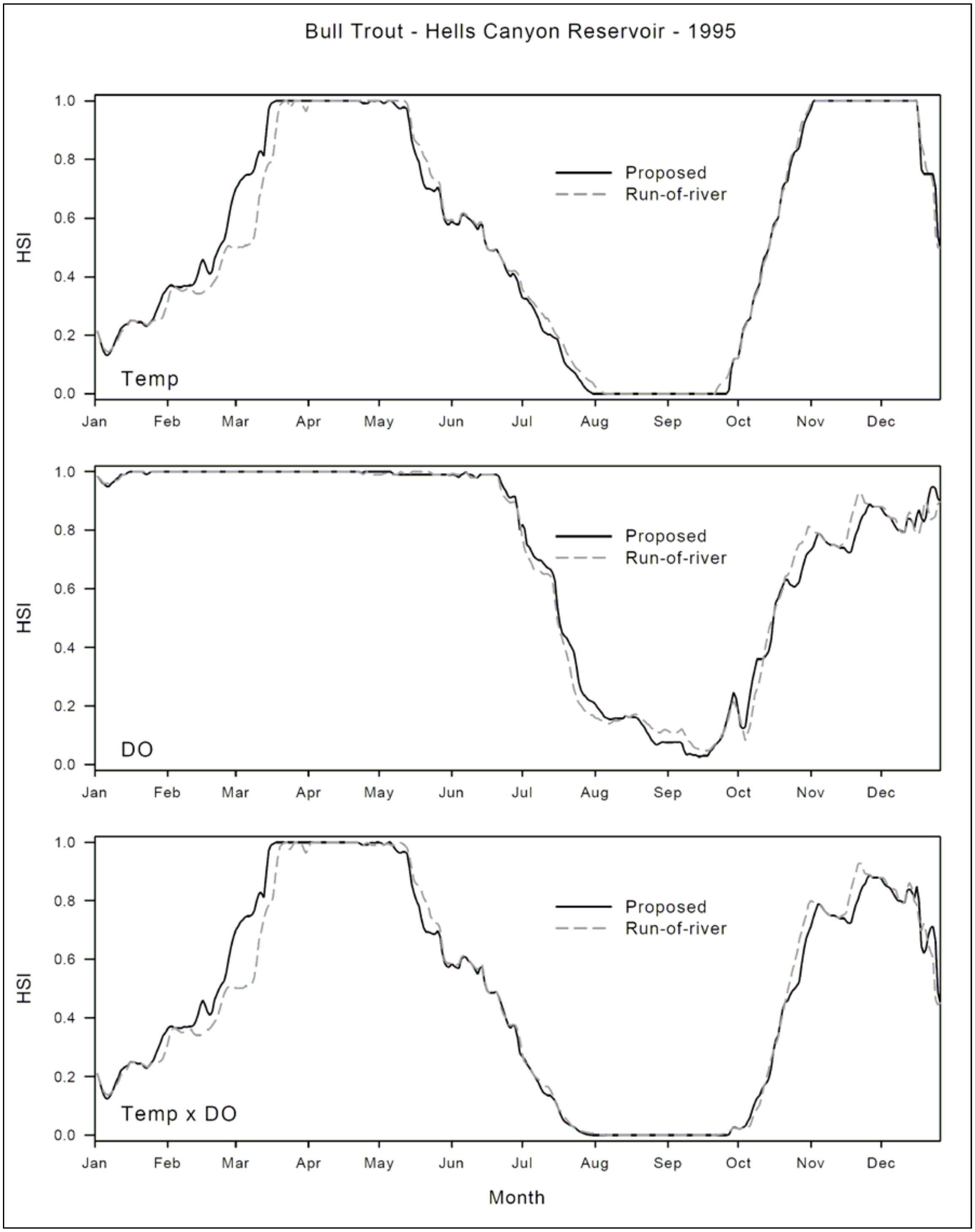


Figure 44. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Hells Canyon reservoir during a medium flow hydrologic year (1995) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

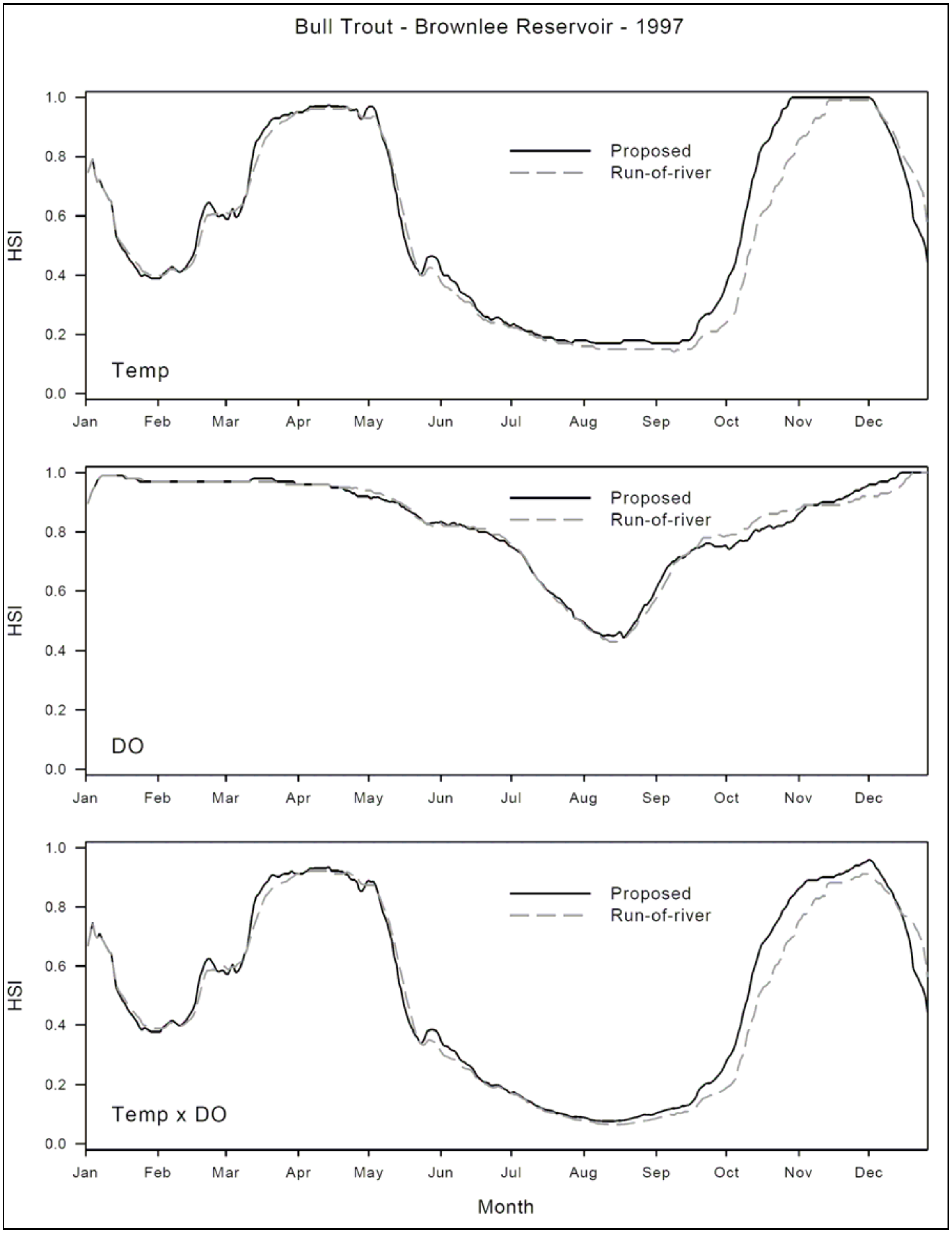


Figure 45. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Brownlee reservoir during an extreme high flow hydrologic year (1997) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

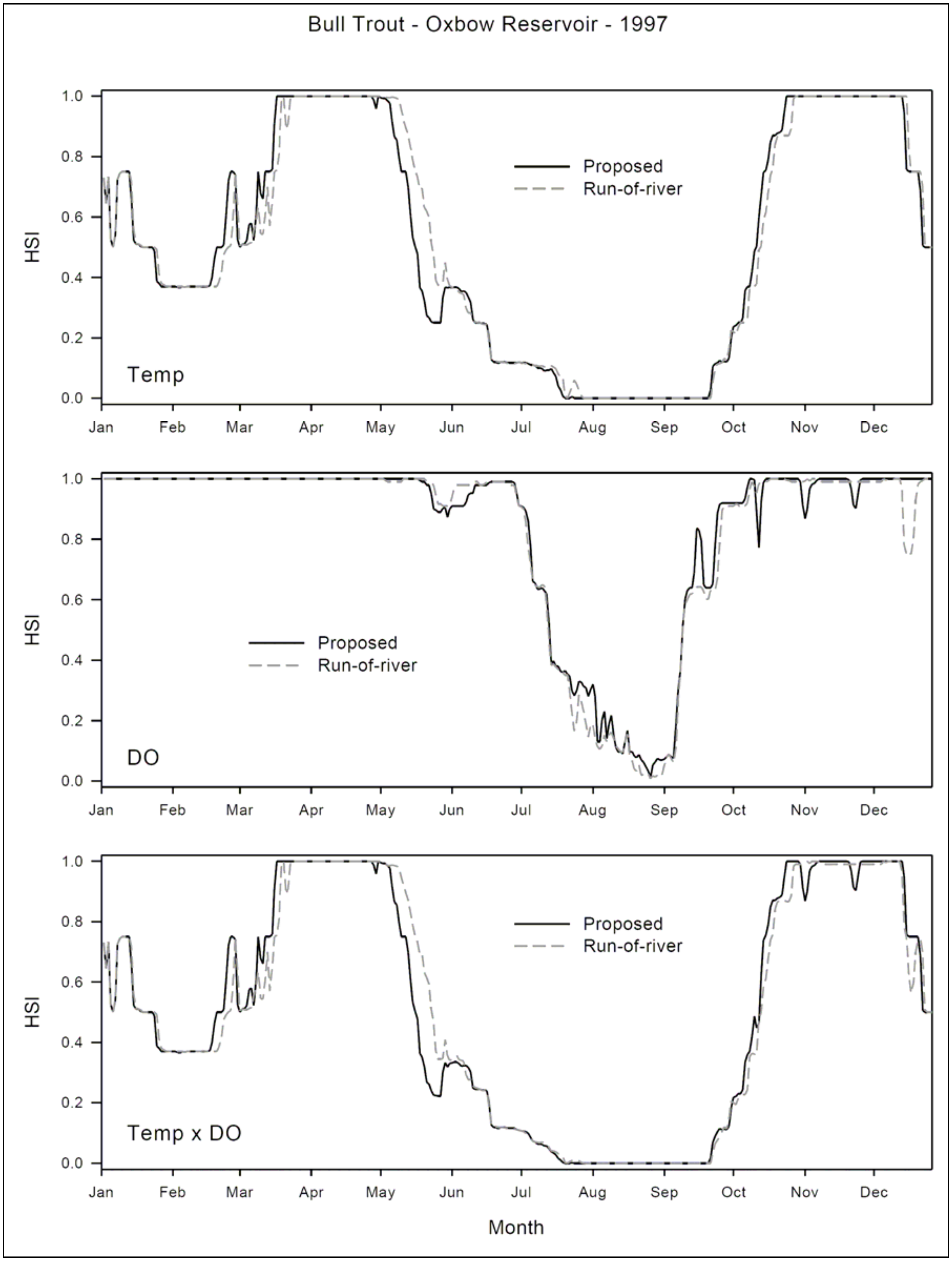


Figure 46. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Oxbow reservoir during an extreme high flow hydrologic year (1997) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

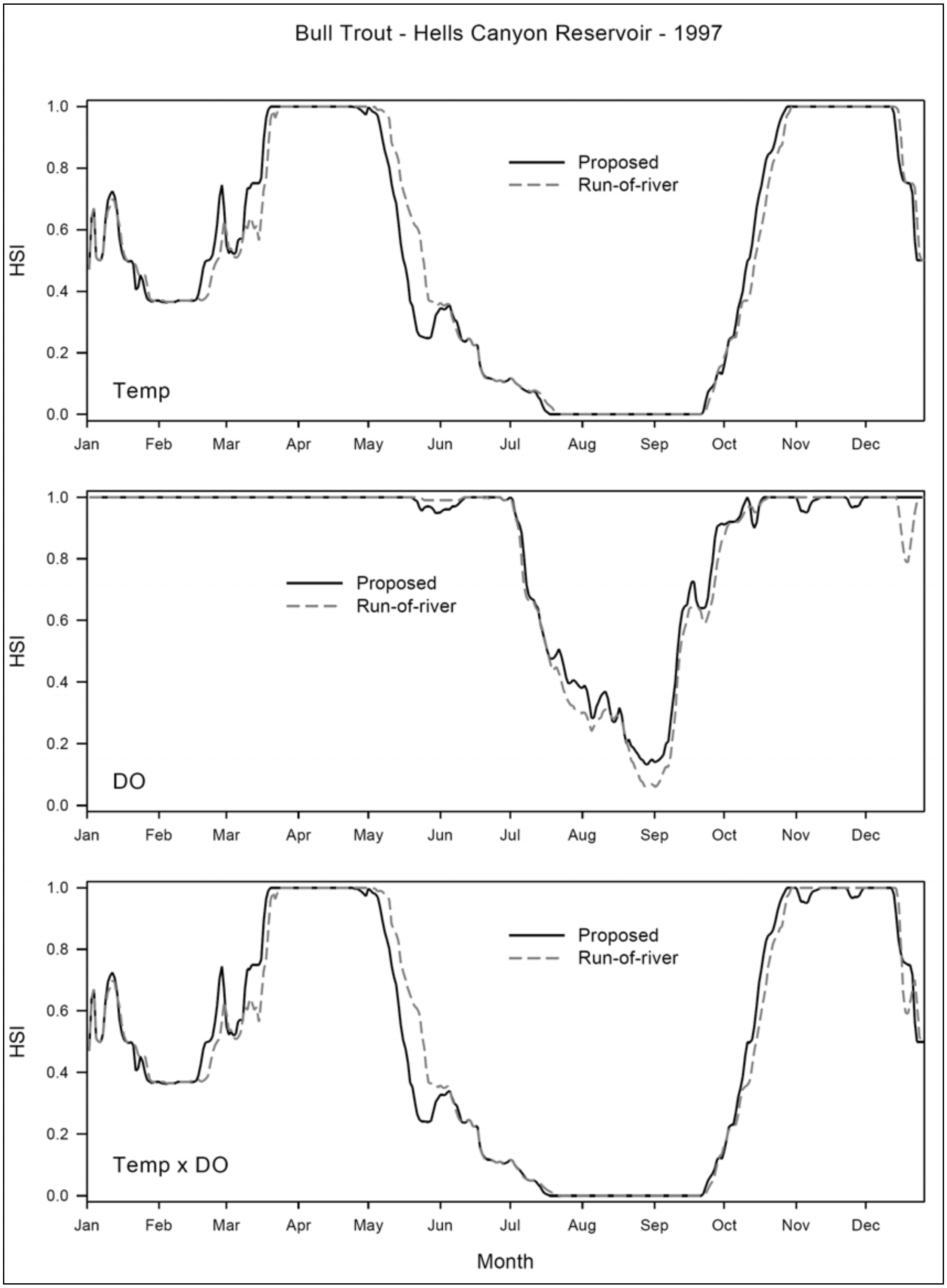


Figure 47. Time series of bull trout habitat suitability indices for temperature, dissolved oxygen and a composite score for temperature and dissolved oxygen at Hells Canyon reservoir during an extreme high flow hydrologic year (1997) and two operational scenarios (proposed and run-of-river full pool). (Source: Chandler, 2004)

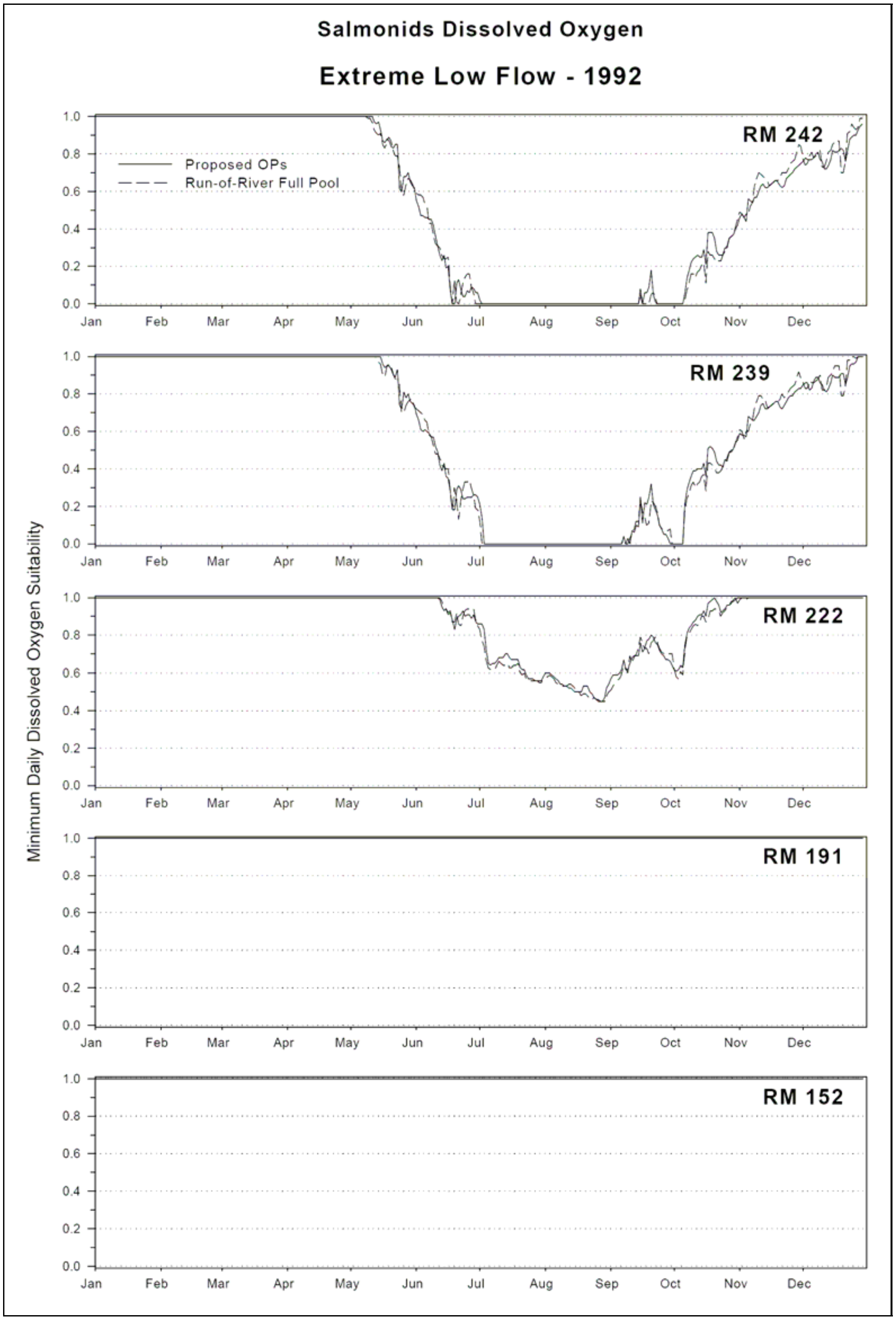


Figure 48. Dissolved oxygen suitability for all salmonids during the extreme low flow year of 1992 modeled under proposed operations and run-of-river full pool operations. Suitability time series are shown for RM 242 (near Hells Canyon dam), RM 239 (below Granite Rapids), RM 222, (near Salt Creek), RM 191 (above Salmon River), and RM 152 (near Asotin) of the Hells Canyon reach. (Source: Chandler, 2004)

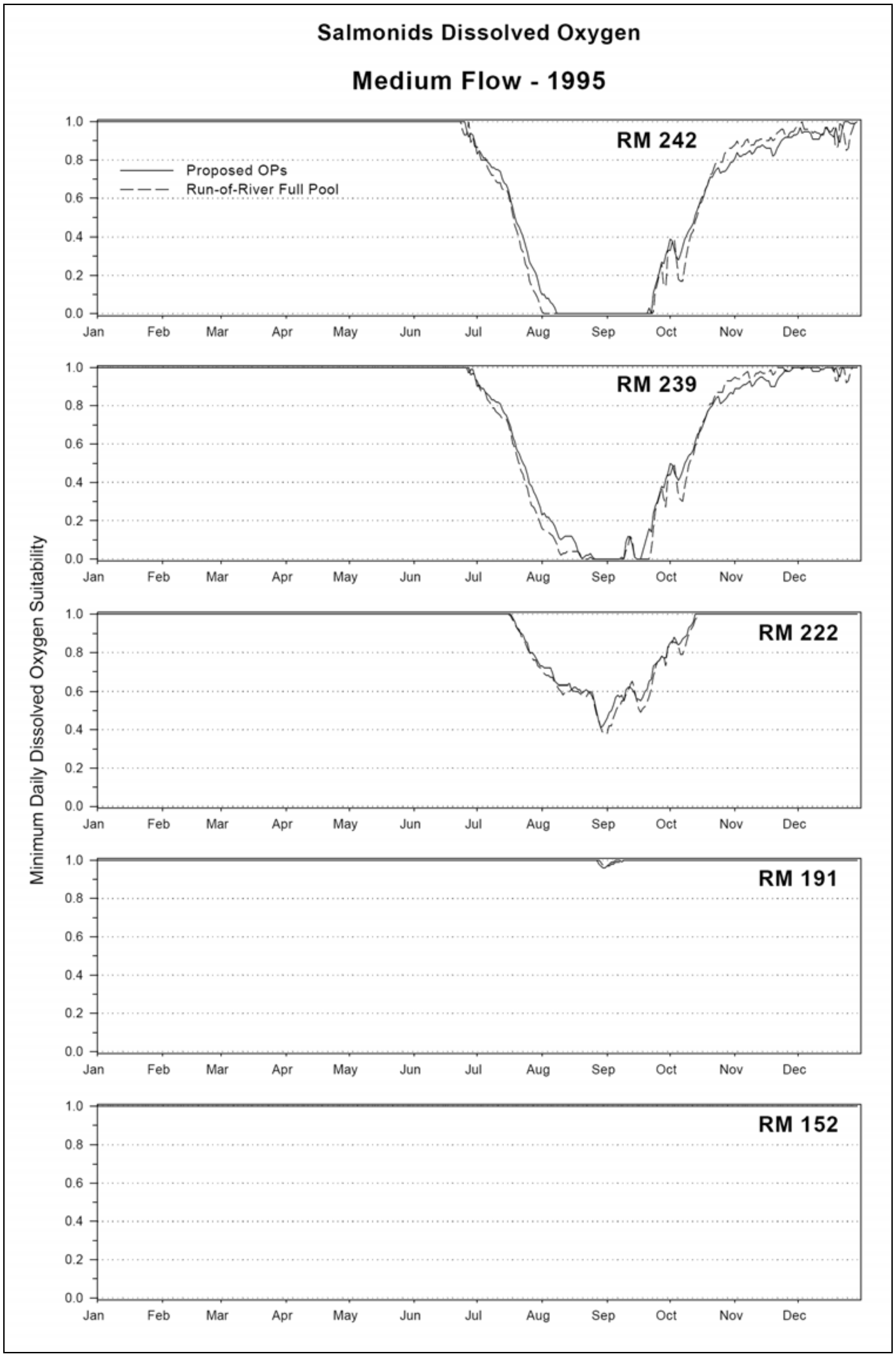


Figure 49. Dissolved oxygen suitability for all salmonids during the medium flow year of 1995 modeled under proposed operations and run-of-river full pool operations. Suitability time series are shown for RM 242 (near Hells Canyon dam), RM 239 (below Granite Rapids), RM 222, (near Salt Creek), RM 191 (above Salmon River), and RM 152 (near Asotin) of the Hells Canyon reach. (Source: Chandler, 2004)

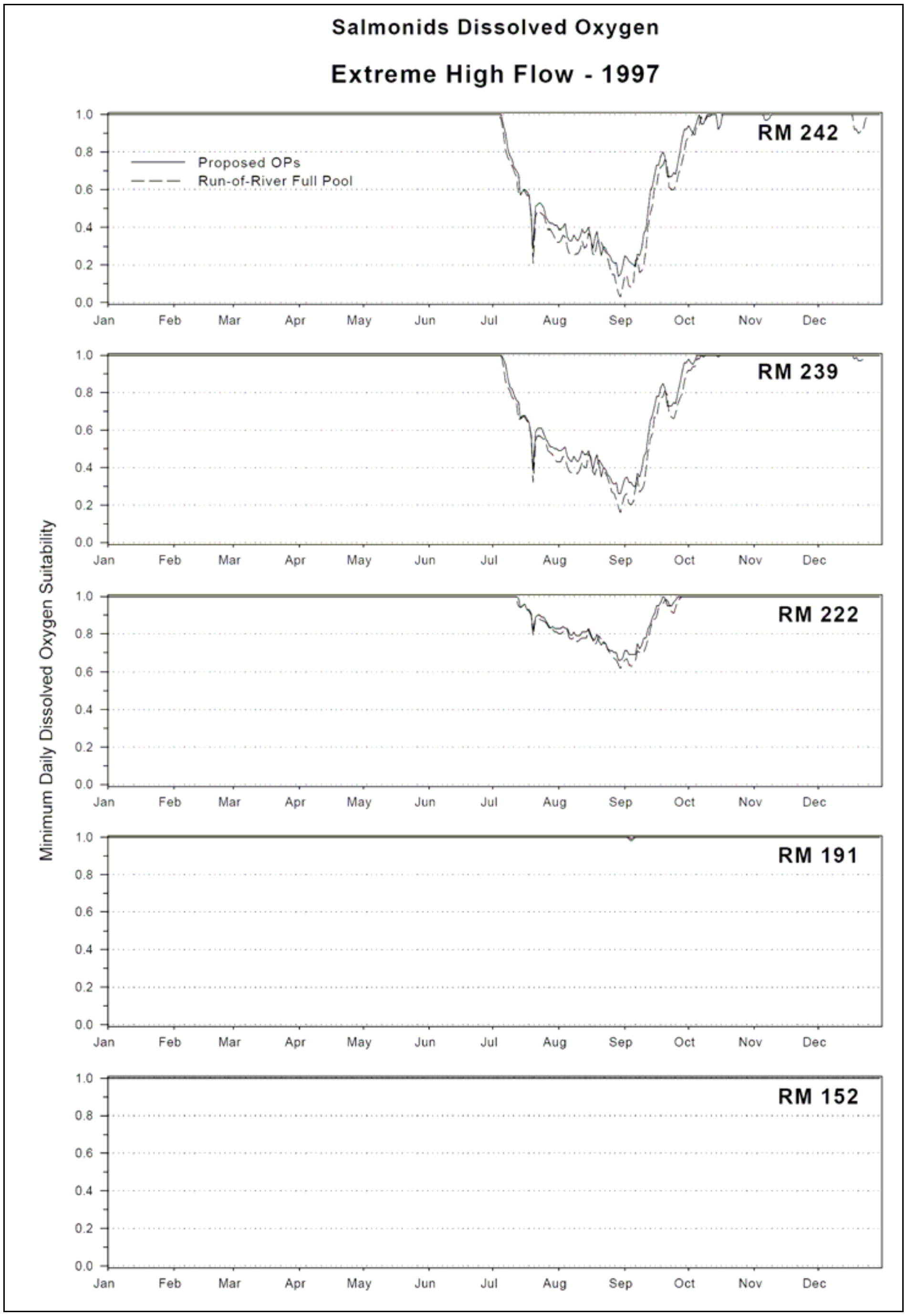


Figure 50. Dissolved oxygen suitability for all salmonids during the extreme high flow year of 1997 modeled under proposed operations and run-of-river full pool operations. Suitability time series are shown for RM 242 (near Hells Canyon dam), RM 239 (below Granite Rapids), RM 222, (near Salt Creek), RM 191 (above Salmon River), and RM 152 (near Asotin) of the Hells Canyon reach. (Source: Chandler, 2004)

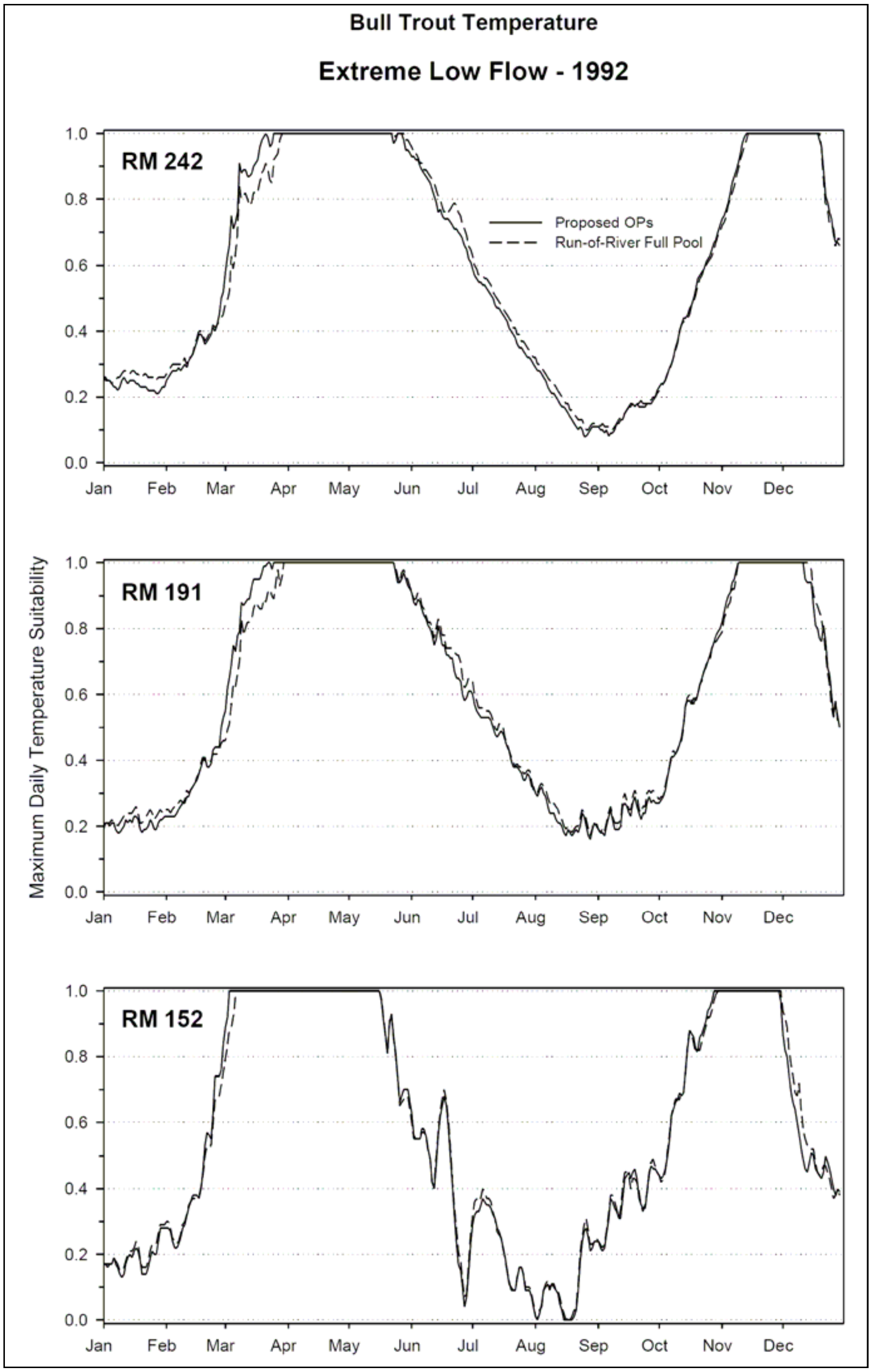


Figure 51. Time series of temperature suitability for bull trout during the extreme low flow year of 1992 modeled under proposed operations and run-of-river full pool operations. Suitability times series are shown for RM 242 (near Hells Canyon dam) RM 191 (above Salmon River), and RM 152 (near Asotin) of the Hells Canyon reach. (Source: Chandler, 2004)

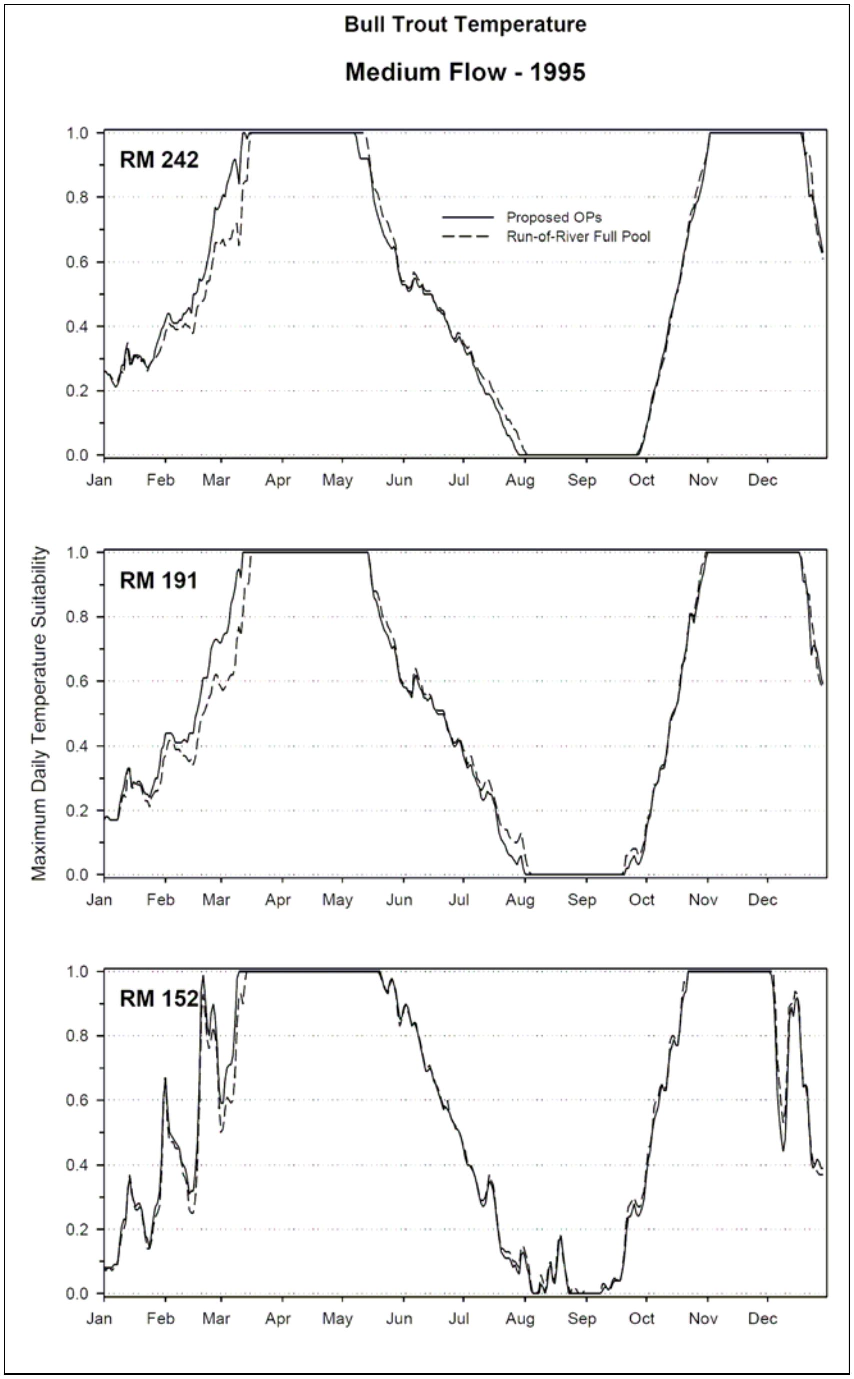


Figure 52. Time series of temperature suitability for bull trout during the medium flow year of 1995 modeled under proposed operations and run-of-river full pool operations. Suitability times series are shown for RM 242 (near Hells Canyon dam) RM 191 (above Salmon River), and RM 152 (near Asotin) of the Hells Canyon reach. (Source: Chandler, 2004)

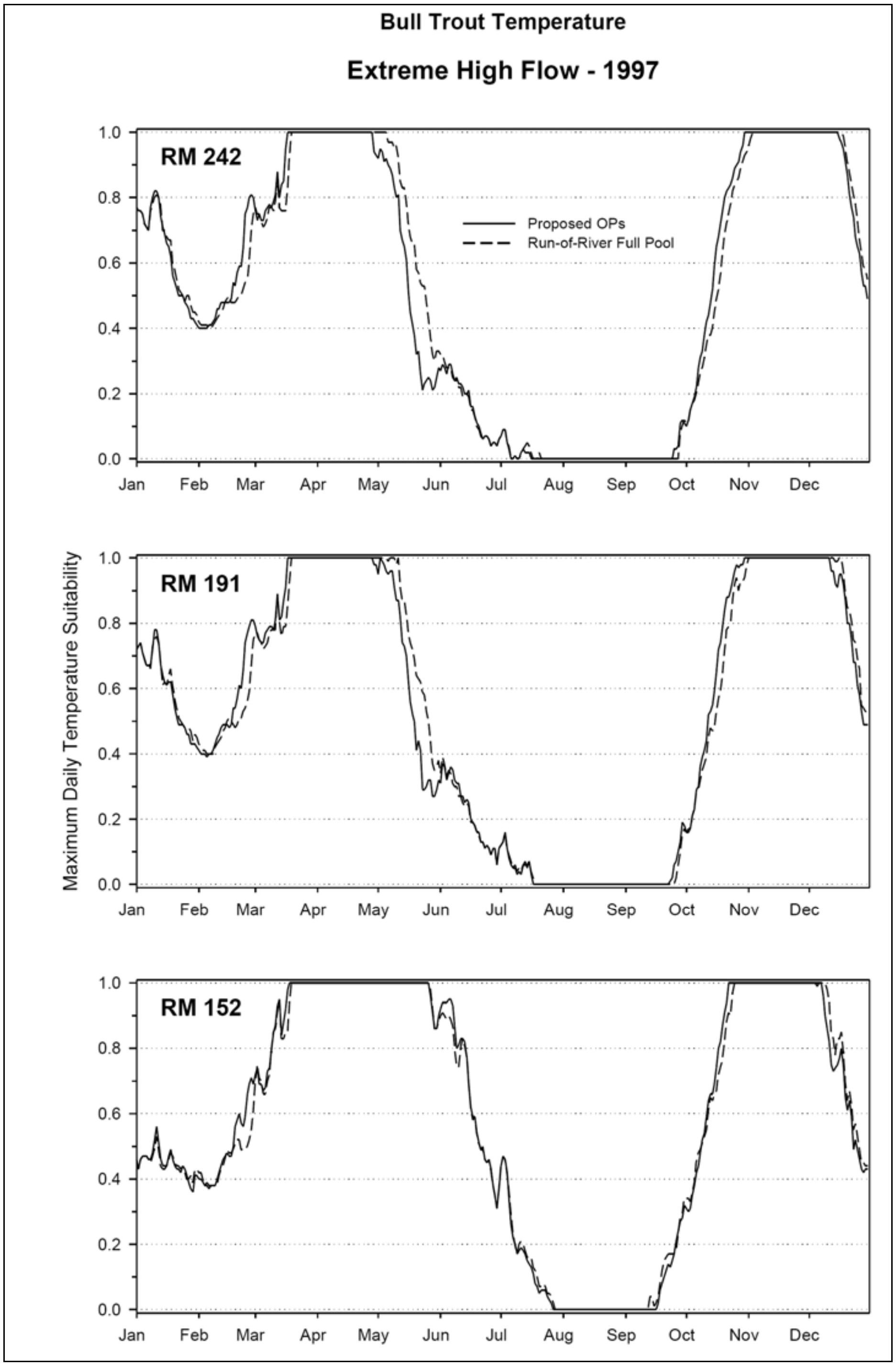


Figure 53. Dissolved oxygen suitability for all salmonids during the extreme high flow year of 1997 modeled under proposed operations and Run-of River Full Pool operations. Suitability time series are shown for RM 242 (near Hells Canyon dam), RM 239 (below Granite Rapids), RM 222, (near Salt Creek), RM 191 (above Salmon River), and RM 152 (near Asotin) of the Hells Canyon reach. (Source: Chandler, 2004)

Radio-telemetry and outmigrant trapping studies that Idaho Power conducted indicated that some bull trout in Indian and Pine creeks continue to exhibit a fluvial life history (Chandler et al., 2003a). The fluvial form appears to be less prevalent in the Wildhorse River, where only a single hybridized bull trout was collected during outmigrant trapping conducted in the fall of 2001. Electrofishing and radio-telemetry data indicate that bull trout used the Oxbow bypassed reach and Hells Canyon reservoir primarily during the late fall and winter, and migrated to tributaries between April and early June, presumably to oversummer and then spawn in the fall. Radio-tagged bull trout downstream of Hells Canyon dam exhibited classic fluvial behavior during both years of study, with many making spring migratory movements downstream to the Imnaha River after wintering in the Snake River. However, two bull trout tagged at the Sheep Creek trap moved into the Snake River and remained in the mainstem near the Sheep Creek confluence through the month of August. More detailed information on the habitat use and the status of bull trout populations in the project area can be found in Chandler et al. (2003d) and Chandler et al. (2003a), respectively.

Radio telemetry studies conducted by Chandler et al. (2003a) also provide some insight into the potential for bull trout to suffer mortality from entrainment through the turbines at the Brownlee, Oxbow, and Hells Canyon developments. Idaho Power used radio-tagged fish to monitor the movement of six bull trout within the project area upstream of Hells Canyon dam, including three bull trout collected within the Oxbow bypassed reach, two bull trout collected in the outmigrant trap on Indian Creek, and one captured in Hells Canyon reservoir just upstream of Hells Canyon dam. The movement of these fish was monitored for an average of 167.3 days (range: 37 to 285 days). None of the fish were detected downstream of Hells Canyon dam, indicating that the potential for entrainment mortality of bull trout that use Hells Canyon reservoir may be relatively limited.

Although no bull trout were radio-tagged and released upstream of Brownlee or Oxbow dams, some inference on entrainment potential is possible from the movements of radio-tagged redband trout that were tagged and released in all three reservoirs. A total of 27 radio-tagged redband trout were released upstream of Brownlee dam (captured in the Brownlee creek weir), 37 redband trout were released in the Oxbow reservoir (collected in the Wildhorse River weir and in Oxbow reservoir), and 68 redband trout were released between Hells Canyon and Oxbow dams (collected in the Indian Creek weir, the Oxbow bypassed reach or in Hells Canyon reservoir). A total of seven (5.3 percent) of these fish were subsequently detected in a downstream reservoir or river reach. Four fish released into Oxbow reservoir were later detected in the Oxbow bypassed reach, and three fish released into Hells Canyon reservoir were later detected downstream of Hells Canyon dam. All of these movements occurred during periods when the respective projects were spilling water, indicating that the fish most likely passed over the project spillways and were not entrained through the project powerhouses.

3.6.1.5 White Sturgeon

The white sturgeon (*Acipenser transmontanus*) is a large, long-lived, late-maturing fish that historically migrated between estuaries along the Pacific coast and large river systems, including the Fraser, Columbia, San Joaquin, and Sacramento rivers. Although white sturgeon may use the marine environment, they do not require access to salt water to complete their life cycle (PSMFC, 1992). White sturgeon inhabit 615 miles of the Snake River downstream of Shoshone Falls, and at least two of its major tributaries, the Salmon and Clearwater rivers. The white sturgeon is classified as a species of special concern by the state of Idaho.

Within the Snake River, some river segments have healthy, reproducing populations of white sturgeon, while others have no detectable recruitment. Many factors have contributed to the sturgeon's current status, including altered habitat, pollution, historical exploitation, and populations fragmented by dams. Snake River sturgeon populations in Idaho began declining as early as the late 1930s (Idaho Power, 2003b). At that time, three dams had been built on the Snake River downstream of Shoshone Falls (Swan Falls, Lower Salmon Falls, and Upper Salmon Falls). Overharvest was believed to be the primary factor responsible for the decline, so fishing regulations were implemented beginning in 1943. Nine additional dams were constructed on the Snake River downstream of Shoshone Falls between the late 1940s and the mid-1970s, and these dams further divided the river habitat into smaller segments, several of which lacked free-flowing river habitat. With the exception of a small harvest fishery by the Nez Perce tribe, sturgeon in the Snake River have been managed as a catch-and-release fishery since 1972 (Idaho Power, 2003b).

Between 1991 and 2001, Idaho Power conducted extensive field studies to evaluate the population status and limiting factors affecting white sturgeon populations in a 427-mile-long reach of the Snake River extending from Shoshone Falls downstream to the confluence with the Salmon River. Studies of populations upstream of Swan Falls dam were completed as part of the pre-filing studies for four Idaho Power projects[63] located between Shoshone Falls and Swan Falls dam,[64] and studies of populations between Swan Falls dam and the Salmon River were conducted as part of the pre-filing studies associated with the Hells Canyon Project.

Idaho Power conducted more than 100,000 hours of sampling effort, primarily using setlines, to determine the status of sturgeon populations in each of nine inter-dam river segments extending from Shoshone Falls to Lower Granite dam. The number of sturgeon captured was sufficient to estimate the size of sturgeon populations in five out of the nine reaches (table 31). Of the nine populations that were studied, only the Bliss-C.J. Strike and Hells Canyon-Lower Granite reaches exhibited a balanced population structure indicative of a self-sustaining population with significant recruitment. Although sturgeon more than 70 cm long were relatively abundant in the Shoshone Falls-Upper Salmon Falls reach, 95 percent of the fish sampled in this reach were judged to be of hatchery origin.[65] Similarly, large sturgeon were relatively abundant in the C.J. Strike-Swan Falls reach, but few juvenile sturgeon were found, suggesting that the population in the C.J. Strike-Swan Falls reach may be supported primarily by the downstream movement of sturgeon produced in the Bliss-C.J. Strike reach. Idaho Power (2003b) estimated that approximately 2 percent of the population in the Bliss-C.J. Strike reach migrated downstream each year.

Table 31. Abundance estimates for white sturgeon populations in Snake River reaches from Shoshone Falls to Lower Granite dam. (Source: Idaho Power, 2003b)

Reach	Year	Number of Fish Sampled[a]	Population Estimate (95% Confidence Interval)	Density[b] (fish/km)
Shoshone Falls–Upper Salmon Falls	2001	224	777 > 70 cm (574–1,201)[c]	18
	1980–1981	14	--	<6
Upper Salmon Falls–Lower Salmon Falls	1980–1981	0	--	--
Lower Salmon Falls–Bliss	1993	38	--	--
	1980–1981	11	--	--

63 The four upstream projects are Upper Salmon Falls (Project No. 2777), Lower Salmon Falls (Project No. 2061), Bliss (Project No. 1975), and C.J. Strike (Project No. 2055).

64 We include information on the upstream populations to support our analysis of cumulative effects on white sturgeon, and of measures proposed in Idaho Power's Snake River White Sturgeon Conservation Plan.

65 Idaho Power (2003b) reports that IDFG and the Nez Perce Tribe stocked 1,208 juvenile white sturgeon in the Shoshone Falls-Upper Salmon Falls reach and 1,774 juvenile sturgeon upstream of Shoshone Falls between 1989 and 1997.

Reach	Year	Number of Fish Sampled[a]	Population Estimate (95% Confidence Interval)	Density[b] (fish/km)
Bliss–C.J. Strike	2000	128	--	--
	1991–1993	669	2,662 > 80 cm (1,938–4,445)	30
	1979–1981	905	2,192 (1,479–4,276)	25
C.J. Strike–Swan Falls	2001	138	--	--
	1994–1996	330	726 > 90 cm (473–1,565)	17
Swan Falls–Brownlee	1996–1997	42	155 > 70 cm (70–621)[d]	7[d]
Brownlee–Oxbow	1998	0	--	--
Oxbow–Hells Canyon	1998	4	--	--
	1992	7	--	--
Hells Canyon–Lower Granite	1997–2000[e]	1,423	3,625 > 70 cm (3,050–4,536)	17
	1982–1984	331	3,955	23
	1972–1975	881	8,200–12,250	--

Notes: cm – centimeter
km – kilometer

[a] Not including recaptures.

[b] Density based on preliminary estimates of kilometers of usable habitat.

[c] 95% artificially propagated fish.

[d] Represents the segment of river from Swan Falls dam (RM 458) to Walters Ferry (RM 444).

[e] Population data combined from the 1997–2000 Idaho Power and Nez Perce Tribe sturgeon surveys.

In the vicinity of the Hells Canyon Project, the reach downstream of Hells Canyon dam supports the only substantial, self-sustaining population of white sturgeon. Although previous studies of this reach produced higher population estimates than Idaho Power's surveys (table 31), these previous surveys used dissimilar gear and sampling protocols and cannot be accurately compared. All three stock assessments have indicated positive and consistent recruitment trends, with juveniles dominating the population. Idaho Power's survey indicates that the abundance of larger fish has responded positively to implementation of catch-and-release regulations in 1972.

The reach between Swan Falls and Brownlee dams appears to be of sufficient length and includes the types of habitat that are needed to support white sturgeon spawning, recruitment, and rearing, but there are indications that sturgeon production in this reach may be water quality limited. These indications include a documented kill of at least 28 adult sturgeon in 1990, which was associated with high water temperatures and extremely low DO conditions in the upstream end of Brownlee reservoir (Idaho Power, 2003b). Sturgeon populations in the segments between Brownlee and Oxbow dams and between Oxbow and Hells Canyon dams appear to be limited by a lack of spawning habitat, and these reaches may not be of sufficient length to retain larvae during the drift phase that occurs shortly after hatching.

3.6.1.6 Reservoir Fisheries

Idaho Power conducted a series of electrofishing and angler surveys to assess the status of fisheries in the project reservoirs and in the Snake River upstream of Brownlee reservoir. Electrofishing surveys involved sampling six randomly selected 100-meter lengths of shoreline during the spring and fall in each reservoir and in the Snake River upstream of Brownlee reservoir. Sampling was conducted between 1991 and 2000. Brownlee reservoir was sampled in all 10 years, and both Oxbow and Hells Canyon reservoirs were sampled annually from 1993 through 2000. The reach above Brownlee reservoir was sampled in 1995, 1996, 1997, and 2000. Fish population sampling was not conducted downstream of Hells Canyon dam to avoid the potential for injuring ESA-listed species in this reach.

Surveyors collected a total of 31 species during the electrofishing surveys, including 14 native and 17 non-native species (table 32). In all three of the reservoirs, smallmouth bass, white crappie and black crappie showed the highest average catch per unit effort (figure 54). Smallmouth bass showed the highest average catch per unit effort in Brownlee reservoir, while white crappie had the highest catch per unit effort in Oxbow and Hells Canyon reservoirs. Upstream of Brownlee reservoir, smallmouth bass had the highest average catch per unit effort, followed by largescale sucker and common carp.

Idaho Power conducted annual creel surveys in all three project reservoirs from 1994 through 1998, and again in 2000. The estimated average annual angler effort expended in each reservoir, as well as the estimated annual average catch and harvest by species, is given in table 33. On average, anglers spent an estimated 459,654 hours each year fishing in Brownlee reservoir, 71,145 hours fishing in Oxbow reservoir, and 85,907 hours fishing in Hells Canyon reservoir.

Crappie and bass were the most commonly caught species in all three reservoirs. The total estimated catch of bass averaged 528,548 fish annually, of which 391,341 fish were caught in Brownlee reservoir. The total estimated catch of crappie averaged 375,929 fish annually, about half of which were caught in Brownlee reservoir. Crappie comprised about half of the harvest in all three reservoirs, with an estimated average annual harvest of 173,024 fish. Catfish had the next highest harvest, with an estimated average harvest of 97,106 fish per year, of which an average of 77,173 fish were harvested from Brownlee reservoir. Among anglers interviewed, catfish was the primary target for 83 percent of the anglers in the upstream half of Brownlee reservoir, 31.7 percent of anglers in lower Brownlee reservoir, 29.6 percent of anglers in Oxbow reservoir, and 25.8 percent of the anglers in Hells Canyon reservoir (Brown, 2003a). Crappie were identified as the primary target of 5, 22.8, 27.5, and 28 percent of the anglers in upper and lower Brownlee, Oxbow, and Hells Canyon reservoirs, respectively.

3.6.1.7 Hells Canyon Riverine Fishery

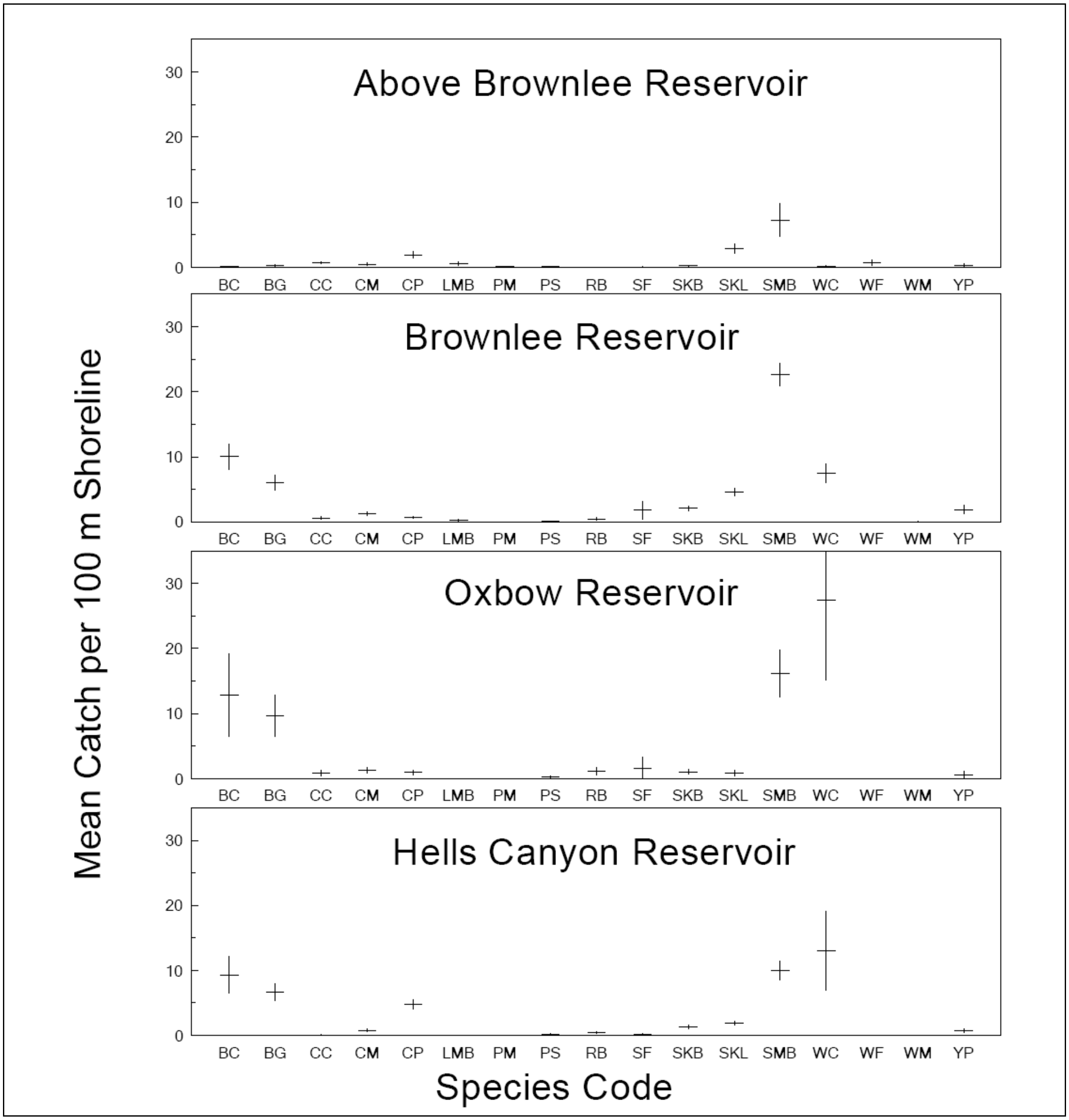
Idaho Power estimated that boat anglers that accessed the Hells Canyon reach from the three most heavily used boat ramps (Cache Creek, Hells Canyon Creek, and Pittsburg Landing) spent 183,000 hours angling in the Hells Canyon reach in 1994 (Brown, 2003b). The types of fish that were most commonly targeted by anglers fishing in the Hells Canyon reach were bass, which were mentioned as a target by 56 percent of the anglers surveyed, followed by trout (45 percent), steelhead (36 percent), white sturgeon (27 percent), “anything” (18 percent), catfish (11 percent) and crappie (4 percent). Anglers that accessed the Snake River at Hells Canyon dam, who primarily fished from the bank, spent an average of 15,356 hours angling each year between 1994 and 1997. The majority (65.9 percent) of the anglers that accessed the river from Hells Canyon dam targeted steelhead. The estimated catch of steelhead from this access point was 532 fish in 1995, 104 fish in 1996, and 1,021 fish in 1997 (Brown, 2003a).

Although Idaho Power did not provide an estimate of the number of steelhead caught by anglers that accessed the Hells Canyon reach from the three downstream boat ramps, they reported that 51,614 hours of fishing effort were directed at steelhead during 1999. Based on the angler effort, catch, and harvest rates presented in Brown (2003b), we estimate that anglers that accessed the Snake River from the Cache Creek, Hells Canyon Creek, and Pittsburg Landing boat ramps in 1999 caught approximately 10,000 steelhead, of which approximately 4,200 fish were harvested.

Table 32. Fish sampled in project reservoirs listed by species code, common and scientific names, and native or nonnative status. (Source: Richter and Chandler, 2003)

Code[a]	**Common Name**	**Scientific Name**	**Status in Snake River**
BK	Banded killifish	*Fundulus diaphanus*	Nonnative
BC	Black crappie	*Pomoxis negromacularus*	Nonnative
BLC	Blue catfish	*Ictalurus furcatus*	Nonnative
BG	Bluegill	*Lepomis macrochirus*	Nonnative
EB	Brook trout	*Salvelinus fontinalis*	Nonnative
BHB	Brown bullhead	*Ictalurus nebulosus*	Nonnative
CC	Channel catfish	*Ictalurus punctatus*	Nonnative
CM	Chiselmouth	*Acrochelius alutaceus*	Native
CO	Coho salmon	*Oncorhynchus kisutch*	Native
CP	Common carp	*Cyprinus carpio*	Nonnative
DB	Bull trout	*Salvelinus confluentus*	Native
DS	Dace spp.	*Rhinichthys* spp.	Native
FHC	Flathead catfish	*Pylodictis olivaris*	Nonnative
LMB	Largemouth bass	*Micropterus salmoides*	Nonnative
MFH	Fathead minnow	*Pimephales promelas*	Nonnative
MS	Mottled sculpin	*Cottus bairdi*	Native
MT	Tadpole madtom	*Noturus gyrinus*	Nonnative
PM	Peamouth	*Mylocheilus caurinus*	Native
PS	Pumkinseed	*Lepomis gibbosus*	Nonnative
RB	Rainbow trout	*Oncorhynchus mykiss*	Native
SF	Northern pikeminnow	*Ptychocheilus oregonensis*	Native
SKB	Bridgelip sucker	*Catostomus columbianus*	Native
SKL	Largescale sucker	*Catostomus macrocheilus*	Native
SMB	Smallmouth bass	*Micropterus dolomieui*	Nonnative
TC	Tui chub	*Gila bicolor*	Native
WC	White crappie	*Pomoxis annularis*	Nonnative
WF	Mountain whitefish	*Prosopium williamsoni*	Native
WM	Warmouth	*Lepomis gulosus*	Nonnative
UC	Utah chub	*Gila atraria*	Native
CL	Oriental weatherfish	*Misgurnus anguillicaudatus*	Nonnative
YP	Yellow perch	*Perca flavescens*	Nonnative

[a] These species codes are used in figure 54.



Note: See table 32 for scientific and common names for each species code.

Figure 54. Mean catch per unit effort for all years combined and selected species. (Source: Richter and Chandler, 2003)

Table 33. Estimated average annual angling effort, catch and harvest rates by species for 1994 through 1998, and 2000. (Source: Brown, 2003a, as modified by staff)

Location	Effort (hours)	Average Catch: Bass	Bluegill	Catfish	Crappie	Yellow Perch	Trout	Total Catch
Brownlee Total	459,654	391,341	18,022	97,683	189,503	19,610	1,480	716,159
Upper Brownlee	194,429	28,913	137	68,535	15,496	1,868	102	114,949
Lower Brownlee	265,225	362,428	17,885	29,149	174,007	17,742	1,378	601,210
Oxbow	71,145	80,681	3,484	13,034	65,950	3,516	4,092	166,664
Hells Canyon	85,907	56,526	14,460	19,641	120,476	17,639	2,536	228,741
	616,706	528,548	35,965	130,359	375,929	40,764	8,108	1,111,564

Location	% of Effort	Percentage of Total Catch: Bass	Bluegill	Catfish	Crappie	Yellow Perch	Trout	Total Catch (%)
Brownlee Total	74.5	54.6	2.5	13.6	26.5	2.7	0.2	100.0
Upper Brownlee	31.5	25.2	0.1	59.6	13.5	1.6	0.1	100.0
Lower Brownlee	43.0	60.3	3.0	4.8	28.9	3.0	0.2	100.0
Oxbow	11.5	48.4	2.1	7.8	39.6	2.1	2.5	100.0
Hells Canyon	13.9	24.7	6.3	8.6	52.7	7.7	1.1	100.0
	100.0	47.5	3.2	11.7	33.8	3.7	0.7	100.0

Location	Effort (hours)	Average Harvest: Bass	Bluegill	Catfish	Crappie	Yellow Perch	Trout	Total Harvest
Brownlee Total	459,654	24,060	13,024	77,173	96,729	7,181	1,138	218,167
Upper Brownlee	194,429	3,059	94	55,696	10,217	199	59	69,264
Lower Brownlee	265,225	21,001	12,931	21,477	86,512	6,982	1,079	148,902
Oxbow	71,145	2,147	2,196	7,647	27,543	1,522	1,818	41,056
Hells Canyon	85,907	3,660	9,976	12,285	48,752	12,471	1,345	87,143
	616,706	29,866	25,197	97,106	173,024	21,174	4,301	346,366

Location	% of Effort	Percentage of Total Harvest: Bass	Bluegill	Catfish	Crappie	Yellow Perch	Trout	Total Catch (%)
Brownlee Total	74.5	11.0	6.0	35.4	44.3	3.3	0.5	100.0
Upper Brownlee	31.5	4.4	0.1	80.4	14.8	0.3	0.1	100.0
Lower Brownlee	43.0	14.1	8.7	14.4	58.1	4.7	0.7	100.0
Oxbow	11.5	5.2	5.3	18.6	67.1	3.7	4.4	100.0
Hells Canyon	13.9	4.2	11.4	14.1	55.9	14.3	1.5	100.0
	100.0	8.6	7.3	28.0	50.0	6.1	1.2	100.0

3.6.1.8 Hatchery Operations

The management plans created by the fishery co-managers identified in the treaty fishing rights case *United States v Oregon* (NPCC, 2004) includes hatchery production programs for the upper Columbia sub-basins. The parties to *United States v Oregon* include the Yakama Nation, and the Warm Springs, Umatilla, and Nez Perce tribes, as well as NMFS, FWS, and the states of Oregon, Washington, and Idaho. The Shoshone-Bannock Tribes is admitted as a party for purposes of production and harvest in the upper Snake River only. These parties jointly develop harvest sharing and hatchery management plans that are entered as orders of the court, which are binding on the parties.

Idaho Power funds the operation of four hatcheries that produce steelhead and spring, summer and fall Chinook salmon. The hatchery system was constructed by Idaho Power between 1961 and 1967 to sustain anadromous fish runs after efforts to provide fish passage through the project were abandoned. The hatcheries were initially constructed to accommodate production levels based on the maximum counts of adult salmon and steelhead at Brownlee and Oxbow dams from 1957 to 1959. Production levels for the hatcheries were expanded in a 1980 settlement agreement between Idaho Power and the states of Idaho, Oregon, and Washington and NMFS. The 1980 Hells Canyon Settlement Agreement specifies the following annual smolt production targets: 1 million fall Chinook salmon, 4 million spring Chinook salmon, and 400,000 pounds of steelhead smolts. In 1985, IDFG modified the 4 million spring Chinook salmon target to 3 million spring Chinook salmon and 1 million summer Chinook salmon, in accordance with terms of the settlement agreement.

The four hatcheries are located on the mainstem of the Snake River upstream of Hells Canyon dam and on two tributaries in the Salmon River basin (figure 55). Adult fish are collected in traps located at Hells Canyon dam, on the Rapid River 1.5 miles downstream of the Rapid River fish hatchery, and at the lower Pahsimeroi hatchery facility. IDFG operates all four of the hatcheries.

The Hells Canyon upstream migrant fish trap is immediately downstream of Hells Canyon dam on the Oregon side of the Snake River. Hatchery-produced adult spring Chinook salmon and steelhead are captured at the trap and transported to the Oxbow fish hatchery. As a condition of the 1980 Hells Canyon Settlement Agreement, a floating barge trap is also maintained at Hells Canyon dam, which serves as a backup to the permanent trap and supplements the collection of adult spring Chinook salmon and steelhead. Since the permanent trap was constructed in 1983, the barge trap has not been used.

The Oxbow fish hatchery is located at the confluence of Pine Creek and Hells Canyon reservoir, just downstream of the Oxbow powerhouse. Spring Chinook salmon caught at the Hells Canyon trap are kept at the Oxbow fish hatchery temporarily, and then are transported to the Rapid River hatchery for spawning, incubation, and rearing. Adult steelhead are kept at the Oxbow fish hatchery until spawning. After spawning, half of the eggs are incubated through the fry stage and then are transferred to the Niagara fish hatchery for rearing. The other half of the inventory is transferred as eyed eggs.

The Rapid River hatchery is located approximately 3 miles upstream of the confluence of the Rapid and Little Salmon rivers. Spring Chinook salmon captured at the Rapid River and Hells Canyon fish traps are spawned at this hatchery, and the eggs are incubated and the fry reared to the smolt stage before they are released into the Rapid River and the Snake River downstream of Hells Canyon dam.

The Niagara Springs hatchery is used to rear steelhead to the smolt stage before they are released into the Snake River downstream of Hells Canyon dam, into the Pahsimeroi River near the Pahsimeroi fish hatchery, and into other streams as directed by IDFG.

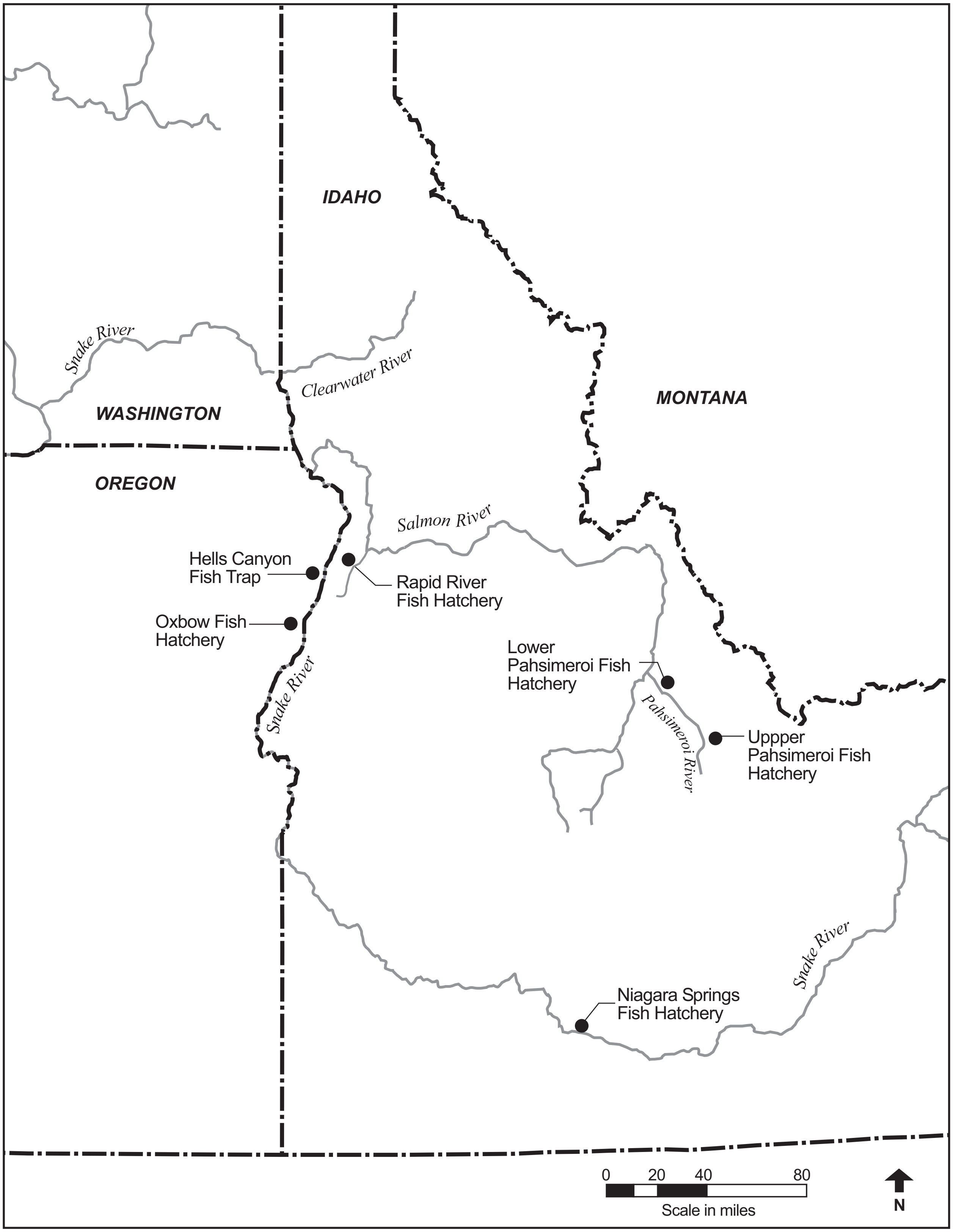


Figure 55. Location of Idaho Power hatchery facilities. (Source: Abbott and Stute, 2003)

The Pahsimeroi hatchery consists of two facilities located about 13 miles apart on the Pahsimeroi River. The hatchery has facilities to trap, spawn, and incubate steelhead and summer Chinook salmon. To limit the effects of whirling disease on fish reared at the hatchery, summer Chinook eggs produced there are incubated to the eyed stage on pathogen-free well water and then are transferred to IDFG's Sawtooth fish hatchery near Stanley, Idaho, for hatching and early rearing on well water. Summer Chinook salmon are then returned to the Pahsimeroi hatchery for final rearing before they are released into the Pahsimeroi River. The eggs from steelhead spawned at the Pahsimeroi hatchery are incubated at the Oxbow hatchery and reared at the Niagara Springs hatchery before they are released into the Pahsimeroi River at the lower facility, about 1 mile upstream of its confluence with the Salmon River.

Steelhead production from the Niagara Springs hatchery has generally been close to, and in some years, has exceeded the 400,000 pound production target specified in the 1980 Hells Canyon Settlement Agreement (table 34). From 1980 through 1999, the mean annual steelhead smolt production was 369,642 pounds or 1,819,621 fish (Abbott and Stute, 2003). During the early years of operation most of the steelhead smolts were released into the Pahsimeroi River, while in recent years almost half of the steelhead smolts have been stocked in the Snake River to improve the recreational steelhead fishery downstream of Hells Canyon dam.

Table 34. Distribution of steelhead smolts produced at Niagara Springs hatchery for brood years 1965 through 1999. (Source: Abbott and Stute, 2003)

Brood Year	Snake River[a]	Pahsimeroi River	Salmon River and Tributaries above the Middle Fork	Salmon River and Tributaries below the Middle Fork	Resident Stocking	Research	Total Number Produced	Total Pounds Produced
1966	616,913	1,292,402	72,440	0	0	0	1,981,755	153,552
1967	342,144	1,544,325	120,000	0	0	349,839	2,356,308	208,570
1968	109,200	1,665,117	0	0	0	0	1,774,317	184,186
1969	1,143,400	1,608,000	0	0	4,508	0	2,755,908	299,235
1970	670,960	1,630,002	0	0	208,069	0	2,509,031	204,803
1971	215,625	1,555,050	0	0	0	0	1,770,675	235,375
1972	848,700	1,543,349	2,159,964	0	0	4,171	4,556,184	163,839
1973	0	1,605,898	354,480	0	3,720	10,429	1,974,527	187,494
1974	0	1,331,280	0	0	0	536	1,331,816	166,640
1975	40,977	1,610,350	80,040	0	0	505	1,731,872	248,708
1976	126,000	1,448,681	0	0	0	1,622	1,576,303	251,835
1977	281,208	1,266,025	0	0	0	0	1,547,233	154,829
1978	344,944	1,372,454	0	0	0	100	1,717,498	244,887
1979	897,207	1,097,060	0	0	0	0	1,994,267	314,100
1980	612,760	862,494	0	0	0	0	1,475,254	316,330
1981	354,150	995,205	0	0	0	0	1,349,355	374,350
1982	92,750	496,140	546,250	0	0	0	1,135,140	181,150
1983	628,700	980,995	0	0	0	0	1,609,695	310,000
1984	952,912	878,530	394,651	0	61,100	0	2,287,193	313,450

Brood Year	Snake River[a]	Pahsimeroi River	Salmon River and Tributaries above the Middle Fork	Salmon River and Tributaries below the Middle Fork	Resident Stocking	Research	Total Number Produced	Total Pounds Produced
1985	1,150,015	614,038	246,440	0	0	0	2,010,493	339,885
1986	839,995	712,200	299,700	0	0	0	1,851,895	419,000
1987	1,281,400	665,800	206,300	0	0	0	2,153,500	405,515
1988	735,500	508,300	415,200	7,200	0	0	1,666,200	406,800
1989	947,200	501,600	401,800	655,700	0	0	2,506,300	476,170
1990	912,000	475,000	381,000	0	0	0	1,768,000	484,025
1991	660,964	504,300	0	282,300	0	0	1,447,564	305,286
1992	660,507	761,800	0	222,560	47,098	0	1,691,965	366,165
1993	609,115	379,948	334,941	214,092	0	0	1,538,096	350,101
1994	614,560	829,277	0	257,772	160,000	0	1,861,609	380,060
1995	630,152	799,220	0	304,123	157,600	0	1,891,095	352,750
1996	660,651	830,654	0	262,348	149,040	0	1,902,693	347,970
1997	653,276	801,541	0	199,007	0	0	1,653,824	361,745
1998	657,665	829,199	0	356,336	183,924	0	2,027,124	444,455
1999	601,907	830,316	0	372,312	760,889	0	2,565,424	457,626

[a] Includes fish stocked in Grande Ronde River (brood year 1966) and Clearwater River (brood year 1972).

The estimated adult contribution from steelhead produced at the Niagara Springs hatchery is shown in table 35. The average number of adult steelhead produced was estimated to be 12,552, and the top four categories of adult contribution were to Salmon River sport harvest (35 percent), Pahsimeroi hatchery rack (24 percent), Columbia River gillnet (21.3 percent) and Hells Canyon trap (11.9 percent). Abbott and Stute (2003) did not estimate the harvest of hatchery-produced steelhead in the Snake River upstream of the Salmon River. However, based on the angler effort and steelhead catch rates presented in Brown (2003b), anglers that accessed the Snake River from the Cache Creek, Hells Canyon Creek, and Pittsburg Landing boat ramps in 1999 caught approximately 10,000 steelhead, of which approximately 4,200 fish were harvested. Given the large number of smolts that are planted each year at Hells Canyon dam, it is likely that most of these steelhead were hatchery fish produced from the Niagara Springs hatchery.

Spring Chinook smolts are produced at the Rapid River (table 36) and Pahsimeroi hatcheries (table 37). Since 1992 when Pahsimeroi summer Chinook salmon were listed as threatened by NMFS, IDFG has operated the Pahsimeroi hatchery in a conservation mode aimed at species recovery. The combined production of spring and summer Chinook salmon at the Pahsimeroi and Rapid River hatcheries has averaged 2,892,649 smolts from 1981 through 1998, 72 percent of the production target of 4,000,000 smolts specified in the 1980 Hells Canyon Settlement Agreement. Summer Chinook salmon produced at the Pahsimeroi hatchery are released into the Pahsimeroi River. Most of the spring Chinook smolts have been released into the Rapid River, with a smaller number released into the Snake River downstream of Hells Canyon dam (table 36).

Table 35. Estimated adult contribution of steelhead produced at Niagara Springs hatchery from 1979 through 1998. (Source: Abbott and Stute, 2003)

Run Year	Coastal Gill Net	Columbia River Gill Net	Columbia River Sport	Commercial Seine	Estuary Sport	Foreign Research Vessel	Freshwater Sport	Hatchery Rack	Mixed Net and Seine	Ocean Sport	Ocean Trawl By-Catch	Ocean Troll	River Trap	Test Fishery Net	Treaty Ceremonial	Treaty Subsistence	Pahsimeroi Rack	Salmon River Harvest	Hells Canyon Rack	Snake River Harvest[a]	Run Year Total
1979	0	82	152	0	0	0	0	0	0	0	0	0	0	0	0	0	195	2,047	23	--	2,499
1980	0	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,620	1,634	339	--	3,669
1981	0	1,448	71	0	0	0	152	15	19	0	0	0	46	0	0	0	3,491	3,347	158	--	8,746
1982	0	1,045	383	0	0	0	122	0	57	0	0	0	30	0	0	0	3,092	4,401	205	--	9,335
1983	0	935	290	0	0	0	1,387	28	33	21	0	0	21	0	28	113	4,651	10,171	872	--	18,550
1984	0	6,148	692	76	0	0	2,211	669	17	0	0	0	34	57	54	1,078	13,776	15,120	1,116	--	41,049
1985	0	4,126	17	0	0	0	69	138	0	0	0	0	0	0	0	612	4,237	4,569	1,343	--	15,111
1986	0	8,447	798	39	0	10	615	42	83	0	10	14	0	0	0	397	3,905	6,779	2,438	--	23,578
1987	0	9,099	1,000	0	0	0	62	62	0	0	0	0	0	0	0	0	5,274	11,691	3,209	--	30,397
1988	0	3,553	16	0	0	16	112	0	67	0	0	0	0	0	0	41	1,521	3,187	2,524	--	11,036
1989	0	4,175	587	0	0	0	0	0	0	0	0	0	0	0	0	0	1,760	4,774	2,729	--	14,025
1990	0	3,439	324	33	0	0	322	33	136	0	0	0	0	0	0	0	1,974	4,091	2,728	--	13,081
1991	0	882	0	37	0	0	147	0	33	0	0	0	0	0	0	152	693	318	1,151	--	3,413
1992	0	606	66	0	0	28	84	74	0	0	0	0	0	0	0	79	1,688	970	1,714	--	5,310
1993	0	3,882	875	0	0	0	197	72	0	0	0	0	0	9	0	0	2,756	2,246	1,259	--	11,295
1994	0	2,706	725	0	16	0	239	36	0	0	0	0	0	54	0	0	814	693	1,403	--	6,686
1995	16	1,156	280	0	0	0	320	226	33	0	0	0	0	0	19	0	1,401	1,259	1,597	--	6,306
1996	6	1,138	384	0	0	0	1,310	168	0	0	0	0	0	0	0	0	2,923	3,130	1,383	--	10,443
1997	0	415	212	0	0	0	747	83	0	0	0	0	0	0	0	0	2,182	3,730	1,270	--	8,640
1998	0	10	0	0	0	0	0	15	0	7	0	0	0	0	0	0	2,094	3,340	2,407	--	7,873
Total	22	53,368	6,872	185	16	54	8,096	1,661	478	28	10	14	131	120	101	2,472	60,047	87,497	29,868	--	251,042

[a] Idaho Power did not estimate angler harvest in the Snake River upstream of the Salmon River.

Table 36. Distribution of spring Chinook smolts released for mitigation purposes from the Rapid River hatchery for brood years 1964 through 1998. (Source: Abbott and Stute, 2003)

Brood Year	Females Spawned	Eggs Collected	Release Year	Smolts Released	
				Rapid River	**Snake River**
1964	197	887,616	1966	588,000	0
1965	133	603,800	1967	479,267	0
1966	621	2,296,000	1968	1,460,150	0
1967	518	2,055,000	1969	900,192	0
1968	1,809	6,640,000	1970	3,178,000	0
1969	1,415	5,171,697	1971	2,718,720	0
1970	3,520	14,560,280	1972	2,809,200	0
1971	1,722	6,038,785	1973	2,908,425	0
1972	3,825	15,072,604	1974	2,707,917	0
1973	3,454	13,510,465	1975	3,373,700	0
1974	1,756	6,890,186	1976	3,358,940	0
1975	2,184	8,503,606	1977	2,921,172	0
1976	3,055	11,492,878	1978	2,413,678	0
1977	3,781	14,160,330	1979	2,866,933	0
1978	2,350	10,026,888	1980	2,604,823	0
1979	1,141	5,648,722	1981	2,372,607	1,001,700
1980	543	1,756,827	1982	1,473,733	0
1981	1,666	6,122,273	1983	2,998,103	250,020
1982	1,883	7,482,330	1984	3,246,197	500,850
1983	859	3,449,471	1985	2,491,238	437,360
1984	821	3,125,911	1986	1,594,688	140,000
1985	2,962	11,082,369	1987	2,836,400	103,000
1986	2,451	10,673,138	1988	2,630,200	400,600
1987	1,310	5,656,145	1989	2,319,500	500,000
1988	1,645	7,905,702	1990	2,520,400	551,200
1989	1,082	4,478,045	1991	2,564,900	500,500
1990	1,063	4,217,103	1992	2,615,500	500,500
1991	657	2,553,218	1993	2,060,283	200,300
1992	1,177	4,534,400	1994	2,547,644	380,500
1993	1,737	7,103,037	1995	2,786,919	499,530
1994	116	490,249	1996	379,167	0

Brood Year	Females Spawned	Eggs Collected	Release Year	Smolts Released	
				Rapid River	Snake River
1995	35	132,001	1997	85,840	0
1996	329	1,171,610	1998	896,170	0
1997	1,138	4,472,573	1999	2,847,283	300,000
1998	723	3,409,130	2000	2,462,354	0
Total	53,678	213,374,389		79,018,243	6,266,060

Table 37. Distribution of summer and spring Chinook smolts released for mitigation purposes from the Pahsimeroi hatchery for brood years 1981 through 2000. (Source: Abbott and Stute, 2003)

Brood Year	Adults Trapped	Females Spawned	Eggs Collected	Eggs Received	Smolts Released
Summer Chinook					
1981	35	4	22,772	0	13,690
1982	39	13	75,402	0	55,803
1983	109	45	261,188	0	209,155
1984	37	4	23,999	0	12,095
1985	110	24	127,332	200,448	258,600
1986	345	106	476,281	374,041	598,500
1987	473	122	696,004	605,091	1,016,300
1988	838	164	1,053,536	317,272	1,058,000
1989	347	66	294,893	0	227,500
1990	470	151	662,641	0	605,900
1991	238	87	437,157	0	375,000
1992	131	35	172,139	0	130,510
1993	169	29	167,200	0	147,429
1994	36	0	0	0	0
1995	80	35	157,938	0	116,811
1996	89	18	85,660	0	65,648
1997	147	32	171,836	0	135,669
1998	127	13	74,105	0	53,837
1999	377	79	371,354	0	283,063
2000	459	123	633,906	0	0
Subtotal	4,656	1,150	5,965,343	1,496,852	5,363,510

Brood Year	Adults Trapped	Females Spawned	Eggs Collected	Eggs Received	Smolts Released
Spring Chinook					
1981	No data	0	0	616,823	437,332
1982	107	27	107,234	1,332,200	1,143,029
1983	232	75	279,398	0	178,782
1984	112	32	145,341	0	80,948
Subtotal	451	134	531,973	1,949,023	1,840,091
Grand Total	5,107	1,284	6,497,316	3,445,875	7,203,601

The estimated contribution of adult spring Chinook salmon produced from the Rapid River hatchery is shown in table 38. The average number of adult spring Chinook salmon produced was estimated to be 5,445, and the top four categories of adult contribution were to the Rapid River rack (62.6 percent), Nez Perce harvest (13.6 percent), Little Salmon sport fishery (8.8 percent) and Treaty ceremonial uses (5.5 percent). Because Chinook salmon smolts produced at the Pahsimeroi hatchery were not marked to differentiate them from wild fish in most years, Idaho Power was not able to estimate the adult contribution of spring and summer Chinook salmon produced at the Pahsimeroi hatchery.

Initial attempts to produce fall Chinook salmon at the Oxbow hatchery were impeded by high rates of pre-spawning mortality, and ultimately by low numbers of fish returning to the trap at Hells Canyon dam (table 39). In an effort to meet the annual production target of 1,000,000 fall Chinook smolts specified in the 1980 Hells Canyon Settlement Agreement, Idaho Power funded a portion of the construction cost of the Corps's Lyons Ferry Hatchery[66] in exchange for sufficient capacity within the hatchery to ensure the availability of 1.3 million eyed fall Chinook eggs annually. The agreement with the Corps included a provision that Idaho Power would not be entitled to any eggs until the hatchery had obtained 80 percent of its own egg quota. As a result of this provision and low numbers of fall Chinook salmon returning to the Snake River, Idaho Power did not receive any eggs from the Lyons Ferry hatchery until 2000, when 122,514 eggs were received, which were reared to produce 115,220 smolts (table 39).

3.6.2 Environmental Effects

3.6.2.1 Effects of Project Operations on Aquatic Resources

We describe Idaho Power's Proposed Operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on reservoir levels and project outflows in section 3.3.2, *Effects of Project Operations on Water Quantity*. In section 3.3.2.2, we identify operation-related recommendations filed by agencies, tribes and other parties (table 9), and we describe three alternative operational scenarios that we use to assess the effects of the various operation-related recommendations. At our request, Idaho Power simulated project operations for these representative scenarios under various hydrologic conditions. Refer to section 3.3.2.2 for additional discussion of the scenarios and the modeling process used for the simulations. We use the results of these simulations to assess the effects of the operation-related recommendations.

[66] The Lyons Ferry hatchery was constructed in 1982 as part of the Lower Snake River Compensation Plan. It is located on the Snake River between Little Goose and Lower Monumental dams, near the confluence of the Palouse River.

Table 38. Estimated adult contribution of spring Chinook produced at the Rapid River hatchery from 1978 through 1998. (Source: Abbott and Stute, 2003)

Run Year	Ocean Troll	Columbia River Gill Net	Columbia River Sport	Test Fishery Net	Freshwater Sport	Hatchery Rack	Spawning Ground	River Trap	Treaty Ceremonial	Treaty Troll	Nez Perce Harvest	Little Salmon Sport	Rapid River Rack	Run Year Total
1978	0	0	0	0	121	26	0	0	0	0	0	1,309	5,769	7,225
1979	0	516	465	0	373	26	0	0	132	0	0	0	3,404	4,916
1980	0	0	0	0	0	13	0	0	20	0	0	0	1,960	1,993
1981	49	246	0	94	0	47	0	0	119	0	0	0	3,263	3,818
1982	0	107	221	117	0	0	0	0	58	0	0	0	3,676	4,179
1983	0	47	0	0	0	0	0	0	0	0	0	0	1,958	2,005
1984	0	87	0	41	0	0	0	0	53	0	100	0	2,356	2,637
1985	0	193	443	80	0	40	0	0	465	0	2,023	2,313	6,727	12,284
1986	0	296	390	130	0	0	0	0	723	0	1,855	1,430	6,723	11,547
1987	160	0	0	0	218	11	0	0	527	0	2,430	422	3,808	7,575
1988	24	2,226	1,350	111	0	88	6	0	892	0	3,520	692	3,780	12,689
1989	0	156	0	0	101	17	0	0	310	0	544	0	2,800	3,928
1990	0	29	435	33	54	0	0	0	383	0	970	565	2,606	5,076
1991	0	88	166	47	44	18	0	0	802	0	0	0	1,913	3,079
1992	0	54	153	0	72	38	0	0	265	0	643	499	2,466	4,190
1993	0	75	86	52	0	21	0	0	947	11	696	423	4,468	6,778
1994	0	48	0	0	0	0	0	0	33	0	0	0	265	346
1995	0	0	0	0	0	53	0	0	0	0	0	0	129	182
1996	0	0	0	0	13	59	0	0	76	0	0	0	1,412	1,560
1997	37	0	0	0	0	279	3	27	396	0	2,196	2,289	10,520	15,746
1998	0	28	0	0	0	92	13	0	77	0	618	172	1,591	2,591
Total	270	4,196	3,709	705	996	828	22	27	6,278	11	15,595	10,114	71,594	114,344

Table 39. Distribution of fall Chinook smolts produced at the Oxbow hatchery for brood years from 1961 through 2000. (Source: Abbott and Stute, 2003)

Brood Year	Adults Trapped	Adults Ponded	Prespawn Mortality (%)	Females Spawned	Eggs Collected	Number Eyed	Percent Eyed-up (%)	Eggs Distributed	Eggs Received	Smolts Released	Fry-to-Smolt Survival (%)
1961	6,658	2,022	63.0	398	1,668,900	1,466,752	87.89	329,552	0	601,636	52.91
1962	2,402	819	31.4	424	2,015,000	1,911,500	94.86	477,000	0	1,100,119	76.69
1963	945	614	54.6	202	774,000	558,100	72.11	0	0	495,540	88.79
1964	1,503	504	27.3	163	779,000	716,900	92.03	0	24,408	650,460	87.74
1965	1,584	1,576	63.8	119	545,200	497,000	91.16	0	0	214,720	43.20
1966	3,612	3,557	38.9	409	1,691,126	1,582,670	93.59	0	0	1,473,590	93.11
1967	1,249	1,235	64.7	217	821,890	798,900	97.20	0	0	202,350	25.33
1968	412	403	22.5	75	274,030	266,871	97.39	0	0	255,536	95.75
1969	50	50	No data	11	54,990	50,591	92.00	0	500,000	497,298	90.32
1970	48	12	100.0	0	0	0	NA	0	0	0	NA
1971	4	4	100.0	0	0	0	NA	0	0	0	NA
1972	7	2	100.0	0	0	0	NA	0	0	0	NA
1973	1	1	100.0	0	0	0	NA	0	0	0	NA
1974	15	0	NA	0	0	0	NA	0	0	0	NA
1975	13	0	NA	0	0	0	NA	0	0	0	NA
1976	0	0	NA	0	0	0	NA	0	0	0	NA
1977	4	0	NA	0	0	0	NA	0	0	0	NA
1978	1	0	NA	0	0	0	NA	0	0	0	NA
1979	8	0	NA	0	0	0	NA	0	0	0	NA
1980–1999[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2000	0	0	NA	0	0	0	NA	0	122,514	115,220	94.05

Note: NA – not applicable

[a] No production during this period.

In the following sections, we evaluate the effects of Idaho Power's Proposed Operations and of operation-related recommendations received from agencies, tribes and other parties on the following resources: (1) primary production and aquatic invertebrates; (2) anadromous fish spawning; (3) anadromous fish rearing; (4) anadromous fish migration; (5) native resident salmonids; (6) white sturgeon; and (7) warmwater fisheries.

Primary Production and Aquatic Macroinvertebrates

Flow fluctuations caused by project operations dewater aquatic habitats along the river margin, which may have adverse effects on periphyton and aquatic invertebrates, and could reduce the food base that is available to fish species including juvenile fall Chinook salmon, native resident salmonids, and white sturgeon. In this section, we evaluate the effects that proposed and alternative operations would have on primary production and aquatic macroinvertebrates based on differences in the timing and amount of aquatic habitat that would be dewatered.

Our Analysis

Numerous investigators have found that periphyton and invertebrate production can be greatly reduced in areas of the streambed that are subject to daily dewatering from load following operations (Gislason, 1985; Gersich, 1980; Brusven and Trihey, 1978; Fisher and LaVoy, 1972). Fisher and LaVoy (1972) reported a 35 percent decline in diversity and abundance (reduction to 65 percent of original numbers) of macroinvertebrates in habitats exposed only 13 percent of the time, reductions to 13 percent in habitats exposed 40 percent of the time, and reductions to 2 percent of the pre-exposure diversity and abundance when habitats were exposed for 70 percent of the time.

Brusven and Trihey (1978) found that insect colonization of newly inundated substrate required approximately 30 days to reach the standing crop of permanently submerged areas in the Clearwater River below Dworshak dam. Cumulative losses of invertebrates from continuous fluctuations can influence drift rates and overall density and diversity of the invertebrate community (Reiser et al., 2005).

To assess the proportion of the streambed that is subject to daily dewatering, we examined hourly plots of the total area of wetted streambed in the Hells Canyon reach and estimated the maximum percentage of streambed that was subject to dewatering under Proposed Operations, under the Year-round 2-Inches-Per-Hour Ramping Rate and Year-round 6-Inches-Per-Hour Ramping Rate sub-scenarios, and under the Flow Augmentation and Navigation scenarios. Plots of the wetted area of streambed upstream of the Salmon River modeled under three water year types are shown in figure 56 for Proposed Operations; figure 57 for Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate); figure 58 for Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate); figure 59 for the Flow Augmentation Scenario; and figure 60 for the Navigation Scenario. The same simulation results for the reach between the Salmon River and Lower Granite reservoir are shown in figures 61 through 65. The maximum percentage of the streambed that is subject to dewatering in each scenario, year and reach is summarized in table 40.

The maximum percentage of the streambed that was dewatered under Proposed Operations in the reach upstream of the Salmon River ranged between 7 percent in an extremely high water year and 12 percent in an extremely low water year. The maximum percentage of the streambed that was dewatered in the lower reach was typically 1 or 2 percent less than in the upper reach. The percentage of streambed dewatered under the Year-round 2 Inches-Per-Hour Ramping Rate was reduced to 3 percent or less in both reaches. The percentage of streambed dewatered under the year-round 6 inches-per-hour ramping rate was reduced to 7 percent above the Salmon River and 4 to 5 percent downstream of the Salmon River confluence. The percentage of streambed that was dewatered in the Flow Augmentation and Navigation scenarios was similar to Proposed Operations, except that the percentage of streambed that was dewatered in extremely high water years was somewhat increased in the upper reach and reduced in the lower reach.

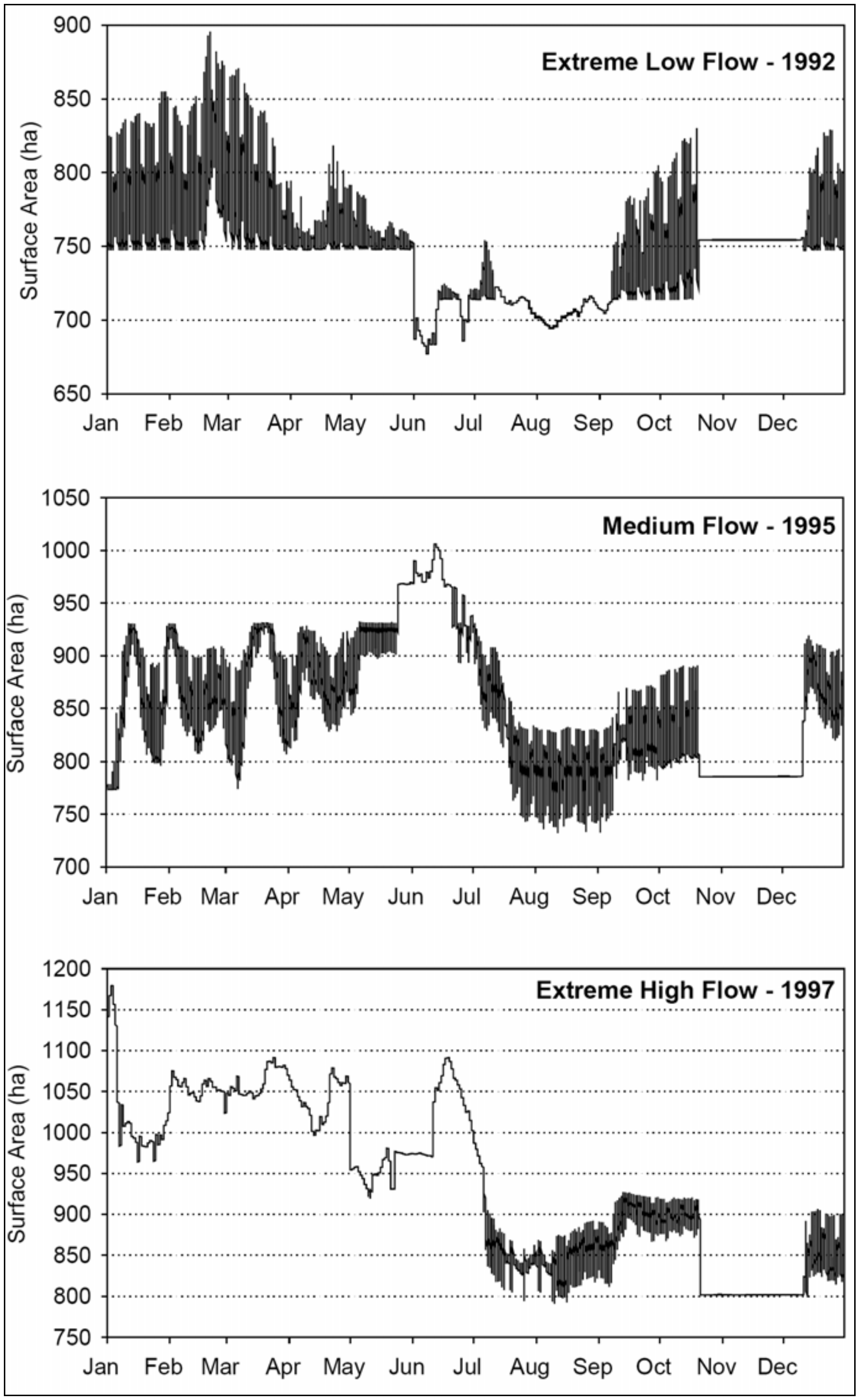


Figure 56. Hourly total wetted stream area predicted for the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) modeled under the Proposed Operations during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

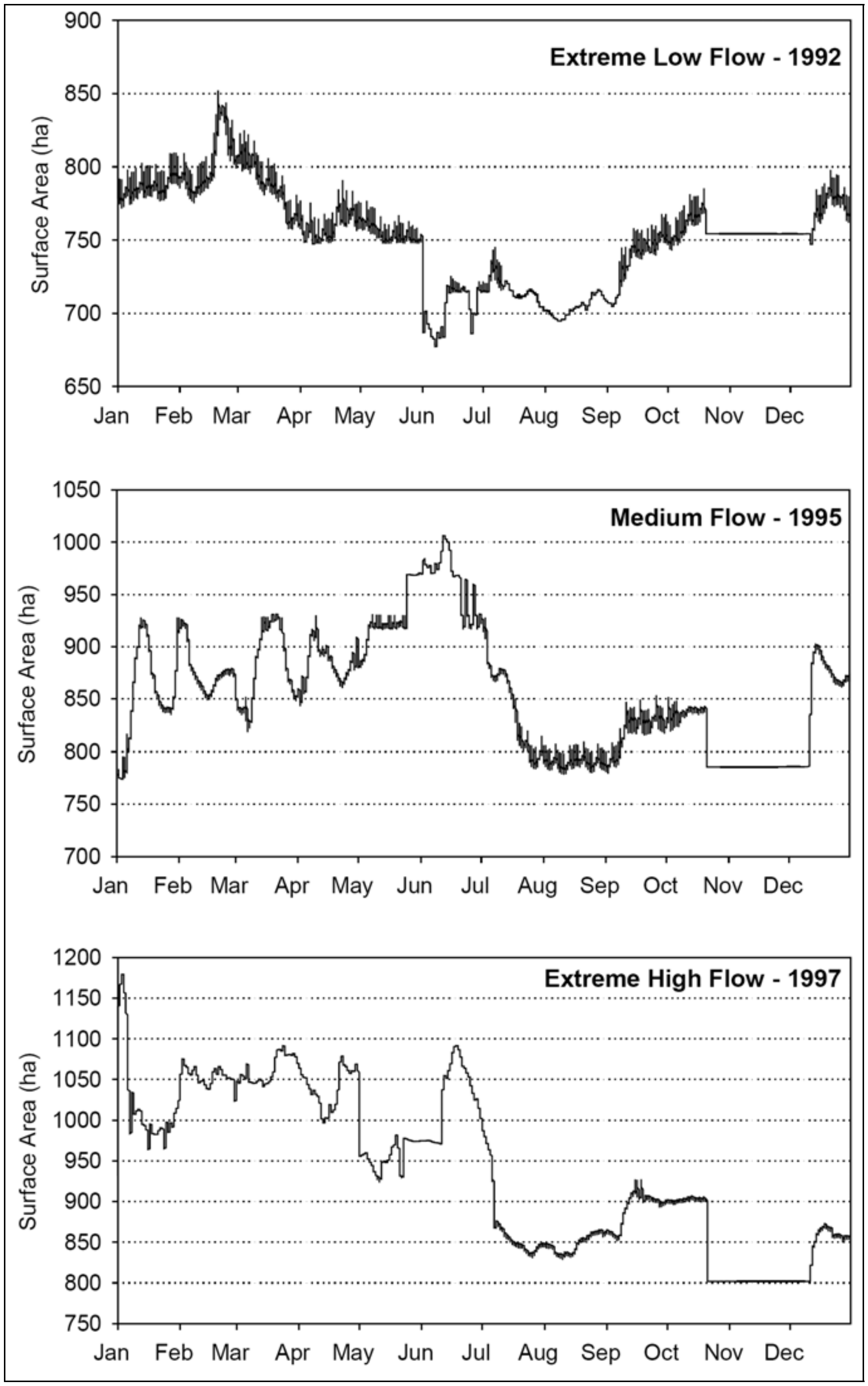


Figure 57. Hourly total wetted stream area predicted for the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) modeled under Scenario 1b, Year-round 2-Inches-Per-Hour Ramping Rate, during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

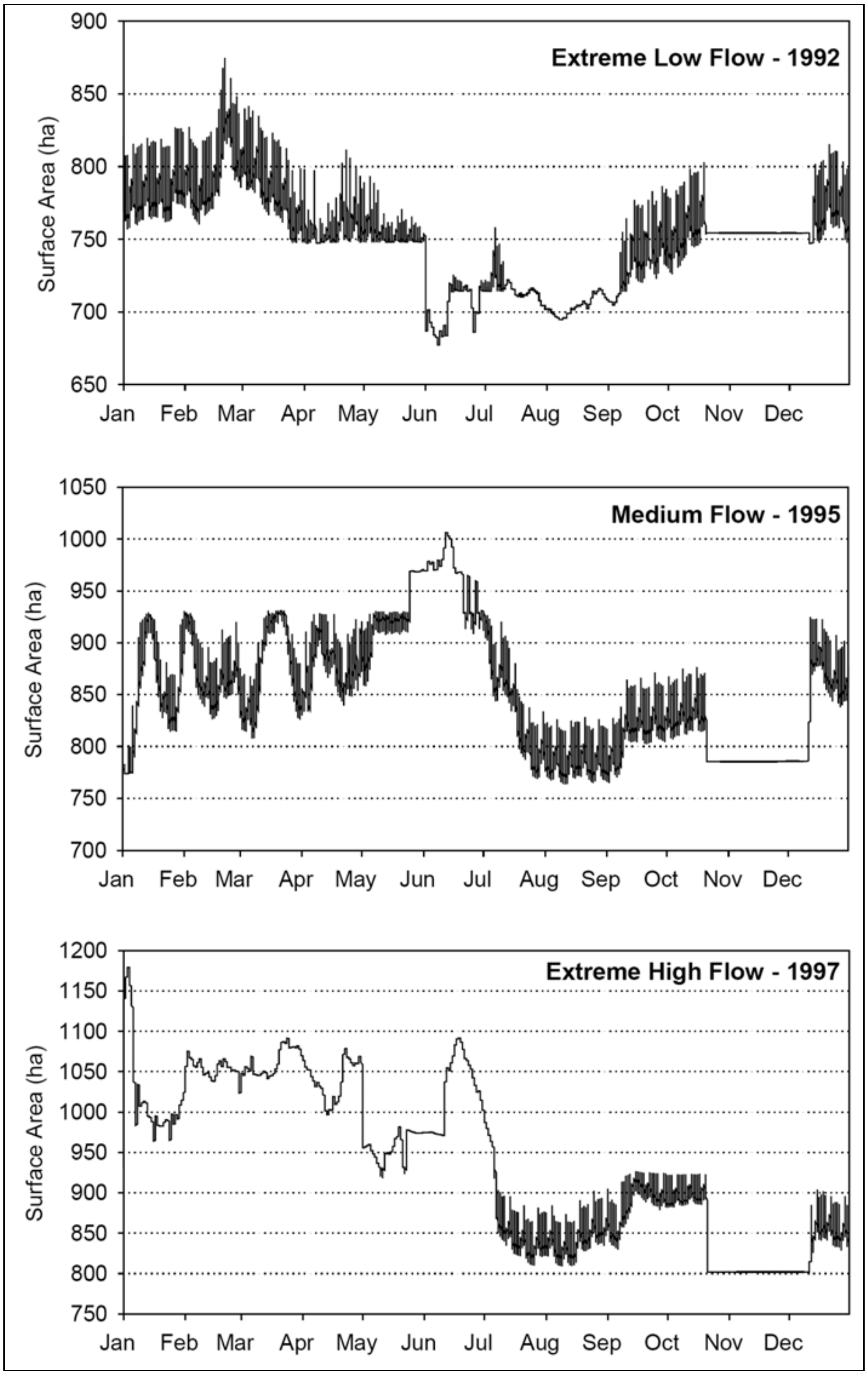


Figure 58. Hourly total wetted stream area predicted for the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) modeled under Scenario 1c, Year-round 6-Inches-Per-Hour Ramping Rate, during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

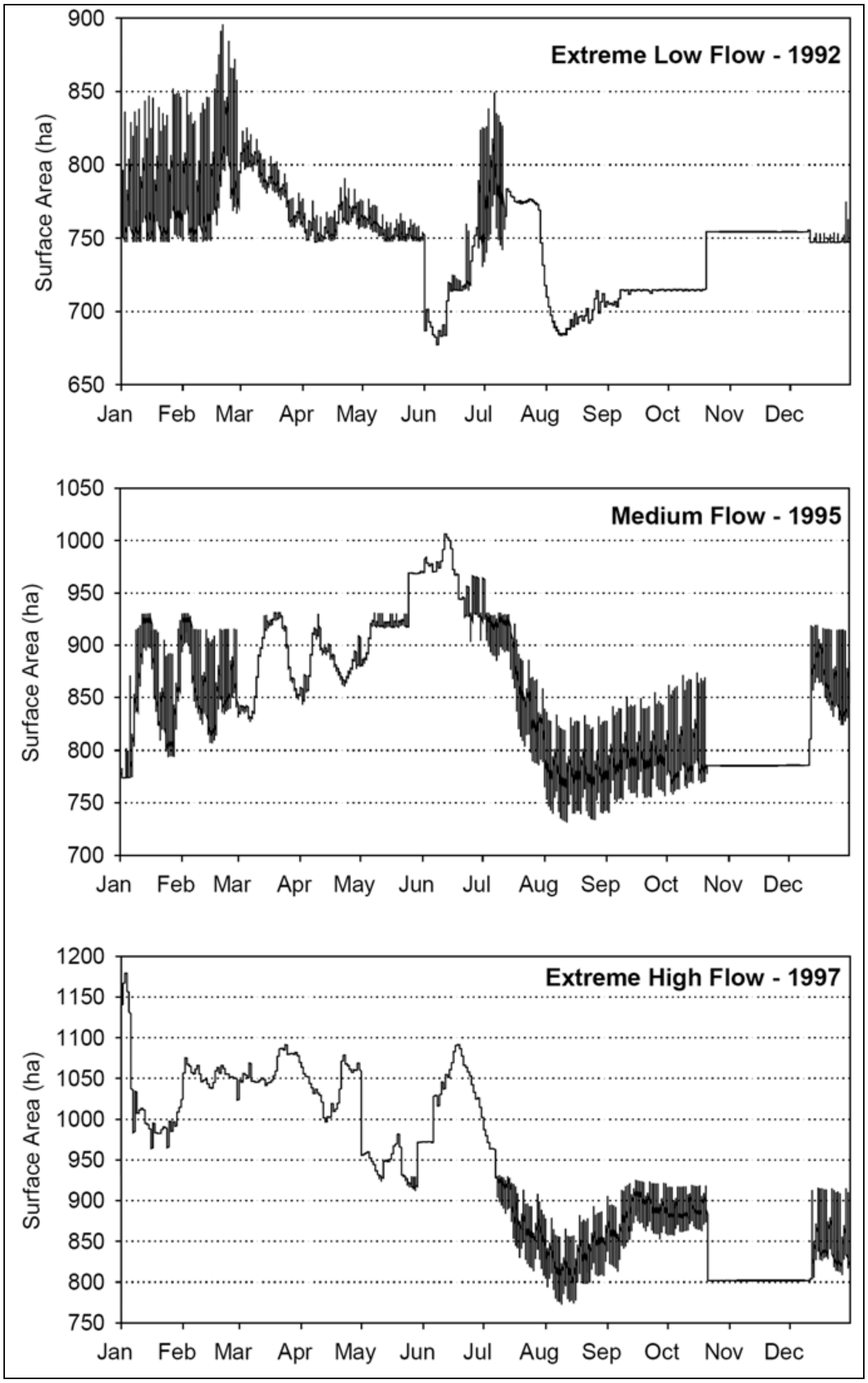


Figure 59. Hourly total wetted stream area predicted for the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) modeled under the Flow Augmentation Scenario during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

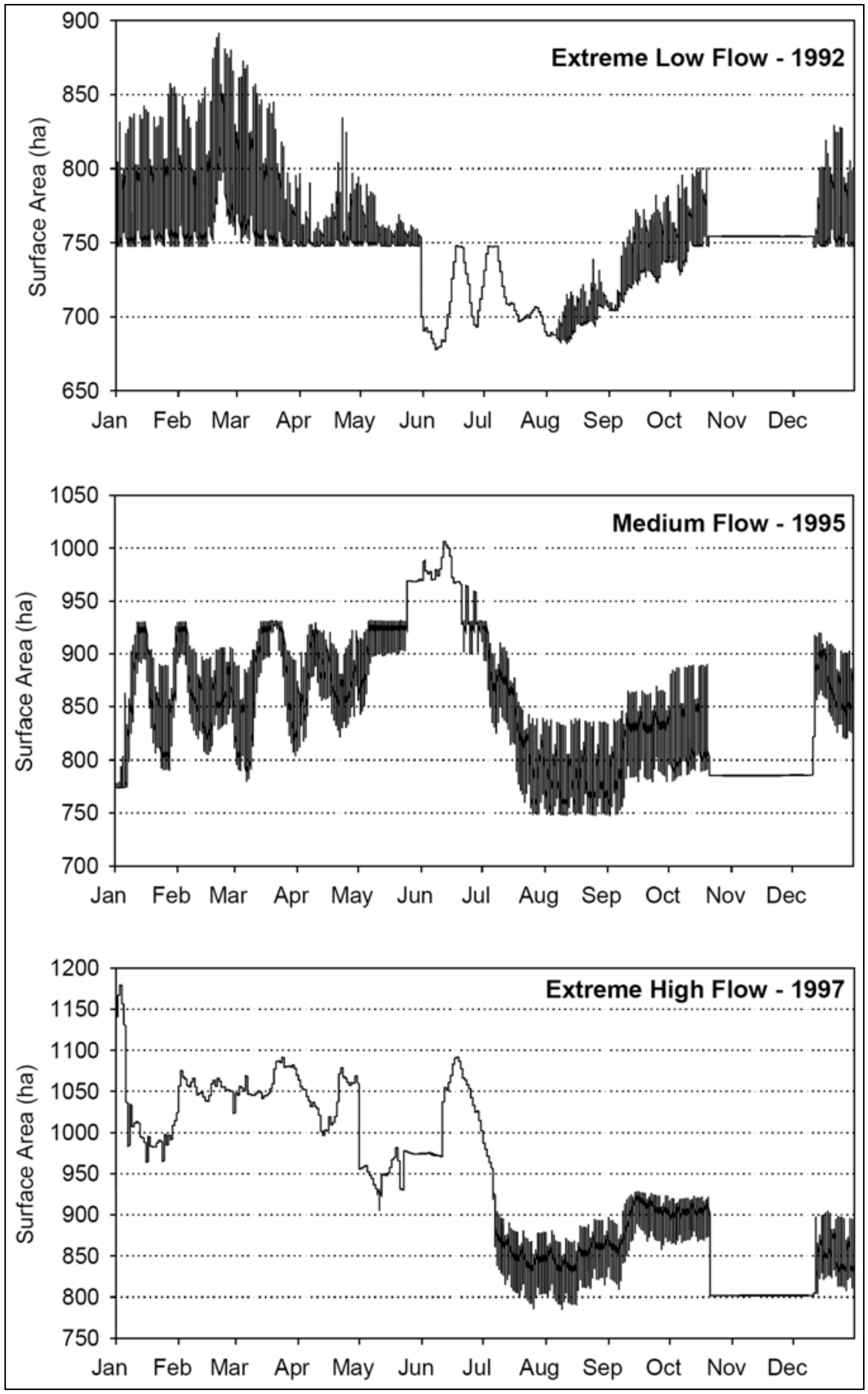


Figure 60. Hourly total wetted stream area predicted for the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) modeled under the Navigation Scenario during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

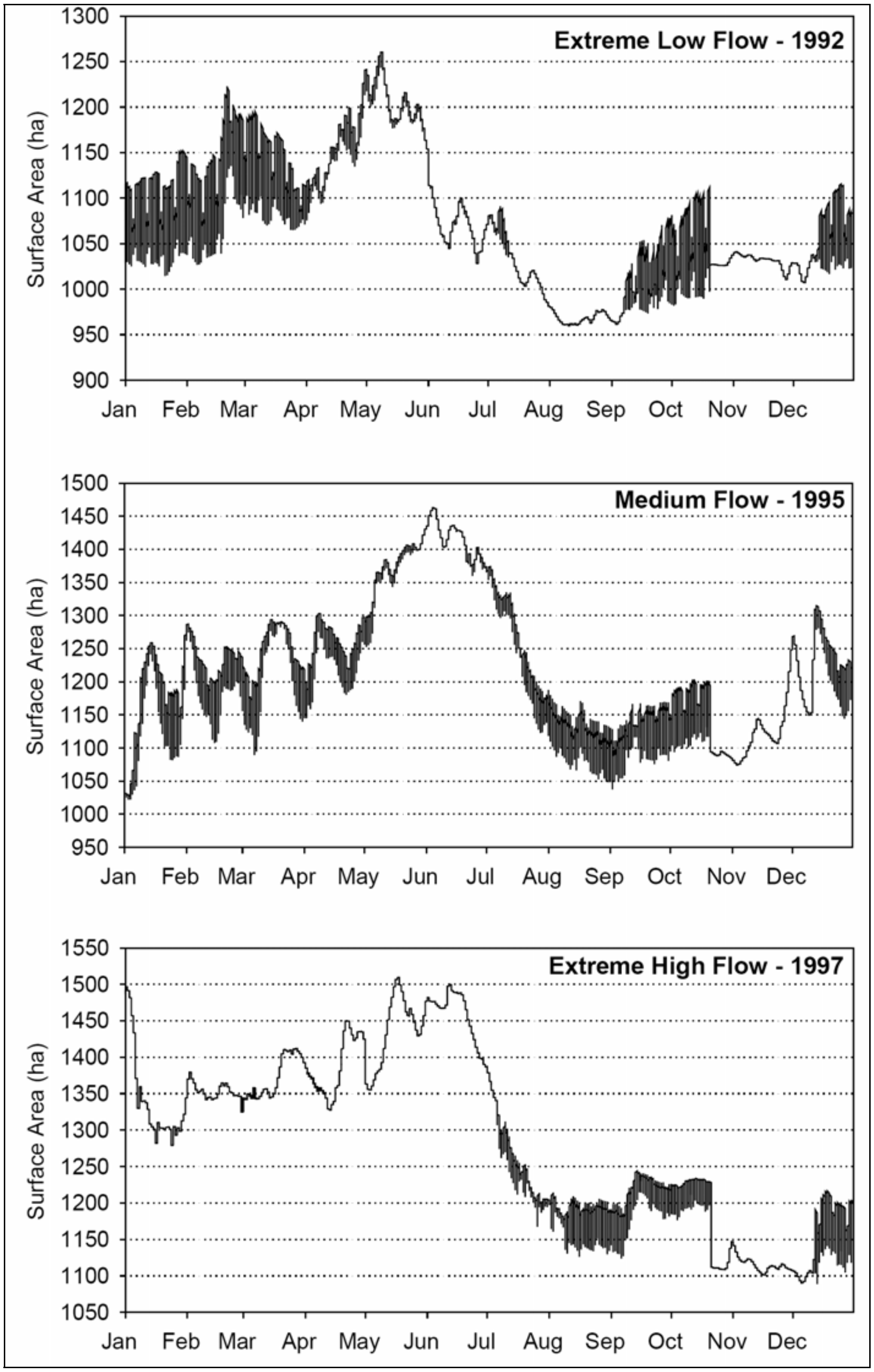


Figure 61. Hourly total wetted stream area predicted for the lower Hells Canyon reach (Salmon River confluence to Lower Granite reservoir) modeled under Proposed Operations during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

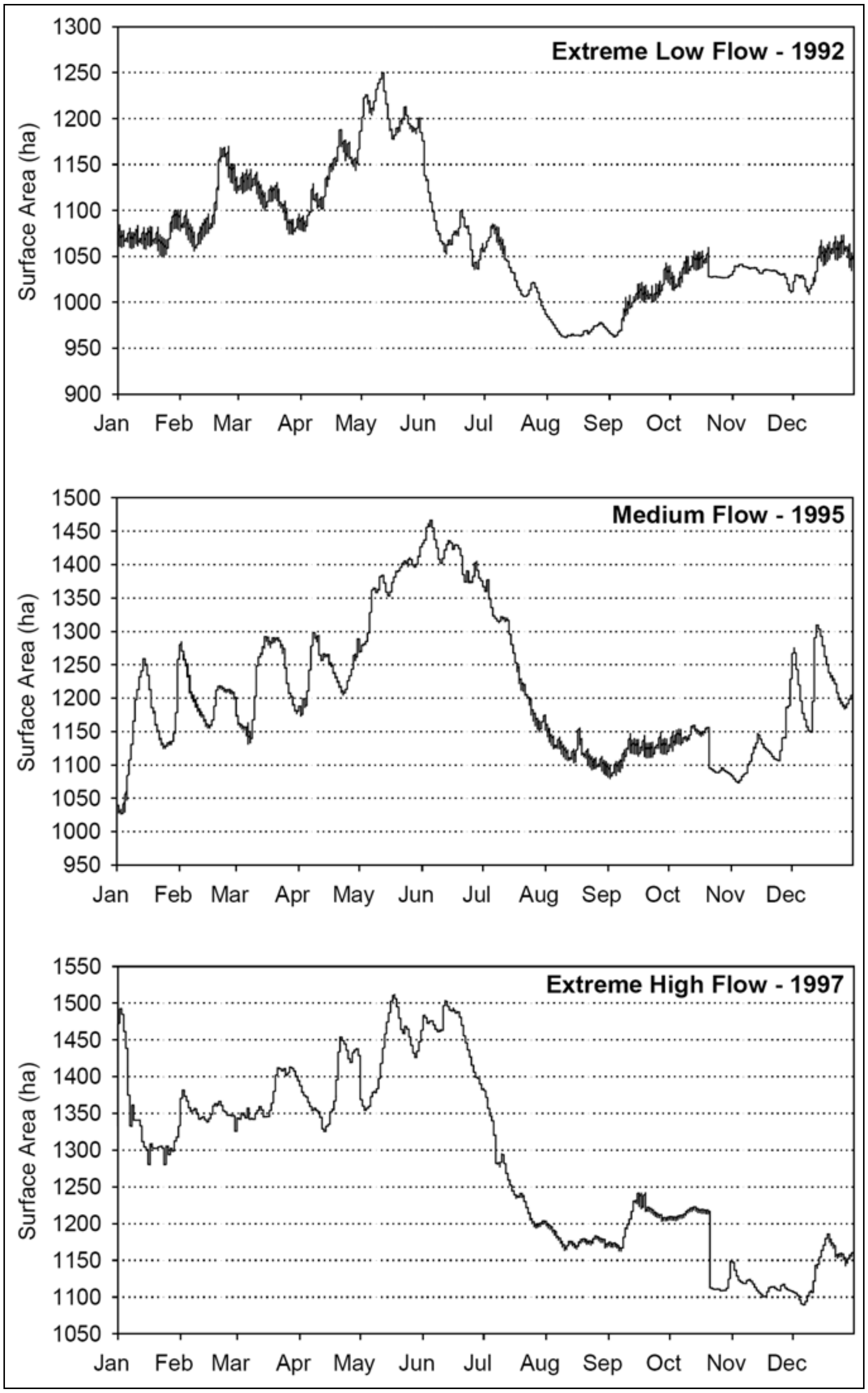


Figure 62. Hourly total wetted stream area predicted for the lower Hells Canyon reach (Salmon River confluence to Lower Granite reservoir) modeled under Scenario 1b, Year-round 2-Inches-Per-Hour Ramping Rate, during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

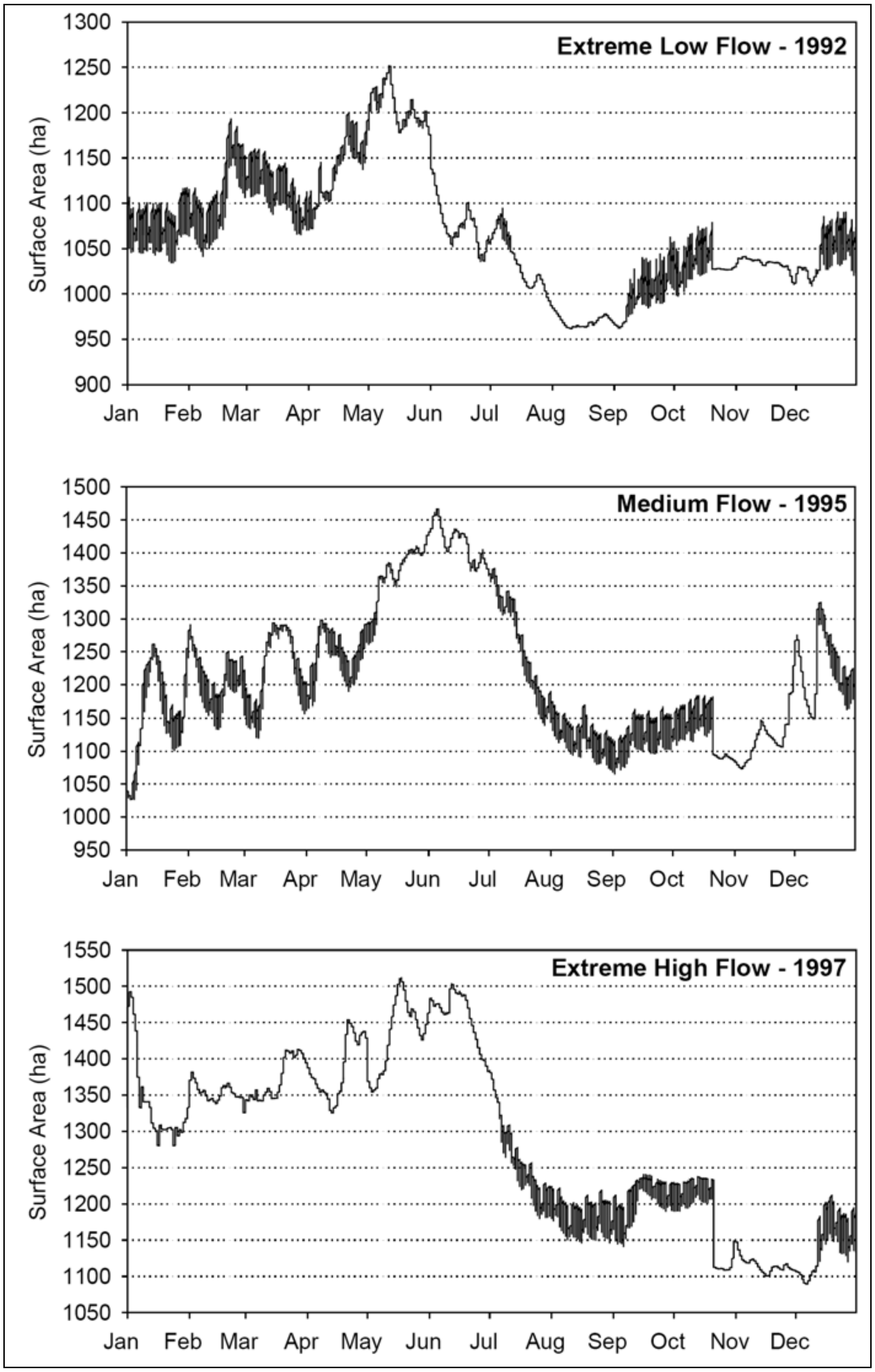


Figure 63. Hourly total wetted stream area predicted for the lower Hells Canyon reach (Salmon River confluence to Lower Granite reservoir) modeled under Scenario 1c, Year-round 6-Inches-Per-Hour Ramping Rate, during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

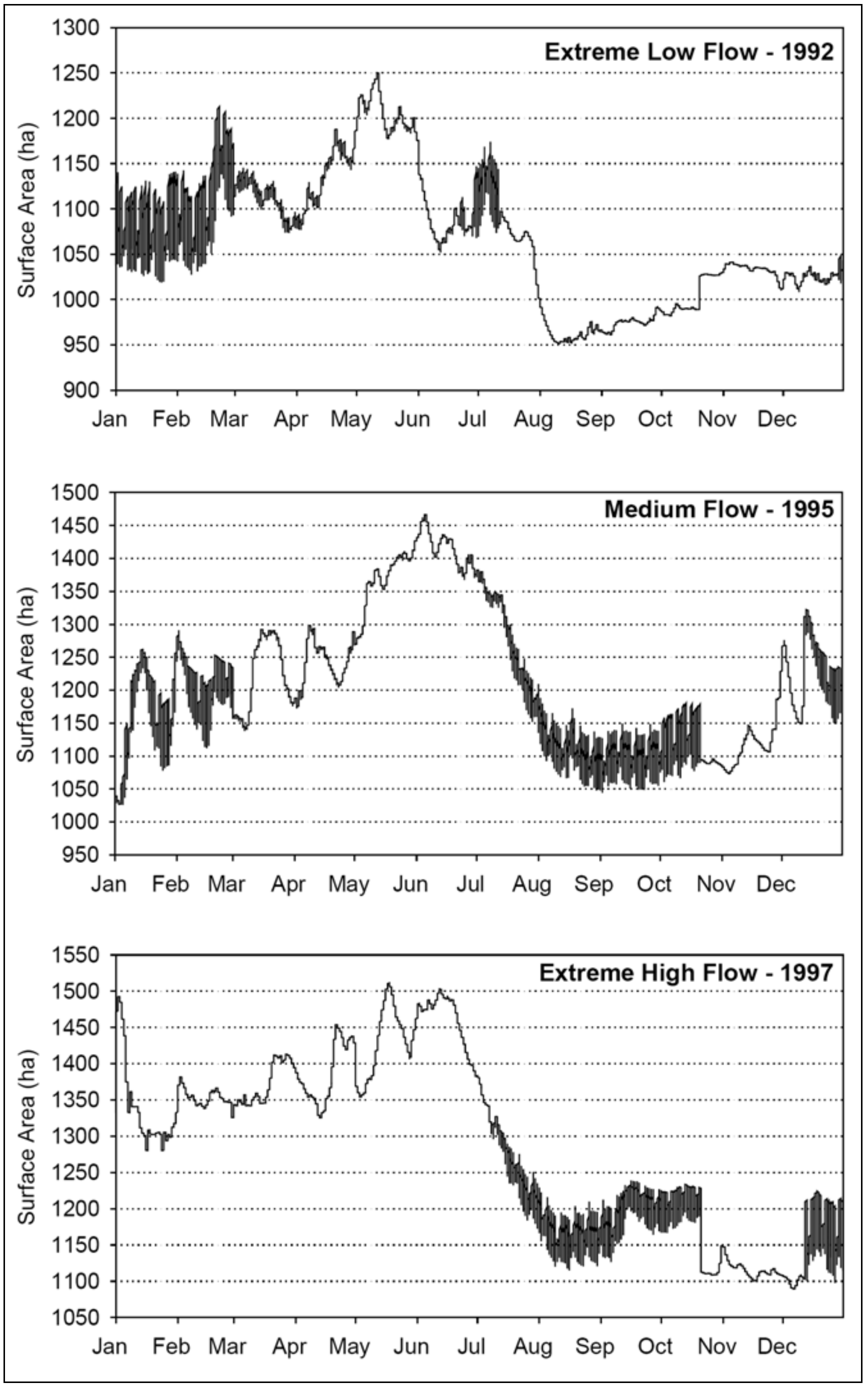


Figure 64. Hourly total wetted stream area predicted for the lower Hells Canyon reach (Salmon River confluence to Lower Granite reservoir) modeled under the Flow Augmentation Scenario during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

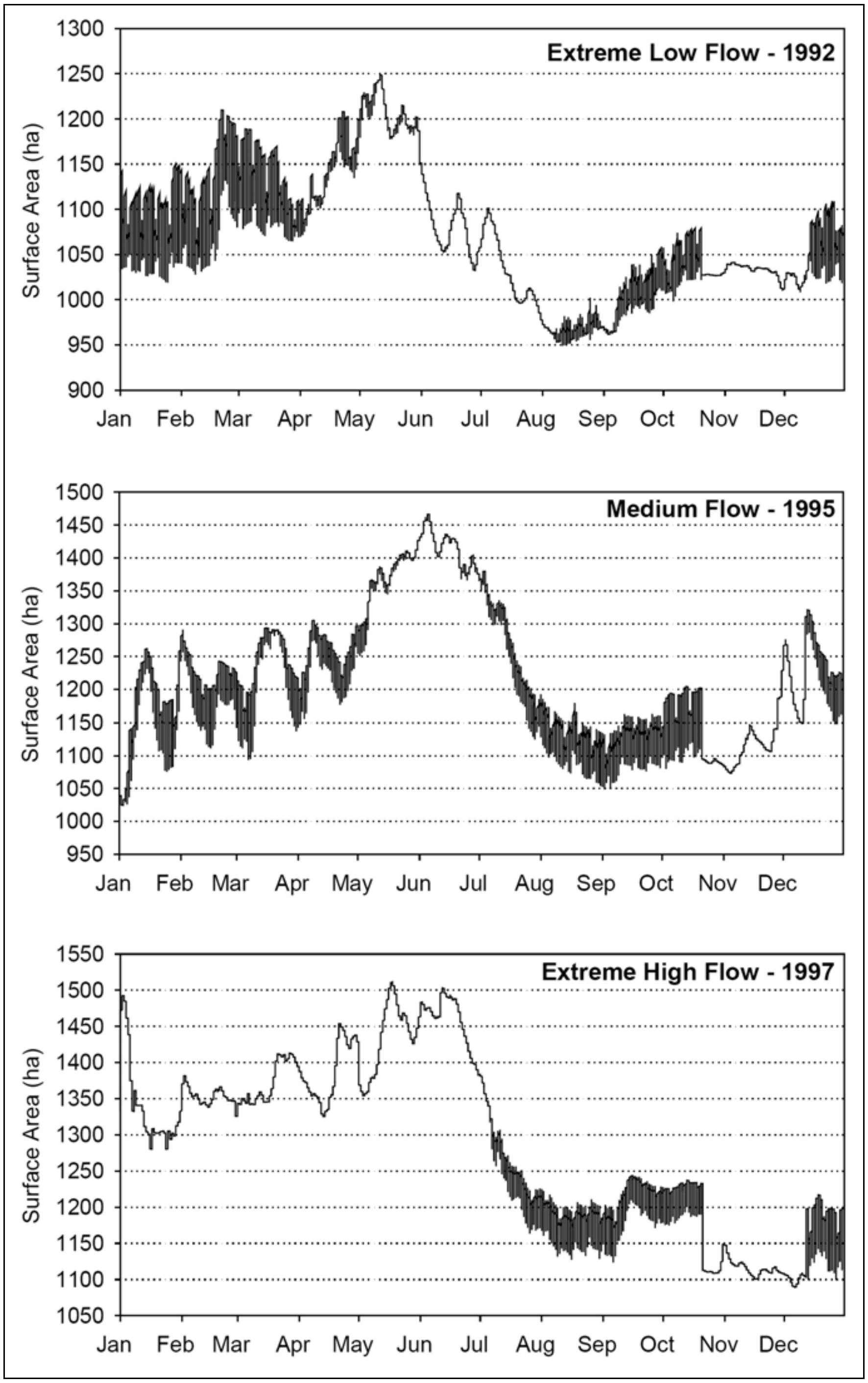


Figure 65. Hourly total wetted stream area predicted for the lower Hells Canyon reach (Salmon River confluence to Lower Granite reservoir) modeled under the Navigation Scenario during the extremely low flow year of 1992 (top), the medium flow year (middle) and the extremely high flow year of 1997 (bottom). (Source: Brink and Chandler, 2005)

Table 40. Estimated maximum seasonal percentage of streambed that would be subject to daily dewatering upstream and downstream of the Salmon River under Proposed Operations and four alternative scenarios. Maxima occur in different seasons depending on the scenario and water year type, see figures 56 through 65. (Source: Brink and Chandler, 2005, as modified by staff)

Scenario	Water Year Type	Maximum Percent of Streambed Exposed Due to Load Following Operations	
		Above Salmon River	Below Salmon River
Proposed Operations	Extremely low	10	10
	Medium	11	8
	Extremely high	7	7
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	3	2
	Medium	3	2
	Extremely high	<1	<1
Scenario 1c (Year-round 6 Inches-Per-Hour Ramping Rate)	Extremely low	7	5
	Medium	7	4
	Extremely high	7	4
Scenario 2 (Flow Augmentation)	Extremely low	10	9
	Medium	11	9
	Extremely high	7	6
Scenario 3 (Navigation)	Extremely low	11	10
	Medium	11	9
	Extremely high	11	5

We concluded in the draft EIS that the reduction in primary production and invertebrate biomass would be roughly proportional to the area of streambed that is subject to frequent dewatering. In its draft EIS comments, Interior states that this is a substantial underestimate because: (1) the shallow-water areas that are most subject to dewatering provide the most important forage area for macroinvertebrates; and (2) there would be a reduction in the standing crop due to stranding losses from repeated dewatering. We reviewed the references cited by Interior (Bailey [1974], Brusven et al. [1974], and R2 Resource Consultants [2005]), and conclude there is the potential that lost invertebrate production could exceed the proportion of the streambed subject to frequent dewatering. However, Brusven et al. (1974) stated that most insect life in the Hells Canyon reach "abounded" in regions not experiencing daily water fluctuations, including the deeper areas that they refer to as the *Cladophora* Zone (27 to 61 inches in depth). They also found that aquatic insects far exceed biomass values of smaller streams in northern Idaho containing less nutrients. Based on this information, we conclude that invertebrate standing crops are likely reduced primarily in areas that are subject to daily dewatering due to reduced periphyton production and from cumulative losses of invertebrates associated with repeated dewatering events.

Although there is some uncertainty regarding the extent of effects on invertebrate production, we conclude that this reduction is likely to be on the order of one to two times the proportion of the streambed that is subject to daily dewatering. Accordingly, we estimate that periphyton and invertebrate production may be reduced under Proposed Operations, in the Flow Augmentation Scenario, and in the Navigation Scenario by approximately 10 to 20 percent upstream of the Salmon River in medium to low flow years, with a lesser reduction downstream of the Salmon River. These effects would be reduced by about one-third by implementing a 6 inches-per-hour ramping rate, and they would be reduced by about three-fourths by implementing a 2 inches-per-hour ramping rate. We discuss effects of lost invertebrate production on the growth rates of fall Chinook salmon, bull trout, and white sturgeon in subsequent sections.

Anadromous Fish Spawning

Flows released from Hells Canyon dam affect the quality and quantity of spawning habitat that is available to fall Chinook salmon in the Snake River between Hells Canyon dam and Lower Granite reservoir, a reach that contains most of the spawning habitat that is currently accessible to fall Chinook salmon in the Snake River basin. The reach is not known to be a major spawning area for any other anadromous fish species. In this section, we evaluate the effects that proposed and alternative operations would have on fall Chinook spawning and incubation until the time that fry emerge from the gravel. Effects on rearing fall Chinook salmon will be addressed in the next section.

Since 1991, Idaho Power has implemented a flow program to enhance spawning and incubation conditions for fall Chinook salmon in the Hells Canyon reach. To prevent redds from becoming dewatered during the spawning season, Idaho Power maintains steady flow conditions to keep spawning activity below a water level that can be maintained throughout the incubation and fry emergence stages. The spawning flow, which has typically been between 9,000 and 13,000 cfs, is determined each year before spawning begins based on forecasted inflows to Brownlee reservoir, predicted hydrologic-year type (low, medium, or high), and availability of habitat. After spawning has ended, Idaho Power maintains a minimum flow that protects the shallowest redd from being dewatered until fry have emerged from the gravel. Idaho Power proposes to continue the fall Chinook spawning flow program, although they indicate an interest in exploring whether some degree of flow fluctuation could be allowed during the spawning period without reducing the availability of spawning habitat or hindering spawning behavior.

Recommendations received from NMFS, the Nez Perce Tribe, ODFW, IDFG, and the Umatilla Tribes relating to the fall Chinook spawning flow program are summarized in table 41 and are discussed below.

Our Analysis

The fall Chinook spawning flow program benefits fall Chinook salmon by maintaining near-optimal flow levels during the spawning period and by preventing dewatering of redds during the incubation period. Since the flow program was first implemented in 1991, the number of adult fall Chinook salmon returning to the Snake River has increased substantially (refer to figure 100 in section 3.8.1.1, *Fall Chinook Salmon*). While other factors such as hatchery supplementation, improved migration survival, and favorable ocean conditions have contributed to this trend, there is little doubt that protecting redds from dewatering has improved incubation survival. NMFS, ODFW, IDFG, the Nez Perce Tribe and Umatilla Tribes all recommend that the fall Chinook flow program be continued.

In its description of this proposed measure, Idaho Power states that modifications of this flow program are currently being evaluated and explored in cooperation with interested agencies. In Groves and Chandler (2003), Idaho Power provides further discussion of the potential for allowing some flow variation during the spawning season. It notes that at flows between 8,000- and 15,000-cfs stage changes by about 0.9 meter. It also states that only 9 percent of measured redds have been observed at depths of less than 0.9 meters. We conclude that fish spawning at these shallower sites could be adversely affected by stage changes of this magnitude. We also note that any flow variation that occurs during the spawning period could result in redds being constructed at higher elevations, which would require higher flows to be maintained during the egg incubation season to avoid dewatering redds. Redds that are constructed at higher elevations would be more vulnerable to exposure (and exposure-related mortality of eggs and fry), especially when inflows to Brownlee reservoir are lower than was forecast at the start of the spawning season. We conclude that maintaining a stable flow during the spawning season is more protective than a variable flow regime would be.

Table 41. Fall Chinook spawning flow, incubation flow, and spawner survey recommendations. (Source: Staff)

Component	Idaho Power	NMFS	Nez Perce Tribe	ODFW	IDFG	Umatilla Tribes
General	Explore salmon flow program modifications in consultation with agencies; flows less than 8,000 cfs may be sufficient to support recovery and moderate flow fluctuations during the spawning period may be possible without reducing the availability of spawning habitat or hindering spawning behavior			ODFW-34. Supports the fall Chinook salmon flow program; consult with ODFW to refine specific details	IDFG-19. Supports the fall Chinook salmon flow program	
Spawning flow	To be determined each year based on forecasted inflows, hydrologic-year type, and availability of habitat, typically between 8,000 and 13,000 cfs	NMFS-1. Stable flow between 8,500 to 13,500, depending on runoff forecast, from when spawning starts between Hells Canyon dam and Lower Granite reservoir to when spawning is complete	NPT-1. Stable flow between 8,500 to 13,000 for the duration of the fall Chinook spawning period	ODFW-34. Stable flow of at least 8,000 cfs from October 1 through May		CTUIR-9. Minimum flow of 9,000 cfs
Incubation flow	Limited by the most critical shallow redd identified within the Hells Canyon reach	NMFS-1. Provide minimum flows equal to or greater than the spawning flow unless NMFS agrees that shallow water redds can be fully protected at a lower flow	NPT-1. Protect redds from becoming dewatered; spawning flow becomes the base flow			CTUIR-9. Minimum flow of 9,000 cfs

Component	Idaho Power	NMFS	Nez Perce Tribe	ODFW	IDFG	Umatilla Tribes
In-season flow modification	Flows may be decreased when inflow or seasonal precipitation decreases below forecasted levels	NMFS-2. Coordinate with NMFS and FWS to ensure operation remains effective for the duration of the license	NPT-1. Report to tribal, federal and state fishery managers any operational change necessary to protect redds			
Spawner surveys	Continue to support and participate in aerial and deep-water spawning surveys; continue temperature monitoring in the Snake River upstream of the Salmon River to estimate when emergence is complete. Note: measures related to monitoring the quantity and quality of spawning gravel are evaluated in section 3.4.2.2, *Sediment Augmentation and Monitoring*.	NMFS-3. Conduct both aerial and deep-water surveys weekly throughout the duration of the spawning period, to be coordinated with NMFS and FWS; each year provide draft reports to NMFS, FWS, ODFW, IDFG and Nez Perce Tribe for comment by July 1, final reports by December 1.	NPT-1. Monitor shallowest redds to ensure they do not become dewatered	ODFW-35. Continue shallow redd surveys; conduct deep water surveys every five years or when escapement increases to 10,000, 15,000 and 20,000 adults (whichever comes first); consult with ODFW and ODEQ to determine temperature monitoring sites	IDFG-2. Continue shallow redd surveys, consult with agencies to determine frequency of deep water redd monitoring, distribute temperature monitoring devices broadly so that effects of localized temperature differences on emergence timing can be determined.	

The spawning flow that is selected each year affects the quantity of habitat that would have suitable depths and velocities for spawning. As the number of spawners approaches the capacity of the habitat, the incidence of redd superimposition may increase, which can adversely affect incubation survival when eggs are disturbed or dislodged by later spawning fish. Idaho Power does not specify a range of spawning flows to be considered for future operations, and proposes that the spawning flow be determined each year based on forecasted inflows to Brownlee reservoir, predicted hydrologic-year type (low, medium, or high), and availability of habitat. NMFS (NMFS-1) recommends that the stable spawning flow be between 8,500 and 13,500 cfs, the Nez Perce Tribe (NPT-1) recommends that the flow be between 8,500 and 13,000 cfs, ODFW (ODFW-34) recommends that the spawning flow be at least 8,000 cfs, and the Umatilla Tribes recommend that the spawning flow be at least 9,000 cfs.

Idaho Power developed three alternative estimates of the number of redds that the habitat between Hells Canyon dam and Lower Granite reservoir could support. One estimate, which includes all areas within known spawning sites that have suitable spawning substrate, results in a capacity of 5,729 redds. A second method, which includes all areas containing suitable substrate regardless of proximity to known spawning areas, produces an estimated capacity of 10,730 redds. The third method, which is based on modeling habitat at 20 spawning sites expanded to include other known spawning sites based on geomorphic channel type, is summarized in table 42. This third method is the only one that provides an estimate of habitat capacity over a range of flows, and it indicates that habitat capacity varies by less than 10 percent at flows between 8,000 and 15,000 cfs.

We do not have a sufficient basis to judge which of the three methods for estimating habitat capacity is the most accurate. However, the relationship between habitat capacity and flow shown in table 42 indicates that steady flows within the 8,000 to 15,000 cfs range should provide near-optimal conditions for spawning fall Chinook salmon. Thus, providing stable flows in this range should minimize the potential for redd superimposition, especially in years when large numbers of fall Chinook salmon spawn in the Hells Canyon reach.

Table 42. Estimated redd capacity for the Snake River at selected discharge levels from Hells Canyon dam. (Source: Groves and Chandler, 2003, as modified by staff)

Hells Canyon Dam Discharge (cfs)	Estimated Snake River Redd Capacity
8,000	3,453
9,500	3,587
13,000	3,753
15,000	3,691
18,000	3,281

Other recommendations made by the agencies and tribes relate to: (1) consultation and monitoring requirements for establishing spawning flow levels; (2) in-season consultation on adjustments to flow levels due to changes in flow forecasts; (3) establishing the flow level that is required to protect redds until fry have emerged from the gravel; (4) determining the number and location of temperature monitors that are needed to track water temperatures and estimate the timing of fry emergence; (5) determining the frequency of both shallow and deep-water redd surveys; and (6) reporting requirements. Consultation with the resource agencies and tribes to determine appropriate monitoring efforts and to improve the efficiency of the flow management decision process would help to maximize resource benefits and avoid imposing any unnecessary constraints on project operations. This consultation could be accomplished through the development of an fall Chinook flow management plan.

Anadromous Fish Rearing

Flow fluctuations and changes in the seasonal flow regime caused by project operations can affect the quality and quantity of rearing habitat and the food supply that is available to rearing juvenile fall Chinook salmon and has the potential to cause juvenile fall Chinook salmon to become stranded on bars or trapped in pools that become isolated from the stream channel. Losses of fry that are trapped in pools may occur due to high water temperatures, increased vulnerability to predation, or stranding if the pools drain before they are reconnected to the river. The Hells Canyon reach is not known to provide important rearing habitat for other anadromous species, but it is the most important production area in the Snake River basin that is still accessible to fall Chinook salmon.

Idaho Power's fall Chinook flow program (which Idaho Power proposes to continue) provides stable flows during the fall Chinook spawning season and maintains flows sufficient to keep redds watered until emergence is complete, but their proposed operations would allow substantial flow fluctuations to occur during the fall Chinook rearing period (approximately March 15 through June 15). Idaho Power proposes to continue its current maximum up- and down-ramping rate of 12 inches per hour as measured at Johnson Bar. Under typical operating conditions,[67] Idaho Power would limit the maximum daily change in flow to 10,000 cfs from June 1 through September 30, and maintain a minimum flow of 6,500 cfs year-round.

Recommendations received from NMFS, Interior, the Forest Service, ODFW, IDFG, the Nez Perce Tribe, the Umatilla Tribes, and AR/IRU related to ramping rates and minimum flows outside of the fall Chinook spawning period are summarized in table 43, and are discussed below.

Our Analysis

Habitat Area

Idaho Power modeled juvenile fall Chinook rearing habitat using one-dimensional (1D) and two-dimensional (2D) modeling techniques. The 2D model was developed based on bathymetry, velocity and substrate data collected at seven sites in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River) and four sites in the lower Hells Canyon reach (Salmon River to the Lower Granite reservoir). Idaho Power expanded the modeling results from these 11 sites to the entire reach based on the geomorphic features of the river channel. The 2D model used habitat suitability criteria for depth, velocity, and substrate to determine habitat suitability.

The 1D method used a one-dimensional hydrodynamic flow model and a detailed digital terrain model of the entire reach extending from Hells Canyon dam to the head of Lower Granite reservoir. The 1D model determined habitat suitability based on depth and shoreline gradient. Idaho Power developed the 1D modeling approach based on work conducted by Tiffan et al. (2002) on the Hanford reach of the Columbia River. Tiffan et al. (2002) found that shoreline gradient was the most important measured variable in determining the presence of subyearling fall Chinook salmon.

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[67] See table FW-4, footnote a, for a description of atypical operating conditions, under which a maximum daily flow change of 16,000 cfs and a minimum flow of 5,000 cfs would be allowed.

Table 43. Ramping rate and minimum flow recommendations outside of the fall Chinook spawning season. (Source: staff)

Component	Idaho Power	NMFS	Interior	Forest Service	ODFW
Year-round ramping rate or minimum flow	Twelve inches per hour measured at Johnson Bar, 6,500 cfs minimum except 5,000 cfs under atypical conditions,[a] maximum daily flow change of 10,000 cfs, except 16,000 cfs under atypical conditions[a]		Interior-66. Conduct a three-phased test program: (1) 12-inches-per-hour ramping rate measured within 1 mile of Hells Canyon dam; (2) same ramping rate with DO enhancement to achieve 6 mg/L or as high as possible; and (3) run-of-river operation at Hells Canyon dam, with continued DO enhancement.	FS-30. Same as Interior, but specifies a minimum flow of 8,500 cfs or inflow, a maximum daily flow change of 10,000 cfs from Memorial Day to Labor Day, and durations of 3, 3, and 5 years for the three test phases.	ODFW-33. Six inches per hour measured within 1 mile of Hells Canyon dam, except during fall Chinook spawning and rearing.
Restrictions specific to the fall Chinook rearing period		NMFS-4. Monitor stranding sites to determine flows to connect entrapment sites to the river; assess effects of load following on forage species, juvenile behavior, entrapment and mortality; release flows sufficient to reconnect the largest entrapment areas at least 2 hours per day; release stable flows of at least 11,500 cfs if daily average temperatures in any pool exceeds 16°C for more than three days or when peak temperatures exceed 19°C for more than 4 hours.		FS-30. Take measures to prevent fall Chinook juvenile entrapment from emergence through the outmigration period.	ODFW-33. Four inches per hour measured within 1 mile of Hells Canyon dam March 21 through June 21.
Consultation and reporting		NMFS-4. Based on study of entrapment areas, develop long-term operational protocols to protect, and minimize negative effects on, rearing juvenile fall Chinook.	Interior-66. Duration and timing of each test to be determined in consultation with FWS; each test would likely require several years to assess effects.		

Component	IDFG	Nez Perce Tribe	Umatilla Tribes	AR/IRU
Year-round ramping rate or minimum flow				AR/IRU-23a. Two inches per hour to be measured at Hells Canyon dam, consult with the Technical Advisory Committee to determine a maximum daily change in discharge to protect biological and other resource values
Restrictions specific to the fall Chinook rearing period	IDFG-1b. Fall Chinook flow program should be revised to include measures to prevent stranding of fall Chinook fry and other species.	NPT-3 and NPT-4. Two-inches-per-hour ramping rate during the fall Chinook rearing period; if stranding is found based on monitoring, release sufficient flows to reconnect entrapment sites twice in a 24-hour period.	CTUIR-10. Two inches per hour during fall Chinook spawning, emergence and early rearing; consult to establish critical flow levels to protect juvenile fall Chinook from stranding and entrapment.	AR/IRU-23b. Identify and monitor potential stranding sites upstream of the Salmon River; take measures needed to minimize potential stranding of fall Chinook, implement a minimum flow that maintains connection to important entrapment pools.
Consultation and reporting				AR/IRU-23d. Develop and implement a monitoring and reporting plan for load following operations

[a] As defined by Idaho Power, atypical conditions would be conditions when Idaho Power determines that operation of the project is needed to: (1) protect the performance, integrity, reliability, or stability of Idaho Power's electrical system or any electrical system with which it is interconnected; (2) compensate for any unscheduled loss of generation; (3) provide generation during severe weather or extreme market conditions; (4) inspect, maintain, repair, replace, or improve Idaho Power's electrical systems or facilities related to the project; (5) prevent injury to people or damage to property; or (6) assist in search-and-rescue activities

Idaho Power used both the 1D and 2D models to develop weighted useable area (WUA) habitat versus discharge relationships for the reaches upstream and downstream of the Salmon River confluence. As shown in WUA versus discharge plots on figures 66 and 67, both models indicate that the Snake River downstream of the Salmon River provides approximately 4 to 5 times as much rearing habitat for fall Chinook salmon as the upstream section from Hells Canyon dam to the Salmon River. The results from both models also indicate that fall Chinook rearing habitat declines with increasing discharge in both sections of the river. Declines in habitat in the upper reach are relatively gradual, while habitat in the lower reach declines rapidly as flows increase to about 25,000 cfs, after which the amount of habitat declines more gradually.

In Brink and Chandler (2005), staff requested that Idaho Power use both the 2D and 1D habitat models to evaluate the effects of different operating scenarios on fall Chinook habitat in the upper and lower Hells Canyon reaches. Idaho Power generated plots of hourly WUA using flow data from 3 water years representing extremely low flow, medium flow, and extremely high flow conditions. Representative plots showing predicted hourly WUA for fall Chinook juveniles in the upper Hells Canyon reach under proposed operations are shown in figure 68 (2D model) and figure 69 (1D model). The period in which juvenile fall Chinook salmon are present in the reach (March 15 to June 15) is indicated by the hatch marks shown on each figure.

To compare the amount of habitat that is predicted to occur in each reach, year, and operating scenario, we used these plots to estimate the maximum and minimum WUA and the normal maximum daily percent fluctuation[68] of WUA that occurred within the fall Chinook rearing period, and we summarized these values in table 44 for the 2D model and in table 45 for the 1D model. For example, from figure 68, we estimated that under proposed operations in the upper Hells Canyon reach in the extremely low flow year, the minimum WUA was 107,000 square meters, the maximum WUA was 125,000 square meters, and the maximum daily fluctuation in WUA was about 5 percent. For the medium flow year, under proposed operations, we estimated that the minimum WUA was 69,000 square meters, the maximum WUA was 122,000 square meters, and the maximum daily fluctuation in WUA was about 8 percent. For the extremely high flow year, under proposed operations, we estimated that the minimum WUA was 38,000 square meters, the maximum WUA was 117,000 square meters, and the maximum daily fluctuation in WUA was less than 1 percent.

Results tabulated from the 2D model plots indicated that the maximum WUA above the Salmon River was similar for all water years and scenarios, ranging between 110,000 and 125,000 square meters (table 44). Maximum WUA downstream of the Salmon River was consistent between scenarios, but more habitat was available in low water years. The 1D model showed the same general relationships (table 45), except that the reduction in WUA values in higher water years was more pronounced than it was in the 2D model.

The minimum WUA values showed a similar consistency between scenarios, and showed consistently lower WUA values in higher water years. Results tabulated from the 2D model plots for the six scenarios showed minimum WUA above the Salmon River did not vary between scenarios but did vary by water year, ranging from 38,000 square meters in the extremely high water year to 107,000 square meters in the extremely low water. Similarly consistent patterns were found in the 2D data from downstream of the Salmon River and in the 1D data for both reaches.

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[68] To illustrate the maximum effect of load following operations while excluding larger changes in flow that do not occur on a regular basis, we based this estimate on the largest percentage change in WUA that occurred in at least 3 consecutive days.

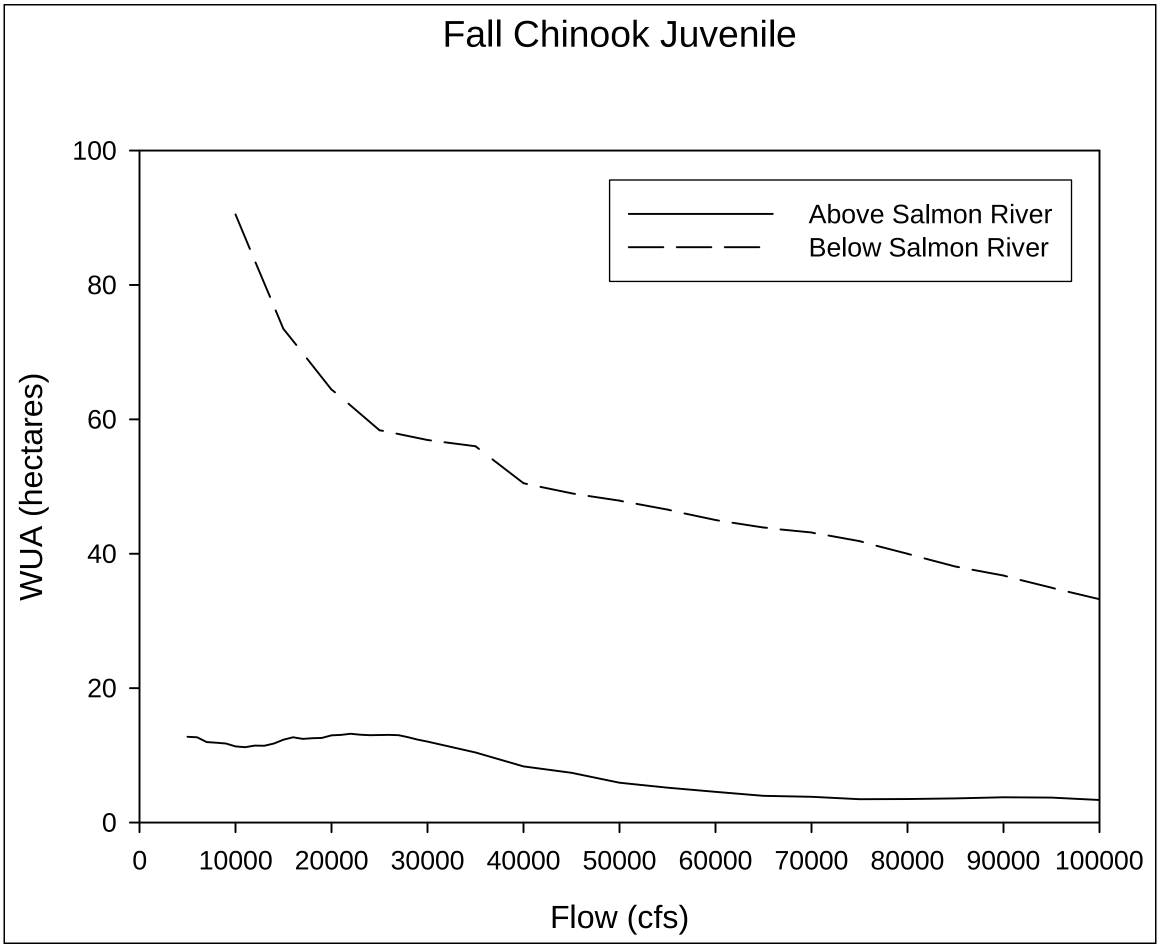

Figure 66. Weighted useable area versus discharge for fall Chinook juvenile habitat above the Salmon River (Hells Canyon dam to the Salmon River confluence) and below the Salmon River (Salmon River confluence to Lower Granite reservoir) predicted using the 2D habitat model. (Source: Chandler et al., 2003c, as modified by staff)

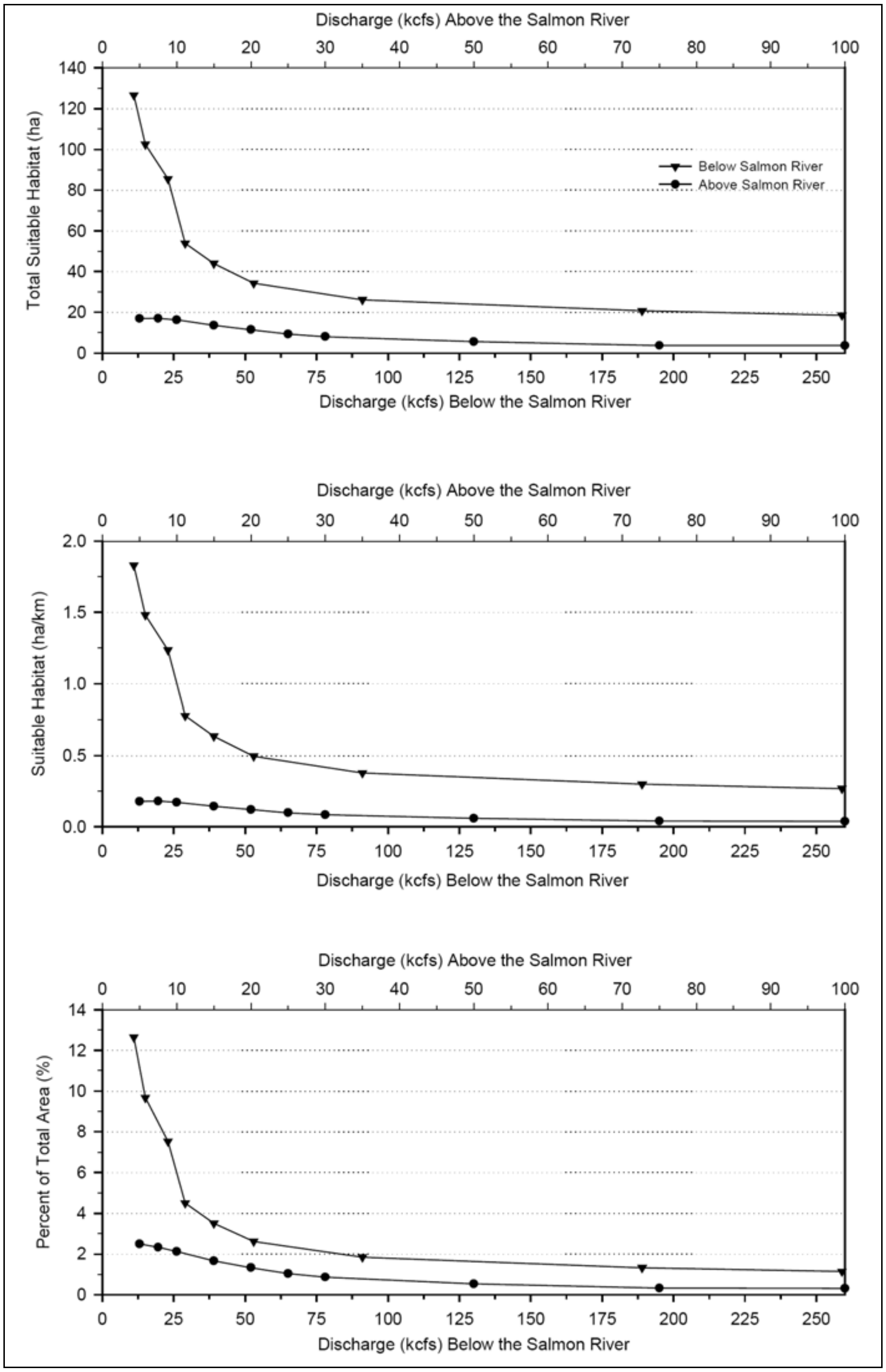

Figure 67. Weighted useable area versus discharge for fall Chinook juvenile habitat upstream of the Salmon River (Hells Canyon dam to the Salmon River confluence) and downstream of the Salmon River (Salmon River confluence to Lower Granite reservoir) predicted using the 1D habitat model. (Source: Chandler et al., 2003c)

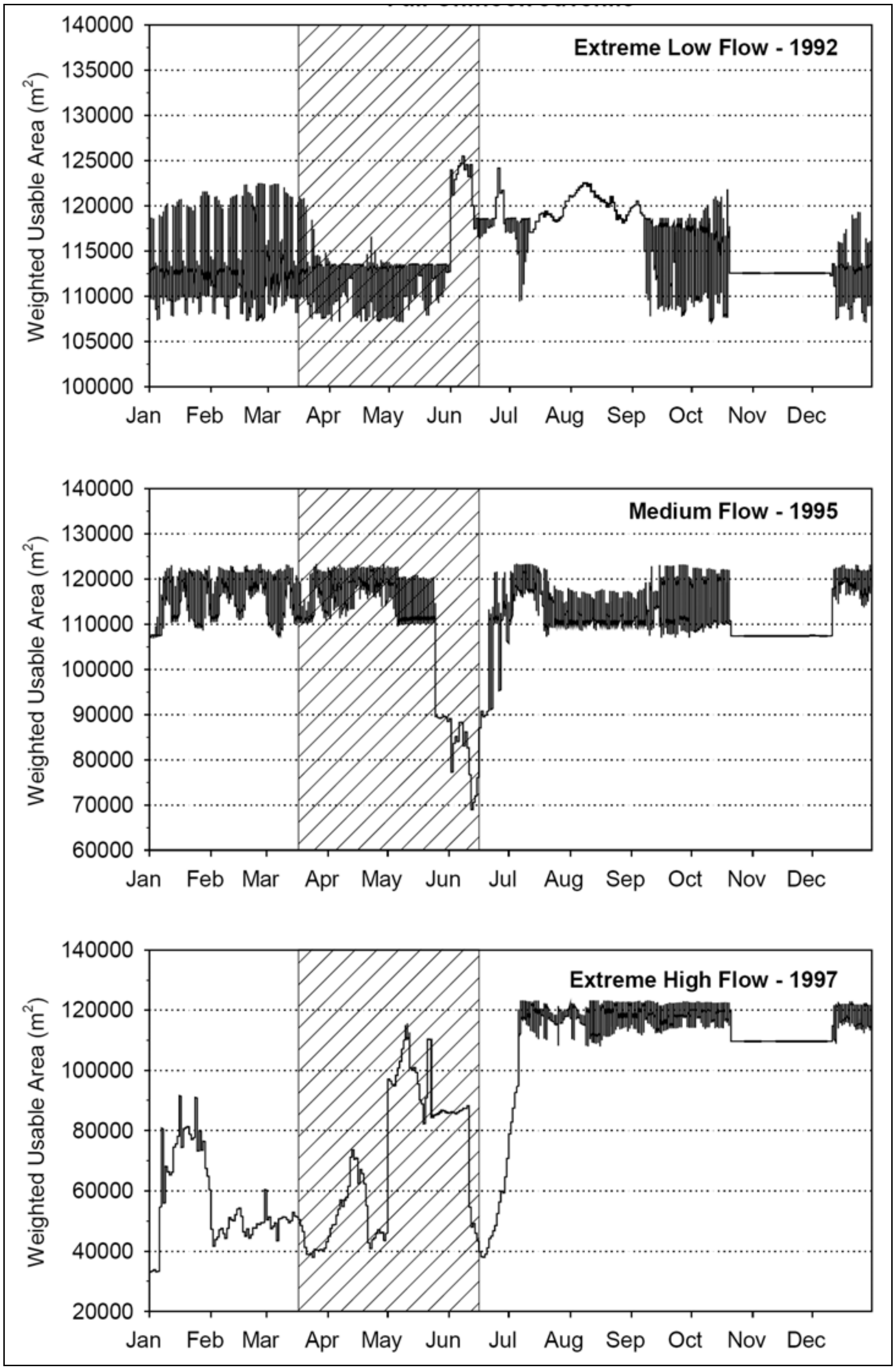

Figure 68. Hourly weighted useable area for fall Chinook juveniles upstream of the Salmon River simulated for proposed operations using the 2D model for three water year types. (Source: Brink and Chandler, 2005)

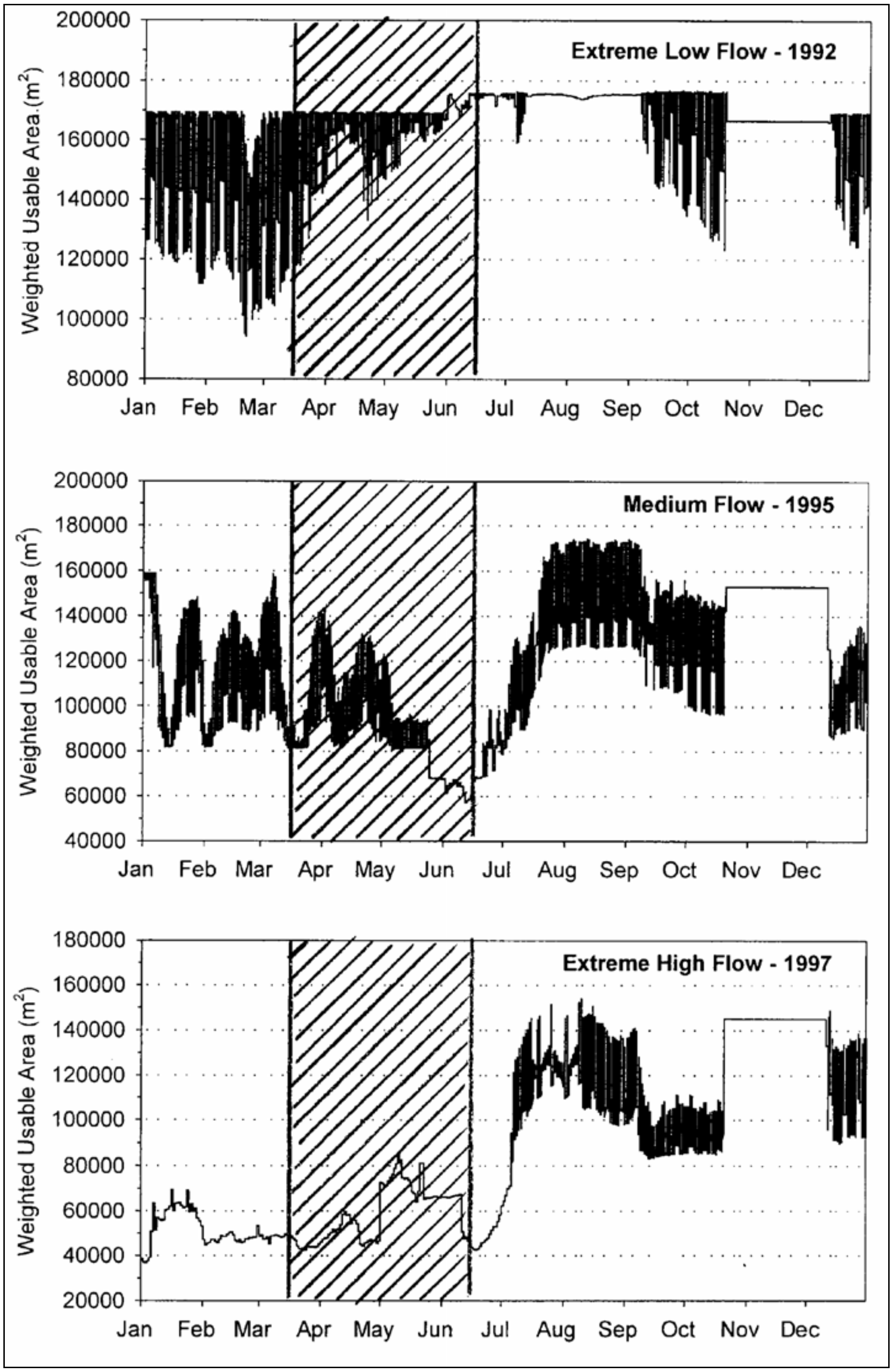

Figure 69. Hourly weighted useable area for fall Chinook juveniles upstream of the Salmon River simulated for proposed operations using the 1D model for three water year types. (Source: Brink and Chandler, 2005)

Table 44. Estimated minimum, maximum, and maximum percent daily fluctuation in WUA during the fall Chinook rearing period (March 15 to June 15), based on 2D modeling of fall Chinook rearing habitat in the Hells Canyon reach upstream and downstream of the Salmon River. (Source: Brink and Chandler, 2005, as modified by staff)

		Above Salmon River			Below Salmon River		
Scenario	**Year**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**
Proposed	Extremely low	107	125	5	550	710	9
	Medium	69	122	8	300	630	9
	Extremely high	38	117	<1	250	490	<1
Scenario 1a (Reregulating)	Extremely low	107	125	<1	560	700	<1
	Medium	69	123	<1	295	605	<1
	Extremely high	38	116	<1	250	490	<1
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	107	125	5	560	700	2
	Medium	69	123	5	295	605	<1
	Extremely high	38	111	<1	250	490	<1
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	107	125	5	560	685	5
	Medium	69	124	11	295	605	5
	Extremely high	38	117	<1	250	490	<1
Scenario 2 (Flow Augmentation)	Extremely low	107	125	5	560	700	2
	Medium	69	124	4	295	610	<1
	Extremely high	38	118	<1	250	490	<1
Scenario 3 (Navigation)	Extremely low	107	125	5	560	700	9
	Medium	69	124	8	295	630	6
	Extremely high	38	120	<1	250	490	<1

[a] WUA values are shown in 1,000 square meters.

Table 45. Estimated minimum, maximum, and maximum percent daily fluctuation in WUA during the fall Chinook rearing period (March 15 to June 15) based on 1D modeling of fall Chinook rearing habitat in the Hells Canyon reach upstream and downstream of the Salmon River. (Source: Brink and Chandler, 2005, as modified by staff)

		Above Salmon River			Below Salmon River		
Scenario	**Year**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**
Proposed	Extremely low	120	177	17	410	1,050	18
	Medium	60	142	29	280	510	15
	Extremely high	40	82	<1	250	310	<1

Scenario	Year	Above Salmon River			Below Salmon River		
		Min WUA[a]	Max WUA[a]	% Fluct.	Min WUA[a]	Max WUA[a]	% Fluct.
Scenario 1a (Reregulating)	Extremely low	152	177	<1	450	910	<1
	Medium	60	120	<1	370	610	<1
	Extremely high	40	82	<1	250	310	<1
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	143	177	5	450	1,020	6
	Medium	60	120	6	275	625	<1
	Extremely high	40	82	<1	250	310	<1
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	133	177	19	420	980	18
	Medium	60	120	24	280	680	22
	Extremely high	40	82	<1	250	310	<1
Scenario 2 (Flow Augmentation)	Extremely low	146	177	8	420	1,020	4
	Medium	60	120	4	280	620	<1
	Extremely high	40	90	8	250	310	<1
Scenario 3 (Navigation)	Extremely low	117	177	32	420	1,020	30
	Medium	60	150	32	280	720	21
	Extremely high	40	93	<1	250	310	<1

[a] WUA values are shown in 1,000s of hectares.

Maximum daily fluctuation of WUA showed substantial differences between scenarios and water year types. Results from the 2D model (table 44) indicate that the maximum daily fluctuation in the upper reach was typically in the 5 to 8 percent range for the extremely low and medium water years for all but the run-of-river scenario, where fluctuations were less than one percent. Fluctuations downstream of the Salmon River were more variable, but showed similar trends. The results from the 1D model (table 45) indicate substantially larger daily fluctuations in WUA for Proposed Operations; Scenario 1c, (Year-round 6-Inches-Per-Hour Ramping Rate); and the Navigation Scenario in the extremely low and medium water years. Upstream of the Salmon River, the maximum fluctuation shown by the 1D model exceeded 20 percent in 1 or more water years under Proposed Operations; Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate); and the Navigation Scenario. Downstream of the Salmon River, the maximum fluctuation in WUA was slightly reduced but followed very similar trends between scenarios.

Increasing habitat stability would benefit rearing fall Chinook salmon by allowing fish to locate and remain in areas of optimal habitat, and by avoiding energy expenditures associated with moving between or residing in less favorable habitats. Based on our evaluation of the WUA patterns modeled by Idaho Power, we conclude that Scenario 1a, Reregulating, would provide the highest level of habitat stability for rearing fall Chinook salmon. Proposed Operations, the Navigation Scenario, and Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate) would provide the least stable habitat conditions. Scenario 1b (Year-round 2-inches-Per-Hour Ramping Rate) and the Flow Augmentation Scenario, which included a 2-inches-per-hour ramping rate restriction during the fall Chinook rearing period, would provide an intermediate level of habitat stability.

The Forest Service filed a review (Hardy, 2006) of Idaho Power's instream flow study with its draft EIS comments. Dr. Hardy raised four primary concerns regarding Idaho Power's approach to modeling effects on juvenile fall Chinook salmon. These were: (1) the basis for using of the 1-D model without including simulated velocities was not adequately verified; (2) modeling rearing habitat without considering proximity to cover may produce unrealistic results; (3) Idaho Power's analysis did not follow standard approaches for determining effective habitat (habitat that remains suitable over the diurnal range of flows); and (4) the analysis did not consider the effects of reduced invertebrate production and reduced drift associated with lost production along stream margins. Although each of these points has some merit, the Forest Service does not refute our conclusion that favorable growth rates of juvenile fall Chinook salmon indicate that any adverse effects of load following on the habitat conditions and food supply for this species have been limited in scope, at least up until the last several years, when growth rates have started to decline (see section 3.6.1.2, *Primary Production and Aquatic Macroinvertebrates*). As we discuss in the following sections, we conclude that reduced ramping during the fall Chinook rearing period would likely benefit juvenile fall Chinook salmon by increasing the food supply and by reducing the potential for mortality from stranding and entrapment.

Food Supply

Flow fluctuations may also affect rearing fall Chinook salmon by affecting the available food supply. Although juvenile Chinook salmon feed on a variety of aquatic and terrestrial insects as well as larval fish (Moyle, 2002), Rondorf et al. (1990) found that aquatic macroinvertebrates predominated in the diet of subyearling Chinook salmon in riverine (unimpounded) habitat in the Columbia River. Although Connor and Burge (2003) report that juvenile fall Chinook salmon downstream of Hells Canyon dam exhibit rapid growth compared to other populations, we note that their study was based on juvenile sampling conducted between 1995 and 2000. Because the number of fall Chinook spawning in this reach has increased approximately four-fold since the 1999 brood year (which produced the juveniles that would have been sampled in 2000), it is likely that competition for available food resources has increased substantially in the Hells Canyon reach.

In subsection *Primary Production and Aquatic Invertebrates* in section 3.6.2.1, we concluded that invertebrate production is likely to be substantially reduced in shallow areas that are regularly dewatered. The maximum percentage of streambed that would be dewatered due to daily flow fluctuations during the fall Chinook rearing period (March 15 to June 15) under Proposed Operations and four alternative scenarios are summarized in table 46. The percentage of the streambed that would be exposed from daily flow fluctuation under proposed operations was less than 1 percent in both the upper and lower reaches in an extremely high flow year and ranged between 5 and 8 percent in both reaches in extremely low and medium water years. The exposed area would be slightly decreased with a 6-inches-per-hour ramping rate and would be reduced to 1 to 2 percent under a 2-inches-per-hour ramping rate.

Table 46. Estimated maximum seasonal percentage of streambed that would be subject to daily dewatering during the fall Chinook rearing period (March 15 to June 15) upstream and downstream of the Salmon River under Proposed Operations and four alternative scenarios. (Source: Brink and Chandler, 2005, as modified by staff)

		Maximum Percent of Streambed Exposed Due to Load Following 0perations Between March 15 and June 15	
Scenario	**Water Year Type**	**Above Salmon River**	**Below Salmon River**
Proposed Operations	Extremely low	5	8
	Medium	7	5
	Extremely high	< 1	< 1

Scenario	Water Year Type	Maximum Percent of Streambed Exposed Due to Load Following 0perations Between March 15 and June 15	
		Above Salmon River	Below Salmon River
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	2	1
	Medium	2	< 1
	Extremely high	< 1	< 1
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	3	3
	Medium	6	3
	Extremely high	< 1	< 1
Scenario 2 (Flow Augmentation)	Extremely low	1	2
	Medium	2	< 1
	Extremely high	< 1	< 1
Scenario 3 (Navigation)	Extremely low	4	7
	Medium	6	6
	Extremely high	< 1	< 1

Another way to examine potential effects on food supply in fall Chinook rearing habitat is based on stage change. If flows are ramped down at the proposed maximum ramping rate of 12 inches per hour for 5 consecutive hours, this would result in a 60-inch change in stage at Johnson Bar, effectively dewatering all of the stream margins that had suitable depths for rearing fall Chinook salmon (< 1.5 meters [59 inches] deep) during the daytime peaking hours. The corresponding stage change that would occur under a 6-, 4- or 2-inches-per-hour ramping rate would be 30, 20 and 10 inches, respectively, indicating that more restrictive ramping rates would protect a substantial portion of the suitable fall Chinook habitat from daily dewatering. Because invertebrate production can be greatly reduced in areas that are frequently dewatered, implementing run-of-river operations or a 2-inches-per-hour or 4-inches-per-hour ramping rate would provide a substantial increase in the food that is available in habitat areas that are used by juvenile fall Chinook salmon.

If invertebrate production is reduced in areas that are frequently exposed during load following operations, this would affect the food supply for rearing fall Chinook salmon and other fish species including redband and bull trout. The reduction in growth rates of fall Chinook salmon observed in the last several years indicates that any reduction in the available food supply is likely to affect growth rates and survival of fall Chinook salmon. In addition, flow fluctuations could cause mortality of several sensitive species of mollusks, or adversely affect the quality of their habitat.

Entrapment and Stranding

In its response to AIR OP-1(f), Idaho Power conducted a study to evaluate the effects of alternative operating scenarios on fish stranding. Idaho Power used helicopter video footage of the Snake River downstream of Hells Canyon dam at a flow of 5,600 to 5,800 cfs to identify areas that formed stranded pools of water where fish could become entrapped as flows recede. From this review, Idaho Power identified 12 entrapment pools to determine the elevations and discharges at which the pools become disconnected from the river. Two of the sites were found to form entrapment pools at flows lower than the 6,500 cfs normal minimum flow proposed by Idaho Power, 3 sites formed entrapment pools at flows between 8,000 and 16,000 cfs, and 7 sites formed entrapment pools at flows greater than 20,000 cfs (Brink and Chandler, 2005).

Idaho Power performed additional survey work in the spring of 2005 to obtain more definitive information on the flows at which potential entrapment pools become disconnected from the river, quantify the number of fish entrapped, and monitor potential losses due to stranding and entrapment (Brink, 2006). Idaho Power reported that it did not attempt to conduct surveys of stranding on cobble bars because it is difficult to detect any small fish that become stranded on coarse substrates. Pressure transducers were installed in pools to determine the flow at which pools became isolated from the river, and water temperatures were continuously monitored in most pools. Fish surveys were conducted on a weekly basis starting on March 15 and ending on June 15.

A total of 22 entrapment pools located between RM 190.5 and RM 234.1 were identified and surveyed during the spring 2005 monitoring studies. Table 47 shows the location and entrapment flow that was determined for each pool, the number of times that each pool was isolated from the river during the survey period, and the estimated number of juvenile fall Chinook salmon that died or became entrapped in each pool. In its analysis, Idaho Power assumed that no fish survived in a pool where the water temperature increased as high as 23°C. Table 48 shows the total number of fish other than wild age-0 fall Chinook salmon that were observed during the entrapment pool surveys.

Idaho Power used the survey data in combination with its 1D hydraulic model of the upper Hells Canyon reach to estimate the percentage reduction in age-0 fall Chinook mortality that would have occurred in 2005 under alternative minimum flows and ramping rates. The results of its analysis indicate that higher minimum flows up to 12,000 cfs would have prevented less than 20 percent of the estimated mortalities (table 49), while ramping rates of 4 inches per hour and 2 inches per hour were predicted to have prevented 93 and 95 percent of the mortalities, respectively (table 50). Idaho Power reported that the effectiveness of these operational constraints would vary between years depending on flow conditions in that year. We also note that reducing the ramping rate would be very likely to reduce stranding losses that may occur in cobble bars, which Idaho Power did not attempt to quantify due to the difficulty of finding stranded fish in dewatered areas with large substrate.

Reducing ramping rates during the fall Chinook rearing season would provide several benefits to juvenile fall Chinook salmon. Based on our analysis of Idaho Power's habitat modeling studies, restricting ramping rates would increase habitat stability, which would reduce energy expenditures from fish having to repeatedly move to find optimal rearing habitats or reduce food intake from residing in sub-optimal habitat. Based on our analysis of effects on invertebrate production, Idaho Power's proposed ramping rate could result in complete dewatering of favored rearing habitats (<1.5 meters deep), which would substantially reduce macroinvertebrate abundance and the food base that is available to fall Chinook salmon in their preferred rearing habitat. Furthermore, from our analysis of Idaho Power's entrapment monitoring work, we conclude that implementing more restrictive ramping rates could substantially reduce mortalities due to stranding and from entrapment.

Idaho Power identifies the primary fall Chinook rearing season to be from March 15 to June 15, while ramping rate restrictions recommended by other stakeholders to protect rearing fall Chinook salmon include March 1 to May 31 (AR/IRU), April and May (Nez Perce Tribe), and March 21 to June 21 (ODFW). Observations on emergence timing reported in Connor et al. (2002) indicate that fall Chinook salmon typically start to emerge in early April in both the upper and lower Hells Canyon reaches. Also, Idaho Power reports that juvenile fall Chinook salmon have completely emigrated from both reaches by the third week in June. Implementing restrictive ramping rates as early as March 15 would benefit rearing fall Chinook salmon by allowing macroinvertebrates time to start colonizing shoreline rearing habitats before fall Chinook fry emerge from the gravel and take up residence in these areas. In addition, maintaining a ramping rate restriction until June 15 would protect the great majority of fall Chinook salmon from the risk of entrapment and stranding losses associated with load following operations.

Table 47. Entrapment site locations, flows at which sites disconnect from the river (entrapment flow), number of entrapment events, and numbers of age-0 fall Chinook salmon estimated to be entrapped and killed between March 15 and June 15, 2005 in the upper Hells Canyon reach of the Snake River. (Source: Brink, 2006)

Site Name	River Mile	Entrapment Flow	No. of events	Entrapments		Mortalities		Temp (23°C)	Total
				Observed	Estimated	Observed	Estimated		
Knight Creek	190.5	17,314	48	406	2,692	3	16	0	16
Trail Gulch	199.3	16,923	52	158	1,105	0	0	0	0
Middle Pine Bar	227.3	15,735	60	2,203	15,842	2	14	2,000	2,014
Lower Turtle Cove	223.5	14,664	60	138	999	0	0	0	0
Saddle Creek	236	14,467	59	1,528	10,390	2	14	0	14
Lower Bernard	235	13,386	56	7	42	3	24	0	24
Lower Pleasant Valley (upper)	213.8	12,619	55	13	74	7	43	7	50
Imnaha	191.7	12,589	54	1,967	12,913	0	0	0	0
Dug Bar	196.1	11,560	48	3	18	2	14	2	16
Russell Bar	219.7	11,309	46	1,443	8,853	4	24	0	24
Durham Bar (pools nos. 2 to 5)	217.5	11,154	46	10,362	55,527	2	17	0	17
Big Sulfur	200	11,007	46	1,681	10,579	1	14	0	14
Dry Creek	200.9	10,756	46	1	7	2	14	0	14
Durham Bar (pool no. 1)	217.5	10,668	45	242	1,400	0	0	0	0
Upper Kirby (downstream)	219.5	10,467	45	1	7	2	14	0	14
Lower Pine Bar	227.1	10,301	43	2,087	13,054	0	0	0	0
Upper Kirby (upstream)	219.5	9,931	43	4	23	1	7	1	8
Hat Creek	235.6	9,919	43	160	391	1	2	0	2
Little Bar	224.9	9,879	43	3,606	22,149	43	196	0	196
Lower Pleasant Valley (lower)	213.8	9,347	39	262	1,364	1	1	140	141
Lower Campbell	205.1	9,195	38	61	275	0	0	77	77
Dry Basin	234.1	8,960	32	36	142	1	2	0	2
		Totals	1,047	26,369	157,846	77	416	2,227	2,643

Table 48. Total number of fish other than wild age-0 fall Chinook salmon encountered during entrapment pool surveys conducted in the upper Hells Canyon reach of the Snake River in 2005. (Source: Brink, 2006, as modified by staff)

	Sampling Method				
Species	**Snorkel Counts**	**Visual Observations**	**Beach Seine**	**Hand Dip Net**	**Electro-fishing**
Hatchery fall Chinook	0	1	0	0	0
Wild spring Chinook	0	2	0	1	0
Hatchery spring Chinook	0	1	0	0	0
Wild steelhead	1	38	0	0	0
Hatchery steelhead	0	25	0	0	0
Smallmouth bass	13	260	3	0	6
Crappie spp.	0	0	2	0	0
Carp	62	142	0	0	30
Largescale sucker	1	2	0	0	0
Bluegill	0	0	0	0	10
Northern pikeminnow	0	0	0	0	1
Sculpin spp.	0	2	0	1	0
Cyprinid spp.	100	175	0	0	0
Yellow perch	0	1	0	0	0

Table 49. Estimated age-0 fall Chinook salmon entrapment losses under the 2005 minimum flow (8,700 cfs) and three alternative modeled flows released from Hells Canyon dam. (Source: Brink, 2006)

Minimum Flow (cfs)	Events	Estimated Number Entrapped	Estimated Total Mortalities	Mortality Rate (%)	Reduction in Entrapment (%)	Reduction in Mortality (%)
8,700	1,047	157,846	2,643	1.67	--	--
10,000	809	133,502	2,217	1.66	15.42	16.12
11,000	630	119,034	2,189	1.84	24.59	17.18
12,000	444	44,057	2,118	4.81	72.09	19.86

Table 50. Estimated age-0 fall Chinook salmon entrapment losses under the 2005 ramping rate (12-inches-per-hour) and three alternative ramping rates applied to Hells Canyon dam operations at an inflow of 11,340 cfs (observed April 26, 2005). (Source: Brink, 2006)

Ramping Rate (per hour)	Events	Estimated Number Entrapped	Estimated Total Mortalities	Mortality Rate (%)	Reduction in Entrapment (%)	Reduction in Mortality (%)
12 inches	1,047	157,846	2,643	1.67	--	--
6 inches	838	152,268	2,407	1.58	3.53	8.93
4 inches	589	112,864	187	0.17	28.50	92.92
2 inches	295	87,964	121	0.14	44.27	95.42

Most of the agencies, tribes, and NGOs recommend ongoing monitoring and adaptive flow management to protect juvenile fall Chinook salmon from stranding and entrapment losses during the rearing and outmigration period. NMFS also recommends that sufficient flow be released each day during the fall Chinook rearing season to reconnect the largest entrapment areas for at least 2 hours each day and increase minimum flows to 11,500 cfs if water temperatures in entrapment pools exceed 16°C for more than 3 days or when peak water temperatures in any pool exceed 18°C for more than 4 hours.

The level of protection that is provided by a specific ramping rate or minimum flow would vary between years, depending on overall flow levels. In addition, the monitoring conducted to date has focused exclusively on juvenile fall Chinook salmon, and has not included monitoring of stranding and entrapment of bull trout. Therefore, monitoring of fall Chinook salmon and bull trout entrapment and stranding would help to identify whether any changes in project operation or other protective measures would be beneficial. For example, fish salvage operations would be beneficial when water temperatures increase to high levels in entrapment pools that are occupied by juvenile fall Chinook salmon, or when occupied pools become disconnected from the river as seasonal flows recede. It would also be beneficial to extend monitoring studies to include habitat downstream of the Salmon River, which does not appear to have been included in Idaho Power's 2005 surveys. Elements that should be considered as part of a monitoring plan include monitoring stranding on cobble bars and entrapment of fish in key pools, determining flows needed to reconnect those pools on a daily basis, mark/recapture surveys to monitor fish distribution, survival assessments, and conducting salvage operations as necessary.

The benefits of NMFS's recommendation that a minimum flow of 11,500 cfs be provided when water temperatures rise to high levels in entrapment pools are uncertain, since most of the 2005 mortalities occurred at the middle Pine Bar pool, which Brink (2006) reports became disconnected from the river at a flow of 15,735 cfs (table 47). However, the benefits of this type of operational measure could be evaluated, refined, and implemented through an adaptive management process.

Finally, we are not convinced that the multi-year ramping rate study recommended by FWS and the Forest Service (table 43) is feasible or warranted. This measure would involve monitoring operational effects on periphyton and aquatic invertebrate productivity during a three-phased operational test period extending over several years, including: (1) 12-inches-per-hour ramping rate measured within 1 mile of Hells Canyon dam; (2) the same ramping rate with DO enhancement to achieve a DO level of 6 mg/L or as high as possible; and (3) run-of-river operation at Hells Canyon dam, with continued DO enhancement. We question two aspects of the proposed ramping rate study recommended by FWS and the Forest Service. First, the schedule for implementing DO measures is likely to be established in the water quality certificate for the project, and it is likely that the certificate will require DO measures to be implemented as soon as practical after license issuance. Second, the program recommended by FWS and the Forest Service would not be likely to allow a sufficient amount of time to monitor the effect of implementing a

12-inch-per-hour ramping rate measured within 1 mile downstream of Hells Canyon dam, which would be more restrictive than Idaho Power's current and proposed ramping rates that would be measured at Johnson Bar. Instead, implementing a comprehensive periphyton and invertebrate monitoring program under the existing and proposed ramping rate would supplement information already collected by Idaho Power at this ramping rate, and would provide a more robust data set to determine the effects of any DO measures that are implemented under a new license. As we discuss in section 3.6.2.15, *Benthic Community Monitoring*, a well-designed monitoring program could assess the effects of load following operations on periphyton and invertebrate production by comparing and evaluating species composition and abundance in areas that have been dewatered at different frequencies over a range of hydrologic year-types. Therefore, we conclude that a comprehensive periphyton and invertebrate monitoring program conducted under the existing and proposed ramping rate, in conjunction with monitoring fish stranding and entrapment, would provide sufficient information to determine whether any further restrictions on ramping rates would be warranted to improve invertebrate production or to reduce fish stranding and entrapment.

Anadromous Fish Juvenile Migration

Project operations could potentially affect downstream migration conditions for anadromous fish produced in the mainstem of the Snake River and its tributaries and, to a lesser extent, fish that emigrate through the Lower Columbia River. Juvenile fall Chinook salmon emigrating from the Hells Canyon reach have the greatest potential to be affected, especially in the reach upstream of the Salmon River where flow and water temperatures are most strongly affected by project operations.

Juvenile fall Chinook salmon historically migrated from the Snake River in May and June, but impoundment of the river and blocked access to historical habitats has led to delayed migration in late June, July, and early August (NMFS, 1999). The thermal regime in the historical production area upstream of the project, which was primarily between Auger Falls (RM 607) and Huntington (RM 328), was influenced by substantial spring inflows and promoted early emergence, rapid growth and early emigration. Current spawning locations are generally cooler compared to the historical production area because they are farther removed from the Thousand Springs reach near Upper Salmon Falls, where spring-inflows provided a warmer incubation and early rearing environment. Loss of access to these spring-influenced production areas resulted resulting in reduced growth potential and delayed emigration of juvenile fall Chinook salmon, which is associated with reduced survival (Connor et al., 1998; Smith et al., 2003). These adverse effects have been compounded by the construction of additional dams on the lower Snake and Columbia rivers, through increased water temperatures, increased predation, and slower migration. According to data from PIT-tag detections,[69] during the past decade the timing of outmigration past Lower Granite dam has advanced by several weeks and the average size of fall Chinook migrants has decreased, apparently due to increased competition for food and space as the number of adult returns has increased approximately 20-fold.

From 1989 to 2000, as part of a comprehensive Snake River flow augmentation effort, Idaho Power released an average of 224 kaf of water from Brownlee reservoir to enhance migration of juvenile fall Chinook salmon. From 1996 through 2000, the augmentation flows were made as part of an energy exchange agreement between Idaho Power and BPA. That agreement expired in April 2001 and was not renewed by BPA. However, from 2002 through 2004, at the request of the Governor of Idaho, Idaho Power cooperated with a rental program initiated by BOR to assist with meeting its commitment to provide 427 kaf of flow augmentation water from the upper Snake River basin. Idaho Power leased the natural flow water rights that were acquired by the BOR from the state water bank for power purposes to

[69] Summarized by NMFS in its letter filed January 26, 2006, stating recommended terms and conditions.

ensure that the BOR rentals complied with state law and passed that water through the project. BOR and BPA were responsible for these costs. Additional augmentation flows were resumed in 2005 as part of an interim agreement to protect federally listed fall Chinook salmon (see figure 70). During the period 1991 through 2000, annual flow augmentation from the upper Snake River basin ranged from 90,000 to 437,281 acre-feet and averaged 371,188 acre-feet. Under the recent Nez Perce settlement, BOR has committed to provide 427 kaf from the upper basin each year for the next 30 years.

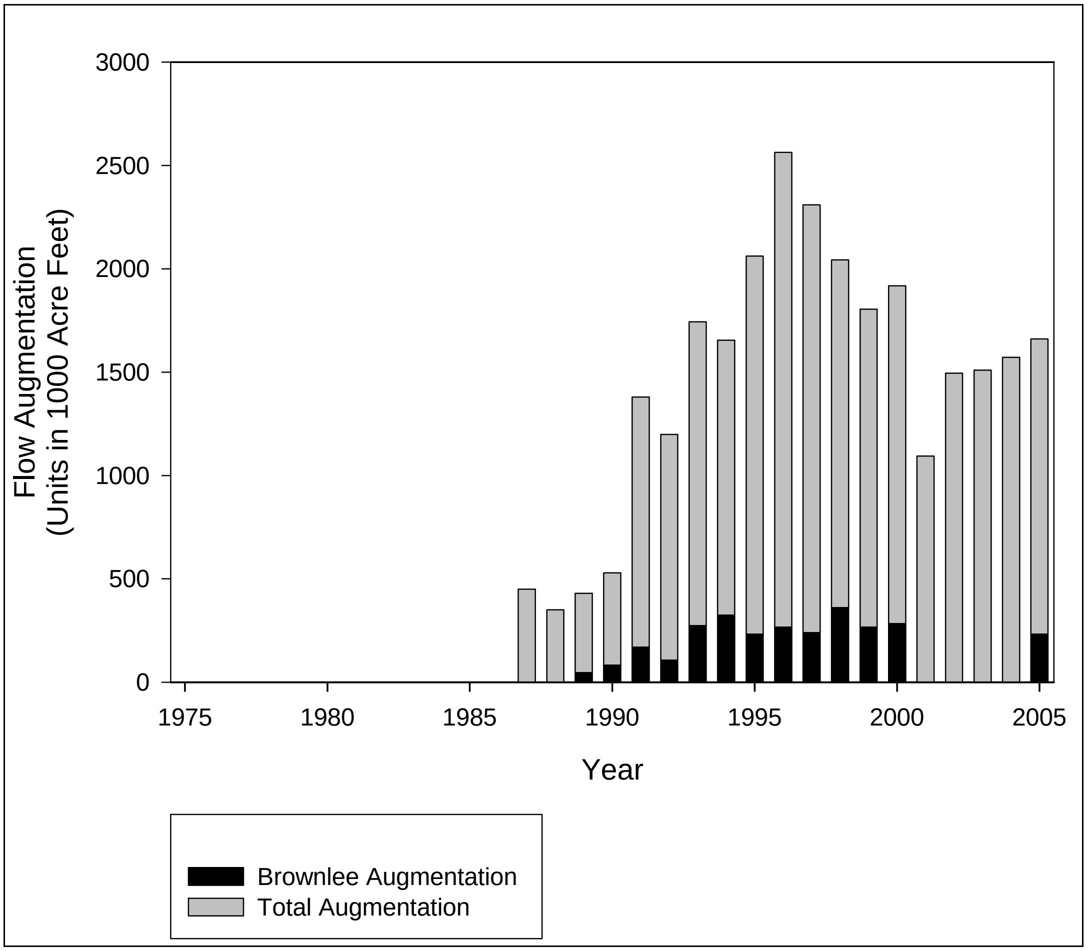

Figure 70. Flow augmentation water provided from Brownlee reservoir and total flow augmentation water provided from the Snake River basin. (Source: Staff)

Idaho Power does not propose any measures to enhance migration conditions for juvenile fall Chinook salmon. However, flow augmentation was recommended by several resource agencies, tribes, and other interested parties as a method to enhance migration by increasing flow through the lower Snake and Columbia River projects (see table 9). Specific recommendations fall into six general categories: (1) providing 237 kaf of flow augmentation water from Brownlee reservoir during the summer subyearling fall Chinook outmigration season; (2) requiring Idaho Power to provide timely passage of flows released from upstream BOR storage facilities; (3) requiring Idaho Power to “shape” or pre-release water to be made up by later deliveries from BOR storage reservoirs; (4) requiring that Idaho Power refill Brownlee reservoir as early as possible to avoid reducing outflows during the spring outmigration season of yearling Chinook salmon and steelhead smolts; (5) managing Brownlee reservoir to maximize flow augmentation during the spring and summer smolt migration seasons using real-time management based on January-July runoff forecasts; and (6) shifting flood control responsibilities to Lake Roosevelt (Grand

Coulee reservoir) on the upper Columbia River to increase flows through the Snake River during the smolt migration season.

Our Analysis

Several studies provide evidence that increasing flows during the fall Chinook subyearling smolt outmigration may increase migration speed and improve survival. Smith et al. (2003) analyzed data from 1995 through 2000 on the survival of PIT-tagged subyearling fall Chinook salmon released into free-flowing sections of the Snake River from mid-June through July. The estimated survival from the point of release to the tailrace of Lower Granite dam decreased for fish released later in the season (figure 71). Estimated survival for the early release groups ranged from 45 to 76 percent, but was 20 percent or less for the later release groups. This decrease in survival was correlated with decreased discharge, increased water transparency, and increased water temperature (figure 72).

Similarly, Connor et al. (2003a) modeled the effect of flow, temperature, and three other factors (initial tagging date, fork length on tagging date, and riverine distance traveled before reaching Lower Granite dam) on the rate of seaward migration of subyearling fall Chinook salmon. Flow and temperature influenced migration rate in the free-flowing sections of the river upstream of the fish's first encounter with a dam, but not in the period between passage at the first dam and the next dam downstream. Connor et al. (2003a) concluded that flow augmentation increases the rate of seaward movement in free-flowing sections of the river.

Connor et al. (1998) analyzed the survival rate of wild subyearling fall Chinook salmon released upstream of Lower Granite dam between 1992 and 1995. They found that detection of fish at the dam was positively related to mean summer flow and negatively related to maximum water temperature (figure 73). Connor et al. (1998) concluded that summer flow augmentation would be a beneficial interim recovery measure because it would increase flow and decrease water temperatures.

In some cases, flow and temperature can account for more than 90 percent of the variability in salmon survival. Connor et al. (2003b) released four cohorts (marked release groups) of wild subyearling fall Chinook salmon in free-flowing sections of the Snake River each year from 1998 to 2000 and compared the probability of survival for the groups. In general, survival increased with increasing flow and decreased with increasing temperature. Connor et al. (2003b) developed a predictive model of survival that included the following variables: (1) tagging date, (2) mean fork length, (3) flow exposure index (mean flow during the period when the majority of smolts within a cohort passed Lower Granite dam), and (4) water temperature exposure index (mean temperature during the period when the majority of smolts within a cohort passed Lower Granite dam). Ninety-two percent of the observed variability in survival between the four groups was attributed to flow and temperature. Using this model, Connor et al. (2003b) estimated the survival that would have occurred in the absence of flow augmentation. In all cases, the model predicted greater survival of subyearling Chinook salmon with flow augmentation than without (figure 74).

Flow augmentation from the Snake River basin may also provide benefits to smolts migrating through the Lower Columbia River migratory corridor. Williams et al. (2006) found that the survival rates of subyearling fall Chinook salmon traveling from the McNary dam tailrace to the John Day dam tailrace was positively correlated with flow, temperature, percent spill and water clarity. However, after the data were adjusted for annual means to remove generalized year effects, only flow was significantly correlated with survival (figure 75). In the multiyear analysis, the regression line slopes for adjusted and unadjusted flow were nearly the same and showed that, on average, each 10,000 cfs increase in the flow index was associated with a 1.3 to 1.5 percent increase in survival.

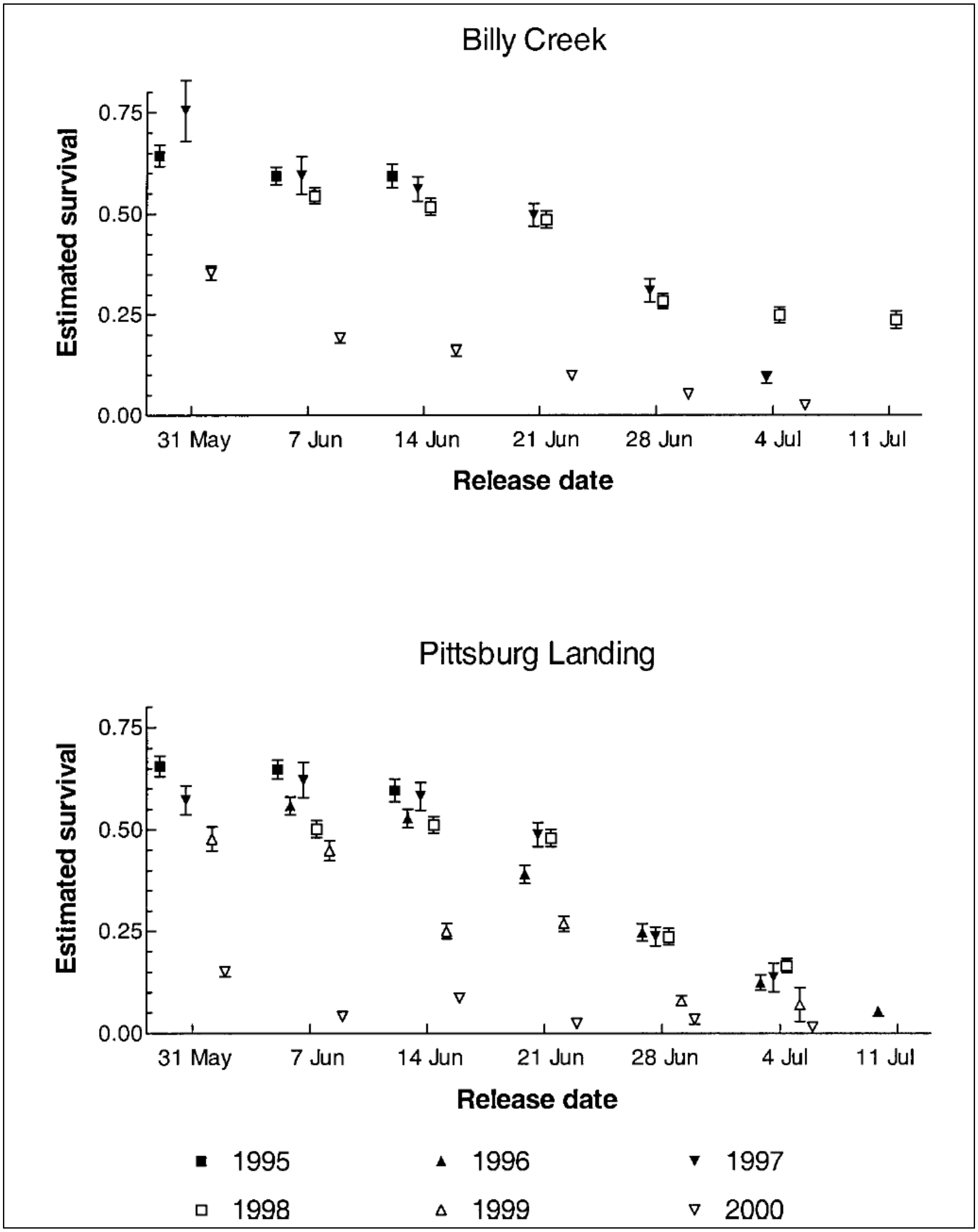

Figure 71. Estimated survival probabilities (with standard errors) from the point of release in the Snake River (Billy Creek [RM 164.7] or Pittsburg Landing [RM 215]) to the tailrace of Lower Granite dam for PIT-tagged hatchery fall Chinook salmon, 1995–2000. (Source: Smith et al., 2003)

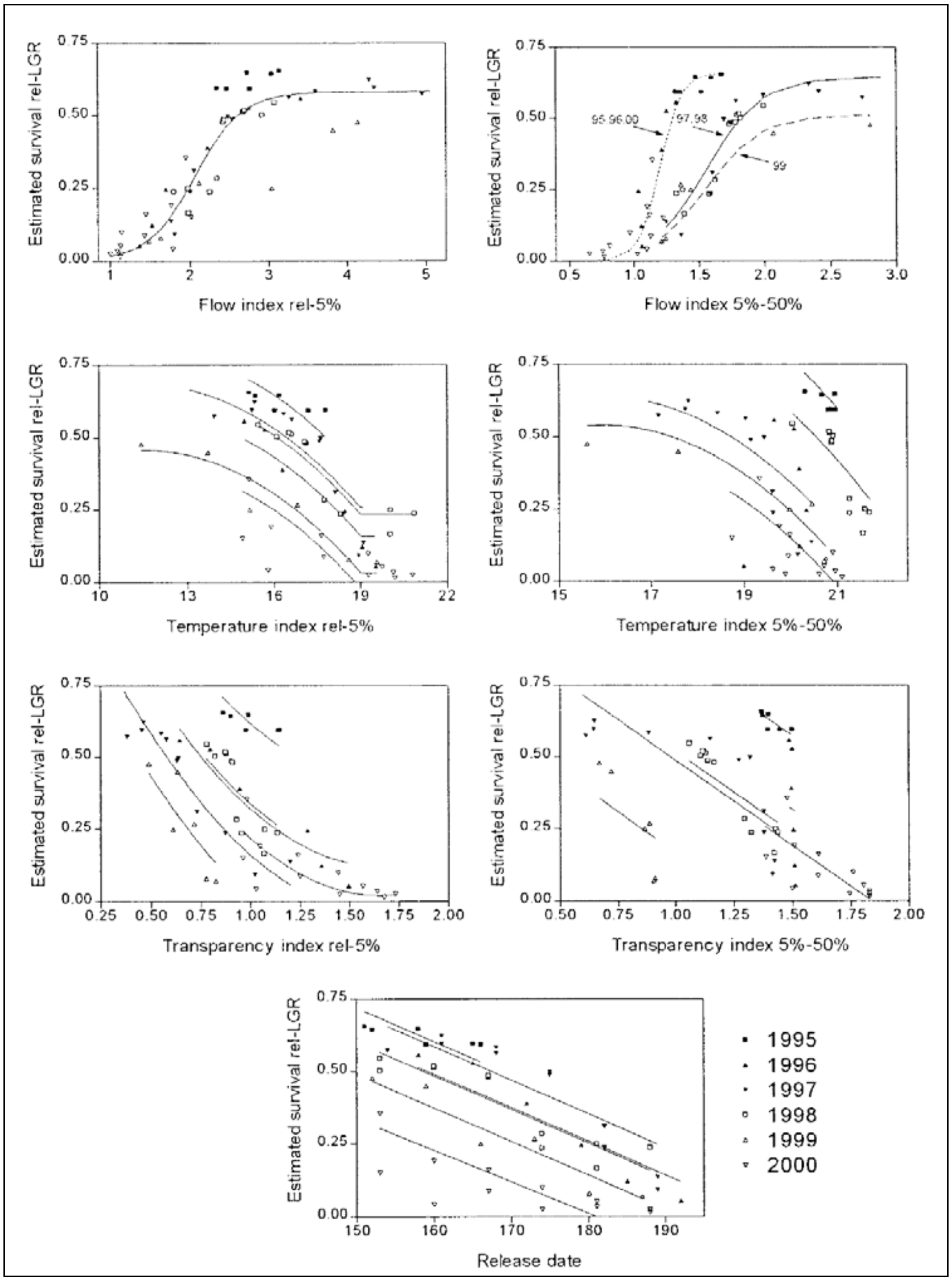

Figure72. Relations between the estimated probability of survival to Lower Granite dam and indices of discharge, temperature, and transparency and release date for groups of PIT-tagged hatchery fall Chinook salmon released at Pittsburg Landing and Billy Creek on the free-flowing Snake River, 1995–2000. Lines illustrate descriptive models selected from generalized additive and linear regression analyses. Indices of exposure for each group were defined as the averages of the daily values of the three river condition variables (flow, temperature, and transparency) during each index period. (Source: Smith et al., 2003)

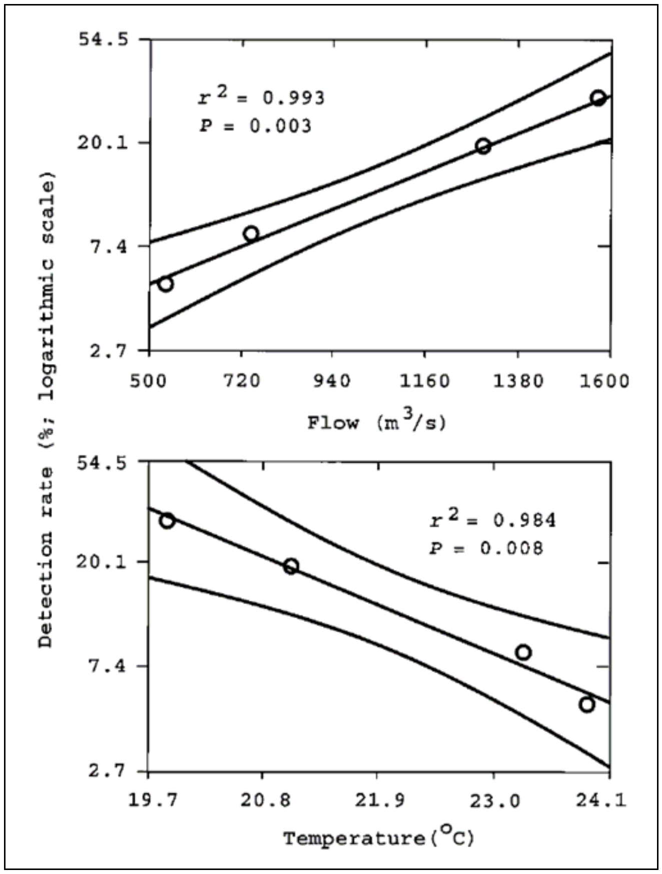

Figure 73. Detection rate of PIT-tagged Snake River subyearling Chinook salmon at Lower Granite dam, 1992–1995 and its relation to mean summer flow (top) and maximum summer water temperature (bottom) in Lower Granite reservoir. Ninety-five percent simultaneous confidence intervals are shown on either side of the regression lines. (Source: Connor et al., 1998)

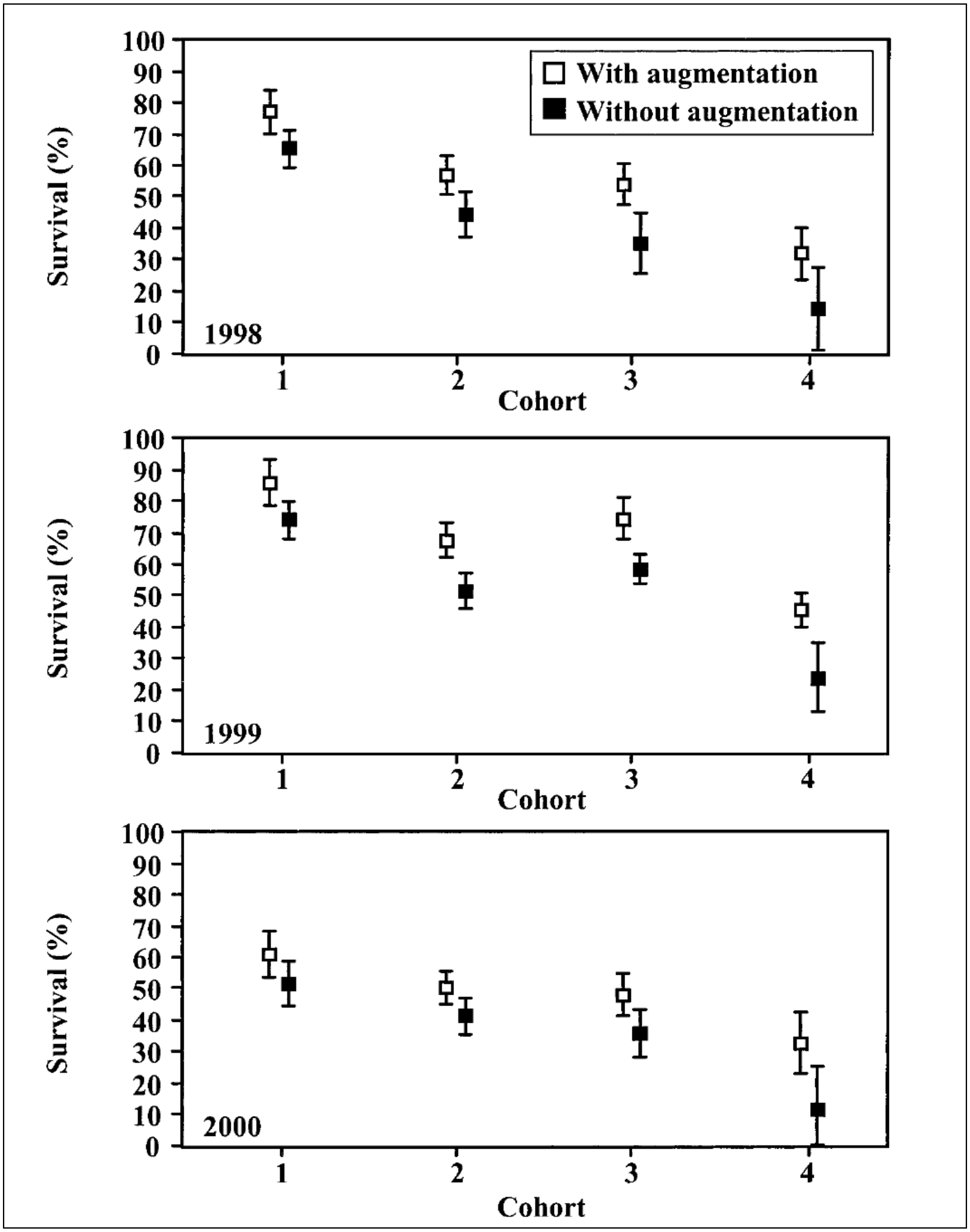

Figure 74. Survival (with 95 percent confidence intervals) to the tailrace of Lower Granite dam for PIT-tagged wild subyearling fall Chinook salmon in 1998 (top), 1999 (center), and 2000 (bottom), predicted from mean flows and water temperatures with and without summer flow augmentation. (Source: Connor et al., 2003b)

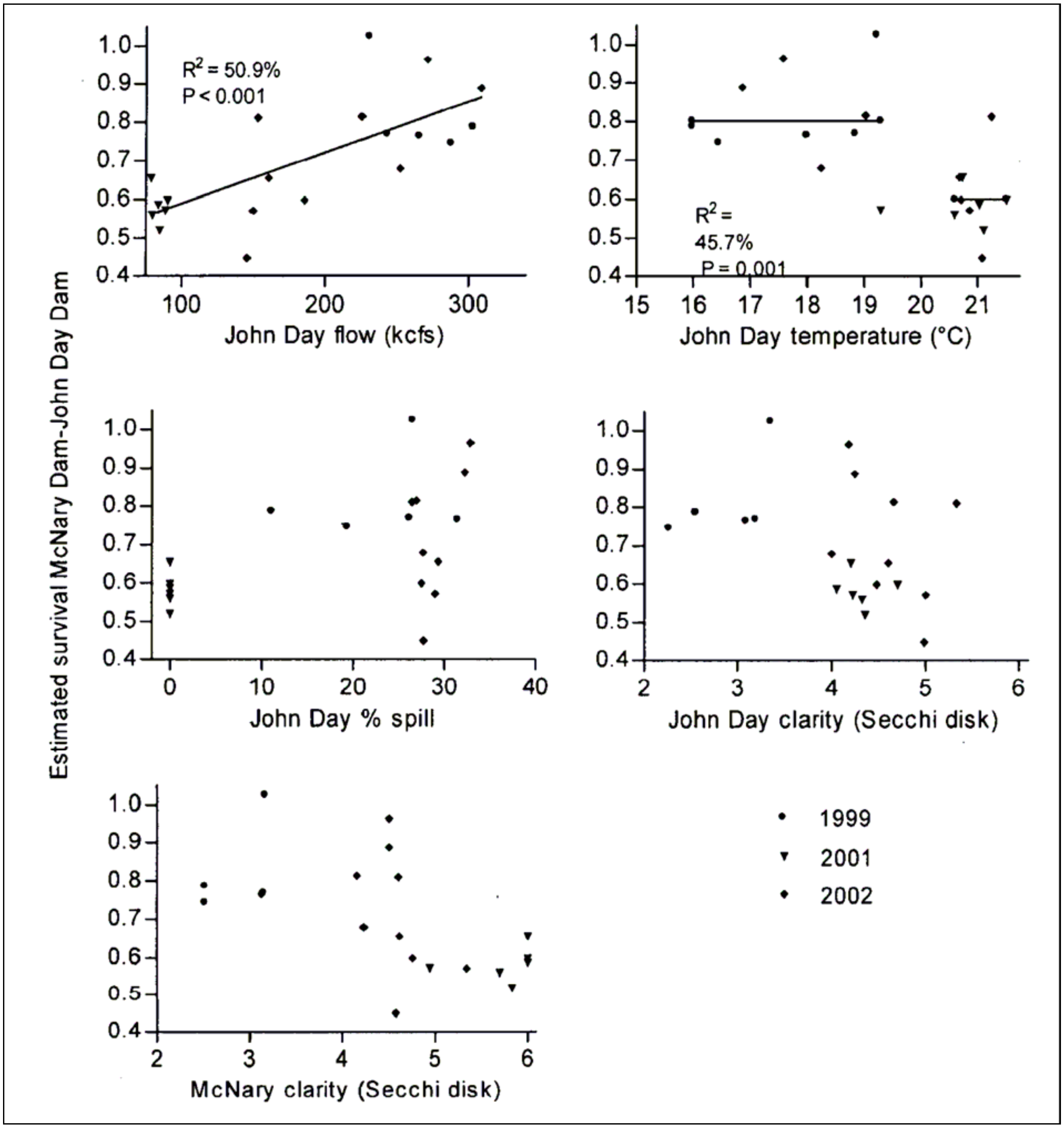

Figure 75. Estimated survival between McNary dam tailrace and John Day dam tailrace plotted against various river condition indices for run-of-river subyearling Chinook salmon released in tailrace of McNary dam, 1999, 2001, and 2002. Flow index panel illustrates simple linear regression line without year effects. Temperature index panel illustrates constant mean survival above and below 20°C. (Source: Williams et al., 2005)

Although the studies summarized above indicate that summer flow augmentation downstream of the project benefits outmigrating subyearling fall Chinook salmon by increasing flow volume and reducing travel time, releasing large volumes of summer flow augmentation water from Brownlee reservoir has the potential to adversely affect subyearling fall Chinook migrants by increasing water temperatures downstream of Hells Canyon dam. In its response to AIR OP-1(e), Idaho Power used a 2-dimensional laterally averaged model (CE-QUAL-W2) to simulate the temperature effects of augmenting river flows by releasing 350,000 acre-feet of storage from Brownlee reservoir during the month of July in 5 representative water years (Scenario 2, Flow Augmentation) (Idaho Power, 2005b). In most cases, there was little temperature effect downstream of the project. However, in an extremely low flow year (1992), simulated water temperatures downstream of Hells Canyon dam increased by up to 2°C under the Flow Augmentation Scenario (figure 76). This temperature increase is likely offset by increased resistance to warming as the higher flow volume passes through the Hells Canyon reach. In addition, downstream of the confluence with the Clearwater River, the effect of warm water released from Brownlee reservoir is compensated for by managed releases of cooler augmentation water from Dworshak dam. Because the majority of fall Chinook salmon that rear in the Hells Canyon reach have begun their seaward migration by early July, most smolts are in and below Lower Granite reservoir by the time flow augmentation water is released from Brownlee reservoir (starting in late June) and few smolts are likely to be affected by any increase in water temperature that occurs in the Hells Canyon reach. In higher water years when the simulated temperature of outflows from Hells Canyon dam was similar to those simulated under Proposed Operations, downstream temperatures in the lower part of the Hells Canyon reach would probably be slightly reduced under the Flow Augmentation Scenario due to reduced warming.

In its April 11, 2006, reply comments on recommended terms and conditions, Idaho Power cites recent testimony from NMFS and other scientists indicating that there is considerable disagreement on the benefits of flow augmentation for Snake River fall Chinook salmon. Part of this uncertainty relates to a recent analysis of scales taken from adult fall Chinook salmon in 2004, which indicated that fall Chinook juveniles that overwinter in the river/reservoir environment before completing their migration the following spring may contribute more than half of the adult returns. In its comments on the draft EIS, NMFS states that its recommendation to maintain Brownlee elevations to within 1 foot of the April 15 and April 30 minimum flood control requirements should benefit these spring migrating fish by minimizing the amount of reservoir space that needs to be refilled to meet summer flow augmentation requirements and minimizing any reduction in flows during the spring migration season. NMFS also states that the proportion of fish from each spawning area that overwinters in the river/reservoir environment is unknown, but fish that adopt this life-history strategy appear to be predominantly from the cooler water spawning and rearing areas and not from the mainstem Snake River that is the most directly affected by project operations.

In 2003, the Independent Scientific Advisory Board (ISAB) completed a review of flow augmentation at the request of the Northwest Power Planning Council. ISAB (2003) concluded that "*there is a range of flow over which survival of PIT-tagged smolts increase with increasing flow and a range of higher flows in which fish survival appears to be independent of incremental changes in flow*." ISAB identified this "break point" to be around 50,000 cfs for the summer-migrating subyearling fall Chinook salmon and 100,000 cfs for spring-migrating yearling Chinook salmon. ISAB further concluded that several parameters that may affect survival are correlated with flow, that there is uncertainty regarding their effects, and that deliberately designed experiments may be needed to determine the effects of these variables. Variables identified by the ISAB include water temperature, water clarity, fluctuations in dam discharges, gas supersaturation, the timing of entry to the estuary and the ocean, and ocean conditions.

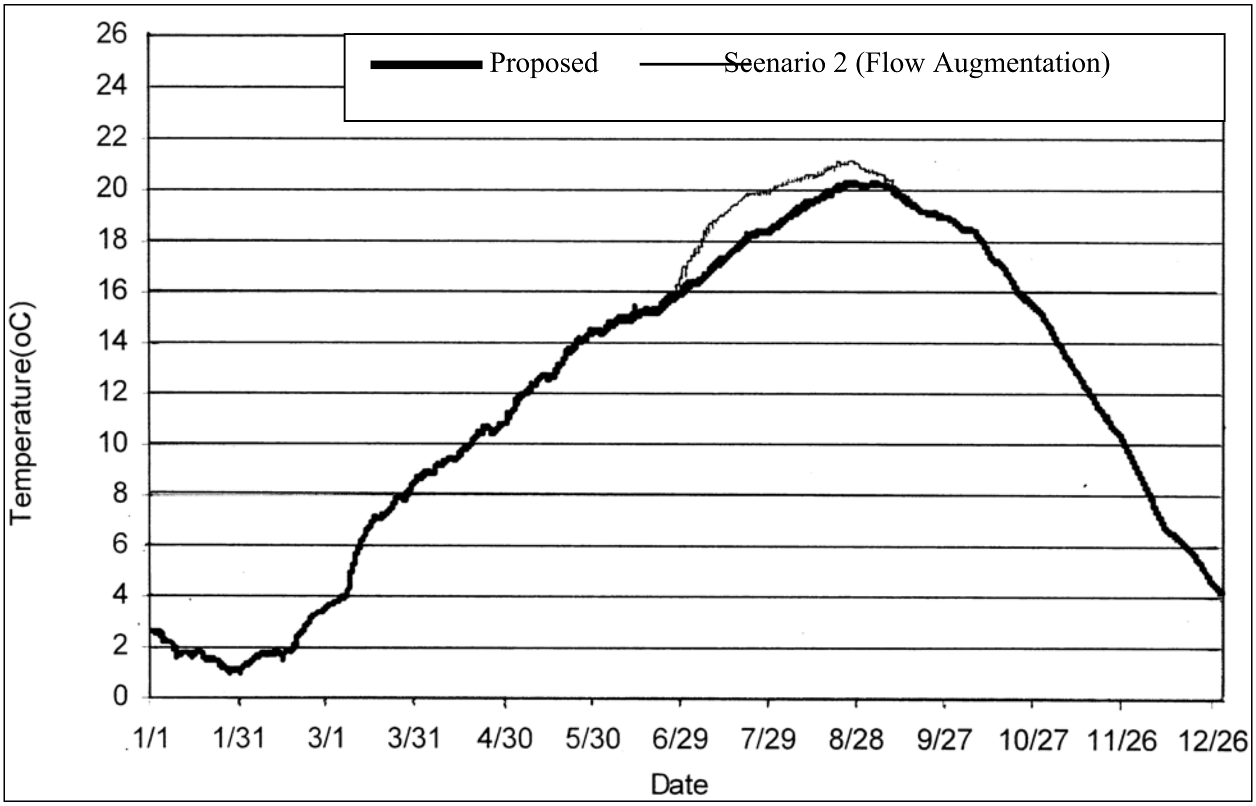

Figure 76. 1992 simulated hourly Hells Canyon outflow temperatures for the Flow Augmentation Scenario and Proposed Operations. (Source: Idaho Power, 2005b

A review of trends in adult fall Chinook returns lends further support to the ISAB conclusion that there is a generally positive relationship between flow and survival for outmigrating fall Chinook salmon. There has been a substantial increase in adult fall Chinook returns past lower Granite dam, closely tracking with both the total flow augmentation provided from the Snake River basin (figure 77) and flow augmentation provided from Brownlee reservoir (figure 78) during the year of outmigration. However, we note that this increase also corresponds with a substantial increase in the number of yearling and subyearling fall Chinook salmon that have been released from acclimation sites upstream of lower Granite dam (table 51). Other factors that may have contributed to increasing returns include ocean conditions favorable to survival and improvements in the passage survival of juvenile salmonids migrating through the Lower Columbia River migratory corridor.

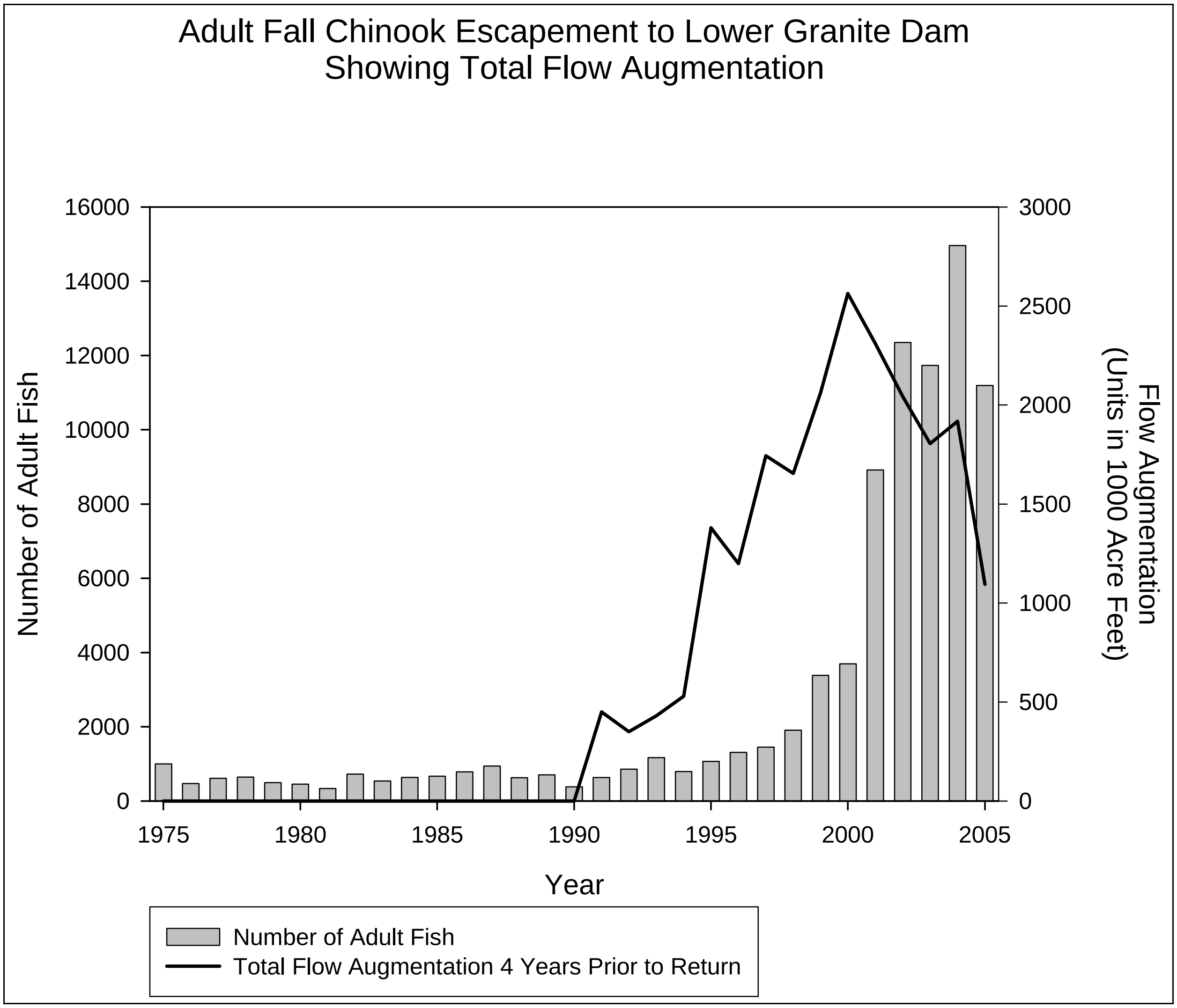

Figure 77. Total adult fall Chinook salmon passing Lower Granite dam and total flow augmentation volume provided from the Snake River basin during the primary year of outmigration (4 years prior to adult return data). (Source: Staff, based on FPC, 2006)

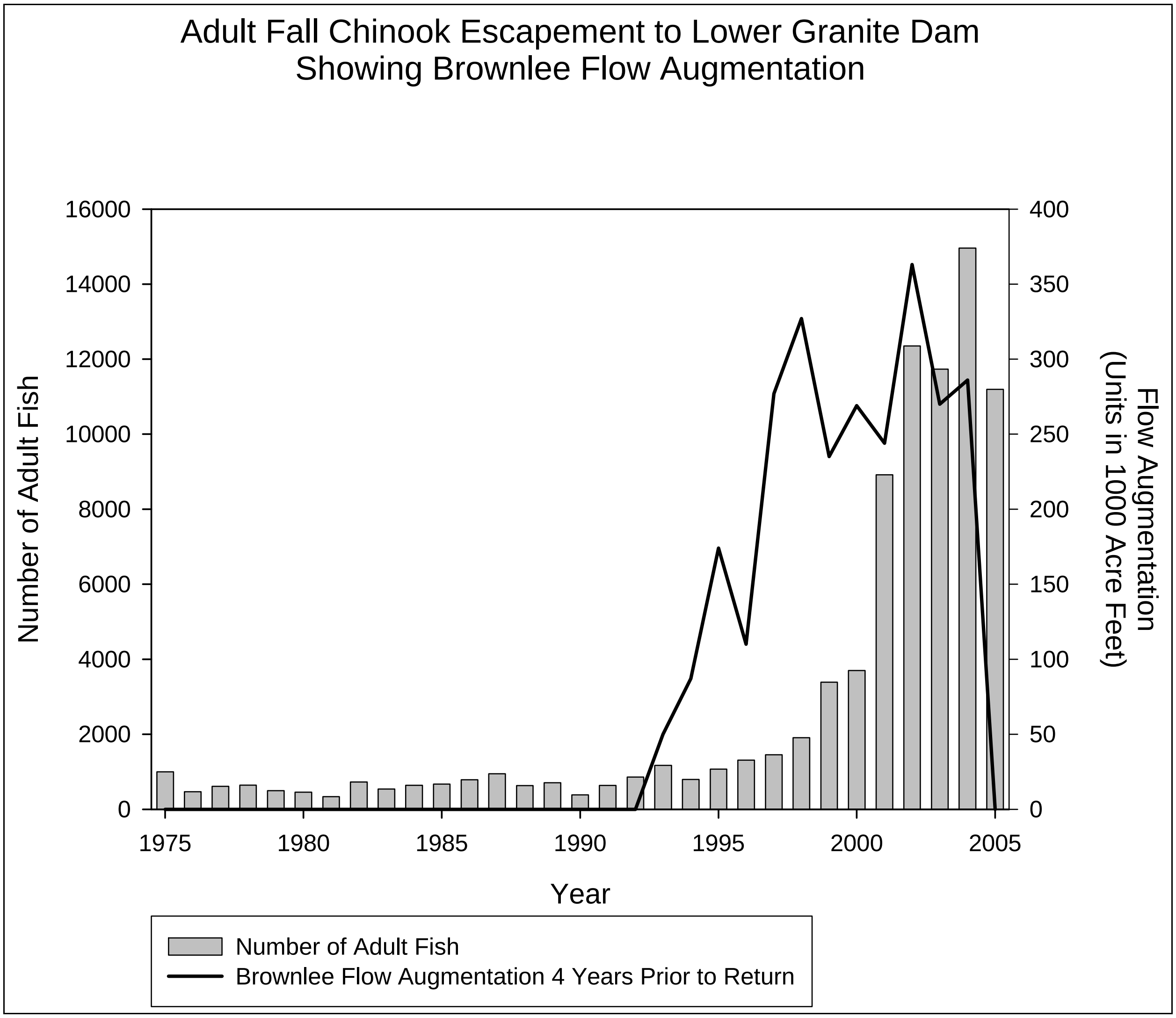

Figure 78. Total adult fall Chinook salmon passing Lower Granite dam and total flow augmentation volume provided from Brownlee reservoir during the primary year of outmigration (4 years prior to adult return data). (Source: Staff, based on FPC, 2006)

Table 51. Total number of yearling and subyearling fall Chinook salmon released from acclimation sites in the Hells Canyon reach (Pittsburg Landing and Captain John Rapids) and in the Clearwater River (Big Canyon), fall Chinook returns over Lower Granite dam, and redd counts in the Clearwater and Snake rivers. (Source: McLeod, 2006).

Year	Total Number of Yearlings Released	Total Number of Sub-yearlings Released	Number of Adult Fall Chinook Salmon Passed over Lower Granite Dam	Number of Fall Chinook Salmon Redds in the Clearwater River	Number of Fall Chinook Salmon Redds in the Snake River
1995	0	0	1,067	20	65
1996	114,299	0	1,308	69	104
1997	345,769	252,705	1,451	72	58
1998	336,191	0	1,909	78	185
1999	529,503	670,033	3,384	184	373
2000	397,339	2,183,447	3,602	180	346
2001	318,932	1,732,167	8,915	336	770
2002	479,358	2,398,079	12,347	527	1,113
2003	437,633	1,700,758	11,724	571	1,524
2004	414,452	1,337,420	14,960	630	1,718

We anticipate that new information will continue to be developed, which we expect to improve our understanding of the physical and biological effects of providing flow augmentation water from Brownlee reservoir. For example, in its draft EIS comments, IDFG cited a recent study funded by BPA (Cook et al., 2006) that modeled the effects of flow releases from Dworshak dam and from Brownlee reservoir on stratification and water temperatures in the four lower Snake River reservoirs. The results suggest that releasing too large a volume of water from the upper Snake River may increase mixing and, therefore, increase summer temperatures in an otherwise cooler hypolimnion, which may also affect the temperature of outflows from Lower Granite reservoir. Based on this work and the likelihood that more information will become available in the future, we conclude that reviewing this information would likely be beneficial to determine whether the information warrants any adjustments to the timing or volume of flow augmentation water that is delivered from Brownlee reservoir.

In the draft EIS, we stated that the discontinuation of flow augmentation from Brownlee reservoir from 2001 through 2004, as shown on figure 70, provided an opportunity to assess the effects of this change on adult fall Chinook salmon returns. We noted that fish that emigrated during this period will return predominantly as 4-year-old fish between 2005 and 2008, and concluded that evaluating adult return trends through 2008 could improve our understanding of the effects of providing flow augmentation water from Brownlee reservoir. In their comments on the draft EIS, multiple parties indicated that they considered this expectation to be unrealistic, given that many factors influence the number of adult fall Chinook salmon that return to the Snake River. Also, NMFS commented that re-evaluating the benefits of flow augmentation in 2009, as detailed in the Staff Alternative in the draft EIS, introduced uncertainty that would impede efforts to complete ESA section 7 consultation for listed salmon and steelhead ESUs. We recognize these concerns, and have developed an alternative approach that would defer the re-evaluation until 6 years after license issuance, remove the focus of the evaluation on adult returns, and include consultation with NMFS to determine whether formal consultation should be reinitiated before any change in Idaho Power's participation in the flow augmentation program is adopted. We conclude that these revisions should effectively address the concerns raised by NMFS and other stakeholders regarding the proposed flow augmentation evaluation report.

The Nez Perce Tribe's recommendation (NPT-7) to manage Brownlee reservoir to maximize flow augmentation during the spring and summer smolt migration seasons includes three components: (1) drafting Brownlee Reservoir by May 15 to augment flows during the spring outmigration period; (2) refilling Brownlee Reservoir by June 15 while passing some portion of inflows during this period; and (3) drafting Brownlee for summer flow augmentation by August 1 and then refill to a level necessary to provide minimum flow of 9,000 cfs for fall Chinook spawning and incubation below the Project. Drawing Brownlee reservoir down to augment river flows during the spring would likely provide some benefits to yearling smolts that outmigrate during the spring, but the findings of the ISAB that we summarized above suggest that augmentation of river flows during this period may provide little or no benefit when flows passing Lower Granite dam are in excess of about 100,000 cfs. In addition, reducing outflows from the project when Brownlee reservoir would be refilled (between May 15 and June 15) could adversely affect juvenile fall Chinook salmon that are rearing or outmigrating through the Hells Canyon reach during this time period.

As noted previously and shown in figure 38, PIT-tag detections at Lower Granite dam indicate that there has been a distinct trend toward earlier emigration of subyearling fall Chinook smolts between 1993 and 2005, with data from 2003 through 2005 indicating that the peak migration occurred between June 1 and July 15. Because most fall Chinook subyearlings typically spend between 20 and 40 days within Lower Granite reservoir before passing Lower Granite dam (Connor et al., 2003), this means that peak emigration from the Hells Canyon reach into Lower Granite reservoir likely occurs from early May into mid-June, coinciding with the period in which Brownlee reservoir would be refilled under the Nez Perce Tribe's recommendation, which could adversely affect the survival of subyearling smolts migrating from the Hells Canyon reach. Finally, although we recognize that maximizing the volume of flow augmentation water provided from Brownlee reservoir during medium and high water years could provide survival benefits to subyearling migrants, we note that the ISAB concluded that the survival rate of subyearling fall Chinook salmon appeared to be independent of flow at river flows exceeding about 35,000 cfs at Lower Granite dam. However, we recognize that the relationship between survival rates and flow may have changed with the implementation of increased summer spills at the downstream Federal Columbia River Power System projects, and that additional evaluation of the potential benefits of increasing flow augmentation volumes in medium and high flow years is probably warranted.

The recommendations to provide timely pass-through of augmentation water released from BOR's storage reservoirs in the upper Snake River basin relate to a concern that Idaho Power could delay passage of this water through Brownlee reservoir to benefit power production at the project. Delaying passage of water could reduce the level of benefit that is provided to outmigrating juvenile anadromous fish. Because Brownlee reservoir provides more than 96 percent of the active storage at the project, we conclude that adoption of measures NMFS-8 (maintain Brownlee reservoir levels within 1 foot of the April 15 and April 30 minimum flood control requirements) and NMFS-9 (draw Brownlee down to 2,066 by July 15 and 2059 by July 31) would ensure that flow augmentation water is passed through the project in a timely manner during the juvenile salmonid migration period, as intended.

The recommendations pertaining to the pre-release (also referred to as "shaping") of augmentation water released from BOR's storage reservoirs could help to ensure that augmentation water is delivered to the Snake River below Hells Canyon dam in a period that would provide maximum benefits to outmigrating juvenile anadromous fish. In its justification for flow shaping (measure Interior-22), BOR indicated that in past years, operational considerations at BOR and at other Idaho Power developments have made it hard to deliver all of its augmentation water by August 31. During the section 10(j) meeting, Idaho Power reported that BOR has developed approaches for managing its storage facilities that have allowed its augmentation water to be delivered to the lower Snake River in a timely fashion.

The recommendations pertaining to refilling Brownlee reservoir as early as possible while meeting flood control obligations are directed toward avoiding excessive reductions in outflows from the project during the spring migration season for yearling steelhead and Chinook salmon smolts. Preventing such flow reductions would help to maintain suitable migration flows for spring-migrating yearling Chinook salmon and steelhead produced in the Salmon River, other Snake River tributaries, and to a lesser extent, spring migrants passing through the Lower Columbia River. These flows would also benefit yearling fall Chinook salmon that are produced in the Clearwater River and the portion of the fall Chinook salmon migrants that overwinter in the Snake River before migrating as yearlings.

Based on runoff forecasts, the Corps establishes flood control curves that specify maximum Brownlee reservoir elevations for February 28, March 31, April 15, and April 30. NMFS (NMFS-8) recommends that Brownlee reservoir be refilled to within 1 foot of the April 15 and April 30 minimum elevations necessary to meet the Corps flood control requirements and to coordinate refill after April 30 with NMFS. This measure would limit the volume of water that must be refilled during the spring outmigration to that required by the Corps for flood control, and would minimize the project's impacts on the spring hydrograph. The Umatilla (CTUIR-7) and Nez Perce (NPT-5) tribes recommend that Idaho Power maintain Brownlee reservoir at its upper flood control rule elevation from February 28 to April 15 of each year. We see little biological benefit, however, in requiring Brownlee reservoir to be maintained at the maximum levels specified for the February 28 and March 31 flood control targets, because these dates precede the spring outmigration (flow objectives identified for the spring outmigration extend from April 10 to June 20). In their draft EIS comments, the Nez Perce and Umatilla tribes also recommend that Brownlee not be refilled during the spring target flow period unless target flows are being met at Lower Granite dam. This recommendation, however, would conflict with NMFS's recommendation that Brownlee be refilled by June 20 to provide storage for flow augmentation during the June 21 through July 31 period to benefit outmigrating subyearling fall Chinook salmon.

Shifting flood control space from Brownlee reservoir to Lake Roosevelt would facilitate meeting flow objectives in the Snake River, but may have adverse effects on flows during the smolt migration season in the upper and mid-Columbia River. In *Comprehensive Development* section 5.2.2, *Flood Storage*, we discuss the issue of agency jurisdiction over flood storage decisions.

Native Resident Salmonids

Flow fluctuations and changes in the seasonal flow regime caused by project operations can affect the quality and quantity of rearing habitat and the food supply that is available to rearing bull trout and redband trout, and have the potential to cause fish to become stranded on bars or trapped in pools that become isolated from the stream channel. Any bull trout or redband trout that become trapped in pools may be subject to mortality from high water temperatures, from increased vulnerability to predation, or from stranding if the pools drain before they are reconnected to the river.

Our Analysis

Habitat Area

Idaho Power modeled adult bull trout and redband trout habitat using two-dimensional modeling techniques. The model was developed based on bathymetry, velocity and substrate data collected at seven sites in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River) and four sites in the lower Hells Canyon reach (Salmon River to the Lower Granite reservoir). Idaho Power expanded the modeling results from these eleven sites to the entire reach based on the geomorphic features of the river channel. The model used habitat suitability criteria for depth, velocity and substrate to determine habitat suitability expressed in Weighted Useable Area (WUA).

Idaho Power's modeling results indicate that habitat available to bull trout and rainbow trout adults declines with increasing discharge over the range of modeled flows, which extended from 5,000 to 100,000 cfs in the upper reach, and from 10,000 to 260,000 cfs in the lower reach (figure 79). Idaho Power used these relationships to evaluate habitat conditions for proposed and alternative operations for three water years representing extremely low flow, medium flow, and extremely high flow conditions (table 52). Representative plots showing predicted hourly WUA for bull trout under Proposed Operations and under the Flow Augmentation Scenario are shown in figures 80 and 81, and the same plots for redband trout are shown in figures 82 and 83.

The potential for adverse effects to bull trout and redband trout is somewhat reduced by the movement of a portion of the population into tributaries as water temperatures increase in the summer. For example, bull trout telemetry studies conducted by Chandler et al. (2003a) indicated that 8 out of 15 bull trout that were tagged and released downstream of Hells Canyon dam moved into the Imnaha River by the end of May.

Food Supply

Flow fluctuations may also affect the food supply available to native resident salmonids. Stream-rearing species (rainbow trout) feed mostly on drifting aquatic organisms and terrestrial insects, but they will also take active bottom invertebrates (Moyle, 2002). Bull trout are opportunistic feeders, with food habits being primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro-zooplankton, and small fish, while adult migratory (fluvial, adfluvial and anadromous) bull trout feed on various fish species (FWS, 2002a). Although many native resident salmonids may move into tributary streams during the summer months, others do not and are dependent year-round on the food supply that is available in the mainstem Snake River.

In the *Primary Production and Aquatic Invertebrates* subsection of section 3.6.2.1, we concluded that invertebrate production is likely to be substantially reduced in shallow areas that are regularly dewatered. In that section, we estimate that production of aquatic invertebrates under the proposed action may be reduced by approximately 10 to 20 percent, compared to what would be available without load following operations. The availability of small forage fish may also be reduced due to stranding or a reduction in primary or secondary production associated with load following operations. We estimate that the food supply available to subadult and adult bull trout would be reduced by a comparable amount of about 10 to 20 percent.

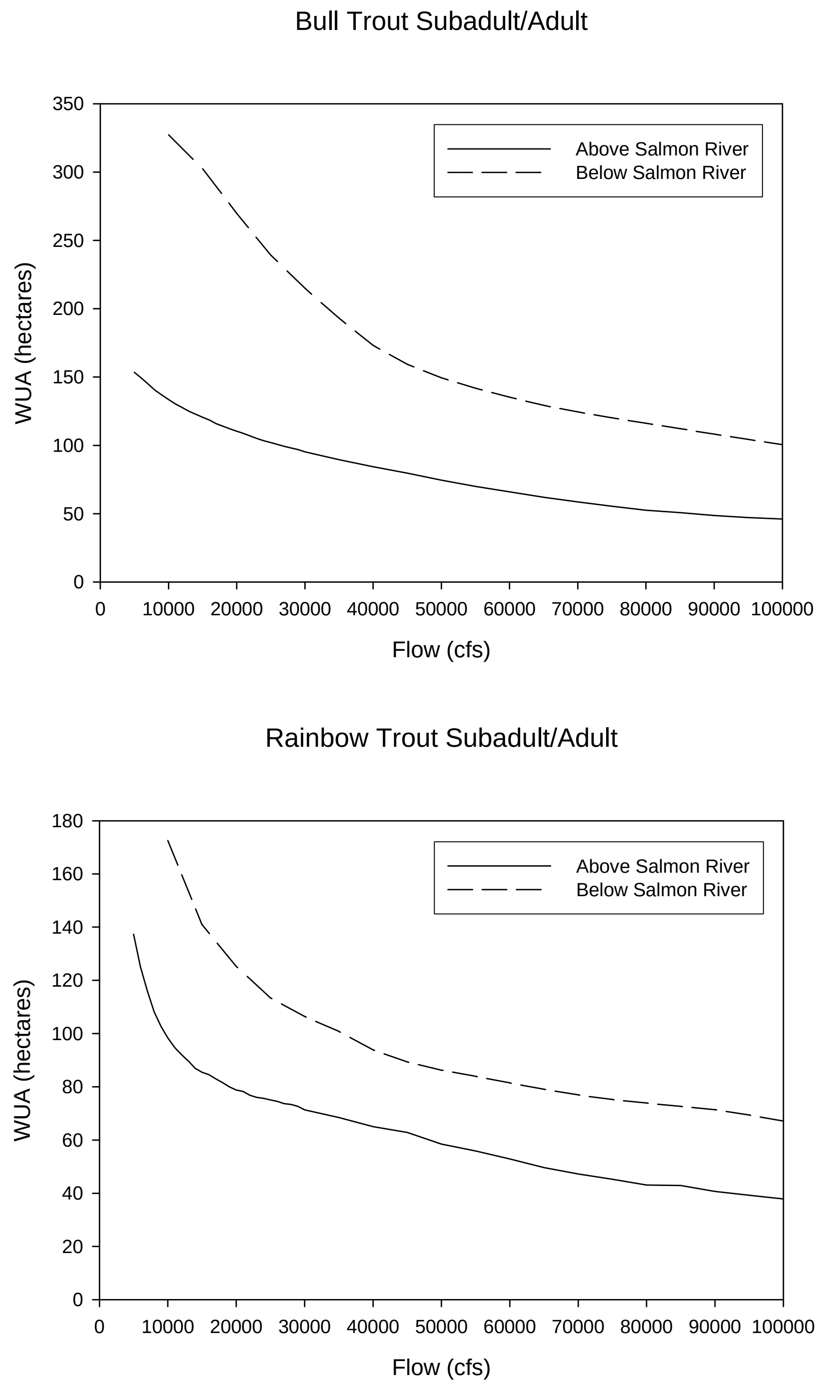

Figure 79. Weighted useable area versus discharge relationships for bull trout (upper plot) and redband trout (lower plot) in the upper and lower Hells Canyon reaches. (Source: Chandler et al., 2003c, as modified by staff)

Table 52. Estimated minimum, maximum, and maximum percent daily fluctuation in WUA for bull trout and redband trout adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River). (Source: Brink and Chandler, 2005, as modified by staff)

		Bull Trout Adults			**Redband Trout Adults**		
Scenario	**Year**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**
Proposed Operations	Extremely low	1,020	1,540	20	740	1,375	27
	Medium	800	1,400	16	600	1,125	21
	Extremely high	475	1,275	17	390	925	15
Scenario 1a (Reregulating)	Extremely low	1,150	1,540	< 1.0	820	1,370	< 1.0
	Medium	800	1,330	< 1.0	620	975	< 1.0
	Extremely high	475	1,250	< 1.0	400	900	< 1.0
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	1,130	1,540	5	810	1,375	6
	Medium	800	1,330	6	620	975	5
	Extremely high	475	1,250	< 1.0	400	900	< 1.0
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	1,070	1,540	10	760	1,375	17
	Medium	800	1,350	11	620	1,020	15
	Extremely high	475	1,250	9	400	900	14
Scenario 2 (Flow Augmentation)	Extremely low	1,020	1,540	16	750	1,375	22
	Medium	800	1,430	15	620	1,125	22
	Extremely high	475	1,320	19	400	975	18
Scenario 3 (Navigation)	Extremely low	1,020	1,540	19	750	1,375	25
	Medium	800	1,390	17	620	1,060	20
	Extremely high	475	1,300	17	400	950	16

[a] WUA values are shown in 1,000 square meters.

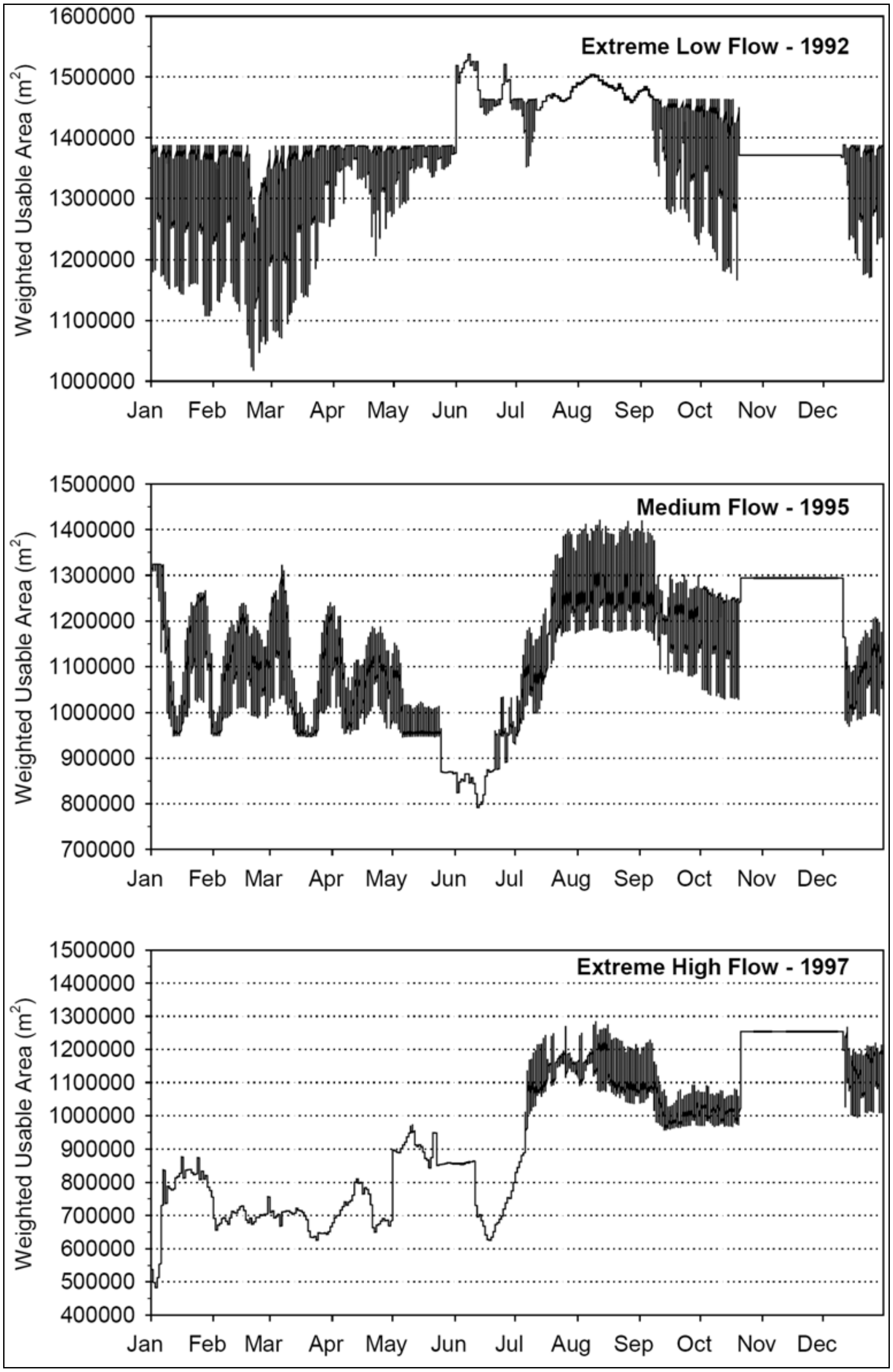

Figure 80. Hourly weighted useable area for bull trout adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

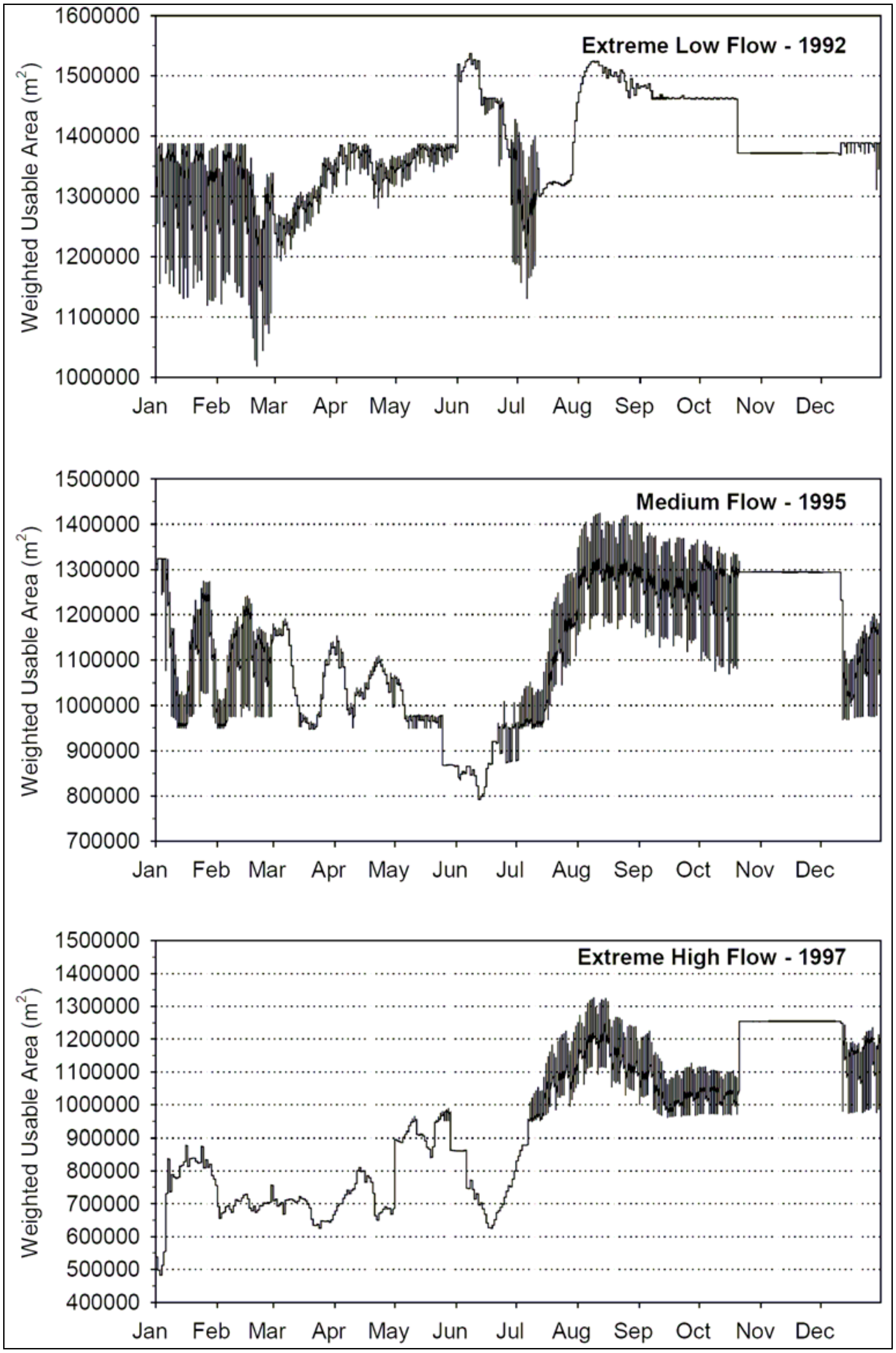

Figure 81. Hourly weighted useable area for bull trout adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

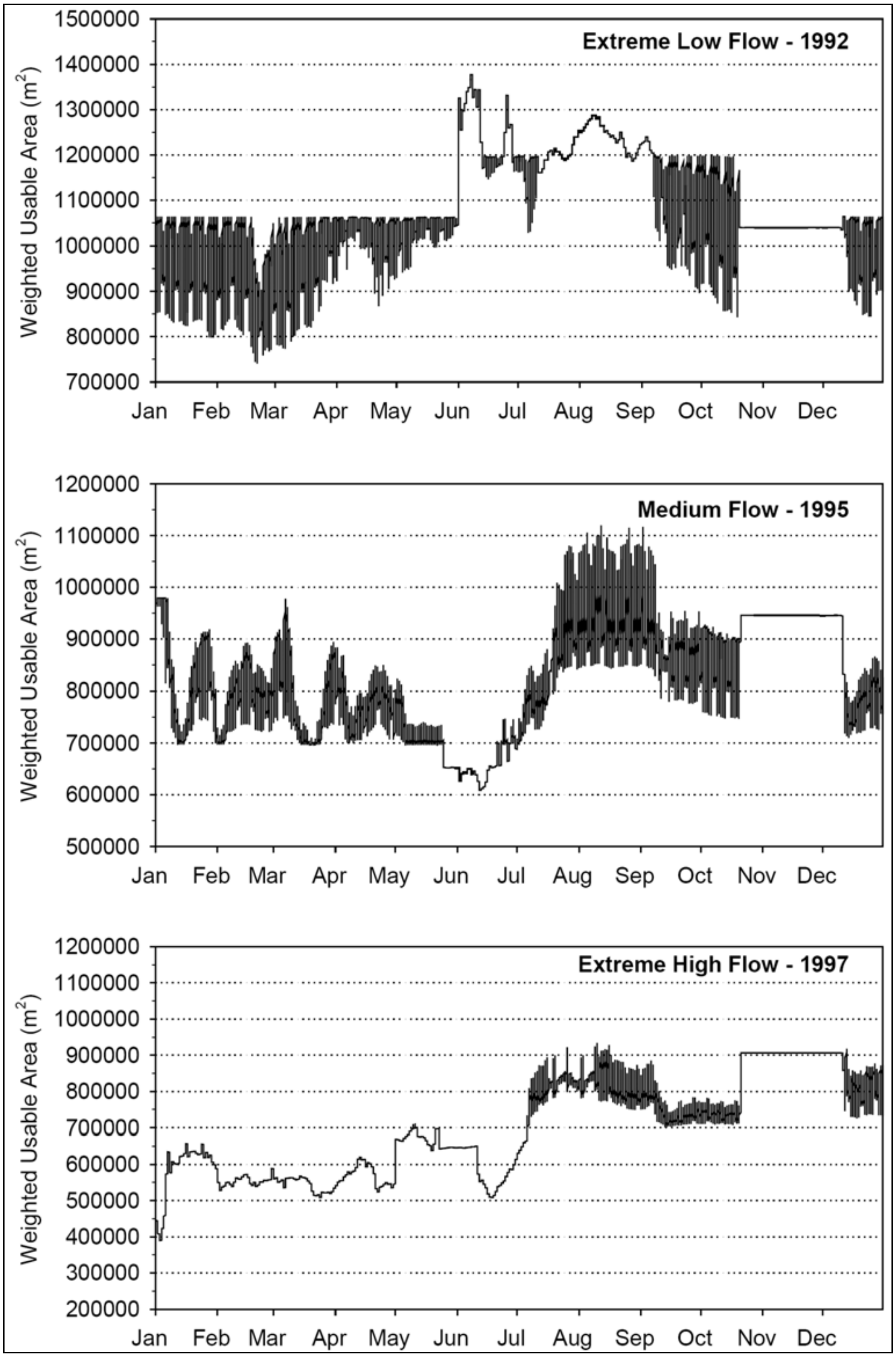

Figure 82. Hourly weighted useable area for redband trout adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

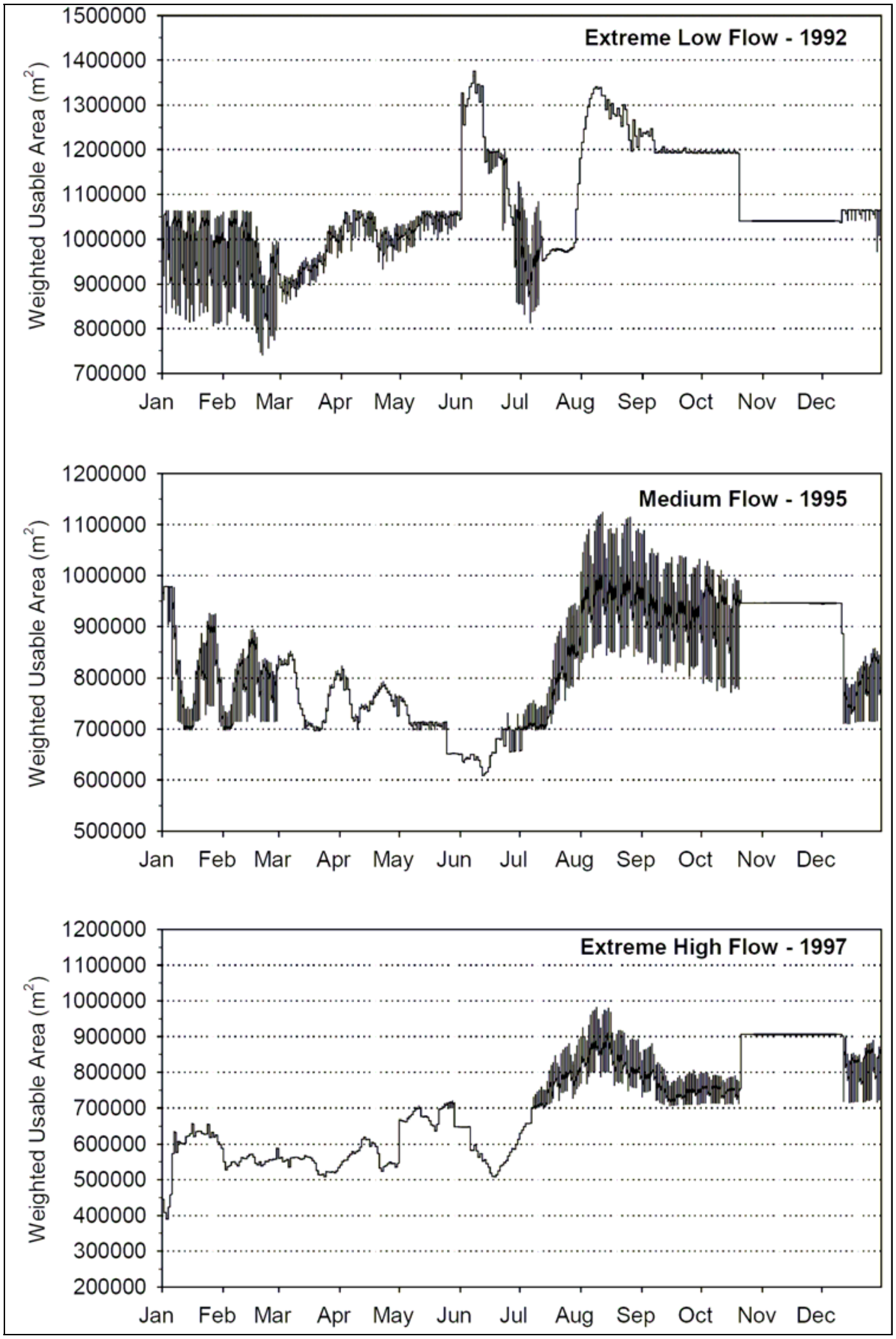

Figure 83. Hourly weighted useable area for redband trout adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

Chandler et al. (2006) reports that the size and condition factor of fluvial bull trout collected in the Snake River are comparable to those found in the unregulated Salmon River and its tributaries. In addition, Schill et al. (1994) collected downstream migrating bull trout in the Rapid River, a tributary to the Little Salmon River. Many of these fish were observed to overwinter in the main Salmon River in the vicinity of the confluence with the Little Salmon River. The size of fluvial migrants in the Salmon River ranged between 180 mm to 600 mm, with an average of 406 mm. Chandler et al. (2006) reports that bull trout captured by Idaho Power in the Snake River below Hells Canyon dam have ranged from 290 mm to 641 mm, with an average of 395 mm. In addition to the size distribution of fluvial bull trout, Chandler et al. (2006) reported that relative weight[70] and weight at length comparisons of bull trout in the Salmon River basin to those captured by Idaho Power below Hells Canyon dam also suggest that the two populations are very similar, relative to their condition. The mean relative weight of bull trout collected in the Salmon River was 86.51 and the mean relative weight of bull trout collected below Hells Canyon dam was 85.99. The similarity in size and condition of these two populations, located in similar stream systems within the same geographic region, suggest that fluctuations associated with load following operations (which occur in the Snake River but not in the unregulated Salmon River) do not have a pronounced adverse effect on growth rates of bull trout in the Hells Canyon reach.

Entrapment and Stranding

As we discussed in the *Anadromous Fish Rearing* subsection of section 3.6.2.1, flow fluctuations may cause fish mortality from fish becoming stranded or entrapped in pools where they may be subject to elevated water temperatures and increased predation potential. However, in Idaho Power’s entrapment studies (discussed previously in *Anadromous Fish Rearing*), Idaho Power did not observe any stranded or entrapped bull trout or redband trout, although some fish species other than fall Chinook salmon, including juvenile steelhead, were observed in entrapment pools. Because of the bull trout’s relative scarcity compared to fall Chinook salmon, additional monitoring would need to be conducted before conclusions could be drawn on the risk of stranding. The daytime habitat use observations of radio-tagged bull trout in the Hells Canyon reach reported by Chandler et al. (2003d) indicate that habitat less than one meter deep was rarely used by bull trout or by redband trout. Studies of diel habitat use in the Flathead River by Muhlfeld et al. (2003) indicate that subadult bull trout may move into shallow, channel margin habitats at night to feed on small fishes. This behavioral attribute may increase the trout’s vulnerability to stranding and entrapment. However, Chandler et al. (2003a) state that in contrast to the unconfined, braided nature of the Flathead River, the Snake River in Hells Canyon is highly confined and characterized by short, deep pools and numerous rapids with large boulder and cobble substrates intermixed with areas of gravel and sand. These differences in channel character suggest that there is less shallow habitat available for feeding forays in the Hells Canyon reach, and less risk of stranding or entrapment. Regardless, the potential for bull trout to become stranded or entrapped due to peaking operations in the Hells Canyon reach is unknown. Additional monitoring to assess this risk would provide useful information.

White Sturgeon

Flow fluctuations and changes in the seasonal flow regime caused by project operations can affect the quality and quantity of habitat that is available to all lifestages of white sturgeon. Because sturgeon tend to reside in deeper areas of the river, there is very little potential for adverse effects from stranding or from dewatering-related reduction of the food supply that is available within their preferred habitats.

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[70] Relative weight is the ratio of a fish’s weight to a standard weight for the same species multiplied by 100, with values exceeding 100 representing above average and less than 100 being below average.

Our Analysis

Idaho Power modeled white sturgeon habitat using two-dimensional modeling techniques in the same manner as we described for native resident salmonids. The relationship between habitat (represented by WUA) and flow was determined for six life stages of sturgeon: spawning, incubation, larvae, young-of-year, juvenile, and adult. Representative plots showing predicted hourly WUA for each lifestage under Proposed Operations and under the Flow Augmentation Scenario are shown in figures 84 through 95. For lifestages that do not occur year-round (spawning, incubation, larvae and young-of-year), the season in which they are present is indicated by hatchmarks.

To compare the amount of habitat that is predicted to occur in each year and operating scenario, we used these plots to estimate the minimum and maximum WUA, and the normal maximum daily percent fluctuation[71] of WUA that occurred within the time period that each lifestage is present. We summarize these values for each lifestage in table 53. We base our analysis on habitat modeling results from the upper Hells Canyon reach (upstream of the Salmon River), where the flow regime and habitat conditions are the most strongly tied to flow releases from Hells Canyon dam.

For white sturgeon spawning under proposed operations, substantial variation in WUA is evident during extremely low and medium water years (table 53 and figure 84). As indicated in figure 85, less WUA variation would occur during the spawning season under the Flow Augmentation Scenario. This is a result of the 2-inches-per-hour ramping rate that this scenario includes during the fall Chinook rearing period. As shown in table 53, implementing a 6-inches-per-hour ramping rate would reduce WUA variations by half in the extremely low water year and by two-thirds in a medium water year, and variation would be further reduced by imposing a 2-inches-per-hour ramping rate.

The white sturgeon incubation and larval lifestages show very similar trends between water years and scenarios (table 53 and figures 86 through 89), as we described for the spawning lifestage. Because the fall Chinook rearing period overlaps with most of the season in which the incubation and larval lifestages occur, implementing ramping rate restrictions during the fall Chinook rearing period would substantially reduce variations in WUA for the incubation and larval lifestages. For white sturgeon larvae in the extremely low flow year, overall WUA values and the variation in WUA increased during July under the Flow Augmentation Scenario (figure 89). This is a result of more water being released during July and the use of this water to support load following operations.

For the young-of-year lifestage, restricting ramping rates during the fall Chinook rearing period provides little benefit, as the transition from the larval to young-of-year lifestage occurs around the same time that fall Chinook salmon emigrate from the Hells Canyon reach. Ramping rate restrictions imposed from mid-June through December would reduce WUA variability for this lifestage, although no load following would occur during the fall Chinook spawning period under Proposed Operations. In the extremely low flow year, WUA fluctuations are eliminated during October under the Flow Augmentation Scenario, since less water is available for load following when Brownlee reservoir is being refilled.

As shown in table 53 and figures 92 through 95, the level of variation in WUA for juvenile and adult lifestages is relatively small, less than 7 percent for all year types and scenarios. This lack of variation results from fish at these lifestages preferring deep, low velocity pool habitats that are relatively unaffected by changes in river flows. The deepwater habitats favored by sturgeon are not subject to dewatering during load following operations, which would reduce the risk of stranding or a reduction in food supply that would affect growth rates of sturgeon. Habitat use information presented in Lepla and Chandler (2003) indicates that all lifestages of sturgeon rarely occur in areas that are less than 4 meters deep.

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[71] To illustrate the maximum effect of load following operations while excluding larger changes in flow that do not occur on a regular basis, we base our estimate on the largest percentage change in WUA that occurs in at least 3 consecutive days.

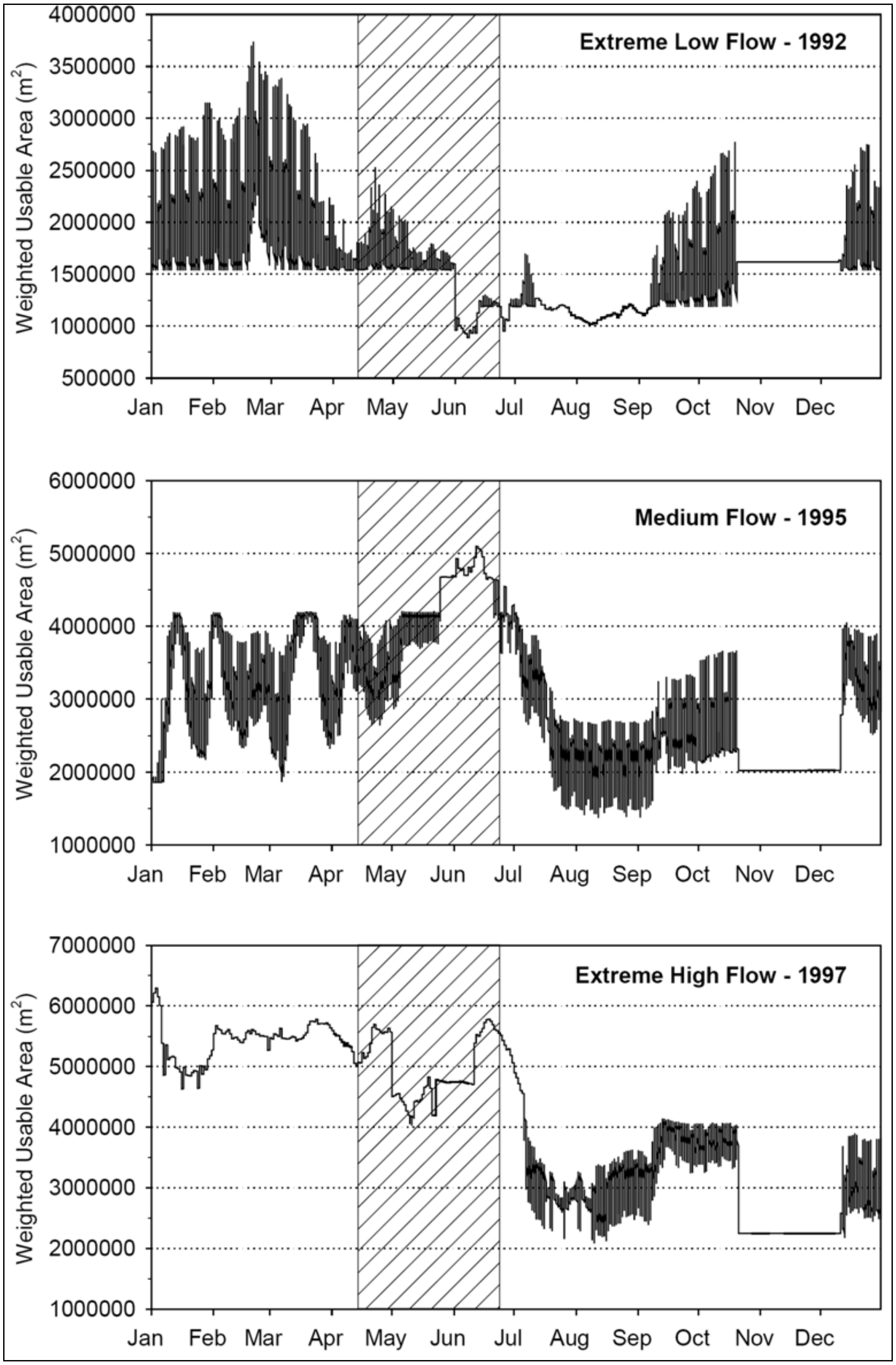

Figure 84. Hourly weighted useable area for white sturgeon spawning in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

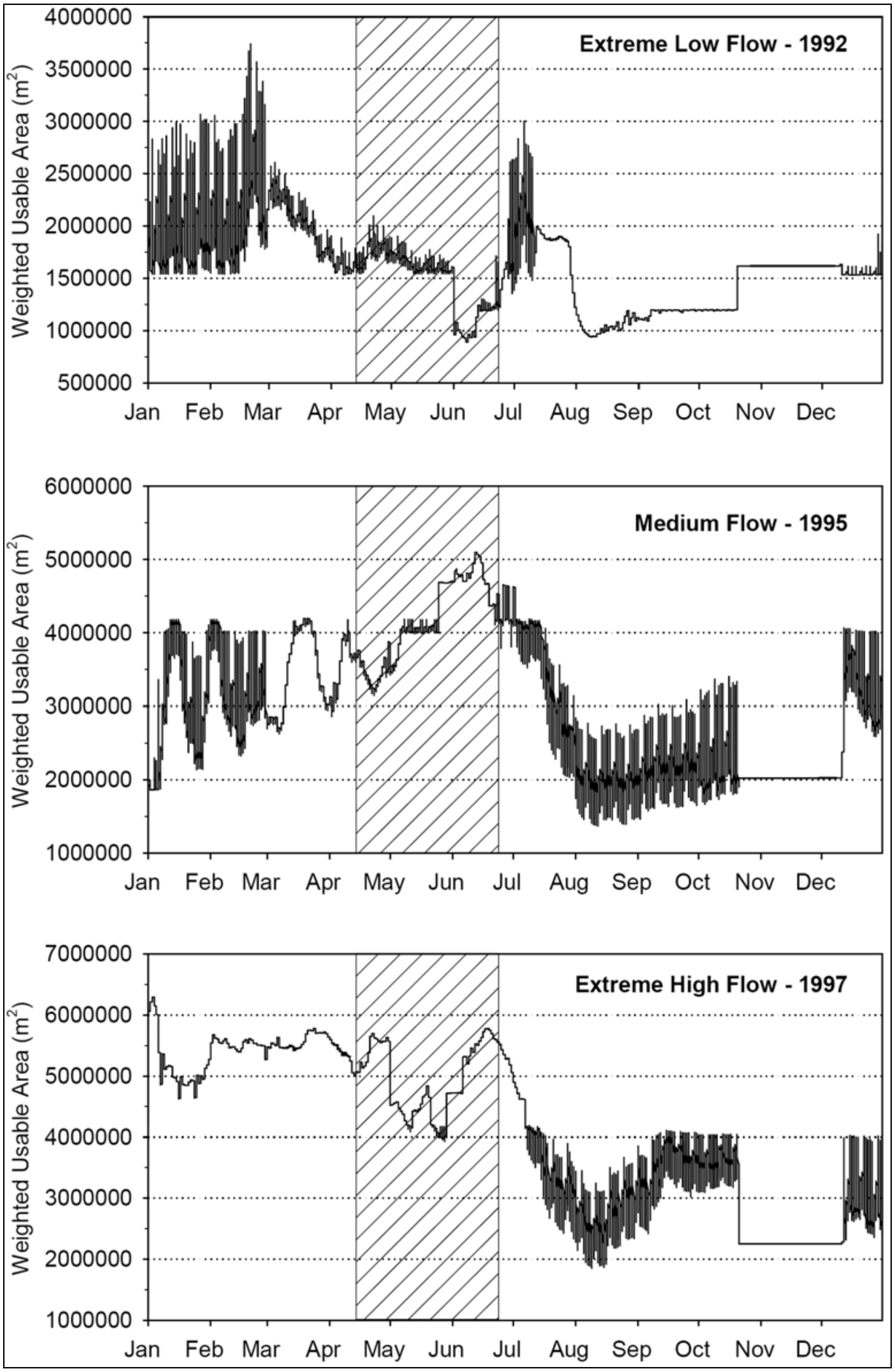

Figure 85. Hourly weighted useable area for white sturgeon spawning in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

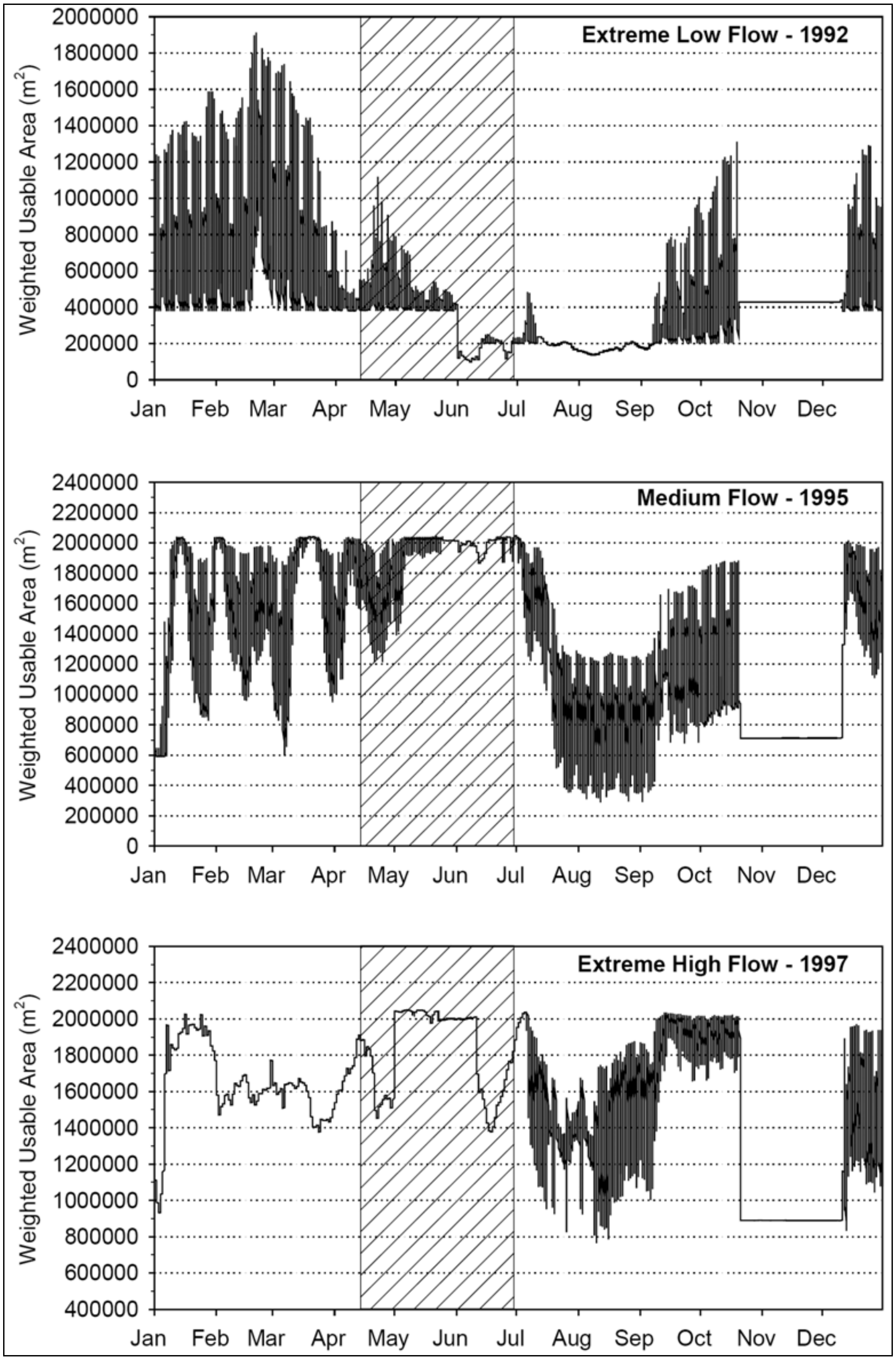

Figure 86. Hourly weighted useable area for white sturgeon incubation in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

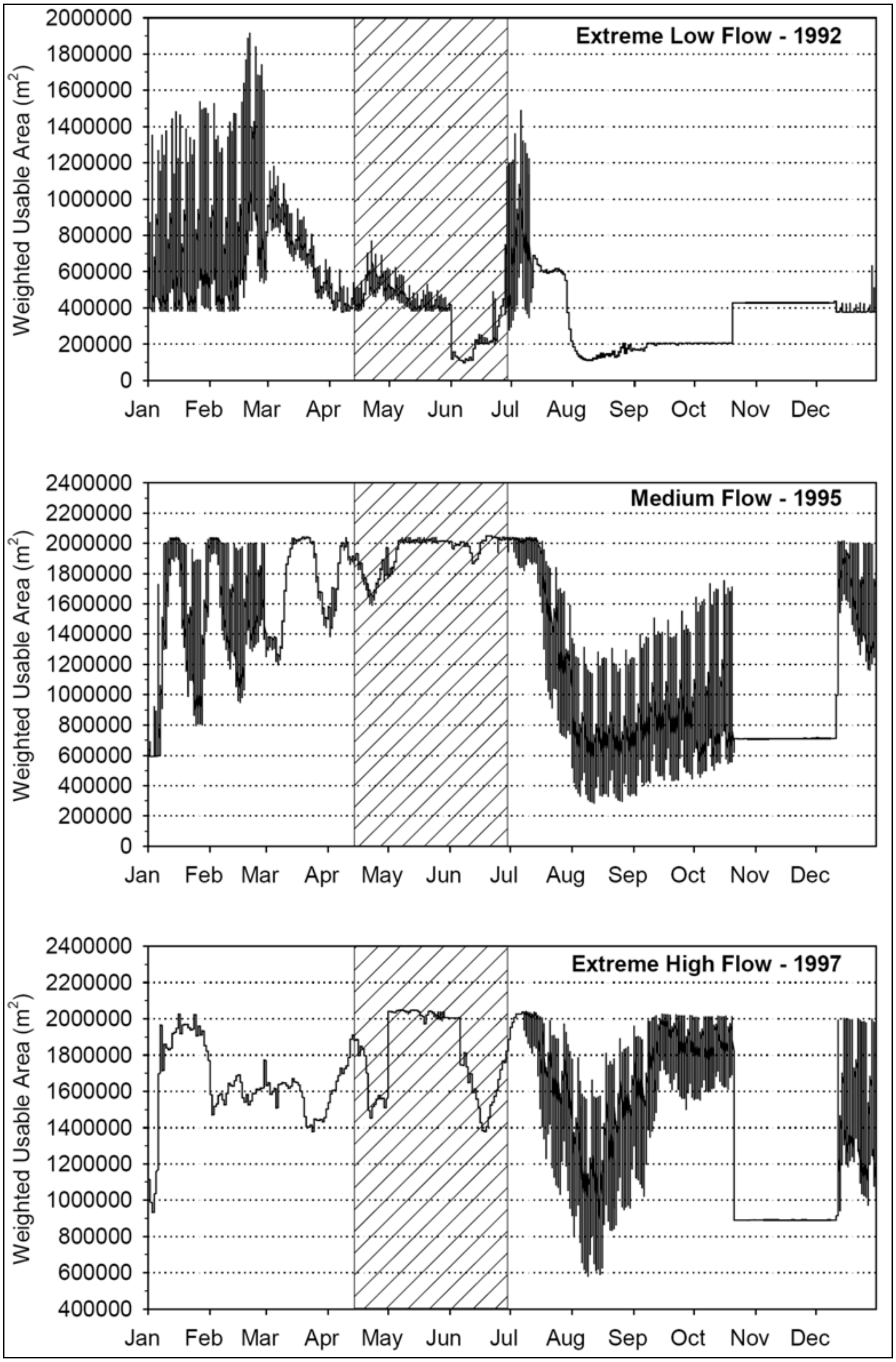

Figure 87. Hourly weighted useable area for white sturgeon incubation in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

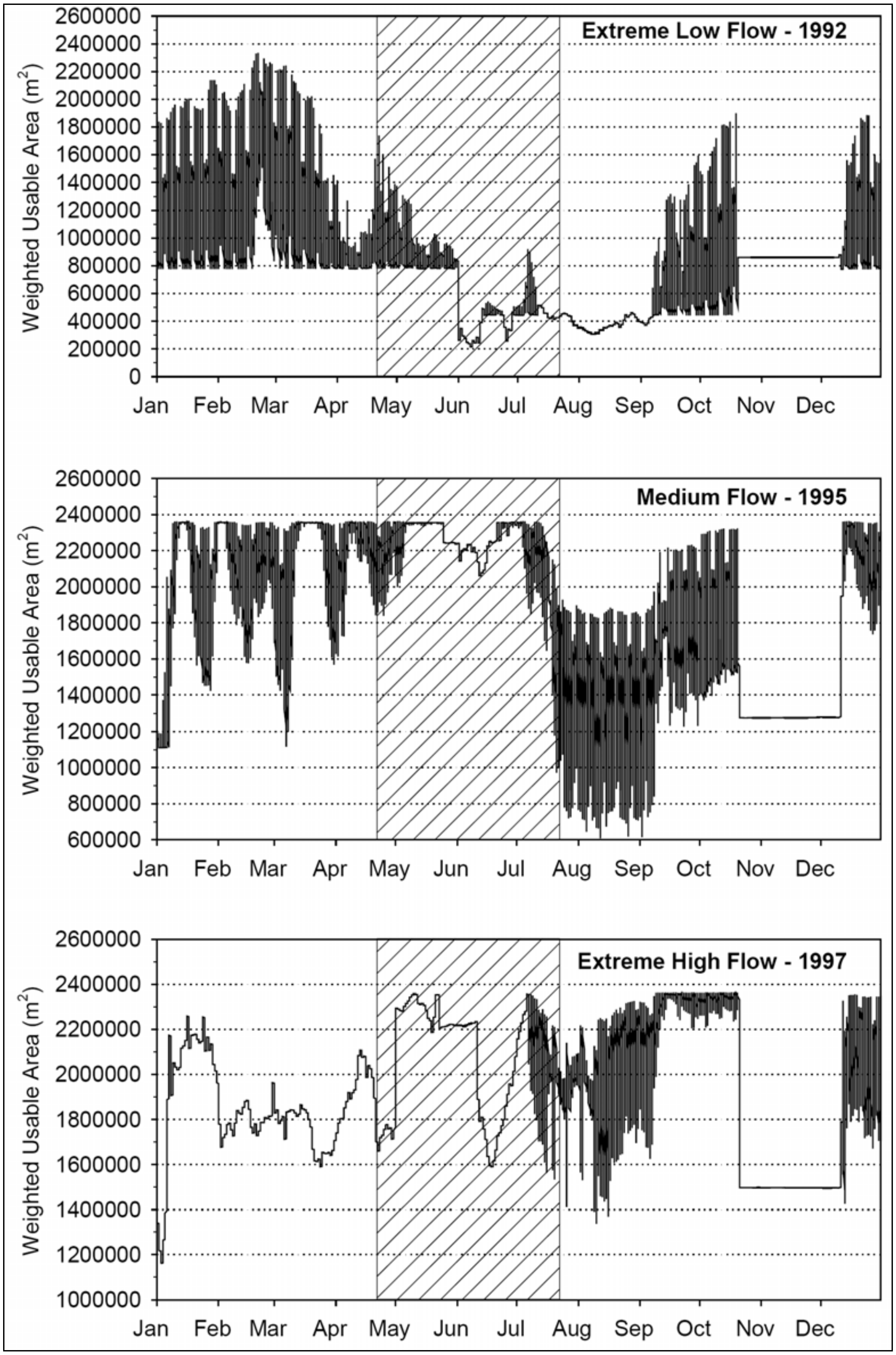

Figure 88. Hourly weighted useable area for white sturgeon larvae in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005).

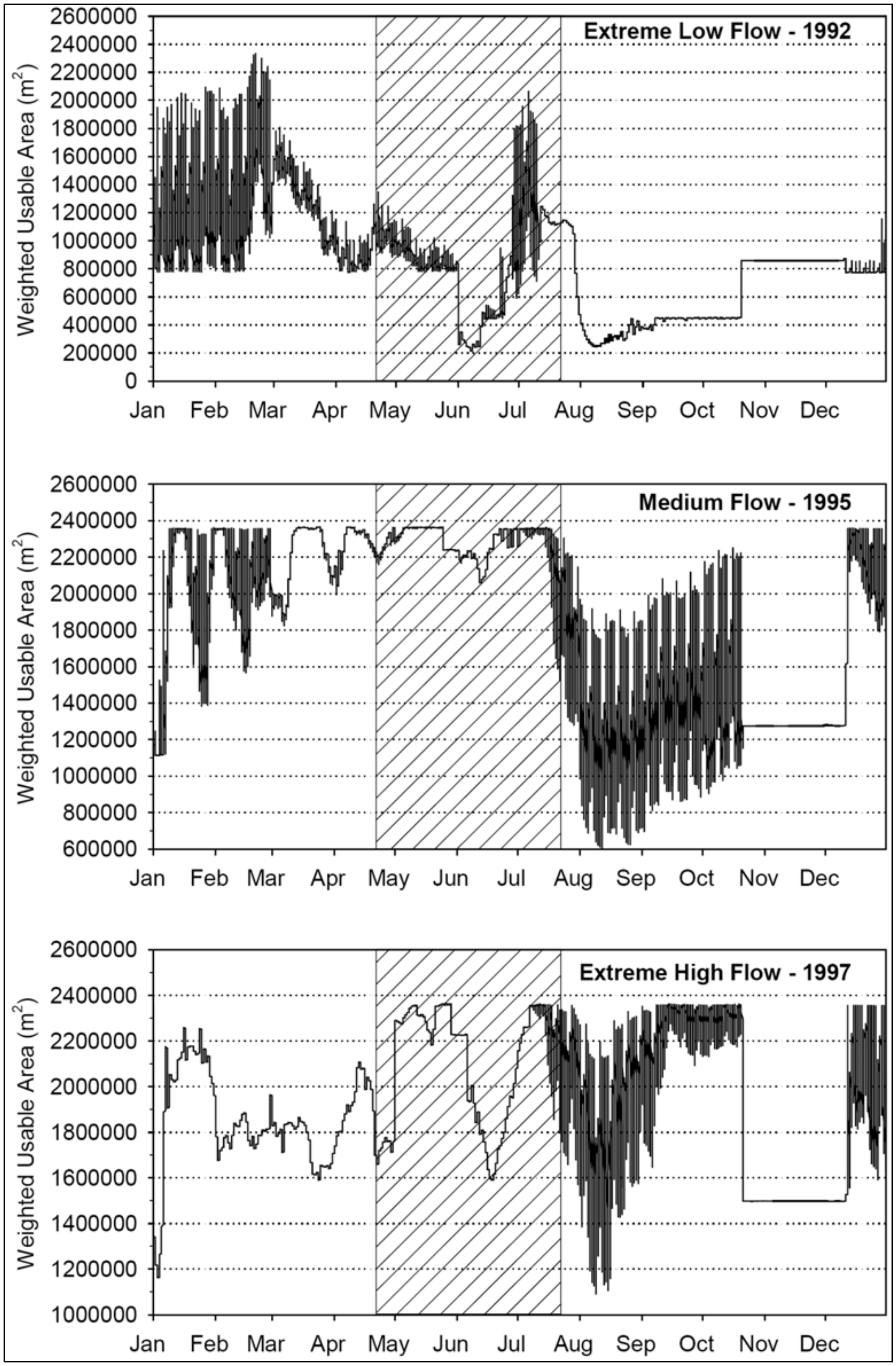

Figure 89. Hourly weighted useable area for white sturgeon larvae in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

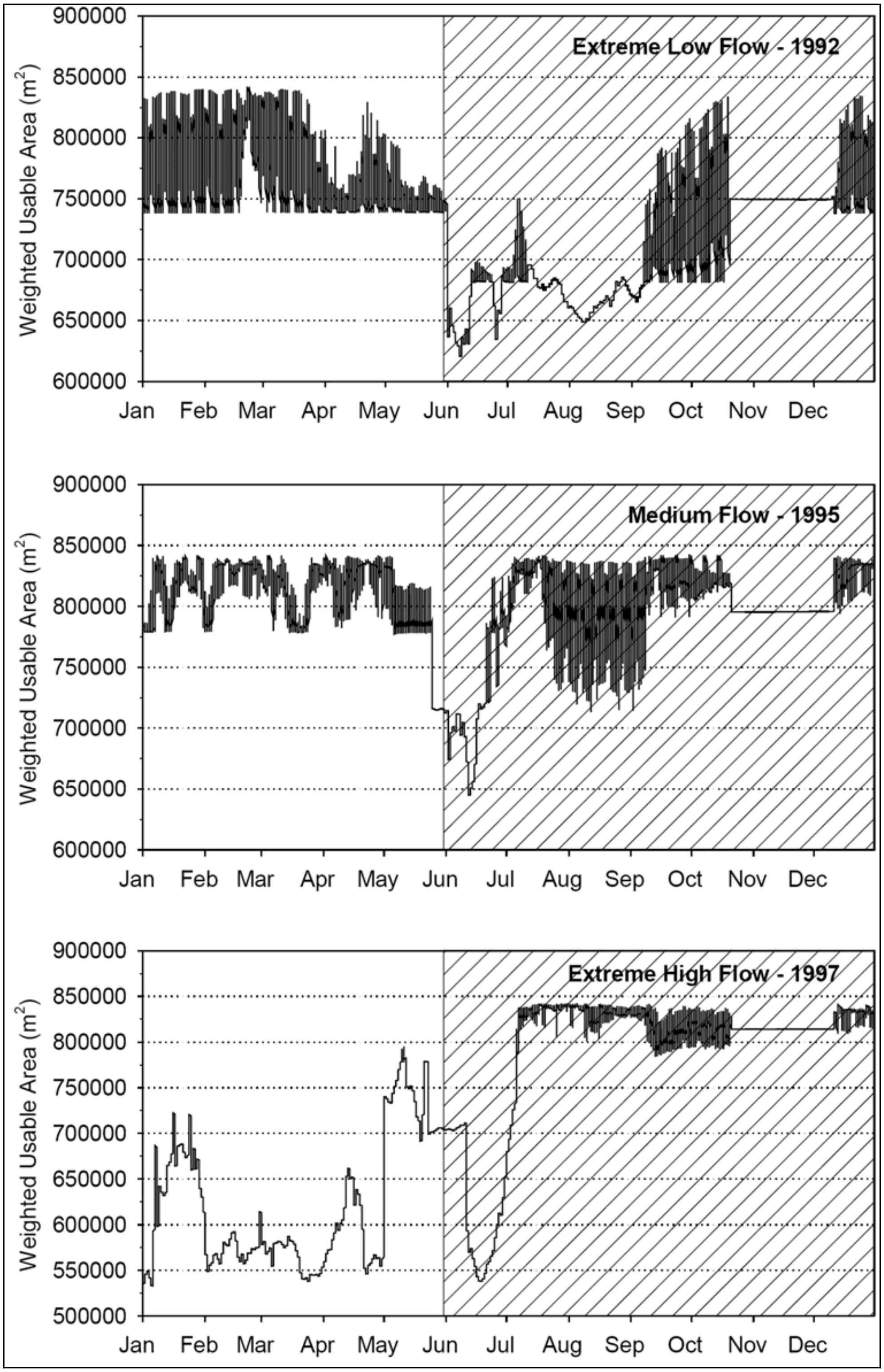

Figure 90. Hourly weighted useable area for white sturgeon young-of-year in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

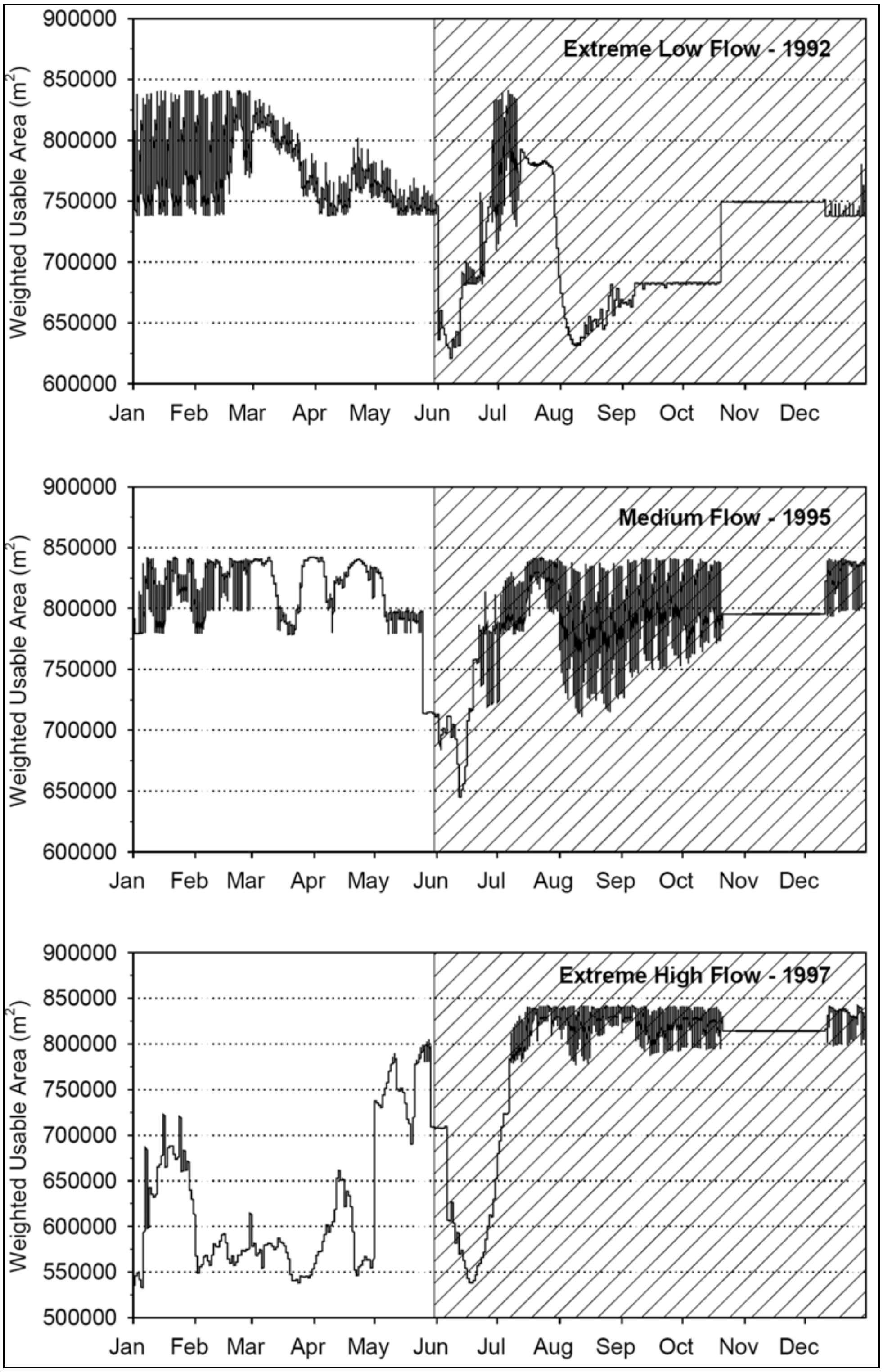

Figure 91. Hourly weighted useable area for white sturgeon young-of-year in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

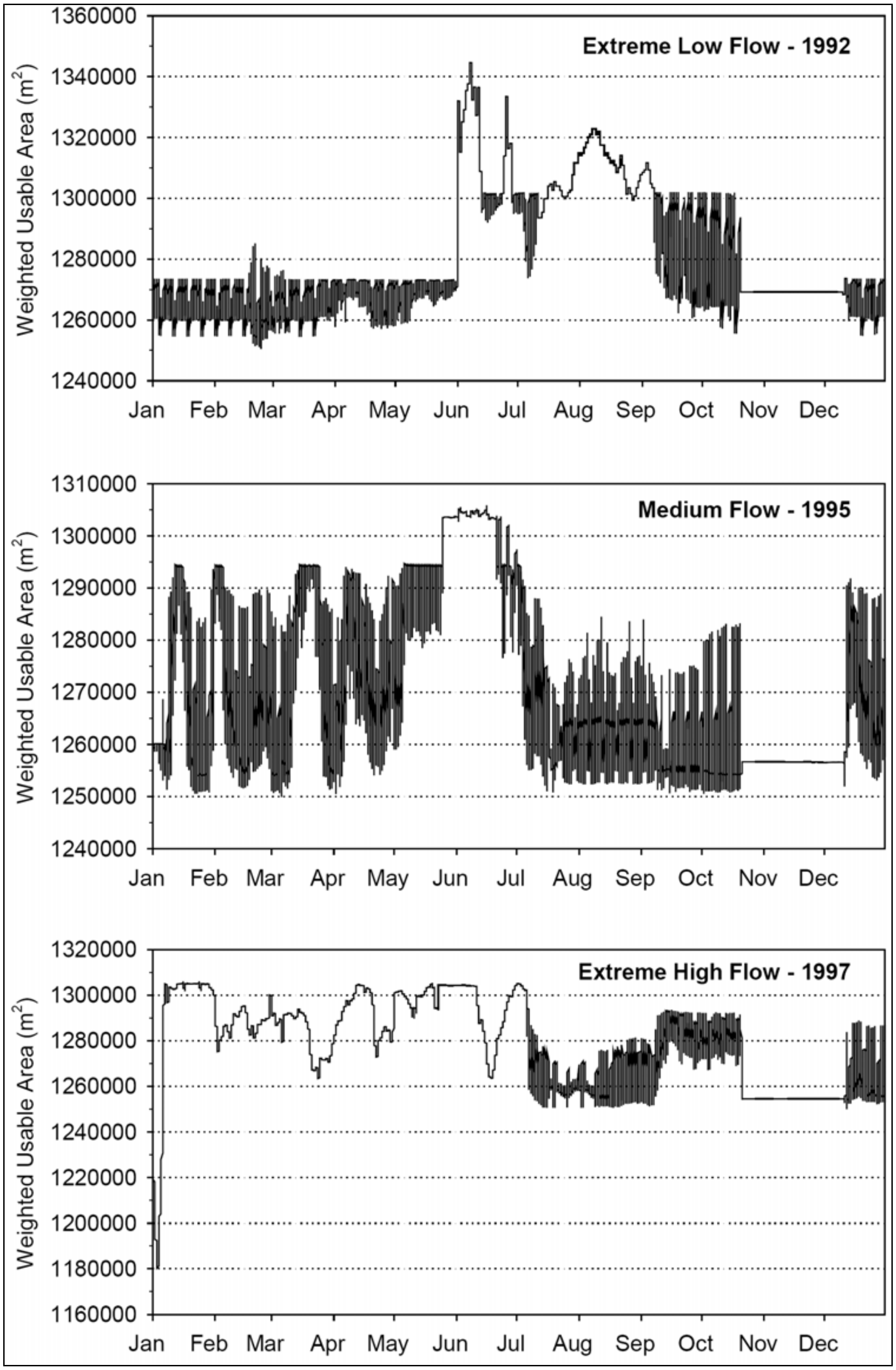

Figure 92. Hourly weighted useable area for white sturgeon juveniles in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

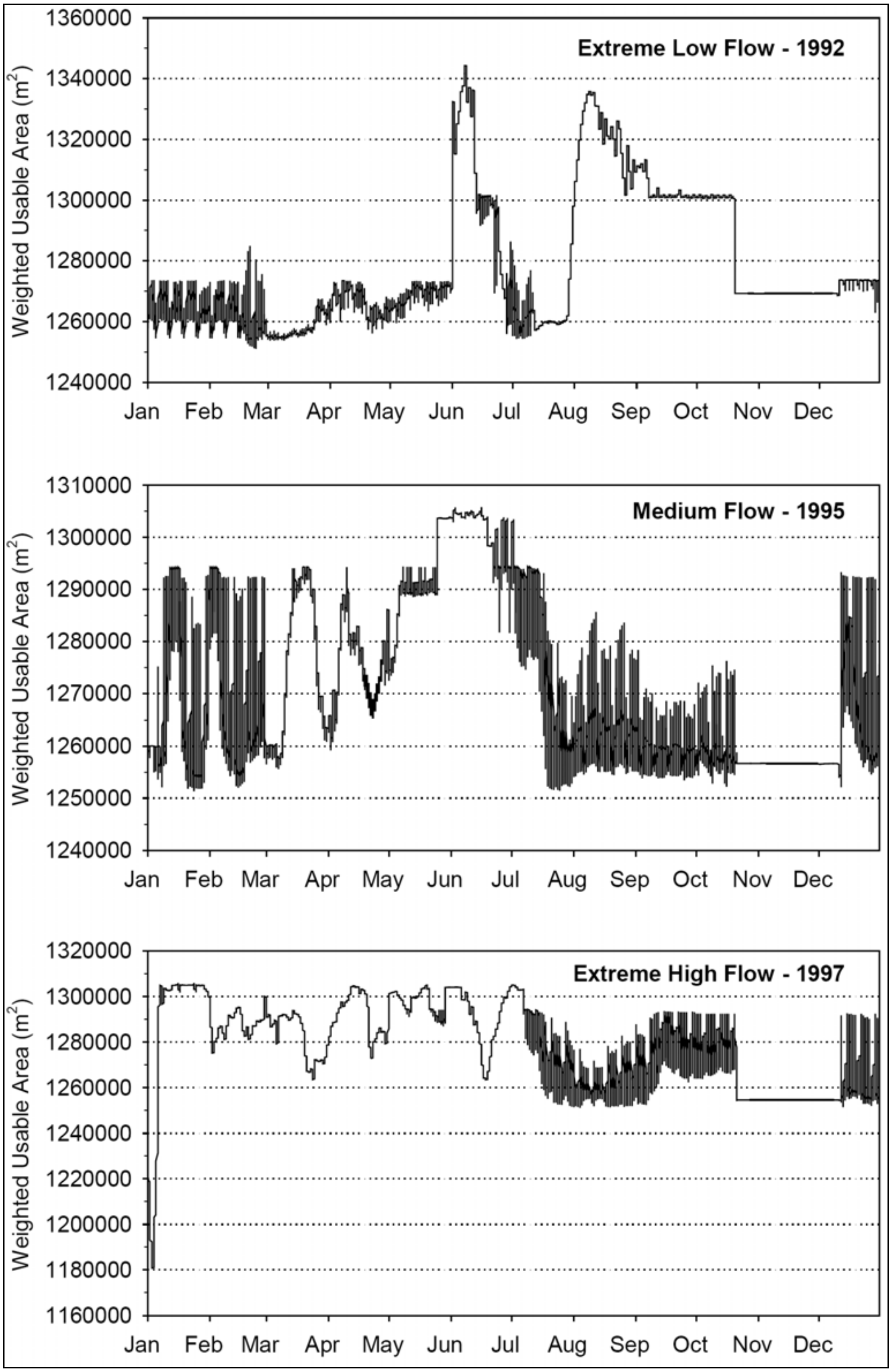

Figure 93. Hourly weighted useable area for white sturgeon juveniles in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

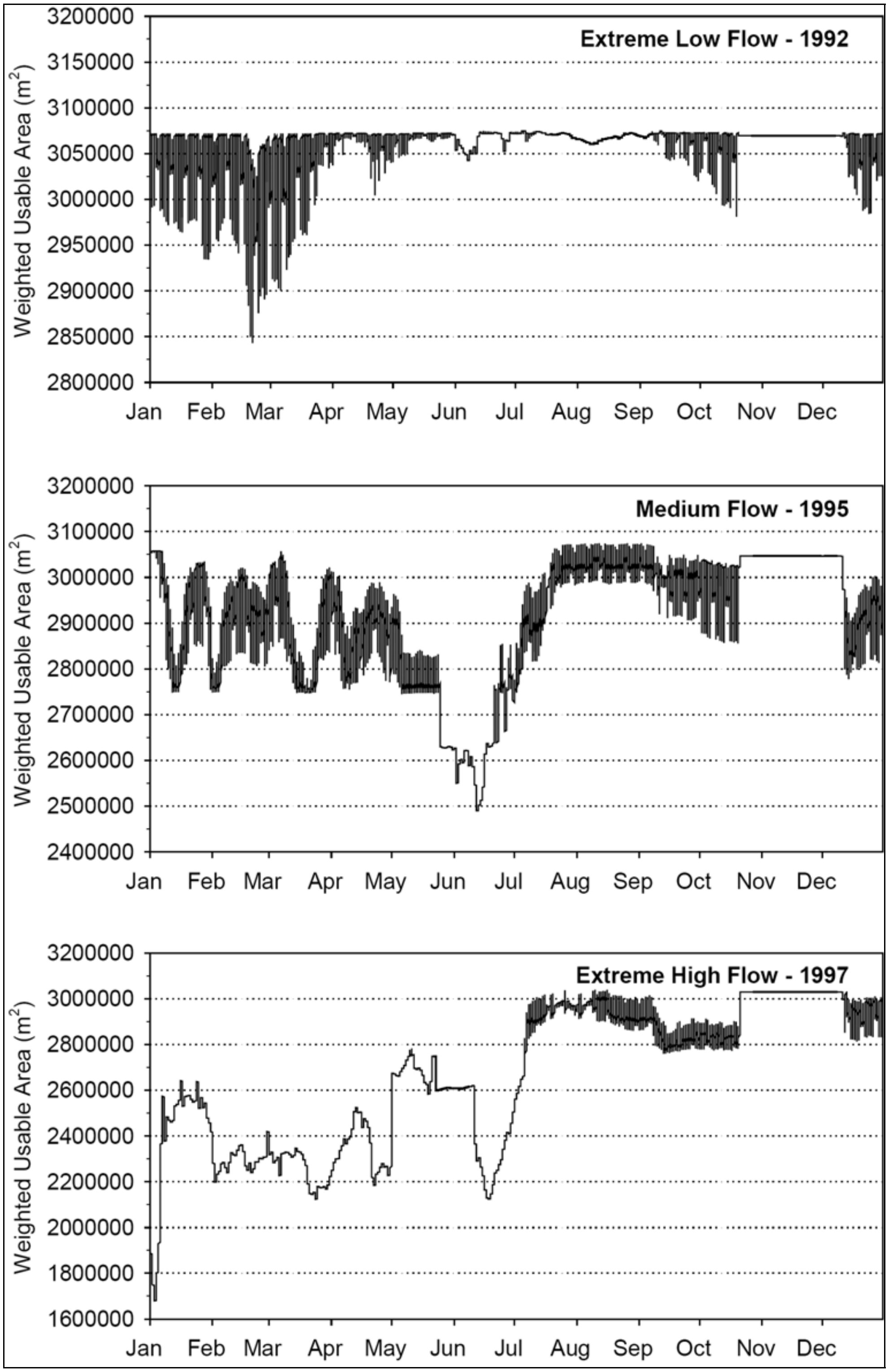

Figure 94. Hourly weighted useable area for white sturgeon adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for Proposed Operations for three water year types. (Source: Brink and Chandler, 2005)

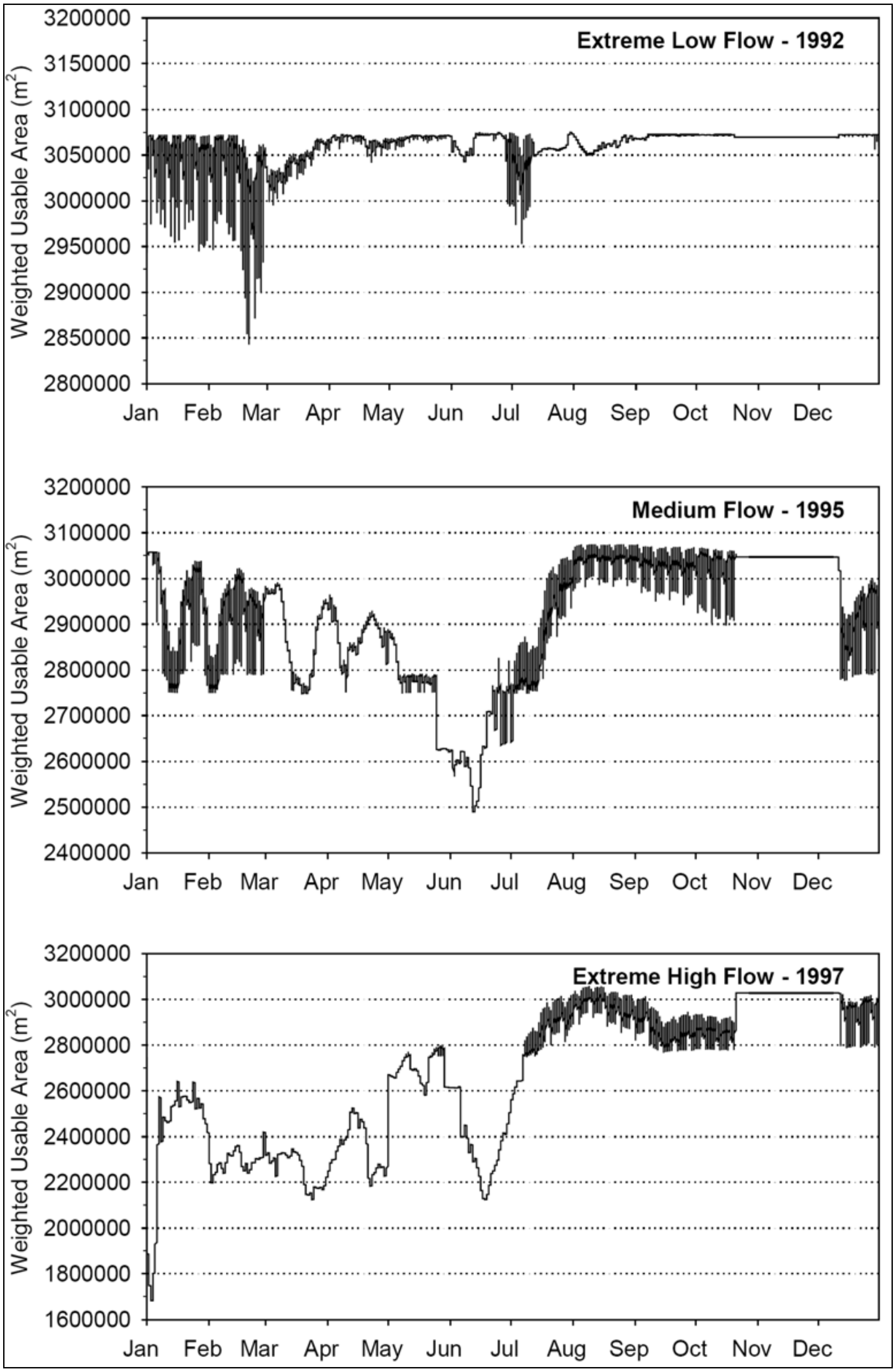

Figure 95. Hourly weighted useable area for white sturgeon adults in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River confluence) simulated for the Flow Augmentation Scenario for three water year types. (Source: Brink and Chandler, 2005)

Table 53. Estimated minimum, maximum, and maximum percent daily fluctuation in WUA for white sturgeon in the upper Hells Canyon reach (Hells Canyon dam to the Salmon River). (Source: Brink and Chandler, 2005, as modified by staff)

		Spawning			Incubation			Larvae		
Scenario	**Year**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**	**Min WUA[a]**	**Max WUA[a]**	**% Fluct.**
Proposed Operations	Extremely low	575	2,500	29.4	100	1,100	50.0	220	1,720	42.2
	Medium	2,600	5,100	25.0	1,200	2,020	36.8	1,650	2,350	19.1
	Extremely high	4,000	5,750	< 1.0	1,380	2,020	< 1.0	1,520	2,350	25.4
Scenario 1a (Reregulating)	Extremely low	900	1,900	< 1.0	100	680	< 1.0	220	1,200	< 1.0
	Medium	3,250	5,100	< 1.0	1,650	2,050	< 1.0	1,600	2,350	< 1.0
	Extremely high	4,200	5,750	< 1.0	1,380	2,020	< 1.0	1,600	2,350	< 1.0
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	875	2,125	13.3	100	750	27.6	220	1,350	22.7
	Medium	3,250	5,200	< 1.0	1,600	2,050	< 1.0	2,080	2,380	< 1.0
	Extremely high	4,200	5,750	< 1.0	1,380	2,020	< 1.0	1,600	2,350	< 1.0
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	875	2,375	15.5	100	1,010	50.0	220	1,620	37.5
	Medium	2,800	5,200	8.3	1,350	2,020	23.2	1,300	2,350	30.0
	Extremely high	4,000	5,750	< 1.0	1,380	2,050	< 1.0	1,600	2,350	20.9
Scenario 2 (Flow Augmentation)	Extremely low	875	2,125	13.3	100	780	27.6	200	2,050	55.1
	Medium	3,200	5,200	< 1.0	1,600	2,020	< 1.0	1,500	2,350	30.0
	Extremely high	4,000	5,750	< 1.0	1,380	2,050	< 1.0	1,600	2,350	< 1.0
Scenario 3 (Navigation)	Extremely low	875	2,750	25.0	100	1,300	24.0	200	1,900	36.0
	Medium	2,500	5,100	28.6	1,110	2,020	29.2	1,050	2,350	44.7
	Extremely high	3,800	5,750	< 1.0	1,380	2,050	< 1.0	1,450	2,350	29.8

Scenario	Year	Young-of-Year			Juvenile			Adult		
		Min WUA[a]	Max WUA[a]	% Fluct.	Min WUA[a]	Max WUA[a]	% Fluct.	Min WUA[a]	Max WUA[a]	% Fluct.
Proposed Operations	Extremely low	620	830	17.6	1,250	1,345	3.1	2,770	3,075	5.4
	Medium	640	835	11.3	1,251	1,305	2.4	2,500	3,075	6.1
	Extremely high	535	835	4.8	1,180	1,305	2.7	1,680	3,020	6.0
Scenario 1a (Reregulating)	Extremely low	625	790	< 1.0	1,255	1,345	< 1.0	2,960	3,075	< 1.0
	Medium	640	835	< 1.0	1,252	1,305	< 1.0	2,500	3,050	< 1.0
	Extremely high	535	835	< 1.0	1,180	1,305	< 1.0	1,680	3,020	< 1.0
Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Extremely low	625	810	3.3	1,252	1,345	< 1.0	2,945	3,075	< 1.0
	Medium	640	840	4.2	1,252	1,305	< 1.0	2,500	3,050	< 1.0
	Extremely high	535	835	< 1.0	1,180	1,305	< 1.0	1,700	3,020	< 1.0
Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Extremely low	625	825	12.3	1,252	1,345	2.3	2,900	3,075	2.0
	Medium	640	835	7.3	1,252	1,305	1.3	2,500	3,050	4.3
	Extremely high	535	835	5.4	1,180	1,305	1.7	1,700	3,020	4.1
Scenario 2 (Flow Augmentation)	Extremely low	625	835	11.4	1,250	1,345	1.0	2,840	3,075	4.1
	Medium	640	835	8.4	1,252	1,305	2.7	2,500	3,075	7.0
	Extremely high	535	835	6.0	1,180	1,305	3.2	1,700	3,050	6.7
Scenario 3 (Navigation)	Extremely low	625	835	12.0	1,250	1,345	1.2	2,850	3,075	4.9
	Medium	640	840	11.9	1,250	1,305	2.5	2,500	3,060	6.6
	Extremely high	535	835	6.0	1,180	1,350	2.7	1,700	3,020	6.6

[a] WUA values are shown in 1,000 square meters

The results of Idaho Power's habitat modeling indicates that under Proposed Operations, load following causes substantial daily variations in WUA for the spawning, incubation and larval life stages of white sturgeon during extremely low and medium water years. However, population sampling reported in Lepla et al. (2003) indicates that all size groups are well represented in the sturgeon population in the Hells Canyon reach (figure 96), indicating that successful reproduction and recruitment occurs in most years. Furthermore, there is no indication that sturgeon growth is adversely affected. Idaho Power reports that condition factors have not declined since surveys conducted in the 1970s and 1980s, despite steady increases in the abundance in the number of fish larger than 92 cm, and Everett et al. (2003, as cited in Chandler et al., 2006) report that growth rates below Hells Canyon dam exceed rates that are observed in the lower Snake River and in the Columbia River.

Warmwater Fisheries

Seasonal changes in water levels in Brownlee reservoir may affect the reproductive success of warmwater species including smallmouth bass, black crappie, white crappie, and channel catfish. These species support a substantial recreational fishery that is important to the economy of local communities.

To promote spawning success for warmwater fish species, Idaho Power proposes to limit the drawdown of Brownlee reservoir during the spawning period. Beginning on May 21, reservoir spawning habitat would be protected for a 30-day period, during which time the reservoir would not be drafted more than 1 foot from the highest elevation reached during the 30-day period, although exceptions would be allowed for system or economic emergencies. From the end of the 30-day period though July 4, the reservoir could be drafted more than 1 foot, but an elevation of at least 2,069 feet msl would be maintained through July 4. Idaho Power also proposes to continue warmwater fish population monitoring to detect long-term effects on fish populations, including annual electrofishing surveys in all three project reservoirs and surveying the Swan Falls-to-Brownlee reach every fifth year.

ODFW (ODFW-51) and IDFG (IDFG-27)support the same operating constraints that Idaho Power proposes to protect warmwater fish spawning, although ODFW recommends that drawdown of Brownlee reservoir to levels below elevation 2,069 msl be allowed if flow augmentation (for salmon migration) occurs before July 4. Recommendations directed at providing water to augment flows during the salmon smolt outmigration, listed in table 9, may also affect water levels during the spawning season for warmwater fish species.

IDFG (IDFG-27) and ODFW (ODFW-50) support Idaho Power's proposal to continue warmwater fish population monitoring, but ODFW also recommends that Idaho Power conduct annual creel surveys in all three project reservoirs and study the food habits of Brownlee reservoir warmwater fish species, including effects of reservoir operations on zooplankton production. IDFG (IDFG-27) recommends that if economic or system emergencies occur that require deviation from Idaho Power's proposed operating regime, that Idaho Power consult with IDFG and ODFW to evaluate alternative strategies to protect warmwater fisheries.

Our Analysis

Water level fluctuations during spawning and early development may affect spawning success of nesting species by dewatering nests or by causing fish to abandon nests. Lowering of water levels during the spawning season may adversely affect crappie survival (Siefert, 1969; Ginelly, 1971) and smallmouth bass nests (Montgomery et al., 1980).

Idaho Power monitored spawning of smallmouth bass, white and black crappie, and channel catfish in Brownlee reservoir from 1991 through 1998. Scuba survey techniques were used to determine the timing and depth of spawning, and to assess incubation success as determined by observing fry in the nests. In each year, multiple surveys were conducted over the spawning season (6 surveys per week in 1992, 1 survey per week in 1993, and two surveys per week from 1994 through 1997).

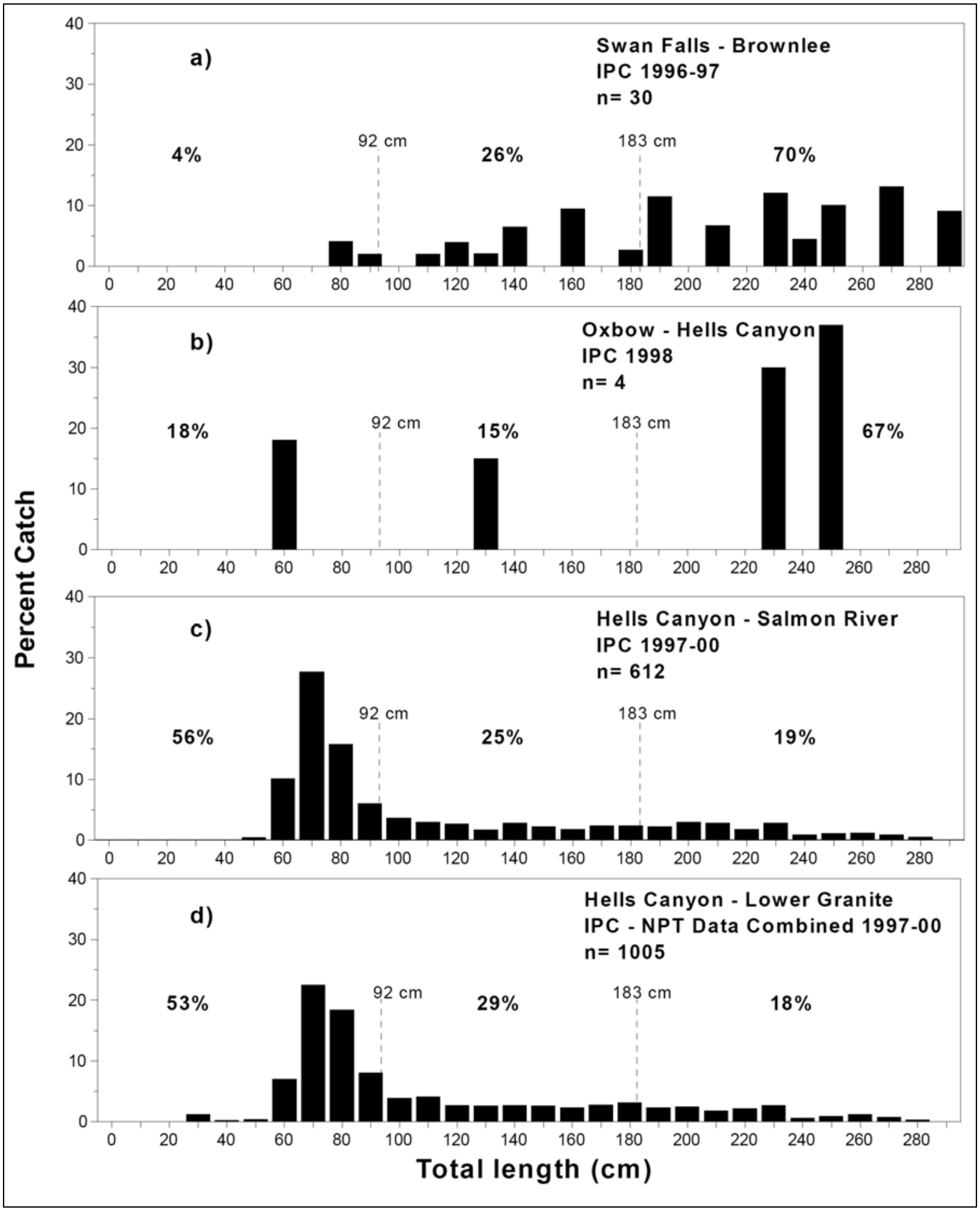

Figure 96. Length-frequency distributions (adjusted for gear selectivity) of white sturgeon sampled with setlines in the Snake River reaches from Swan Falls to Lower Granite dams. (Source: Lepla et al., 2003)

Idaho Power's findings regarding the time of spawn, nest duration and nesting depth is summarized in table 54. Because of difficulty distinguishing between black and white crappie and hybrids of the two species during scuba surveys, observations on these species were combined. Based on their evaluation of nesting success, Richter and Chandler (2001) concluded that drawdowns exceeding 4 feet during the nesting period caused a substantial reduction in nesting success for smallmouth bass, and a similar reduction was observed for crappie when drawdowns exceeded 5 feet. Although the number of channel catfish nests that were observed in Brownlee reservoir was small (N = 18), the data collected from these nesting sites indicate that catfish nest success did not show any relationship to the amount of draft (up to 12 feet) that was observed during the nesting period. Idaho Power's observations indicate that increasing water levels over active nests did not adversely affect nesting success.

Table 54. Spawning seasons, nesting duration and nest depths of smallmouth bass, crappie, and channel catfish in Brownlee reservoir. (Source: Richter and Chandler, 2001, as modified by staff)

Species	**Peak Spawning Period**	**Mean Nest Duration**	**Typical Nest Depth**
Smallmouth bass	May 19 to June 1	14.5 days	3 to 8 feet
White and black crappie	May 10 to May 21 and June 8 to June 24	7.3 days	7 to 15 feet
Channel catfish	Mid-June through July	16.5 days	6 to 18 feet

Idaho Power modeled Brownlee reservoir elevations under each of the evaluation scenarios. A comparison of reservoir elevations for each scenario indicates that Scenario 2 (Flow Augmentation) is the only scenario where seasonal elevations in Brownlee reservoir differ substantially from Proposed Operations. Simulated reservoir elevations for three water year types under these two flow scenarios are shown in figures 97 through 99. The spawning period for smallmouth bass, crappie, and channel catfish are indicated by hatch marks.

As shown on figure 97, simulated reservoir levels during the smallmouth bass spawning period declined slightly in the extremely low flow water year under both Proposed Operations and the Flow Augmentation Scenario, but reservoir levels did not decline by more then 3 feet during the 14-day nest duration at any time during the spawning period. In the medium and extremely high flow water years, reservoir levels increase during the spawning season and through the 7-day period when later-spawned eggs would still be in the nest. Since level reductions exceeding 4 feet are not likely to occur, our analysis indicates that nest success for smallmouth bass should not be adversely affected under any of the scenarios regardless of water year type.

As shown on figure 98, simulated reservoir levels during the crappie spawning period decline slightly in the extremely low flow water year under both scenarios. Reservoir levels increase slightly within the 7-day period after spawning ends when nests would still be active (prior to hatching). The maximum reduction in water level for an active nest is 2.1 feet for both scenarios, and the maximum increase in water level is just under 2 feet. In the medium flow year, water levels increase rapidly during the crappie spawning period, and decline slightly after the spawning season ends in both scenarios. The maximum reduction in water levels during the 7-day active period for nests constructed at any time during the spawning season is 2.1 feet. Similarly, in the extremely high flow year, simulated water levels increase rapidly during most of the crappie spawning season, and then hold steady after the maximum pool elevation is attained. Since level reductions exceeding 5 feet are not expected to occur, our analysis indicates that nest success for crappie should not be adversely affected under any of the scenarios regardless of water year type.

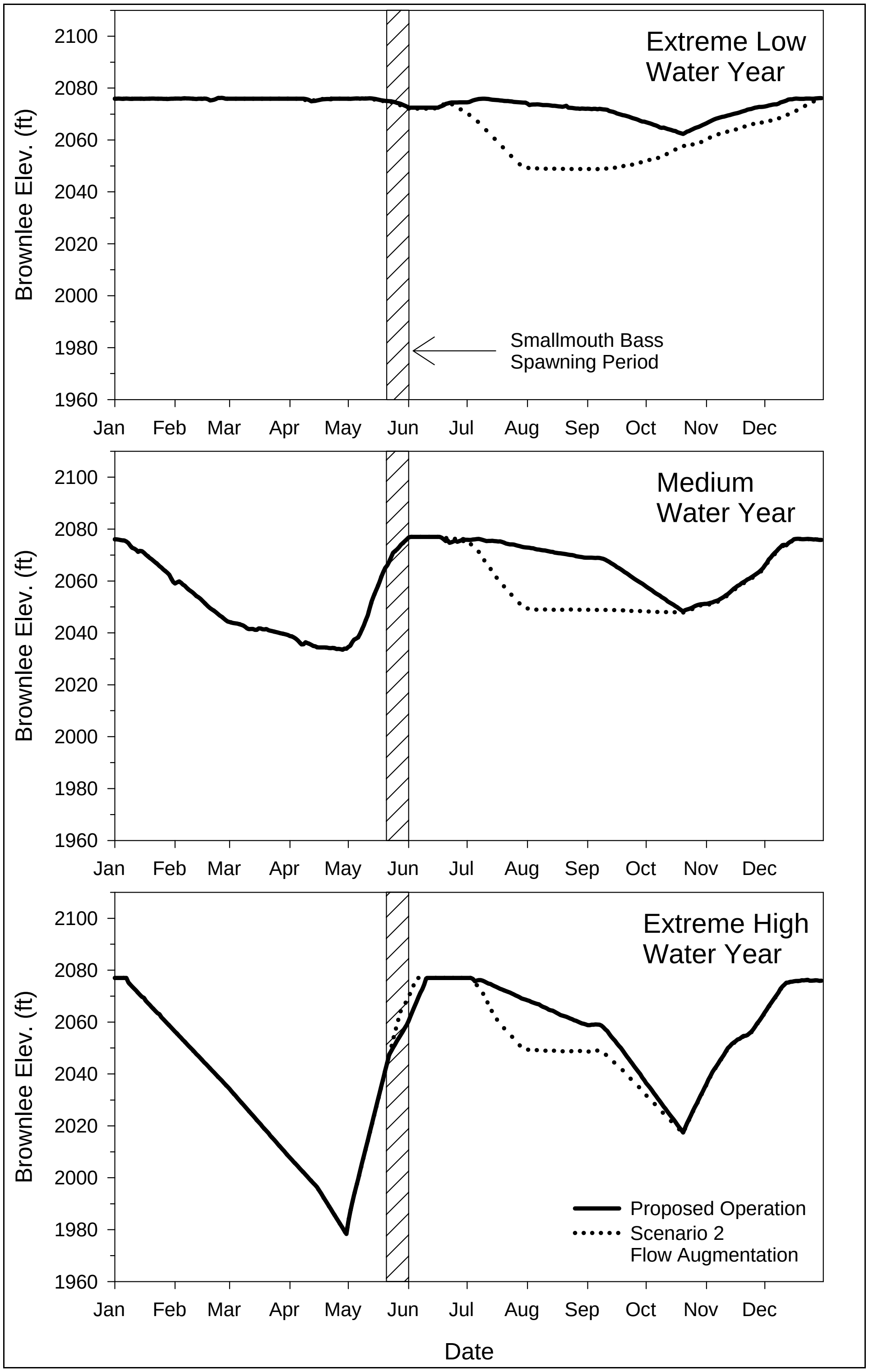

Figure 97. Smallmouth bass spawning period and Brownlee reservoir elevations predicted for three water year types for Proposed Operations and for Scenario 2, Flow Augmentation. (Source: Brink and Chandler, 2005, as modified by staff)

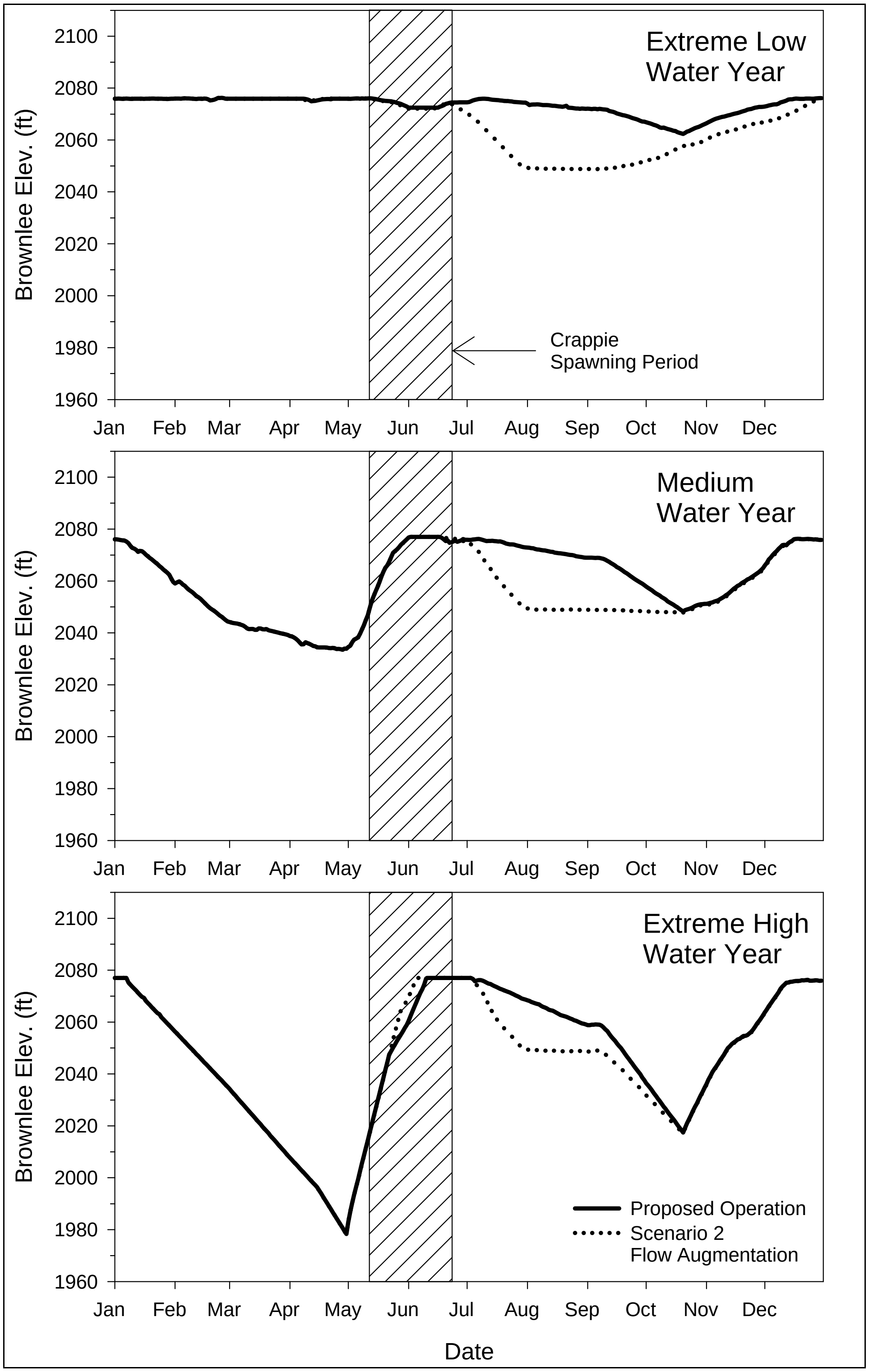

Figure 98. Crappie spawning period and Brownlee reservoir elevations predicted for three water year types for Proposed Operations and for Scenario 2, Flow Augmentation. (Source: Brink and Chandler, 2005, as modified by staff)

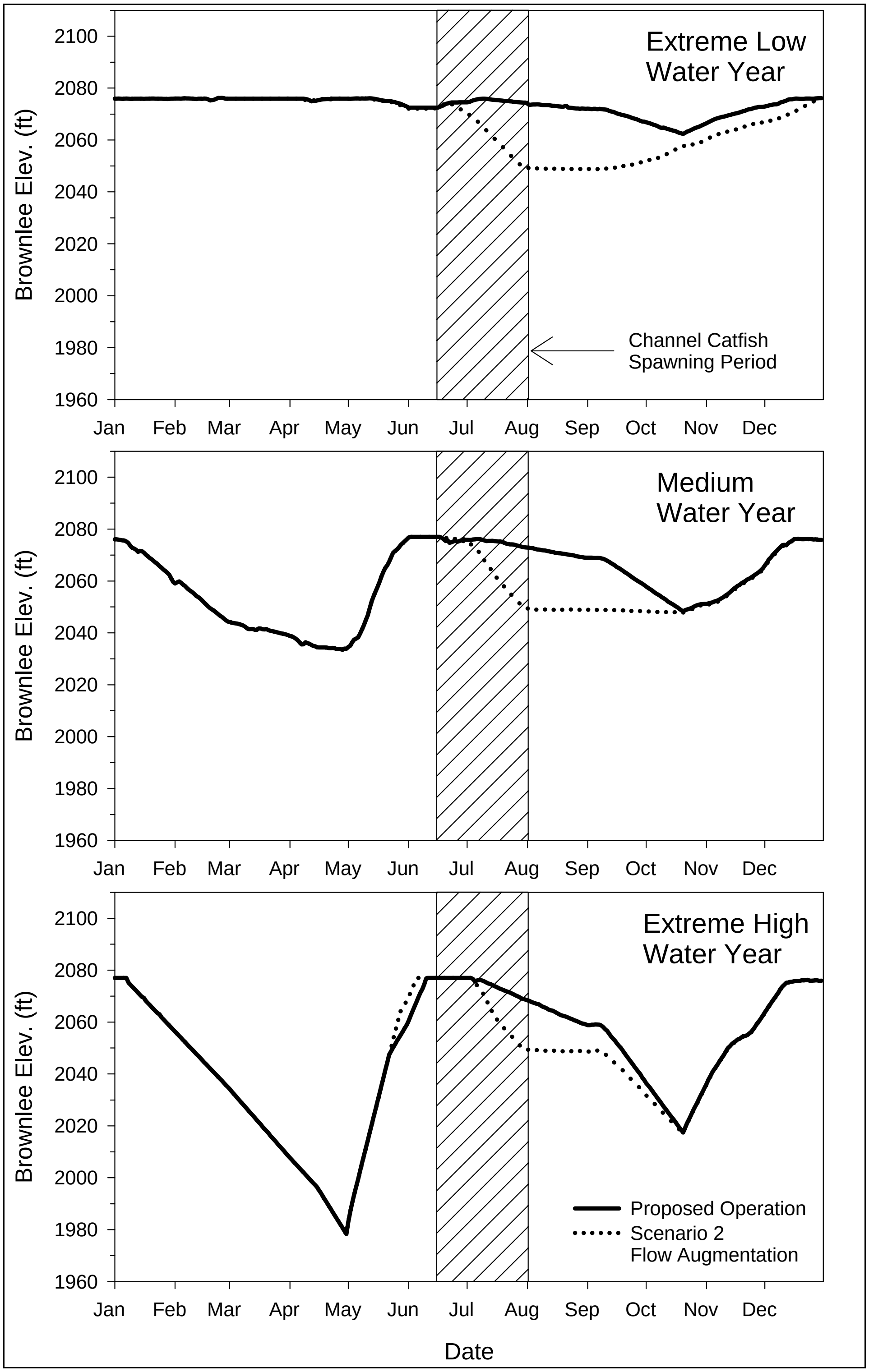

Figure 99. Channel catfish spawning period and Brownlee reservoir elevations predicted for three water year types for Proposed Operations and for Scenario 2, Flow Augmentation. (Source: Brink and Chandler, 2005, as modified by staff)

Because they spawn later in the summer, channel catfish nests are exposed to greater reductions in water levels, especially under the Flow Augmentation Scenario (figure 99). To evaluate the change in reservoir level that individual nests would be exposed to while they are active, we plotted the change in simulated reservoir elevation that each nest would be exposed to over the 17 days between when spawning occurred and when fry would emerge from the nest. These values are plotted for each scenario by the date spawned for each water year type in figure 100. The figure shows that while drawdowns would be more substantial in the Flow Augmentation Scenario, the extent of elevation change that occurs during the 17-day period when any nest is active would not exceed 8 feet. Because channel catfish are relatively deep spawners, it appears that relatively few channel catfish nests would be adversely affected. As noted above, Richter and Chandler (2001) did not observe any reduction in channel catfish nesting success under drawdowns of up to 12 feet, but this was based on a relatively small number of observations (18 nests).

Based on the preceding analysis, the alternative scenarios representing the range of agency recommendations, including flow augmentation, should not have any substantial adverse effects on warmwater fish spawning. Limiting reservoir fluctuation to a maximum of 1 foot from May 21 through June 20, as proposed by Idaho Power and recommended by ODFW, would minimize adverse effects to smallmouth bass over their entire spawning season and minimize adverse effects to crappie in the latter half of their spawning season. Limiting drawdown to elevation 2,069 (an 8-foot drawdown from full pool) through July 4 would protect early-spawning channel catfish but would afford little protection to later spawning fish, since their spawning period extends to the end of July and nests may remain active until mid-August. However, based on our analysis, there is a relatively small potential for adversely affecting channel catfish, even under the Flow Augmentation Scenario.

Idaho Power proposes to conduct annual warmwater fish population monitoring at established electrofishing sites in each reservoir, and every fifth year between Swan Falls dam and Brownlee reservoir. This measure would provide a mechanism to monitor changes in species composition and abundance in response to environmental conditions, project operations and recreational fishing effort. This information would be useful for guiding reservoir fisheries management decisions and to determine whether operational restrictions included in the license are effective in promoting consistent recruitment. Creel surveys would require a considerably greater level of effort, and angler success can be affected by a range of factors including weather and level of angler skill that make them a less consistent measure of fish populations than electrofishing. Thus, annual creel surveys recommended by ODFW (ODFW-50) likely would be a more costly and less useful approach for monitoring fish population trends.

In addition, ODFW's recommendation (ODFW-52) that Idaho Power conduct a study of warmwater fish species food habits in Brownlee reservoir, including effects of project operations on zooplankton production, would be of little benefit. As indicated by relative weights exceeding 85 for all species (Richter and Chandler, 2003), Idaho Power's studies indicate that warmwater fish in Brownlee reservoir do not appear to be limited by their food supply.

IDFG (IDFG-27) recommends that Idaho Power consult with IDFG and ODFW to evaluate alternative strategies to protect warmwater fisheries in the event that economic or system emergencies occur that require deviation from its proposed operating regime. In its April 11, 2006, reply comments, Idaho Power reports that most, if not all, situations can be handled within existing license constraints. As a standard license condition, licensees are required to report departures from operational requirements and the effects of the departures. Such reports would provide a mechanism for identifying the need for alternative warmwater fish protection strategies.

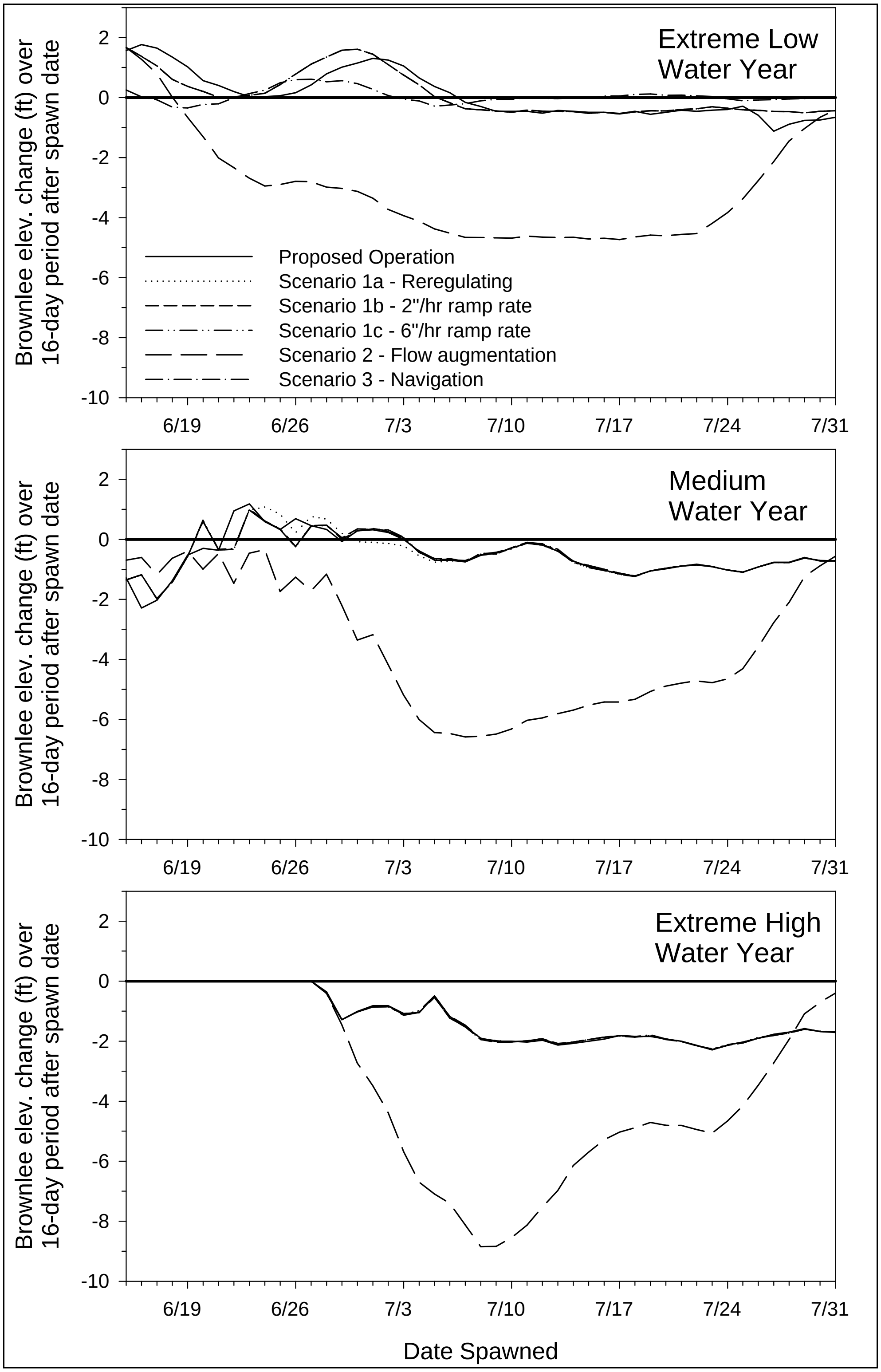

Figure 100. Elevation change during an estimated active nest duration of 16 days for channel catfish nests constructed between June 15 and July 31. (Source: Brink and Chandler, 2005, as modified by staff)

In its comments on the draft EIS, ODFW indicated that it supported staff's recommendation for warmwater fish monitoring, provided Idaho Power coordinated annually with ODFW and included appropriate sampling techniques for monitoring the abundance of channel catfish, which were identified in Idaho Power's angler survey effort as a key target species for anglers. During the 10(j) meeting, Idaho Power indicated that its sampling effort could be modified to include gill netting for sampling catfish at minimal additional cost. Coordination with ODFW in the development of the sampling program would ensure that appropriate protocols for sampling this important recreational species is included in the monitoring program, and would help to determine whether any changes in the health of catfish populations may be related to project operations.

Drawdown of Brownlee reservoir for other project purposes (i.e., flood control, power generation, and flow augmentation) would likely continue to have some adverse effects on the warmwater fishery in Brownlee reservoir. Drawdowns can adversely affect nesting success and can flush larvae and juvenile lifestages of the warmwater species from the reservoir. However, annual consultation with ODFW, IDFG, and BLM on the results of warmwater fisheries monitoring efforts would provide a forum to discuss the effects of project operations on the warmwater fishery. Such consultation may identify opportunities for reservoir levels to be managed in ways that minimize adverse effects on the warmwater fishery.

3.6.2.2 Dissolved Oxygen

Aquatic organisms require varying amounts of DO in the water to thrive. The amount of DO present in water is related to water temperature, atmospheric pressure, and the presence of plants, nutrients, and bacteria that produce and consume oxygen during photosynthesis and respiration. For most fish and aquatic organisms, as temperatures rise, metabolic demand also rises, increasing the need for oxygen to maintain respiratory and metabolic functions. Salmonids generally require DO concentrations of at least 7 mg/L and are less tolerant of low DO concentrations than warmwater fishes, which can tolerate DO concentrations as low as 3 to 4 mg/L.

Water quality criteria and TMDL targets for the Snake River-Hells Canyon area are presented in table 17. The TMDL targets for DO range from a minimum of 6.5 mg/L for coolwater life to 8 mg/L water column DO or not less than 90 percent saturation for coldwater aquatic life and salmonid rearing in the downstream Snake River (RM 247 to 188) (table 17). Following development of the TMDL, EPA approved new water quality standards for both Idaho and Oregon. Oregon's DO criteria for coldwater aquatic life and spawning are essentially the same as the TMDL targets. Although Idaho's DO criteria are less restrictive that the TMDL targets, the Idaho criteria are not controlling; water quality must satisfy the most restrictive applicable standard, which, in this case, is the TMDL target. DO concentrations measured between the Snake River inflow to Brownlee reservoir and about 10 miles downstream of Hells Canyon dam are presented in figures 28 and 31.

Increasing DO levels in project reservoirs and downstream of Hells Canyon dam would increase the usable habitat in the project reservoirs, reduce the incidence of fish kills, and improve conditions for spawning of fall Chinook salmon downstream of Hells Canyon dam. Increasing DO levels in project reservoirs would also reduce the exposure of aquatic organisms to contaminants by expediting the degradation of organochlorine compounds and reducing the availability of methylmercury (the biologically available form of mercury) in reservoir sediments.

Idaho Power's proposed measures and recommendations of agencies, tribes, and others are discussed, along with their effects on the physical environment, in section 3.5.2.2, *Dissolved Oxygen*.

Our Analysis

As noted in section 3.5.1.3, *Biological Productivity*, results of monitoring DO concentrations in the Hells Canyon dam tailwater showed that DO concentrations were less than the water quality targets on more than half of the days in each of the years between 1991 and 2000. The DO targets were not met during 58 percent of the days in the high flow year of 1997 or during 98 percent of the days in the lower flow years of 1991 and 1993 (Myers et al., 2003a). The measured DO concentrations never met the 11.0-mg/L spawning criterion in the fall (October 24 through December 31) and did not meet the criterion between 17 to 100 percent of the time in the spring (January 1 through May 10). At least one of the coldwater criteria was not met 59 to 98 percent of the time during the remainder of the year (Myers et al., 2003c). High levels of nutrient and organic matter loading appear to be the primary cause of low DO concentrations.

Figure 28 shows that in the medium flow year of 1995, DO was less than 8 mg/L at all measurement points in Brownlee, Oxbow, and Hells Canyon reservoirs, except for a few measurements near the surface of the reservoirs in July. Bottom-dwelling channel catfish are most susceptible to DO levels near zero at depth; however, they may move to shallower littoral zones to avoid these areas (Idaho Power, 2003a). The persistence of low DO levels near the surface, and levels below 5 mg/L at depth could interfere with salmonid spawning success downstream of Hells Canyon dam.

Low DO levels in project reservoirs and downstream of Hells Canyon dam also may result in suboptimal or lethal conditions for white sturgeon. During low-flow years, low DO conditions lethal to sturgeon can comprise up to 80 percent of the bottom 2-meter layer in Brownlee reservoir. Low river inflows and excessive nutrient levels, likely exacerbated by high water temperatures (25–26°C), resulted in DO levels (< 0.86 mg/L) throughout the water column that were lethal for sturgeon near the upper end of Brownlee reservoir (RM 324) in 1990 and caused the deaths of 28 adult white sturgeon (Lepla and Chandler, 2003).

Although no sturgeon mortalities have been attributed to poor water quality in Oxbow or Hells Canyon reservoirs, low DO levels that are potentially lethal to sturgeon can comprise up to 73 percent of the bottom 2-meter layer in Oxbow reservoir and 42 to 55 percent in Hells Canyon reservoir during summer months in low-flow years (Lepla and Chandler, 2003). Downstream of Hells Canyon dam, DO concentrations measured in the tailrace can also drop to as low as 2.8 mg/L for several weeks during late summer months, especially in low flow years. These conditions likely persist for a few miles downstream of the dam, but no sturgeon mortality has been attributed to these events (Lepla and Chandler 2003). Although population trends observed in the Bliss reach indicate that sturgeon recruitment is impeded in low flow years, Lepla and Chandler (2003) report that this trend was not observed in the population downstream of Hells Canyon dam.

Low DO concentrations and high water temperatures were also implicated in a kill of approximately 100 adult hatchery steelhead and one channel catfish that were isolated in a pool downstream of Hells Canyon dam. This event occurred when flows were reduced in the fall of 2002 (letter from N.F. Gardiner, Idaho Power, Boise, ID, to M.R. Salas, Secretary, FERC, Washington, D.C., dated October 31, 2002).

Modeling conducted by Idaho Power indicates that DO levels that are below optimal for bull trout may persist for up to 20 miles downstream of Hells Canyon dam (see figures 48, 49, and 50 in section 3.6.1.4). However, modeled water temperatures throughout the reach are also unsuitable for bull trout from early July through mid-October, as shown in figures 51, 52, and 53 in section 3.6.1.4. Most redband and bull trout likely move into tributaries during the summer months, although Idaho Power's radio telemetry studies (Chandler et al., 2003a) show that some bull trout remain in the mainstem Snake River during the summer, using temperature refugia where coolwater tributaries enter the river.

An analysis of the effectiveness of Idaho Power and agency/tribal recommendations in increasing DO levels is presented in section 3.5.2.2, *Dissolved Oxygen.* Idaho Power's proposed reservoir supplementation would not increase DO concentrations of Brownlee or Hells Canyon discharges to above the 6.5-mg/L coolwater target, although it would fulfill the intent of the TMDL load allocation (IDEQ and ODEQ, 2004) and would be responsive to the Nez Pierce Tribe recommendation for reservoir supplementation. Any incremental increase in DO provided where it is currently below the target level would likely benefit aquatic species; however, the extent of such benefit would depend on the location, duration and timing of any increase realized.

Idaho Power's proposed reservoir aeration system was designed for the current level of nutrient loading from upstream sources. As loadings of nutrients and organic matter experience slow long-term reductions from implementing the TMDL, the extent of algae blooms would be reduced and the sediment oxygen demand would tend to decrease. This would result in higher DO levels, particularly near the bottom of Brownlee reservoir's transition zone. The long-term effects of these changes are expected to incrementally improve fish habitat in the upper end of the reservoir over a new license period. However, it is expected to take decades for implementation of the TMDL to substantially reduce nutrient and organic matter loadings. Thus related improvements in water quality are also not expected for decades.

As noted in section 3.5.2.2, *Dissolved Oxygen,* the analysis of oxygen supplementation measures provide a basis for Idaho Power to develop a DO enhancement plan, in consultation with IDEQ, ODEQ, and other federal, state, and tribal agencies responsible for managing fish and wildlife, to refine the proposed reservoir DO supplementation measure and evaluate the need for additional or alternative aeration measures. Implementing the plan would help Idaho Power confirm whether reservoir supplementation is cost effective and evaluate whether alternative measures, including reducing nutrient and organic matter loadings from tributaries and injecting oxygen into forebay waters, would be more cost-effective or provide a greater overall level of benefit to habitat conditions for fish in the project area.

In its January 31, 2007, application for water quality certification, Idaho Power proposes to implement the following measures to increase DO levels in the project area: (1) in-reservoir aeration or upstream phosphorus trading to meet the 1,125 tons/yr DO load allocation in Brownlee reservoir; (2) aerating turbines at Hells Canyon or Brownlee dam to add 1,500 tons per year DO downstream of Hells Canyon dam; and (3) installing a destratification system in the deep pool in the Oxbow bypass to address thermal stratification and anoxic conditions within the deeper waters of the pool.

Of the two potential measures intended to meet Idaho Power's load allocation for Brownlee reservoir, Idaho Power would evaluate phosphorus trading first. This option would be pursued only if an appropriate trading partner can be found. The phosphorus trading program could provide substantial benefits to aquatic resources in upstream habitat and within the project area, especially in the project reservoirs. These benefits would increase over time, as the amount of nutrients retained in sediments and aquatic vegetation is reduced. Reservoir aeration, in comparison, would provide a more localized and temporary benefit. Phosphorus trading measures implemented in project tributaries could act in concert with other tributary habitat enhancements proposed by Idaho Power and recommended by other stakeholders (addressed in section 3.6.2.10, *Tributary Habitat Enhancements*) to substantially improve habitat conditions for native resident salmonids and improve the prospects for the eventual restoration of salmon and steelhead to these tributaries. Phosphorus trading could also expedite progress toward attaining water quality conditions in the Marsing reach, which would (1) support restoration of fall Chinook salmon, (2) improve habitat conditions for white sturgeon in the Swan Falls to Brownlee reach, and (3) improve habitat conditions for white sturgeon and native resident salmonids in all three of the project reservoirs.

Turbine aeration at Hells Canyon dam would benefit aquatic resources by addressing the DO deficit that extends approximately 10 to 20 miles downstream of Hells Canyon dam on a seasonal basis. Aerating turbine discharge at Brownlee dam would have the additional benefit of increasing DO levels in Oxbow and Hells Canyon reservoirs, as well as in the Oxbow bypassed reach. Idaho Power proposes to implement the measure at Brownlee dam if it is found that this measure would provide reasonable assurance that targets below Hells Canyon dam would be met.

Installation of a destratification system in the deep pool in the Oxbow bypassed reach would reduce anoxic conditions that currently occur in the pool. This has the potential to benefit aquatic resources that use the bypassed reach, including bull trout and redband trout. The system would provide compressed air to bubble diffusers that would be anchored on the bottom of the pool.

3.6.2.3 Total Dissolved Gas

TDG levels above 110 percent of saturation can be injurious to fish by causing gas bubble trauma (GBT). When TDG levels in water are high, gas-permeable membranes of fish, most often gills, eyes, skin and yolk sacs, absorb the excess gas and develop bubbles that interfere with blood flow, causing hemorrhages and blood clots. Smaller fish are more permeable than larger fish because their membranes are thinner; therefore, they are more susceptible to GBT, while larger fish can tolerate somewhat higher levels before they begin to be affected. Fish affected by GBT often swim upside down or vertically, sometimes looking as if they are gasping for air at the surface.

TDG levels decrease approximately 10 percent for every meter of depth, so as fish go deeper in the water column, the effects of GBT are reduced. Similarly, as fish swim closer to the surface, TDG levels are higher and the potential for GBT is greater. Therefore, bottom-dwelling fish and fish that swim lower in the water column are less susceptible to GBT.

As we noted in section 3.5.1.4, *Total Dissolved Gas*, TDG levels as high as 136.3 percent of saturation have been measured 1.5 miles downstream of Hells Canyon dam. TDG levels exceeding 110 percent persist up to 47 miles downstream when spills at Hells Canyon dam are between 9,000 and 13,400 cfs, and levels exceeding 110 percent may persist for up to 67 miles downstream of Hells Canyon dam when spills at the dam exceed 19,000 cfs (Myers and Parkinson, 2003). Maximum TDG levels in Brownlee reservoir measured just upstream of the dam were just below the 110 percent criterion. Spill events greater than 3,000 cfs at Brownlee resulted in TDG levels above 110 percent saturation, with a maximum TDG level measured at 143 percent during spills greater than 55,000 cfs. High TDG levels persist through the Oxbow reservoir to Oxbow dam. Comparisons of TDG levels upstream and downstream of Oxbow dam showed that TDG levels both increased and decreased after passing Oxbow dam. Spill rates less than 2,000 cfs and greater than 24,000 cfs appear to reduce TDG, while spills between 5,000 and 24,000 appear to increase TDG downstream of Oxbow dam (section 3.5.1.4). Spills at Oxbow dam can elevate TDG up to at least 128 percent of saturation even when Oxbow forebay TDG levels are less than 110 percent.

Proposals and recommendations relevant to TDG abatement are discussed in section 3.5.2.3, *Total Dissolved Gas*. Idaho Power proposes to continue preferential use of crest (upper spillway) gates for passing spills at Brownlee dam. They also propose to install flow deflectors on the Hells Canyon and Brownlee dam spillways that would alter the flow characteristics from the spillway to reduce air entrainment deep in the tailrace during spill episodes of up to the 10-year, 7-day average flood flows. In addition, Idaho Power proposes a yet unknown TDG abatement structure to meet the TMDL TDG load allocation for Oxbow dam. NMFS, Interior, AR/IRU, and the Umatilla Tribes also recommend that Idaho Power design and construct gas abatement structures at Hells Canyon and Brownlee dam spillways to reduce TDG levels in Oxbow and Hells Canyon reservoirs and the free-flowing Snake River downstream of Hells Canyon dam.

AR/IRU (AR/IRU-18a) recommend that Idaho Power conduct real-time TDG monitoring either during periods of high spill or consistent with Idaho Power’s water quality certification once is it issued (whichever is more rigorous). They recommend the monitoring program be designed to detect TDG violations and quantify the affected reaches downstream of Hells Canyon Project dams. They further recommend that a Technical Advisory Committee develop a compensation program to quantify and address losses of aquatic biota in years when attaining the TDG standards is not feasible.

Our Analysis

In its comments on the draft EIS, Interior notes that historical information confirms that spill at the project has caused GBT in fish and fish kills. However, Idaho Power observed few effects to fish related to high levels of TDG, with occasional symptoms of GBT disease identified in adult anadromous salmonids returning to Hells Canyon dam during recent spill periods. Idaho Power also reports that FWS sampling of juvenile salmonids 20 miles below Hells Canyon dam showed no signs of GBT (Idaho Power, 2003a). However, no party has conducted any sampling to evaluate the incidence of GBT closer to Hells Canyon dam. Sampling conducted by Idaho Power at locations upstream of Hells Canyon dam, however, found that a wide range of fish species showed evidence of GBT during the sampling period (table 55). Fish sampled when TDG levels were less than 120 percent did not show evidence of GBT, but severe GBT was observed in some fish when TDG levels exceeded 125 percent (Richter et al., 2006). The incidence of severe GBT was the highest in the Brownlee tailrace, but fish with severe GBT were also observed in the Oxbow bypassed reach, Oxbow forebay, and in Hells Canyon reservoir near the Oxbow tailrace when high TDG levels occurred (figures 101 through 104).

Idaho Power's proposal, and the recommendations of others, to address TDG abatement cover a variety of approaches including: (1) operational changes at Brownlee dam; (2) designing and constructing TDG abatement structures at Hells Canyon, Brownlee, and/or Oxbow dams; (3) monitoring; (4) adaptive management; and (5) developing a compensation program for high TDG levels. The effects of these proposals on TDG levels are discussed in more detail in section 3.5.2.3, *Total Dissolved Gas*.

The current design of Hells Canyon spillway deflectors proposed by Idaho Power are not expected to be effective at spills of greater than 30,000 cfs. However, Idaho Power proposes to quantitatively optimize the final design so that it would be effective up to the 10-year 7-day average flood flow. This should reduce the frequency and severity of most supersaturation events, thus reducing the potential for fish to be exposed to high TDG levels downstream of Hells Canyon dam. Reductions in TDG that result in meeting the TMDL load allocations and water quality standards would be beneficial to aquatic resources by decreasing the chances of exposure to TDG levels above 110 percent saturation and therefore the likelihood of fish developing GBT disease.

AR/IRU's recommendation to conduct real-time monitoring would help quantify TDG levels and affected reaches downstream of project dams. Knowing when and where TDG levels are exceeding the 110 percent saturation level, coupled with knowledge of fish presence in those reaches during those times, would facilitate assessments of the potential mortality from GBT disease. AR/IRU's recommendation to develop some type of compensation program for identified losses from effects of TDG would potentially mitigate for these unavoidable losses. However, without more information on the nature of the compensation being recommended, we cannot assess its effect on aquatic resources in project waters.

In its January 31, 2007, application for water quality certification, Idaho Power (2007a) proposes to implement several measures in addition to the measures proposed in its license application (preferential spilling through the upper spill gates at Brownlee dam and installing spillway flow deflectors at Hells Canyon dam). These are: (1) evaluation of TDG reduction measures at Oxbow dam as an early implementation measure; (2) installation of Brownlee dam spillway flow deflectors; and (3) installation of the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam. Implementing these additional measures should help reduce the incidence of gas supersaturation within and downstream of the project, and reduce the risk of gas bubble trauma on aquatic resources within Oxbow and Hells Canyon reservoirs and downstream of Hells Canyon dam.

Table 55. The ercentage of each species collected during the 2006 sampling season (January–June) by the rank of GBT. Ranks 1 through 4 represent percentages of skin area covered with bubbles of 0. 1 to 5, 6 to 25, 26 to 50, and >50. (Source: Richter et al., 2006)

	Percentage by Rank					**Total Number Collected**
Species	**0**	**1**	**2**	**3**	**4**	
Black crappie	90.9	9.1	0	0	0	11
Bluegill	91.8	5.2	1	0	2	97
Brown bullhead	0	100	0	0	0	1
Channel catfish	95.4	1.2	0	1.2	2.3	87
Chiselmouth	89.4	4.3	0	6.4	0	47
Common carp	91.6	3.5	2.1	2.1	0.7	143
Fall Chinook	100	0	0	0	0	1
Kokanee	100	0	0	0	0	2
Largemouth bass	0	0	0	100	0	1
Mottled sculpin	100	0	0	0	0	2
Pumpkinseed	100	0	0	0	0	3
Rainbow trout	83.3	4.5	3.4	3.7	5.0	378
Northern pikeminnow	93.9	2.7	2.7	0.7	0	295
Bridgelip sucker	97.5	1	1	0.5	0	198
Largescale sucker	96.8	2.1	0	0.5	0.5	377
Steelhead	100	0	0	0	0	13
Smallmouth bass	85.7	6.4	3.2	2	2.7	1,022
White crappie	78	5.5	7.7	4.4	4.4	91
Mountain whitefish	91.7	0.9	1.8	0.8	4.6	109
Yellow perch	91.8	5.2	0.8	0.8	1.5	134
Total Percentage for Each Rank	**89.5**	**4.3**	**2.3**	**1.8**	**2.2**	**3,012**

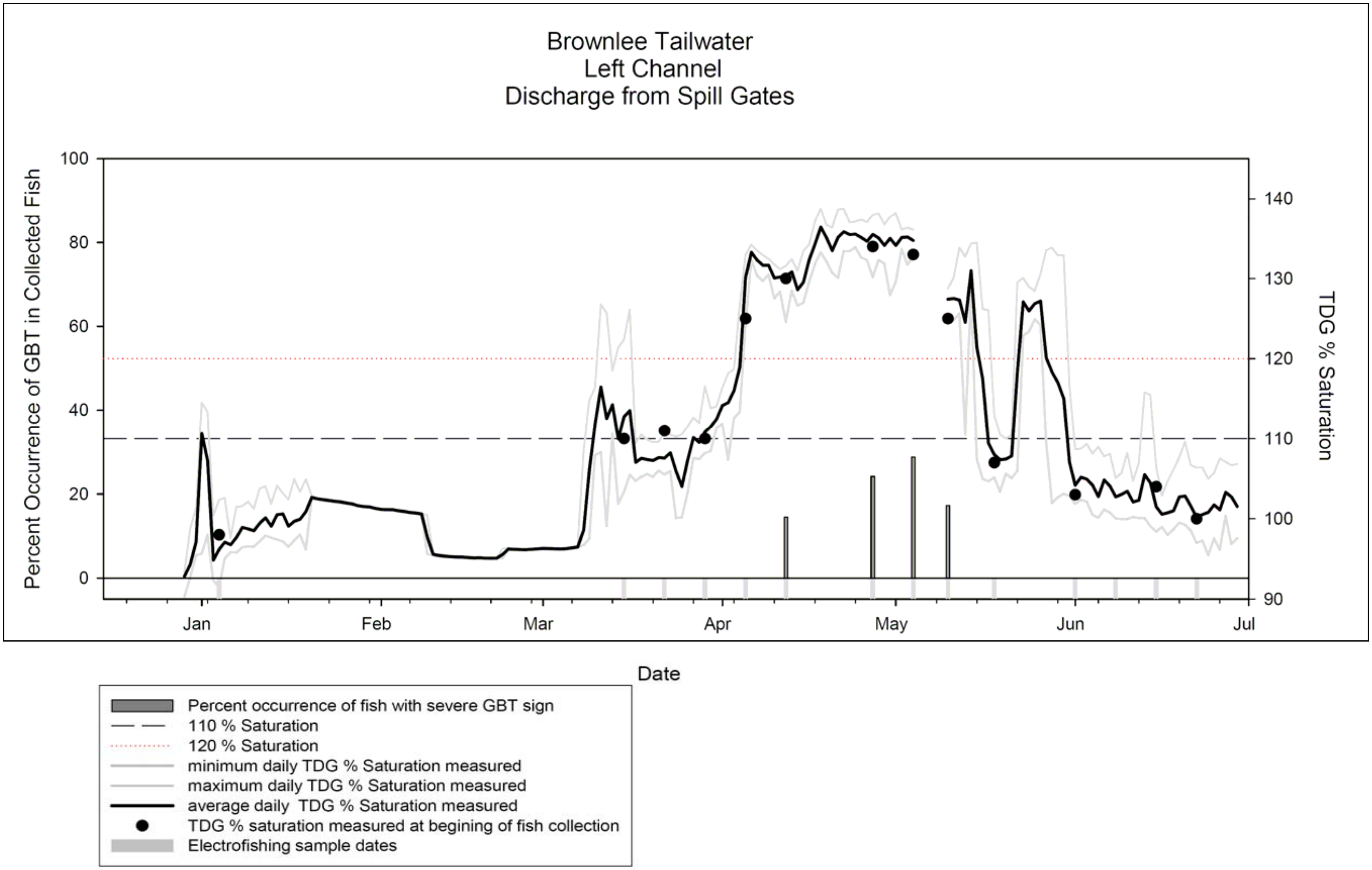

Figure 101. Percent occurrence of fish with severe gas bubble trauma (GBT) and percent saturation of TDG taken during weekly sampling in the Brownlee tailwater in the spring of 2006. (Source: Richter et al., 2006)

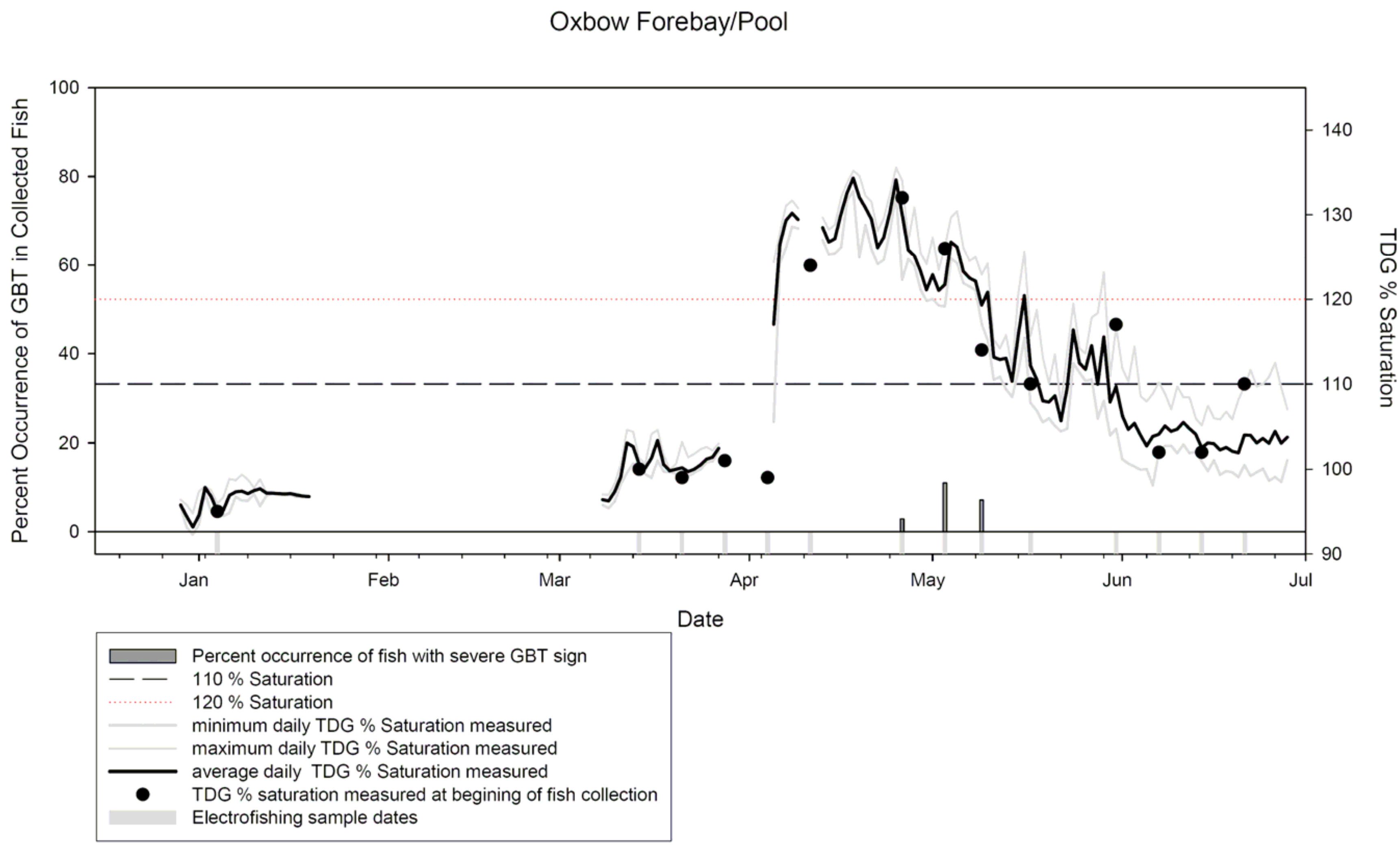

Figure 102. Percent occurrence of fish with severe gas bubble trauma (GBT) and percent saturation of TDG taken during weekly sampling in the Oxbow forebay/pool in the spring of 2006. (Source: Richter et al., 2006)

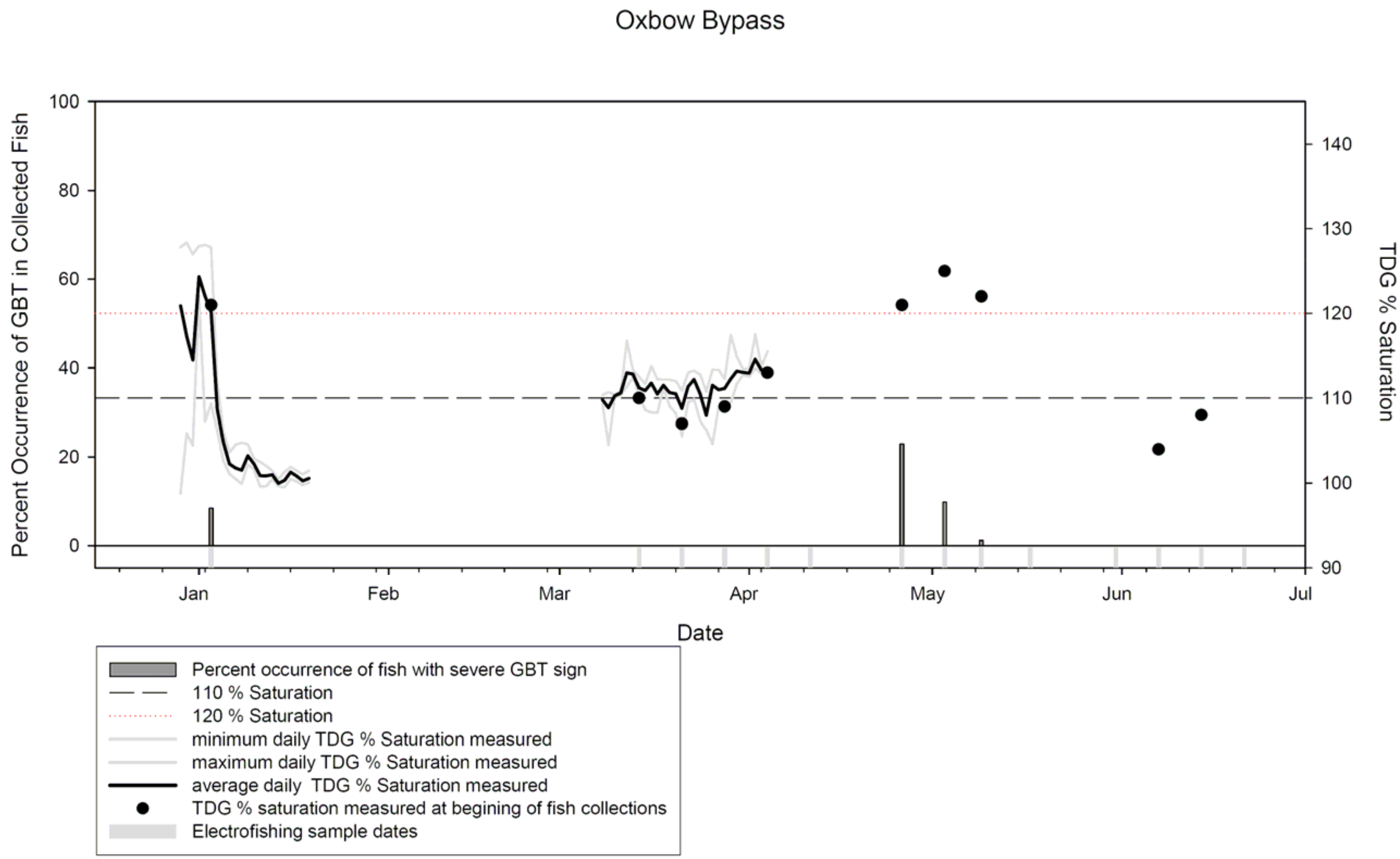

Figure 103. Percent occurrence of fish with severe gas bubble trauma (GBT) and percent saturation of TDG taken during weekly sampling in the Oxbow bypassed reach in the spring of 2006. (Source: Richter et al., 2006)

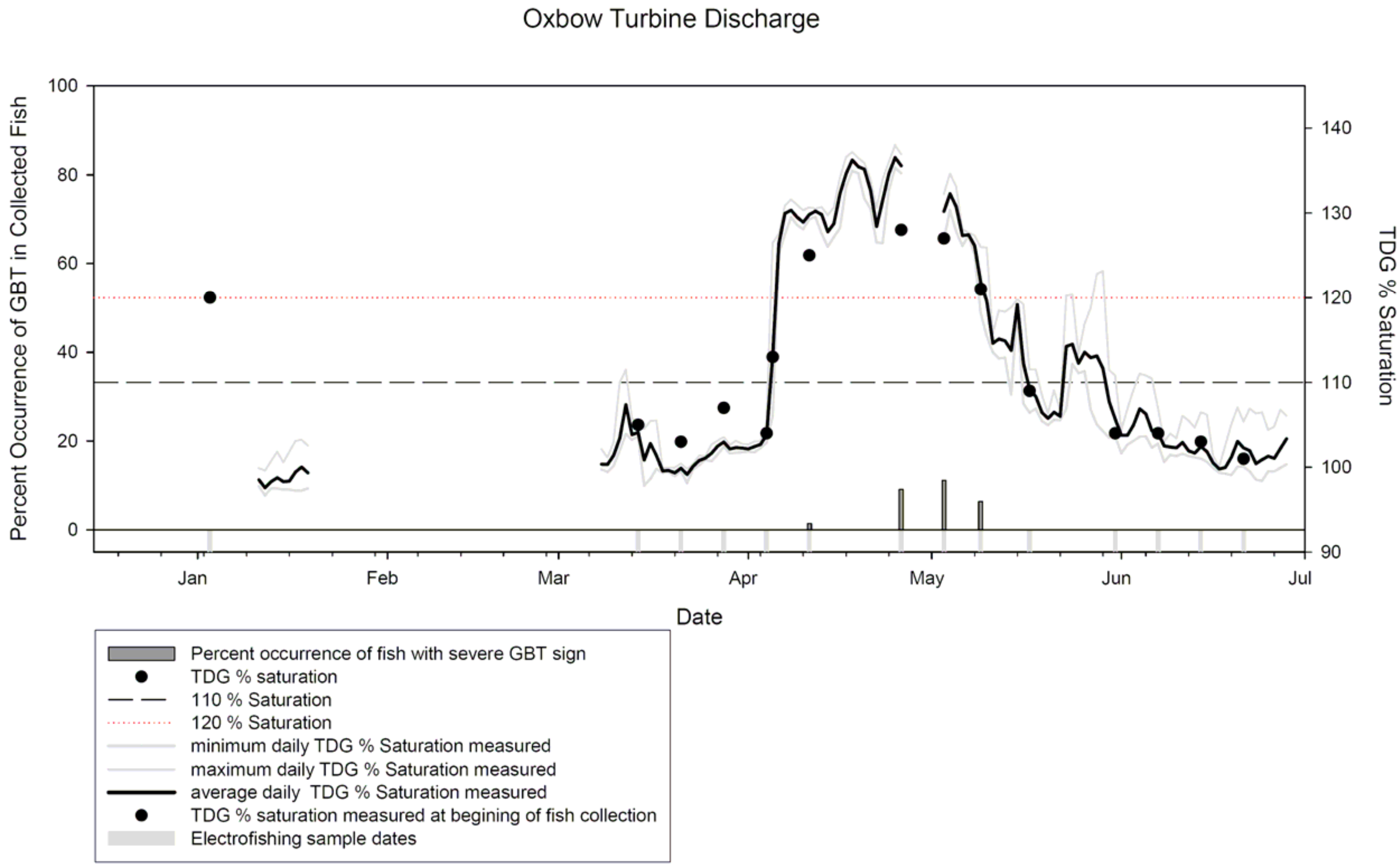

Figure 104. Percent occurrence of fish with severe gas bubble trauma (GBT) and percent saturation of TDG taken during weekly sampling in Hells Canyon reservoir near the Oxbow powerhouse discharge in the spring of 2006. (Source: Richter et al., 2006).

3.6.2.4 Water Temperature

As described in section 3.5.1.2, *Temperature*, Brownlee reservoir substantially alters Snake River temperatures. Storage of water in the reservoir and the depth of the powerhouse intake delay seasonal warming and cooling of water downstream of Brownlee dam compared to conditions that would occur without the project in place. Compared to inflows, this thermal lag reduces exceedances of criteria for supporting coldwater aquatic life during the summer, but increases the exceedances of temperature criteria for salmonid spawning at the start of the spawning season for fall Chinook salmon (figure 29).

The seasonal shift in the water temperature regime downstream of Hells Canyon dam may affect white sturgeon in some years by delaying the attainment of water temperatures that are considered optimum for sturgeon spawning (10 to 16°C) until slightly after peak flows have occurred, which could adversely affect spawning conditions for this species. However, as we note in section 3.6.2.1, population sampling reported in Lepla et al. (2003) demonstrates that all size groups are well represented in the sturgeon population in the Hells Canyon reach, indicating that successful reproduction and recruitment occurs in most years.

Alteration of the thermal regime caused by the project also shifts the time period that water temperature is optimal for bull trout rearing (6 to 12°C) later by about 2 weeks, but provides more suitable habitat conditions for bull trout during the summer and early winter by moderating the temperature extremes of inflowing water. Water temperatures downstream of Hells Canyon dam are particularly important to fall Chinook salmon, which are the only salmonid species that spawns and rears primarily in the mainstem river downstream of Hells Canyon dam. The seasonal shift in water temperatures caused by the project has the potential to adversely affect fall Chinook salmon by causing water temperatures to be above optimal during the start of the spawning season and by causing fish to emerge into a cooler environment with reduced growth potential. Later in the spring and early summer, fall Chinook salmon may benefit from delayed warming, which delays the onset of stressfully high water temperatures.

In its license application, Idaho Power did not propose any measures to address the effects of the project on water temperatures. However, in its application for water quality certification (Idaho Power, 2007a), Idaho Power proposes to use an adaptive approach to identify the project's responsibility for elevated temperatures downstream of Hells Canyon dam. Based on an evaluation of measures, Idaho Power would then implement identified watershed measures (which may include hydrologic measures or restoration of riparian vegetation or channel morphology) or a bubble upwelling system in Brownlee reservoir to address the project's contribution to the thermal load downstream of Hells Canyon dam.

Proposals and recommendations relevant to the installation of a temperature control device are discussed in section 3.5.2.4, *Water Temperature*. Some of the stakeholders expressed interest in continued investigation of a temperature control structure at Brownlee dam. The most extensive analysis of Idaho Power's temperature control structure modeling is presented by the Umatilla Tribes. In their recommended terms and conditions, the Umatilla Tribes (CTUIR-22) request additional studies to further investigate the potential benefits of constructing a temperature control structure at Brownlee dam, and present an analysis, prepared by CRITFC, that raises several questions about the approach and results of Idaho Power's modeling. In its April 10, 2006, reply comments, Idaho Power addressed many of the questions raised by CRITFC. CRITFC provided responses to Idaho Power's reply comments; these responses were filed with the Commission as appendix 1 to the Umatilla Tribe's November 3, 2006 comments on the draft EIS. At a meeting held with FERC staff on March 6, 2007, the Nez Perce Tribe also discussed the CRITFC analysis. Finally, Idaho Power filed a white paper on July 30, 2007, which provided a detailed literature review on the potential thermal effects of the project on fall Chinook salmon. We discuss pertinent aspects of these filings below.

Our Analysis

Water temperatures in the Snake River downstream from Hells Canyon dam may affect the survival, development, and timing of spawning and outmigration of anadromous salmonids. For example, multivariate models indicate that water temperature exerts a greater effect than any other factor on the survival of yearling Chinook salmon as they migrate through the Snake River (Williams et al., 2004). In addition to altering developmental timing and outmigration, water temperature alterations may affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification (EPA, 2001b). Water temperatures downstream of Hells Canyon dam are particularly critical for fall Chinook salmon, which are the only salmonid species that spawns and rears primarily in the Hells Canyon reach, downstream from Hells Canyon dam.

In the draft EIS, we focused our analysis on the potential benefits of using a temperature control structure to enhance thermal conditions for fall Chinook salmon downstream of Hells Canyon dam. These benefits could include: (1) reducing stress, prespawning mortality, and adverse effects on gamete viability by reducing water temperatures just prior to and during the fall Chinook salmon spawning season; or (2) promoting faster growth and earlier outmigration of rearing fall Chinook salmon juveniles by providing warmer water temperatures during the spring to accelerate the emergence and growth rate of fry. In this final EIS, we expand our analysis to include our consideration of the alternative measures proposed by Idaho Power in its application for water quality certification, which include implementing watershed measures or a bubble upwelling system in Brownlee reservoir to reduce water temperatures downstream of Hells Canyon dam during the fall Chinook spawning season.

In the following subsection, we evaluate the potential benefits of the measures proposed by Idaho Power and recommended by other stakeholders for key lifestages of fall Chinook salmon, as well as any incidental effects on other aquatic species.

Fall Chinook Spawning and Incubation

Idaho Power acknowledges in its license application that elevated fall temperatures could contribute to stress on adult fall Chinook salmon and reduced gamete viability. However, based on its review of the literature and of the temperatures that occur during the spawning season, it concludes that the temperature lag caused by the project is unlikely to have a substantive effect on spawning or incubating fall Chinook salmon. Idaho Power reported that less than 2 percent of fall Chinook salmon spawn before temperatures have diminished to levels below 16.0°C (Groves, 2001), and states that the results of most laboratory studies suggest that spawning at water temperatures of up to 16.5ºC does not have deleterious effects on the incubation survival of fall Chinook salmon.

On July 30, 2007, Idaho Power filed a white paper with the Commission outlining the thermal effects of the project on fall Chinook salmon (Idaho Power, 2007c). The white paper includes a detailed review of studies on the effect of water temperatures on the incubation survival of fall Chinook salmon eggs, as well as effects on other lifestages. Idaho Power concluded that the applicability of most studies to survival rates in the Hells Canyon reach was limited because they were conducted under uniform water temperatures, which is very different from the declining temperature regime that occurs during the spawning and incubation period of fall Chinook salmon. Idaho Power identified three studies, however, that were conducted under a declining temperature regime. Combining the data from these studies, Idaho Power noted that the survival trends shown in all three studies were very consistent (figure 105), and concluded that the thermal shift created by the project has had little effect on the success of incubation survival for those redds spawned at initial temperatures between 16 ºC and 16.5 ºC.

Our review of the available literature, including Idaho Power's white paper, leads us to conclude that adverse effects may occur at initial spawning temperatures less than 16.5 ºC. First, in figure 105, two out of three data points where the highest exposure temperature was 16.5 ºC showed elevated rates of mortality, between approximately 28 and 37 percent. Second, the results of the study by Olson et al.

(1970) suggest that adult fall Chinook salmon that acclimated to higher water temperatures were less able to tolerate high incubation temperatures. Olson et al. (1970) used four groups of salmon eggs spawned at temperatures between 8.9 and 12.6 ºC. For fish spawned at the highest temperature of 12.6 ºC, the incubation mortality increased progressively at higher initial incubation temperatures, even under a declining temperature regime. For example, the mortality rate of fish spawned at 12.6 ºC increased from 3.6 percent at an initial incubation temperature of 13.7ºC to 28.1 percent at an initial incubation temperature of 15.9ºC. Of the other two studies that Idaho Power used to generate figure 105, Geist et al. (2006) used an adult acclimation temperature of 12ºC, and Olson and Foster (1955) did not report the adult acclimation temperature. Based on these results, we conclude that elevated water temperatures, which sometimes exceed 16ºC at the initiation of fall Chinook salmon spawning in the Hells Canyon reach, are likely to adversely affect the incubation survival of fall Chinook salmon that spawn at the beginning of the spawning season.

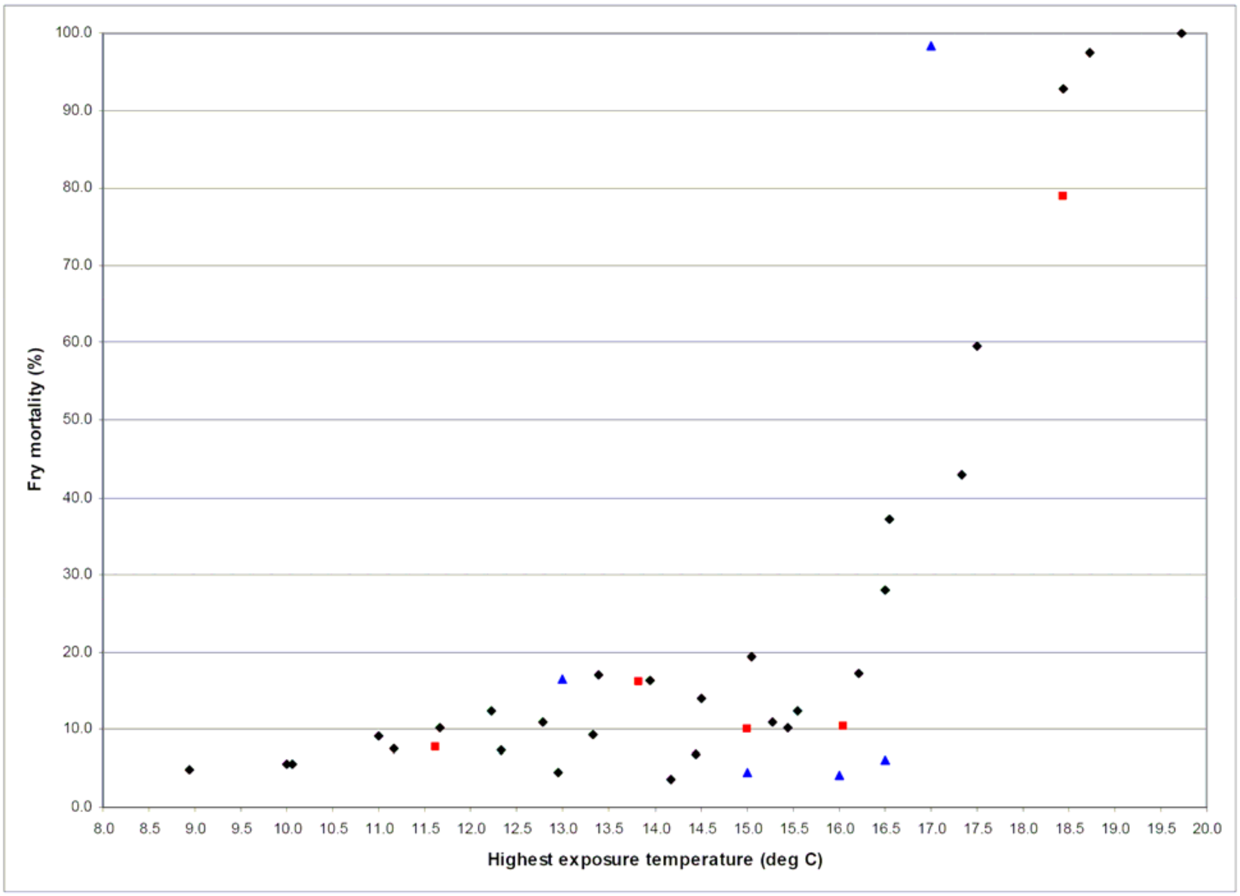

Figure 105. Final fall Chinook salmon fry mortality relative to the highest water temperature (ºC) that embryos were exposed to during natural/variable temperature experiments (data from Olson and Foster [1955] shown in square symbols, Olson et al. [1970] shown in diamonds, and Geist et al. [2006] shown in triangles). (Source: Idaho Power 2007c)

Our analysis in section 3.5, *Water Quality*, subsection 3.5.2.4, *Water Temperature*, indicates that each of the alternative Brownlee temperature control structures that Idaho Power evaluated has the potential to reduce water temperatures during the fall Chinook spawning season. Based upon our preceding analysis, we conclude that this would benefit fall Chinook salmon by increasing the incubation survival of fish that spawn in the early part of the spawning season, when water temperatures are relatively high. However, our analysis in section 3.5.2.4 also identifies several potential adverse effects of installing and operating a temperature control structure to reduce water temperatures in the fall. These include the likelihood of increasing water temperatures in the summer months and the potential for increasing the release of hypolimnetic water that may have low DO and elevated concentrations of ammonia, mercury, or organochlorine compounds. Idaho Power's analysis of the effects of operating a temperature control structure to reduce fall water temperatures indicates that resulting elevated summer water temperatures may extend downstream to Lower Granite reservoir (Idaho Power, 2005j), where it could cause a slight reduction in outmigration survival.

Our analysis in section 3.5, *Water Quality*, subsection 3.5.2.4, *Water Temperature*, also indicates that installing a bubble upwelling system in Brownlee reservoir could reduce water temperatures downstream of the project during the fall Chinook salmon spawning period. However, our analysis indicates that this technique may not be sufficient, by itself, to meet the project's full temperature responsibility. We also identified several potential adverse effects of the bubble upwelling system. These include the potential for increased mixing of water within the reservoir, thereby increasing the exposure of reservoir fish to hypolimnetic water that may have low DO and/or high concentrations of ammonia, mercury, or organochlorine compounds; and the release of these waters into the river downstream of the project. Low DO and increased ammonia concentrations could have adverse effects on the health and survival of aquatic species. In addition, increased exposure of aquatic organisms to mercury and organochlorine compounds could have adverse effects on fish-eating wildlife, anglers that consume warmwater fish species caught in the project reservoirs, and tribal members that consume sturgeon harvested in subsistence fisheries.

Finally, our analysis in section 3.5.2.4 indicates that watershed measures, such as temperature trading, offer an alternative approach for meeting the project's temperature responsibility. This approach involves implementing measures in the watershed upstream of the project that would act to cool inflows to, and outflows from, the project. Potential methods for reducing fall temperatures in upstream reaches include increasing shade by restoring or enhancing riparian vegetation, altering channel morphology to reduce warming, and altering the hydrologic regime by reducing the volume of warm agricultural return flows or by augmenting existing flows. These measures would tend to reduce water temperatures in and downstream from the tributaries where they are implemented for a more prolonged period, potentially extending throughout the warm summer and fall seasons. In addition to reducing water temperatures, some watershed measures have the potential to enhance water quality and aquatic habitat by (1) reducing sediment and nutrient loads, and (2) improving the quantity and quality of instream and riparian habitat. We conclude that implementing watershed measures has the potential to benefit fall Chinook salmon by reducing water temperatures downstream of Hells Canyon dam during the fall Chinook salmon spawning season without the potential adverse effects that we identify for temperature control and bubble upwelling systems. We also conclude that implementing watershed measures would provide a broad array of habitat and water quality benefits that could enhance other aquatic resources including native resident salmonids, white sturgeon, and warmwater fisheries.

Fall Chinook Rearing and Outmigration

As we conclude in section 3.5.2.4, the installation of a temperature control structure has some potential to enhance the growth rates of rearing fall Chinook salmon by increasing water temperatures in the spring, counteracting the temperature lag that is caused by the project. Increased growth rates could contribute to earlier outmigration or outmigration at a larger size, both of which could improve outmigration survival. However, our analysis shows that the ability to increase water temperatures using a temperature control structure is primarily limited to years with below average flows, and that increases prior to March 14 would be minimal in all years. In addition, increasing water temperatures during the spring could adversely affect the survival of yearling spring Chinook salmon and steelhead produced in tributaries downstream of Hells Canyon dam. Also, Idaho Power, in commenting on the draft EIS, notes that the analysis presented by NMFS in its 2005 biological opinion on operation and maintenance of the BOR's upper Snake River basin projects suggests that cooler springtime (April 3–June 20) temperature conditions in the Snake River are beneficial to spring migrating yearling salmonids.

Implementing watershed measures is unlikely to expedite warming in the spring. Rather, such measures would likely reduce warming in the spring, which could benefit yearling smolts migrating from downstream tributaries. In addition, implementing watershed measures would likely reduce water temperatures later in the late spring and summer, when water temperatures are above optimal for rearing salmonids, which would improve rearing and migration conditions for outmigrating juvenile fall Chinook salmon.

3.6.2.5 Oxbow Bypassed Reach Flows

Diversion of flow through the Oxbow powerhouse reduces flow in the 2.5-mile-long bypassed reach immediately downstream of the dam, affecting the quantity and quality of habitat available to bull trout. Idaho Power currently releases a minimum flow of 100 cfs through the bypassed reach. Idaho Power proposes to continue releasing minimum flows of 100 cfs from the Oxbow dam spillway to maintain existing conditions in the bypassed reach.

Interior (Interior-43) recommends that, within 1 year of issuance of a new license, Idaho Power develop and implement a plan to provide sufficient flow in the Oxbow bypassed reach to meet water quality standards and life history requirements for bull trout. The plan would identify the duration, timing, and quantity of flow necessary to provide for the movement, foraging, and rearing of adult and sub-adult bull trout in the Oxbow bypassed reach, including unrestricted access to Pine and Indian creeks. Interior (Interior-63) also recommends that Idaho Power provide adequate flows and oxygen supplementation to maintain water quality parameters in the Oxbow bypassed reach. AR/IRU (AR/IRU-11c) recommend that Idaho Power provide sufficient flows in the Oxbow bypass to allow physical access to the proposed Oxbow fish trap as well as to maintain adequate water quality for bull trout.

In its April 10, 2006, reply comments, Idaho Power states that Interior's recommendation to meet water quality standards, specifically to provide year-round water temperatures of 16°C or less in the Oxbow bypassed reach, is unrealistic and unnecessary based on the fluvial life history of bull trout and redband trout. Idaho Power also states that Interior's concern regarding limited attraction flow to the base of Oxbow dam, the site of a prospective upstream migrant trap, is without merit because bull trout and other species have been documented downstream of the Oxbow dam. In its April 26, 2007, filing with the Commission and its January 31, 2007, application for water quality certification, Idaho Power (2007a) proposes to install and operate a destratification system for the deep pool in the Oxbow bypassed reach just upstream of the Indian Creek confluence.

Our Analysis

The Oxbow bypassed reach currently provides overwintering habitat for bull trout and redband trout. However, high temperatures and low DO concentrations render this area unsuitable for native resident salmonids during warmer months when they typically seek refuge in Pine and Indian creeks. As discussed in section 3.5.2.5, *Oxbow Bypassed Reach Flows*, the poor water quality conditions in this reach are largely a result of the quality of the water released from Oxbow reservoir and, at higher reservoir elevations, inundation from the upper end of Hells Canyon reservoir. Idaho Power's proposal to continue releasing minimum flows of 100 cfs would have little effect on the existing water quality issues in the bypassed reach.

Increasing DO and reducing water temperatures in the bypassed reach to levels suitable for redband trout and bull trout would provide additional habitat that could be used during warmer months. However, increasing bypass flows are not likely to have a substantial beneficial effect because current conditions in the bypassed reach are primarily influenced by the condition of water released from Oxbow reservoir. While increasing spill flows may provide some increase in DO within the bypassed reach, Myers and Chandler (2003) found that water temperatures in the bypassed reach rise to levels that are unsuitable for native resident salmonids before DO conditions become adverse. This finding is supported by Idaho Power's telemetry studies, which indicated that all bull trout moved out of the bypassed reach by the middle of May and did not return until October (Chandler et al., 2003a).

As part of the study, Idaho Power examined the effect that different flows would have on habitat conditions for resident salmonids (Myers and Chandler, 2003). Study results indicate that increasing flow would provide little improvement in water quality conditions in the bypassed reach (see section 3.5.2.5, *Oxbow Bypassed Reach Flows*). Likewise, increasing bypass flow did not substantially increase the amount of habitat suitable for native resident salmonids. Although increasing flow would increase the wetted width of the bypassed reach, the study found that corresponding increases in velocity reduced the suitability of available habitat. Thus, increasing flows in the Oxbow bypassed reach are not likely to improve habitat conditions for native resident salmonids. In addition, the proposed minimum flow release of 100 cfs appears sufficient to provide overwintering habitat for these species.

To address Interior's concern regarding access to, and passage through, the bypassed reach for migrating bull trout under existing minimum flow conditions, Idaho Power cites observations of bull trout and steelhead in the bypassed reach near the base of the dam as evidence that this concern is unwarranted. Although this proves that fish can access this area, it is based on few observations and anecdotal evidence. The presence of fish in the bypassed reach does not disprove that other fish could have difficulty accessing this area. Following construction of the Oxbow trap, radio-tracking studies would be necessary to demonstrate accessibility conclusively and to ensure that a high percentage of fish are able to locate and enter the trap.

Interior also expressed concern regarding the accessibility of Pine and Indian creeks to bull trout seeking refuge from the bypassed reach. Chandler et al. (2003a) evaluated tributary access for resident salmonids and did not identify any obstruction at the mouths of Pine and Indian creeks. However, the possible remediation of obstructions caused by alluvial deposits are included in the discussion of potential tributary habitat enhancement measures (see section 3.6.2.10, *Tributary Habitat Improvements*). In developing plans for tributary habitat enhancement measures, re-evaluation of the accessibility at the mouths of Pine and Indian creeks at low bypassed reach flows and low Hells Canyon reservoir water levels would ensure that resident salmonids are allowed access to these tributaries.

In its January 31, 2007, application for water quality certification, Idaho Power proposes to install a destratification system in the deep pool in the Oxbow bypassed reach. This has the potential to benefit aquatic resources that use the bypassed reach, including bull trout and redband trout, by reducing anoxic conditions that currently occur in the pool. The system would provide compressed air to bubble diffusers that would be anchored on the bottom of the pool.

3.6.2.6 Anadromous Fish Restoration

The Hells Canyon Project has blocked anadromous fish from accessing spawning and rearing habitats upstream of Hells Canyon dam since initial attempts to provide passage were discontinued several years after Brownlee dam was constructed. Idaho Power proposes to develop actions and measures that are targeted toward the restoration of passage and habitat for bull trout, but does not propose to restore passage for anadromous fish to habitat within and upstream of the project. State and federal agencies, tribes, and NGOs propose a range of specific approaches for restoring anadromous fish to areas upstream of Hells Canyon dam. The Burns Paiute and Shoshone-Paiute Tribes also provide general recommendations for habitat improvement and for the restoration of anadromous fish to historical habitat, but they do not recommend any specific approach or priority for restoration activities. None of these entities provided any type of comprehensive resource plan for restoring anadromous fish to the upper Snake River basin.

Fish passage-related measures, including a preliminary section 18 fishway prescription filed by Interior, are summarized in table 56. We summarize recommendations directed at improving water quality and habitat conditions to foster restoration of anadromous fish in table 57.

Our Analysis

A successful anadromous fish restoration effort above Hells Canyon dam would restore self-supporting runs in historically available habitat as well as increase the size, and maintain the genetic diversity, of Snake River populations. Idaho Power proposes several measures to benefit native resident salmonids in the project area (see section 3.6.2.8, *Resident Salmonid Passage,* and section 3.6.2.10, *Tributary Habitat Improvements*). While these measures could also provide some benefit for anadromous fish, they are not targeted toward restoring anadromous fish populations.

During the pre-filing period, Idaho Power conducted extensive studies to evaluate the potential for anadromous fish restoration, and concluded that restoring self-supporting runs was possible only in certain tributaries and under the most optimistic assumptions (Chandler and Chapman, 2003b). In most tributaries, habitat and water quality conditions have been degraded by land use practices and development of the basins to support irrigated agriculture, and to provide municipal water supply. Water quality in the mainstem of the Snake River upstream of the project is degraded, and the existence of eight mainstem dams in the downstream migratory corridor cause mortality during the upstream and downstream migration of all anadromous species. NMFS chose not to issue a section 18 fishway prescription at this time, stating that poor water quality severely limits the potential for fall Chinook salmon to incubate through emergence, and the degraded habitat in most tributaries would similarly limit the possibilities for successful reintroduction of spring Chinook salmon and steelhead into most areas upstream of the project. Nonetheless, state and federal resource agencies, tribes, and NGOs recommend numerous measures for upstream and downstream passage, mainstem studies, and habitat and water quality improvements as part of an overall restoration effort.

While the Idaho Power analysis is informative, there is enough uncertainty in the evaluation of restoration options that a phased restoration plan warrants consideration. These uncertainties include assumed survival rates for all lifestages, including incubation, freshwater rearing, migration, and ocean rearing. Accordingly, after assessing the various agency, tribe, and NGO recommendations in the following paragraphs, we present and evaluate a phased restoration approach that addresses the uncertainties surrounding restoration, while incorporating many of the agency, tribe, and NGO recommendations.

Providing upstream passage for anadromous fish would allow access to historically available spawning and rearing habitat within and upstream of the project. Upstream passage facilities would also allow gene flow between isolated native resident salmonid populations and enhance fluvial life histories within the project area (see section 3.6.2.8, *Resident Salmonid Passage*). In addition, the return of anadromous species to nutrient-poor tributaries containing native resident salmonids would provide supplemental marine-derived nutrients and increased forage (see section 3.6.2.11, *Marine-derived Nutrients*). Pursuant to ESA take restrictions, however, the reintroduction of ESA-listed stocks above Hells Canyon dam could impose economic consequences on upstream land and water users. The use of suitable, unlisted steelhead and spring Chinook salmon stocks currently maintained in Idaho Power's hatchery system would avoid such consequences.

Table 56. Anadromous fish restoration recommendations.[a] (Source: Staff)

Component	NMFS (NMFS-14c, 16, 17)	Interior[b] (Interior-46a, 46b, 46c, 47a, 47b, 49, 60)	IDFG (IDFG-9)	ODFW (ODFW-1 to -17, 22, 24, 40)	Umatilla Tribes (CTUIR-11a, 11b, 11c, 12a to 12f)	Nez Perce Tribe (NPT-8b, 8c)	AR/IRU (AR/IRU-1 to 7)
Upstream Passage Facilities							
Hells Canyon trap modifications	Yes	**Yes**	Yes	Yes	Yes	Yes[c]	Yes
Oxbow trap	Yes [c]	**Yes**	Yes[d]	Yes	Yes	Yes[c]	Yes [c]
Brownlee trap	Yes [c]	Yes[d]	No	No	Yes	Yes[c]	Yes [c]
Downstream Passage Facilities							
Tributary traps	Study feasibility at 3 tributaries	**Weirs at Pine Creek, Indian Creek, Wildhorse River**, and Eagle Creek	No	Weirs at Pine Creek, Powder River (Eagle, Daly, and Goose creeks)	Weirs at Pine Creek, Powder River (Eagle Creek), Weiser and Payette rivers	Weirs at Pine Creek, Eagle Creek, Weiser and Payette rivers	Weirs at Pine Creek, Powder River (Eagle, Daly, and Goose creeks), evaluate restoration in other reaches incl. Weiser and Payette rivers
Hells Canyon fish screen	No	No	No	Yes	Yes, or weir at Pine Creek	No	Yes, if most effective method to provide passage from Pine and Indian creeks
Brownlee smolt trap	No	Develop and refine plans for transporting fall Chinook around project reservoirs	No	No	Not specified	No	Yes
Mainstem Passage Studies							
Hells Canyon passage	No	No	No	Yes	Yes, including drawdown	No	Yes
Oxbow passage	No	No	No	No	Yes, including drawdown	No	Yes

Component	NMFS (NMFS-14c, 16, 17)	Interior[b] (Interior-46a, 46b, 46c, 47a, 47b, 49, 60)	IDFG (IDFG-9)	ODFW (ODFW-1 to -17, 22, 24, 40)	Umatilla Tribes (CTUIR-11a, 11b, 11c, 12a to 12f)	Nez Perce Tribe (NPT-8b, 8c)	AR/IRU (AR/IRU-1 to 7)
Brownlee passage	No	No	No	No	Yes, including drawdown	No	Yes, including drawdown
Swan Falls incubation monitoring	Yes	Yes	Yes	Yes	Not specified	No	Yes
C.J. Strike incubation monitoring	Yes	Yes	Yes[e]	No	Not specified	No	Yes
Bliss reach incubation monitoring	Yes	No	Yes[e]	No	Not specified	No	Yes
Swan Falls migration studies	Yes	No	No	Yes	Not specified	No	Yes
C.J. Strike migration studies	Yes	No	No	No	Not specified	No	Yes
Bliss reach migration studies	Yes	No	No	No	Not specified	No	Yes
Other							
Stock assessments	No	Yes	No	Yes	Not specified	No	Yes
Monitoring effects on resident fish	No	No	No	Yes	Not specified	No	Yes

[a] Table does not include general recommendations made by the Burns Paiute and Shoshone-Paiute Tribes to restore anadromous fish to historical habitats.

[b] Items shown in **bold** are part of FWS section 18 preliminary fishways prescription.

[c] Not explicitly recommended, but is implied by the recommendation to restore anadromous fish to upstream tributaries.

[d] IDFG recommends that if the Oxbow trap is not constructed, the estimated $7 million cost of this measure be allocated to tributary habitat improvements.

[e] IDFG recommends monitoring egg survival in the Marsing reach every 5 years, but does not specify whether Bliss or C.J. Strike reaches should be included.

Table 57. Water quality improvement recommendations related to anadromous fish restoration. (Source: Staff)

NMFS	Interior [b]	IDFG	ODFW	Umatilla, Shoshone-Bannock and Burns Paiute Tribes	Nez Perce Tribe	AR/IRU
NMFS-14. Provide $10 million per year for the first 5 years, $5 million per year during years 6 through 30 to fund TMDL implementation. Measures to be selected, evaluated and prioritized by a review committee, with funds to be redirected to alternative measures if water quality or egg-to-fry survival goals are not met.	Interior-33. Acquire and restore 14.6 miles of tributary habitat (BLM)	IDFG-11, 14, 16. Increase funding from levels proposed by Idaho Power, includes provisions for re-allocating funding if fish passage measures are not implemented; if the Oxbow trap is not constructed re-allocate $7 million to habitat restoration measures.	ODFW-33. Implement alternative habitat improvement measures to compensate for any species or reaches where reintroduction efforts are terminated, up to $5 million per year, if passage is abandoned; implement a separate plan to compensate for continued effects and unavoidable losses; provide $100,000 per year to fund water quality improvement projects in Swan Falls reach.	CTUIR-1, BPT-6, SBT-1a. Provide a mitigation fund directed toward artificial production and habitat enhancements to compensate for unavoidable effects.	NPT-8a. Provide $150 million over 30 years to fund TMDL implementation in lieu of providing passage for fall Chinook to habitat upstream of Brownlee reservoir.	AR-IRU-12g, 27. Establish trust fund for onsite and offsite mitigation directed at habitat enhancement and restoration efforts to address ongoing effects; implement water quality improvement measures to aid in sturgeon recovery

[a] Table does not include general recommendations made by the Burns Paiute and Shoshone-Paiute Tribes to restore anadromous fish to historical habitats.

[b] Section 10a recommendation; not included as part of the FWS preliminary fishway prescription.

Modifications to the Hells Canyon trap as proposed by Idaho Power for improved hatchery system operations (McMillen et al., 2005) would allow the on-site sorting of fish and eliminate the need to transport fish to the hatchery for identification. The Hells Canyon trap could also facilitate the passage of adult spring Chinook salmon and steelhead to project tributaries (e.g., Pine and Indian creeks) and the immediate release of fall Chinook salmon. Providing passage over Hells Canyon dam and subsequently monitoring reproductive success and habitat use in Pine and Indian creeks would be a relatively low cost means of evaluating the assumptions and feasibility of restoring spring Chinook salmon and steelhead.

Construction and operation of an adult fish trap at Oxbow dam could be used to provide access to the Wildhorse River for spring Chinook salmon and steelhead. Likewise, construction and operation of an adult fish trap at Brownlee dam could provide spring Chinook salmon and steelhead access to Powder River tributaries including Eagle, Goose and Big creeks. Once spring Chinook salmon and steelhead runs were reestablished, adult fish traps at each of the three project dams could allow fish to move volitionally to their natal tributary.

Although upstream fish passage facilities would provide access to historical habitat, successful restoration would be dependent upon adequate water quality and habitat in spawning, incubation, and rearing locations, as well as in the migratory corridors that lead to and from these locations (see section 3.6.2.10, *Tributary Habitat Improvements*). In addition, providing passage and reintroduction to previously inaccessible habitat may expose anadromous and resident salmonid populations to certain risks. The risk of pathogen exposure to other anadromous stocks or resident fish (see section 3.6.2.9, *Fish Pathogen Assessment*) and the risk of genetic introgression with other stocks require consideration (Chandler and Abbott, 2003).

Following production through stocking or natural reproduction, steelhead and Chinook salmon smolts would require safe and timely passage downstream through the project to maximize their recruitment potential. Although fish screens or other collection devices at the Hells Canyon, Oxbow and Brownlee dams could potentially accomplish this, these alternatives would require very substantial facilities. An alternative approach is for steelhead and spring Chinook smolts to be collected using traps at the mouths of tributaries and transported downstream of the project, which would require much smaller and less expensive installations. In addition, collecting and transporting smolts directly from tributaries would eliminate their exposure to predation, adverse water quality conditions, and migratory delays associated with reservoir passage. Idaho Power proposes to install a weir at the mouth of Pine Creek for the purpose of collecting and monitoring bull trout. While this installation could also be used for smolt collection, its effectiveness would require operability at high spring flows during which smolt migration occurs. The installation and effective use of tributary traps at Pine Creek, Indian Creek, and the Wildhorse River would collect the majority of smolts entering the project below Brownlee dam and therefore render a fish screen or collection system at Hells Canyon and Oxbow dams unnecessary. Likewise, if steelhead and spring Chinook salmon were reintroduced to Eagle Creek, collecting smolts with a trap at the creek mouth would facilitate their transport below the project and eliminate passage through the project reservoirs.

Idaho Power does not propose mainstem downstream fish collection or bypass facilities at any of the project dams. The only downstream passage routes that are available to migrating fish at Brownlee dam are through turbine or spill passage, which can cause substantial injury and mortality. Because nearly all of the production of fall Chinook smolts above Brownlee dam would occur in the mainstem Snake River, a mainstem collection and transport facility would be required to maximize passage survival through the project. By collecting smolts at a collection point upstream of, or at the head of, Brownlee reservoir and transporting them below the project, mortality and delay caused by passage through Brownlee, Oxbow and Hells Canyon reservoirs would be avoided. This facility could also provide passage for steelhead and spring Chinook salmon if they were eventually restored to upstream tributaries.

State and federal agencies, tribes, and NGOs recommend several specific monitoring and evaluation measures, including passage, incubation, and migration studies. Because the feasibility of restoration is largely uncertain, many of these studies would help in prioritizing and, subsequently, evaluating the success of initial efforts as well as identifying triggers for implementing further actions. Tracking radio-tagged adult Chinook salmon and steelhead would help determine the effectiveness of upstream passage facilities, as well as the percentage of each species that safely reach spawning habitat and successfully spawn. Similarly, marked, PIT-tagged or radio-tagged smolts could be used to help quantify collection efficiencies and survival at traps.

The Umatilla Tribes, Shoshone-Bannock Tribes, and AR/IRU recommend that passage studies include an evaluation of reservoir drawdowns as a means of enhancing downstream passage. Drawdowns would increase reservoir water velocities and the rate of downstream migration as a result. However, in Oxbow and Hells Canyon reservoirs this benefit would be negligible if smolts were collected in traps before entering the reservoirs. Despite drawdowns, the travel distance required to pass project reservoirs would remain long, particularly in Brownlee reservoir, and smolts would still be exposed to predation and adverse water quality conditions associated with reservoir passage. Drawdowns would also cause substantial reductions in electrical generation, and could adversely affect recreation and warmwater fish spawning in project reservoirs.

Successful reintroduction of fall Chinook salmon to the mainstem Snake River between Swan Falls dam and Brownlee reservoir appears to be limited by water quality conditions in the intragravel incubation environment. A study conducted by Idaho Power using simulated redds to assess the condition of historical fall Chinook spawning habitat in this reach found toxic levels of hydrogen sulfide and low levels of DO, suggesting that incubation survival would be variable and low (Chandler et al., 2003b, Groves and Chandler, 2005). Subsequent incubation monitoring in egg baskets within the same reach confirmed low survival, especially relative to concurrent incubation monitoring downstream from Hells Canyon dam (Groves et al., 2006).

As a means to improve water quality in the Brownlee to Swan Falls reach and other mainstem reaches, NMFS and the Nez Perce Tribe recommend that Idaho Power provide funding to support TMDL implementation, as developed by ODEQ and IDEQ. Providing TMDL funding as recommended by NMFS and the Nez Perce Tribe would expedite improvements in water quality by reducing nutrient loads, which would over time alleviate toxic hydrogen sulfide and low DO levels in the intragravel incubation environment. The NMFS approach would include funding an aquatic resource committee to evaluate and prioritize projects, to identify opportunities to coordinate efforts with other conservation plans or programs, and to re-direct funding if water quality or egg-to-fry survival levels do not show substantial improvement over time. These measures would help return the historical fall Chinook spawning habitat upstream of the project to a condition that would be suitable for reintroduction, and would provide ancillary benefits by improving water quality conditions for other aquatic species, including resident native salmonids and white sturgeon within and upstream of the project. However, the vast majority of nutrient loading upstream of the project is not related to the continuing operation of the Hells Canyon Project or to the operation of Idaho Power's upstream hydroelectric projects. Nonetheless, we recognize the substantial benefits of these measures. However, we conclude that the condition of spawning habitat upstream of the project is not attributable to the Hells Canyon Project or to Idaho Power's upstream projects on the Snake River.

Some agencies, tribes, and NGOs recommend studies to monitor fall Chinook egg incubation and smolt migration in the Swan Falls, C.J. Strike, and Bliss reaches. In the draft EIS, we acknowledged the historical importance of fall Chinook production areas upstream of Brownlee dam, but we concluded that the information already collected by Idaho Power indicates that these types of studies do not need to be repeated until there has been a substantial improvement in water quality upstream of the project, and we included in the Staff Alternative a measure that would require Idaho Power to consult with NMFS, IDFG, ODFW, ODEQ, IDEQ and the tribes to determine what ongoing water quality monitoring programs in the basin[72] can provide information that would be useful for tracking improvements in water quality, and to file a report every 5 years that summarizes the available and relevant monitoring information. Provisions would be made in the project license for the Commission to reconsider the initiation of fall Chinook reintroduction studies when the management agencies have determined that water quality conditions have improved to a point where they could support self-sustaining runs of fall Chinook salmon upstream of the project. In addition, we expect to re-assess water quality conditions as they relate to the condition of historical fall Chinook spawning habitat when the Swan Falls Project license comes up for renewal in 2010.

In their comments on the draft EIS, agencies and tribes stated their view that conditions in the water column are a poor predictor of water quality conditions within the intragravel incubation environment that is influenced by other factors such as the amount of fine sediment that is present in the substrate. Comments filed by the Shoshone-Bannock Tribes also pointed to a study (Keller Bliesner & Associates, 2005), which indicated that water quality conditions in the Snake River upstream of Brownlee reservoir have not deteriorated substantially since the 1960s when fall Chinook were successfully spawning upstream of Brownlee reservoir. The report concluded that conditions in the C.J. Strike reach are not much different now than they were at the time of project construction, and that conditions are beginning to improve (Keller Bliesner & Associates, 2005).

Certainly, the amount of sediment in the substrate affects DO levels within the gravel by affecting the flow of water through the substrate and through biological oxygen demand from decomposing organic material. The reduction in seasonal peak flows caused by water storage at upstream reservoirs operated by BOR has likely contributed to the build-up of fine sediment in the intragravel environment and the establishment of rooted aquatic vegetation. Because of these factors, we maintain that substantial improvements in the condition of the intragravel incubation environment in the Swan Falls reach would require a sustained improvement in overall water quality (i.e., reduced nutrient loading), followed by one or more substantial high flow events to dislodge rooted aquatic vegetation and to cleanse fine sediments from potential spawning areas.

Habitat in many of the tributaries that steelhead and spring Chinook salmon would potentially be able to access has been degraded through various land and water use activities, particularly in basins above Brownlee dam, in which irrigation is extensive (Chandler and Chapman, 2003a). Because degraded tributary habitat could limit the restoration of spring Chinook salmon and steelhead, state and federal agencies, tribes, and NGOs recommend a variety of tributary habitat enhancement measures. As part of a plan to benefit native resident salmonids, Idaho Power proposes many similar measures in Pine Creek, Indian Creek, the Wildhorse River, and other smaller tributaries to the project (see section 3.6.2.10, *Tributary Habitat Improvements*). Prospective measures such as conservation easements, land acquisition, riparian corridor fences, purchase or lease of water rights, culvert passage improvements, screening of irrigation diversions, and instream habitat enhancement would improve access to, and the productive capacity of, habitat for steelhead and spring Chinook salmon.

Chapman and Chandler (2001) estimated the potential smolt yields that would result from providing passage at the Hells Canyon Project, as well as upstream mainstem projects owned by Idaho Power. Table 58 shows estimated smolt yields by mainstem river section and tributary basin, assuming that passage was provided at Idaho Power dams but without passage being provided at other manmade

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[72] The licenses issued for Idaho Power's Upper Salmon Falls, Lower Salmon Falls, Bliss, and C.J. Strike projects all require continuous monitoring of water temperature and DO. Year-round monitoring is required at the Bliss Project, while monitoring at C.J. Strike is required from June 15 through November 15, and monitoring at Upper and Lower Salmon Falls is required from March 1 through November 25.

barriers in the tributary subbasins. These estimates are based on existing conditions, as well as the assumptions that water quality would not be limiting and that reintroduction would be successful.

Table 58. Incremental smolt yields with fish passage provided at Idaho Power's mainstem Snake River dams under various passage scenarios. (Source: Chapman and Chandler, 2001, as modified by staff)

Passage Scenario	Spring Chinook	Steelhead	Fall Chinook	Sockeye
1. Hells Canyon dam				
Pine Creek	58,473	23,234	0	0
Indian Creek	0	3,295	0	0
Subtotal	58,473	26,529	0	0
2. Oxbow dam				
Wildhorse River	37,736	14,774	0	0
Subtotal	37,736	14,774	0	0
Cumulative Subtotal (includes no. 1)	96,209	41,303	0	0
3. Hells Canyon Project, No Action at other dams				
Mainstem Snake River	0	0	1,839,626	0
Eagle Creek	40,007	16,653	0	0
Weiser River	65,008	31,204	0	0
Lower Snake River tributaries (e.g., Brownlee Creek)	0	15,683	0	0
Goose and Big creeks	0	11,025	0	0
Subtotal	105,015	74,565	1,839,626	0
Cumulative subtotal (includes no. 2)	201,224	115,868	1,839,626	0
4. Swan Falls dam				
Mainstem Snake River	0	0	734,535	0
Subtotal	0	0	734,535	0
Cumulative subtotal (includes no. 3)	201,224	115,868	2,574,161	0
5. C.J. Strike dam				
Mainstem Snake River	0	0	1,700,000	0
Bruneau River	375,517	149,048	0	0
Subtotal	375,517	149,048	1,700,000	0
Cumulative Subtotal (includes no. 4)	576,741	264,916	4,274,161	0
6. Bliss dam				
Mainstem Snake River	0	0	0	0
Subtotal	0	0	0	0
Cumulative Subtotal (includes no. 5)	576,741	264,916	4,274,161	0

Passage Scenario		Spring Chinook	Steelhead	Fall Chinook	Sockeye
7.	**Lower Salmon Falls dam**				
	Mainstem Snake River	0	0	0	0
	Billingsley Creek (11 km)	0	2,640	0	0
	Subtotal	0	2,640	0	0
	Cumulative Subtotal (includes no. 6)	576,741	267,556	4,274,161	0
8.	**Upper Salmon Falls dam**				
	Mainstem Snake River	0	0	0	0
	Salmon Falls Creek	62,192	24,678	0	0
	Rock Creek	60,740	24,163	0	0
	Cedar Draw Creek (5 km)	0	600	0	0
	Subtotal	122,932	49,441	0	0
	Cumulative Subtotal (includes no. 7)	699,673	316,997	4,274,161	0

Given the uncertainty of successful restoration and based on the collective recommendations of resource agencies, tribes, and NGOs, we evaluate a phased approach to providing access to upstream habitats, based on the incremental reintroduction of fish to habitat as it is deemed suitable. This program could focus on tributaries within the project area that currently support resident salmonids and where good quality habitat is accessible without requiring passage at any major dams or reservoirs within the tributary. Based on our review of Idaho Power's reintroduction studies, tributaries that meet these criteria include Pine Creek, Indian Creek, the Wildhorse River, and several tributaries to the Powder River, especially Eagle Creek. These tributaries were also identified by many of the stakeholders as being suitable targets for an anadromous fish restoration effort.

The timing and details of each phase are presented in table 59. This approach could begin with the development of a fish passage plan in consultation with agencies and tribes. Initial passage efforts could involve providing upstream passage over Hells Canyon dam for spring Chinook salmon and steelhead and monitoring subsequent habitat usage in Pine and Indian creeks. When smolt production from these tributaries are deemed sufficient to warrant downstream passage provisions, smolt traps could be installed at the tributaries to collect smolts for transport downstream of Hells Canyon dam. If adult returns warrant expansion of the program to additional spawning and rearing habitat, the next step could be to install an adult fish trap for providing passage over Oxbow dam and access to the Wildhorse River. After smolt production from the Wildhorse River was deemed sufficient, a smolt trap could be installed at this location also. If adult returns warrant additional expansion, installing an adult trap at Brownlee dam could then be considered to provide access to rearing habitat in the Powder River basin. Again, after smolt production from the Powder River or one of its tributaries are found to be sufficient, a smolt trap could be installed at this location also.

Table 59. Phased anadromous fish passage plan. Source: developed based on the collective recommendations of resource agencies, tribes, and NGOs

Component	Timing or Trigger	Description
Fish Passage Plan	One year after license	Develop a plan, in consultation with agencies and tribes, to: (1) determine whether steelhead and spring Chinook should be re-introduced to Hells Canyon reservoir tributaries; (2) develop pathogen assessment plan if needed; (3) identify stocks/sources

Component	Timing or Trigger	Description
		of adult and/or juvenile fish to be used; (4) develop plan for conducting adult migration studies, spawning surveys, and juvenile production assessments in Hells Canyon reservoir tributaries; (5) develop a contingency plan for smolt acclimation if surplus adult fish do not migrate to, or spawn in, target tributaries; (6) identify triggers to implement design and construction of smolt trap and truck facilities at Indian and Pine Creek; (7) identify triggers to initiate habitat capacity and passage studies at the Wildhorse River and Powder River tributaries; (8) identify triggers to initiate habitat capacity and passage studies at historical fall Chinook habitat upstream of Brownlee reservoir (Swan Falls and Bliss reaches); and (9) develop guidelines for bull and redband trout passage and related monitoring efforts (see section 3.6.2.8, *Resident Salmonid Passage*).
Fall Chinook Water Quality Monitoring Reports	One year after license	Develop a plan in consultation with the management agencies and tribes to summarize data from ongoing water quality monitoring programs upstream of Brownlee dam to track improvements in water quality relevant to fall Chinook spawning and incubation habitat in historical spawning areas upstream of Brownlee dam. File a summary report with the Commission every 5 years starting in year 5.
Pine and Indian Creek production assessment	Approximately years 2 to 5, timing to be specified in plan	Conduct adult migration studies, spawning surveys, and juvenile production assessments in Hells Canyon reservoir tributaries.
First tributary smolt trap (first tributary to meet smolt production trigger)	Smolt production trigger	Design and construct a trap at Pine or Indian Creek capable of collecting 90% of outmigrating smolts under typical flow conditions (low to medium-high flow year). Initiate trap and truck transport of smolts downstream.
Second tributary smolt trap	Smolt production trigger	Design and construct a trap at Pine or Indian Creek capable of collecting 90% of outmigrating smolts under typical flow conditions (low to medium-high flow year). Initiate trap and truck transport of smolts downstream.
Oxbow adult trap	Seven years after license issuance, but only if surplus steelhead or spring Chinook are available (after meeting spawner targets in Pine and Indian creeks)	Design and construct an upstream migrant trap at Oxbow dam. Conduct adult migration studies to determine whether minimum flows are sufficient to enable passage through the Oxbow bypassed reach. Conduct spawning surveys and juvenile production assessments in the Wildhorse River.
Wildhorse River smolt trap	Based on smolt production trigger	Design and construct a trap at the Wildhorse River capable of collecting 90% of outmigrating smolts under typical flow conditions (low to medium-high flow year). Initiate trap and truck transport of smolts downstream.

Component	Timing or Trigger	Description
Brownlee adult trap	Twelve years after license issuance, but only if surplus steelhead or spring Chinook are available (after meeting spawner targets in Hells Canyon and Oxbow reservoir tributaries)	Design and construct an upstream migrant trap at Brownlee dam. Conduct spawning surveys and juvenile production assessments in the Powder River tributaries.
Powder River smolt trap(s)	Based on smolt production trigger	Design and construct a trap at the Powder River or at Eagle, Daly and Goose creeks capable of collecting 90% of outmigrating smolts under typical flow conditions (low to medium-high flow year). Initiate trap and truck transport of smolts downstream.

Because of the use of various triggers, this phased restoration approach would ensure that each phase proceeds only when the available information suggested that it would be successful. Upon successful completion, this approach could yield the following benefits: (1) restoration of spring Chinook salmon and steelhead production in Pine Creek, Indian Creek, the Wildhorse River, and possibly the Powder River basin (including Eagle Creek); (2) increased opportunities for tribal and recreational harvest of anadromous fish; and (3) benefits to other species, including bull trout and bald eagles. We provide our estimate of the smolt production and adult returns that could result from successful implementation of this approach in table 60. The estimates in table 60 are based on smolt production levels estimated in Chapman and Chandler (2003) and appear to be conservative, especially for steelhead. Based on adult steelhead trapped in the first 3 years of operation at Hells Canyon dam, Idaho Power estimated that there was a total adult return of 2,700 steelhead to Pine and Indian creeks alone. The number of adult salmon and steelhead could also increase over time as tributary enhancements and TMDLs are implemented, or as additional measures are implemented to increase survival rates in the lower Snake and Columbia river migration corridors.

Table 60. Estimated smolt production and adult returns from habitat made accessible under the phased restoration approach (assumes that no passage is provided at other dams in tributary streams). (Source: Chapman and Chandler, 2001, as modified by staff)

Stream/Reach	Spring Chinook	Steelhead
Pine Creek	58,473	23,234
Indian Creek	0	3,295
Wildhorse River	37,736	14,774
Eagle Creek (Powder River tributary)	40,007	16,653
Goose and Big creeks	0	11,025
Total smolts produced	136.216	68,981
Smolts surviving to Lower Granite tailrace (0.718 for spring Chinook, 0.741 for steelhead)[a]	97,803	51,115
Adult return under low smolt-to-adult return rate[b] (0.012)	1,174	613
Adult return under high smolt-to-adult return rate (0.039)	3,814	1,993

[a] Spring Chinook smolts surviving to the Lower Granite tailrace were calculated assuming 90 percent collection efficiency, 98 percent transportation survival to Hells Canyon tailrace, 88.5 percent survival from the Hells Canyon tailrace to Lower Granite reservoir, and 92 percent survival from Lower Granite reservoir to Lower Granite tailrace, or 71.8 percent survival overall. Steelhead smolts surviving to the Lower Granite tailrace calculated assuming 90 percent collection efficiency, 98 percent transportation survival to Hells Canyon tailrace, 92.3 percent survival from the Hells Canyon tailrace to Lower Granite reservoir, and 91 percent survival from Lower Granite reservoir to Lower Granite tailrace, or 74.1 percent survival overall. For both species, the first two values are staff estimates; the last two values are Idaho Power's best estimate from E.3.1-2, chapter 11, table 3.

[b] Values are Idaho Power's best estimates from E.3.1-2, chapter 11, pages 6 and 7.

In their comments on the draft EIS, ODFW and the Shoshone-Bannock Tribes provided information indicating that water quality and habitat conditions in some of the project tributaries, especially in Pine Creek and several tributaries to the Powder River, are sufficient to consider reintroducing steelhead and spring Chinook salmon at this time. Also, during the 10(j) meeting, the agencies stated that surplus hatchery steelhead and spring Chinook salmon have historically been planted in areas upstream of Hells Canyon dam to provide recreational fisheries in Hells Canyon reservoir and in the Boise River. IDFG reports that some of the steelhead planted in Hells Canyon reservoir have been observed spawning in Pine and Indian creeks.

Continuing the practice of stocking surplus adult steelhead in Hells Canyon reservoir, in conjunction with installation of a weir and trap fishway in Pine Creek as prescribed by FWS, provides an opportunity to evaluate the spawning and reproductive success of any adult steelhead that migrate into Pine Creek. This same approach could be used to evaluate the production of spring Chinook salmon, which have been stocked upstream in the Boise River in the past. This evaluation could also be expanded to include Indian Creek when a weir and trap is installed on that stream, and there is potential that the number of surplus hatchery steelhead and spring Chinook salmon that are released into Hells Canyon reservoir could be increased to facilitate this evaluation.

The utility of the planned Pine Creek weir and trap fishway for evaluating the production of steelhead and spring Chinook salmon could be limited if the facility is not capable of collecting most of the juvenile outmigrants, which would be expected to migrate primarily during the spring when flows are relatively high. It could be worthwhile to explore the potential benefits of constructing the Pine Creek weir in a manner that would allow the collection of juvenile anadromous fish during the high flow spring months. As we discuss in the next section, the Pine Creek weir and trap fishway could be designed to effectively screen the entire flow volume at least 90 percent of the time during an average water year. Constructing the facility to accommodate this higher level of flow would also enhance the ability to monitor the emigration of bull trout over most of the year.

Information obtained from the evaluation of the Pine Creek weir and trap, to promote the production of juvenile steelhead and spring Chinook salmon in Pine Creek, would be useful for guiding decisions regarding the design of any facilities that would be installed in the future at Indian Creek and on the Wildhorse River, as prescribed by FWS. If results suggest that expansion of the passage program to other tributaries should be considered, this could be accomplished through the license amendment process.

3.6.2.7 Fish Passage Facilities

The Hells Canyon Project blocks anadromous fish from accessing spawning and rearing habitats upstream of Hells Canyon dam and isolates local populations of the federally-listed bull trout. The Hells Canyon fish trap facility is currently used only to collect anadromous salmonids for hatchery broodstock and, as designed and operated, cannot collect small resident species, such as bull trout. The Hells Canyon trap also limits the opportunity for on-site sorting and handling of anadromous fish.

Idaho Power proposes modifications to the Hells Canyon trap that would facilitate the collection of fish of any size that successfully migrate up the fish ladder and enter the trap. Additional modifications would allow the on-site handling and sorting of captured fish and provide a means of releasing fish back to the river or holding fish for transport to appropriate hatchery locations. Idaho Power also proposes the construction of a fish trap at Oxbow dam and a tributary trap (weir) at the mouth of Pine Creek.

Either implicitly in recommendations to restore anadromous fish to upstream tributaries, or explicitly, NMFS, Interior,[73] IDFG, ODFW, AR/IRU, Shoshone-Bannock Tribes, Umatilla Tribes, and Nez Perce Tribe support the structural modifications to the Hells Canyon fish trap proposed by Idaho Power. ODFW also recommends that Idaho Power operate the trap year-round, 24 hours per day, and ensure that trap modifications accommodate the passage of Pacific lamprey. Interior, IDFG, and ODFW recommend that, as part of a fish passage plan, Idaho Power develop design, operation/trapping, and evaluation plans in consultation with the agencies. Interior also reserves authority to prescribe the construction, operation, and maintenance of fishways at the project, including measures to determine, ensure, or improve fishway effectiveness. In its April 10, 2006, reply comments, Idaho Power states that operating the Hells Canyon trap during two discrete periods (October 15–December 1 and March 15–June 30) would be sufficient for the collection of anadromous and resident salmonids. Idaho Power also states that lamprey passage should not be considered in modifying the Hells Canyon trap because few lamprey currently return to the Snake River basin.

Management agencies, tribes, and NGOs recommend additional passage facilities for anadromous and resident salmonids, including tributary traps (e.g., at the mouth of Pine Creek) for collecting downstream migrants, and traps for upstream migrants at Oxbow and Brownlee dams. These prospective facilities and their respective benefits are discussed in detail in section 3.6.2.6, *Anadromous Fish Restoration*. The discussion herein is, therefore, limited to the modifications to the Hells Canyon fish trap and the merits of consultation between Idaho Power and agency and other stakeholders in designing, operating, and evaluating fish passage facilities.

Our Analysis

Initial restoration efforts proposed by Idaho Power, recommended by the agencies, NGOs, and tribes, and included in the FWS section 18 preliminary fishway prescription and Idaho Power's alternative to the FWS prescription, include modifications to the Hells Canyon fish trap. Currently, the Hells Canyon trap uses a fish separator to remove small fish before they enter the trap holding pool and is, thus, unsuitable for capturing small migrating resident fish such as bull trout and redband trout. The existing trap also requires the transport of captured anadromous fish to hatchery facilities where they are sorted to determine their origin. Hatchery-origin fish are retained for broodstock but wild fish require transport back to the river for release. Such a procedure imparts additional stress and migratory delay on wild fish, but is currently necessary because adequate handling and sorting facilities are lacking at the Hells Canyon trap.

Idaho Power developed detailed design drawings and operational plans for several alternative plans to facilitate the capture of smaller fish and provide onsite handling and sorting facilities, as well as other improvements (McMillen et al. 2005). In consultation with the agencies, Idaho Power selected Alternative 3 Revised as the most appropriate design (figure 106). This design eliminates the fish separator, such that smaller fish would be retained in the trap. Additional modifications under this design

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[73] Part of FWS section 18 preliminary fishways prescription.

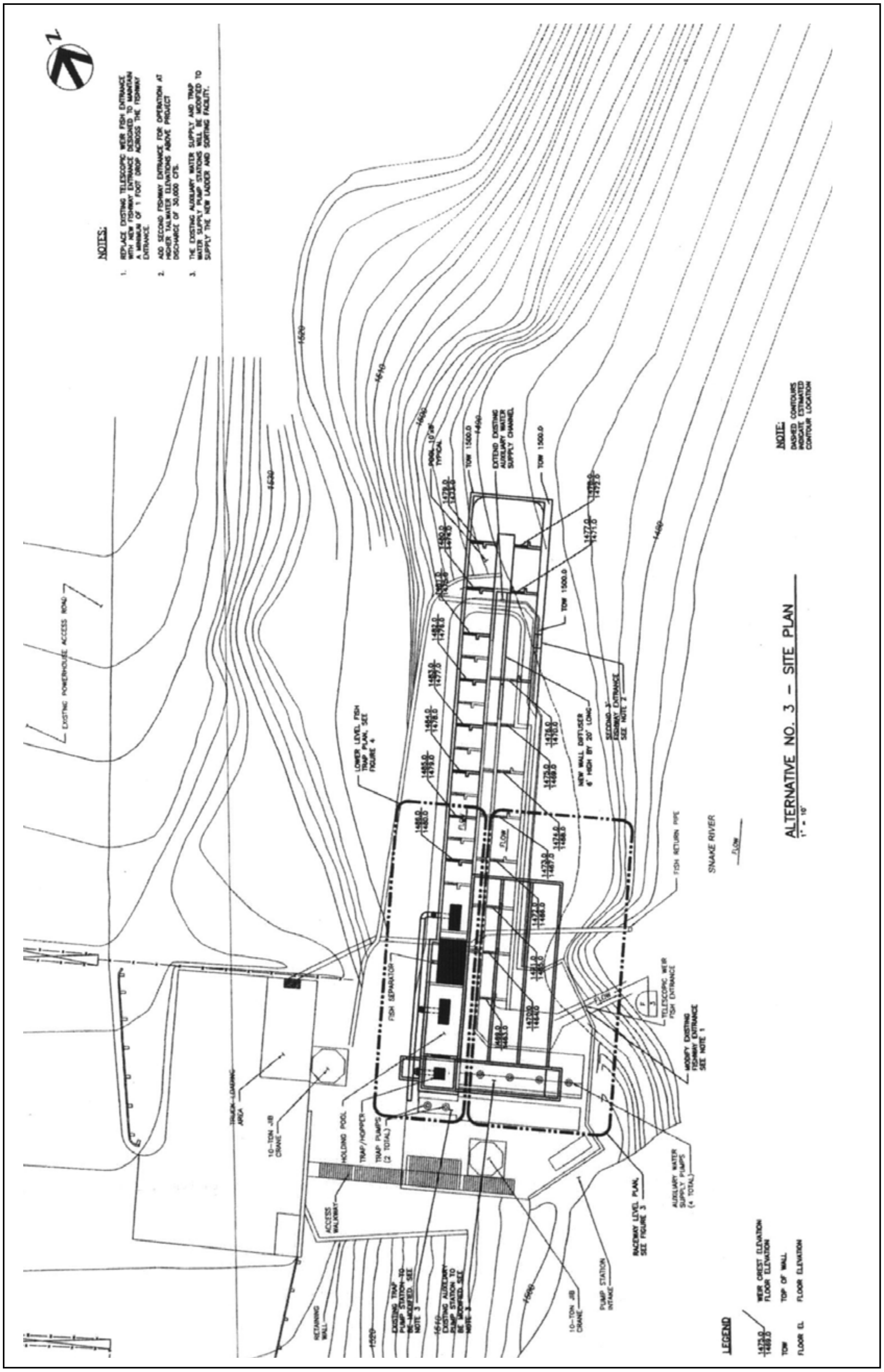

Figure 106. Plan view of Hells Canyon trap modification Alternative 3 revised.

would extend the existing ladder portion of the fishway, add a second fishway entrance, and raise the exterior wall nearest to the Snake River to ensure effective operation at river flows up to 50,000 cfs, while further protecting the facility during flood events. Modifications would also include a new pre-lock holding and counting area, a photoelectric fish counter, a new fish lock, and new sorting and holding areas. This design would allow for the sorting and holding of multiple species, the scanning of fish for marks and/or tags, and the safe and timely return of wild fish to the river after sorting.

Idaho Power's proposal to limit operation of the Hells Canyon trap to two discrete periods may be warranted based on the known timing of steelhead and Chinook salmon returns. However, the migration timing of resident salmonids is not as well understood. Initially operating the trap year round and 24 hours per day, as recommended by ODFW, would help identify the daily and seasonal timing of fish movement based on the presence or absence of trapped bull trout or redband trout. If observations made during continual operation suggest that changes in operation are appropriate, a modified operation schedule could be considered at that time.

Although the historical range of Pacific lamprey extended well upstream of the location of Hells Canyon dam, few are currently documented passing Lower Granite dam. Further, the best approach for passing lamprey remains unclear. As such, modifying the Hells Canyon trap to accommodate lamprey would have little benefit at this time. If restoration and passage efforts downstream of the project substantially increase the number of lamprey that pass Lower Granite dam, an effective means of providing upstream passage would be appropriate, at that time, to restore this species to habitat within and above the project. We consider the effects of the Hells Canyon Project on the population size of Pacific lamprey to be very limited. However, it is clear that the project blocks access to a substantial amount of habitat that was historically used by this species. Participation by Idaho Power in regional forums on Pacific lamprey restoration would help to identify opportunities for evaluating and implementing measures that could benefit Pacific lamprey in habitat that is currently blocked by the project or that is affected by project operations downstream from Hells Canyon dam.

The proposed modifications to the Hells Canyon trap were developed in consultation with, and are recommended by, the management agencies. However, details regarding the final design of the trap, operation of the trap, the destination of the various species trapped, and evaluation of the trap's effectiveness require further development. As recommended by ODFW, IDFG, and Interior, a fish passage plan that includes these details, developed in consultation with the agencies, would ensure that this facility is operated to meet the goals of the restoration program.

Idaho Power's proposed fish trap at Oxbow dam and tributary trap at Pine Creek, as well as the fish passage facilities recommended by the agencies, NGOs, and tribes for both anadromous and resident fish restoration, would also require further development depending on the ultimate progression of the overall restoration effort. These passage facilities are discussed in section 3.6.2.6, *Anadromous Fish Restoration*, and section 3.6.2.8, *Resident Salmonid Passage*, and many are part of the FWS preliminary fishway prescription and Idaho Power's alternative to the fishway prescription. A comprehensive plan for the implementation of fish passage facilities, developed in consultation with the agencies, would help to provide effective fish passage facilities. A successful plan would include schedules and implementation triggers for the design, construction, operation, evaluation, and modification of passage facilities that were effective, timely, and operated as intended.

3.6.2.8 Resident Salmonid Passage

Construction of the Hells Canyon Project has blocked upstream passage and impeded downstream movement of native resident salmonids, thereby isolating local populations, inhibiting fluvial life histories, and reducing access to additional habitat and thermal refugia. The primary native resident salmonid species of concern are redband trout and the federally listed bull trout.

Idaho Power proposes a two-phased Fish Passage Plan for transporting resident salmonids above Hells Canyon and Oxbow dams. The first phase would involve collecting bull trout, redband trout, and possibly other species in the Hells Canyon trap after it is modified (see section 3.6.2.7, *Fish Passage Facilities*) and transporting them to areas upstream of the Hells Canyon dam. The second phase would involve the construction of a new trap, similar in operation and design to the Hells Canyon trap, at the base of the Oxbow dam to collect fish for transport upstream. However, because of uncertainty surrounding the intent of fish collected in the trap and the status of habitat in tributaries such as the Wildhorse River, Idaho Power proposes delaying construction of the Oxbow trap for a minimum of five years following completion of the Hells Canyon trap modifications. Idaho Power also proposes to design, construct, and operate a permanent weir in Pine Creek to monitor the fluvial component of resident salmonid populations.

Interior filed a preliminary fishway prescription (Interior-87) that would require Idaho Power to develop a passage plan within 6 months of the issuance of a new license. The prescription would provide for: (1) the construction and operation of a weir at the mouth of Pine Creek; and (2) the identification of specific habitat conditions that would trigger implementation of passage-related actions in Indian Creek, the Wildhorse River, and the Oxbow bypassed reach. Interior prescribes that the plan include: (1) specifications for construction and operation of permanent weirs, as well as trap and haul fishways, on these tributaries; (2) suitable upstream and downstream release points for adult and juvenile fish; (3) a description of the location, functional design, and operating characteristics of all upstream and downstream fishways; and (4) schedules and milestones for their timely modification, operation, and evaluation. Interior also prescribes that within 1 year of license issuance, Idaho Power develop a post-construction monitoring plan and implementation schedule to monitor fishway effectiveness.

In response, Idaho Power submitted an alternative prescription that identifies the types of triggers that would be included in the passage plan and would control the timeline of construction of the Oxbow fish trap and the Indian Creek and Wildhorse River weir and trap fishways. Under Idaho Power's alternative, these triggers would be based on the status of bull trout within these tributaries in terms of their abundance, the potential for hybridization with non-native brook trout, the potential of the fishways to contribute toward recovery, and habitat conditions necessary to support bull trout. Idaho Power's alternative also specifies that development of functional designs and monitoring plans would not be initiated until the trigger criteria for a facility have been met. Under their alternative prescription, Idaho Power would file a Bull Trout Passage Plan within one year that would include: (1) final engineering design plans for modification of the Hells Canyon fish trap and the Pine Creek monitoring weir and trap, as well as operating protocols; (2) locations of release points and handling of all lifestages of bull trout and other fish collected at the two facilities; (3) provisions for bull trout transport between Pine Creek and Hells Canyon dam; (4) an assessment of monitoring needed to evaluate the risk of introducing deleterious pathogens; and (5) a post-construction monitoring plan.

On January 3, 2007, Interior filed its modified fishway prescription. The modified prescription requires that the Pine Creek monitoring weir and trap be constructed within 2 years, but adopts the triggers proposed by Idaho Power for construction of the upstream fish trap at Oxbow and the Indian Creek and Wildhorse River permanent weir and trap fishways. Interior's modified prescription maintains language regarding the need for appropriate upstream passage flows for the Oxbow fish trap that was not included in Idaho Power's alternative prescription. Interior states that the operational period for the Pine Creek fish weir and trap would be established in the Bull Trout Passage Plan. However, Idaho Power proposes to operate the weir and trap from October through December, when the downstream passage facilities would be operated.

The Forest Service (FS-32), IDFG (IDFG-14), ODFW (ODFW-10), and the Umatilla Tribes (CTUIR-12e) support Idaho Power's proposal to develop and implement a passage plan that would use the modified Hells Canyon trap and a newly constructed Oxbow trap to provide upstream passage for resident salmonids. The agencies, tribes, and AR/IRU also recommend that Idaho Power design, construct, and operate tributary weirs, additional to the proposed Pine Creek weir. Prospective weir sites include Indian Creek, the Wildhorse River, and Eagle Creek. Most of these recommendations are intended to facilitate reintroduction of anadromous fish to these tributaries, and we discuss those recommendations in detail in section 3.6.2.6, *Anadromous Fish Restoration*. The agencies also state that the implementation of various plan components should be contingent upon the feasibility of passage measures and the suitability of habitat to which fish would gain access. To improve tributary habitat, such that the translocation of resident salmonids would be beneficial, Idaho Power proposes, and the agencies and AR/IRU recommend, specific tributary habitat enhancement measures, which are described in detail in section 3.6.2.10, *Tributary Habitat Improvements*.

ODFW (ODFW-18) recommends that Idaho Power conduct a population viability risk analysis of genetic and demographic costs incurred by donor and recipient bull trout populations. ODFW (ODFW 36-b and 37) also recommends that Idaho Power investigate bull trout mortality associated with spill or turbine passage.

Our Analysis

The provision of passage for native resident salmonids within the project would reestablish connectivity among currently isolated populations. Due to small population sizes and obstructed immigration and gene flow between populations, bull trout are particularly susceptible to extinction. Based on a population viability assessment conducted by Idaho Power (Pratt, 2003-E.3.1-7, Ch 2), enhancing movement between bull trout populations within the project was found to have the greatest chance of increasing population persistence, compared with any other management activity. Annual immigration rates of as little as one to six mature females into each subpopulation would significantly reduce the risk of extinction for these populations.

By tracking radio-tagged bull trout, Chandler et al. (2003a) provided some evidence that small fluvial components persist in populations in Indian Creek, Pine Creek, and the Wildhorse River. Providing passage between isolated tributaries and the Snake River would enhance fluvial life histories. Likewise, providing passage would allow bull trout to access additional thermal refugia and forage, as well as spawning and rearing habitat. Collectively, improving access to these habitats would increase growth, fecundity, and egg deposition and, consequently, abundance. Although redband trout populations are less susceptible to extinction, they would similarly benefit from increased connectivity.

Use of the Hells Canyon and Oxbow traps to provide passage would require the transport of collected fish to their appropriate destination. Collection and transport at the Hells Canyon dam would provide connectivity between bull trout populations below the dam and populations in Pine and Indian creeks, as well as any other smaller tributaries to the Hells Canyon reservoir with suitable habitat. Likewise, passage at the Oxbow dam would provide connectivity between the aforementioned populations and bull trout in the Wildhorse River and smaller tributaries to the Oxbow reservoir.

Despite the apparent benefits of providing passage for bull trout, uncertainties remain regarding the appropriate timing and destination for fish translocation. Of particular concern is the presence of brook trout and brook-bull trout hybrids in tributaries to which bull trout would gain access. Chandler et al. (2003a) documented brook trout in every drainage that contained bull trout and found that hybridization was particularly prevalent in the Indian Creek and the Wildhorse River basins. Thus, translocating bull trout may only be warranted subsequent to the brook trout eradication efforts described in section 3.6.2.10, *Tributary Habitat Improvements*. Similarly, habitat degradation and alteration within certain tributaries may require remediation before fish are translocated to maximize the associated benefits. Such habitat enhancement measures include the screening of irrigation diversions, improved passage at culverts, and other methods also described in section 3.6.2.10, *Tributary Habitat Improvements*.

Idaho Power's population viability assessment (Pratt, 2003) examined the viability of existing bull trout populations under current conditions and identified potential measures, such as increased connectivity, that would improve their status. However, the risks associated with implementing passage measures remain unclear. While increased connectivity would benefit recipient populations, it would coincide with losses from donor populations and potentially offset such a benefit. As recommended by ODFW (ODFW-18), a risk analysis that considers the genetic and demographic effects of increased immigration and emigration would be useful in developing procedures for translocation within the fish passage plan.

ODFW also recommends (ODFW-36b and 37) that Idaho Power evaluate mortality associated with spill and turbine passage. Depending on the release locations of bull trout collected in the dam traps or tributary weirs, evaluating turbine or spill mortality would help to quantify any losses associated with these passage routes. In addition, this information would be useful for guiding decisions on optimal release locations for fluvial fish that are collected as they emigrate from project tributaries. We anticipate that the need for a population viability risk analysis and evaluation of turbine or spill mortality would be determined during development of the bull trout passage plan associated post-construction facility evaluations and trigger-related monitoring required under Interior's modified fishway prescription.

Rather than establishing a fixed schedule for the implementation of resident salmonid passage measures, a phased approach, whereby the implementation of subsequent measures is contingent upon the success of initial measures, would help to promote the achievement of milestones for native resident salmonid restoration before reallocating efforts to other measures. Idaho Power's alternative prescription and the FWS revised prescription indicates that triggers would be based on: (1) the status of bull trout within these tributaries in terms of their abundance; (2) the potential for hybridization with non-native brook trout; (3) the potential of the fishways to contribute to recovery; and (4) habitat conditions necessary to support bull trout. Inclusion of these more detailed trigger elements would help to ensure that constructed facilities would provide a benefit to bull trout populations, and that the timeline is consistent with habitat enhancement and brook trout eradication efforts described in section 3.6.2.10, *Tributary Habitat Improvements*.

Likewise, postponing the design and construction of fish passage facilities and the development of monitoring plans until the appropriate trigger conditions have been met, as stated in Idaho Power's alternative prescription and adopted in the FWS modified prescription, would be consistent with an adaptive management approach. The design, construction, and operation of fish passage facilities is expected to require some modification over the course of the restoration effort. The information garnered from initial efforts, such as the modification and operation of the Hells Canyon trap, the construction and operation of a weir in Pine Creek, and the resulting movement of bull trout in the Hells Canyon reach, would help guide subsequent passage facilities and monitoring plans.

The FWS modified prescription requires that the Pine Creek monitoring weir and trap be constructed within 2 years, which would expedite the collection of information on fluvial populations of bull trout in Pine Creek. This compares to Idaho Power's alternative prescription, which did not specify a time frame for construction of the Pine Creek weir and trap. The FWS modified prescription also requires that the future fishway/trap at the base of Oxbow dam include measures and operations necessary to provide adequate attraction flow to safely attract bull trout into the trap for collection and transport upstream. This measure would ensure that conditions in the bypassed reach do not impede connectivity. Finally, Interior would require that the period of operation of the Pine Creek monitoring weir and trap fishway be established in the bull trout passage plan, while Idaho Power proposed an operating period of October through December. Based on our review, we conclude that additional consultation would help in determining the seasonality of operation. We also conclude that some flexibility may need to be retained to adjust the operational season based on the results of initial operation and monitoring.

3.6.2.9 Fish Pathogen Assessment

Prospective measures to restore anadromous fish, improve connectivity among resident fish populations, and supplement marine-derived nutrients through carcass outplants have the potential to introduce fish pathogens to areas within, and upstream of, the project. These pathogens could adversely affect resident fish populations, including the federally listed bull trout.

Before implementing prospective passage measures, Idaho Power proposes to develop, fund, and implement a pathogen risk assessment plan for the Pine-, Indian-, and Wildhorse core areas, in consultation with ODFW and IDFG fish pathologists. Following an initial assessment of pathogen risks, Idaho Power proposes follow-up surveys at 5-year intervals if the initial risks associated with upstream passage were deemed acceptable. In its April 10, 2006, reply comments, Idaho Power explicitly defines the scope of the proposed pathogen assessment as including the Snake River downstream of Hells Canyon dam (including the Imnaha River), Hells Canyon reservoir, and Oxbow reservoir during initial passage and restoration efforts.

IDFG, AR/IRU, and the Shoshone-Bannock Tribes (IDFG-12, AR/IRU-9c, and AR/IRU/SBT-6) support Idaho Power's proposal, but IDFG recommends that Idaho Power begin consultation with the IDFG Fish Health Laboratory prior to the issuance of a new license to discuss potential pathogens, sampling protocols, and priority sampling locations. Although supporting the measures proposed by Idaho Power, ODFW (ODFW-21), and AR/IRU (AR/IRU-7d) recommend the expansion of pathogen surveying and monitoring to both native resident and anadromous populations above, within, and below the project. In addition, ODFW recommends that the development of a pathogen assessment plan take place in the first year, and initial assessment in the third year, following issuance of a new license. ODFW also recommends that Idaho Power provide funding for a fish health specialist, supplies, and services associated with production of hatchery fish and the fish passage program, as well as fish health examination and storage areas.

Our Analysis

By increasing the connectivity among currently isolated native resident salmonid populations, fish passage measures proposed by Idaho Power (see section 3.6.2.8, *Resident Salmonid Passage*) would increase the risk of pathogen transfer among these populations. Although the distribution of pathogens within and above the project is poorly understood, the current isolation of resident fish populations suggests that they may host different pathogen assemblages. Increased movement among populations would therefore increase both the risk of exposure to new (or exotic) pathogens or different strains of endemic pathogens and the reintroduction of once-endemic pathogens. Pathogens of concern include several bacterial, viral, and parasitic species.

Idaho Power proposes to assess fish pathogens in the context of risks associated with resident salmonid passage. Based on a pathogen workshop held in 2000, Chandler and Abbott (2003) state that the introduction of pathogens that were not endemic to the area prior to project construction may pose the greatest risk to resident salmonids. Of particular concern is the introduction of the parasite *M. cerebralis* (whirling disease) to Pine Creek, Indian Creek, and the Wildhorse River where it has not been documented. In light of the concern regarding *M. cerebralis* and other pathogens, a comprehensive assessment of pathogen risks associated with resident salmonid passage would require the expansion of efforts beyond the Pine Creek, Indian Creek, and Wildhorse River basins if passage were provided beyond Oxbow and Hells Canyon reservoirs. Further, because resident fish from downstream of the project would potentially gain access to these tributaries, an assessment of the distribution of pathogens downstream of Hells Canyon dam would also be warranted.

In addition to the risks associated with resident fish passage, the prospective outplanting of salmon carcasses for nutrient supplementation (see section 3.6.2.11, *Marine-derived Nutrients*) represents an additional vector for the (re)introduction of pathogens to native resident salmonid habitat within and above the project. Resident fish in any reach or tributary within, or above, the project, would be exposed to increased risks associated with pathogen introduction. These risks are not specifically addressed in Idaho Power's proposed measures described above. If either the passage of resident fish or carcass outplants are undertaken, the risks of disease transfer need to be considered through a pathogen risk assessment plan. To the extent possible, an understanding of the existing distribution of pathogens below, within, and above the project in both resident and anadromous salmonid populations would inform decision-makers of the risks associated with passage measures. Given the difficulty of completely understanding pathogen distributions, continued monitoring of pathogens among salmonid populations every 5 years, as proposed by Idaho Power, would facilitate an adaptive approach in which efforts could be expanded or modified based on the continued absence or spread of pathogens. Idaho Power's proposal to provide a full-time fish pathologist on its staff, if needed, would facilitate monitoring efforts and provide a logical interface between Idaho Power and management agencies regarding fish health issues.

3.6.2.10 Tributary Habitat Improvements

Construction and operation of the Hells Canyon Project has adversely affected bull trout and redband trout populations in the project area, primarily through a loss of habitat connectivity. These species require access to quality tributary habitat for every life stage and life history. Through a variety of causes, resident salmonid habitat in tributaries to the project has been degraded. In this section, we evaluate the effects that proposed and alternative tributary habitat enhancement measures would have on these bull trout and redband trout populations.

Idaho Power proposes to prepare and implement a Tributary Habitat Enhancement Plan within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to project reservoirs. They propose to assemble a Technical Advisory Committee including FWS, IDFG, and ODFW to work with landowners to identify, prioritize, and recommend actions and measures primarily targeting benefits to bull trout within the project area. Measures identified may include cooperative maintenance agreements in which Idaho Power would provide capital and construction costs, and the landowner would assume costs of O&M of the facility. Measures of priority would be those for which direct benefits to bull trout can be demonstrated. Such measures may be directed at the following types of impacts: (1) culvert passage at small tributaries that drain into the project reservoirs and that could provide coldwater refuge to native salmonids; (2) irrigation diversions that are along mainstem migration corridors or within primary spawning and rearing areas of bull trout (implementation of this measure would depend on landowner maintenance agreements); and (3) land use effects on key riparian corridors that are currently in bull trout spawning and rearing areas or those that may extend the present range of spawning and rearing areas of bull trout.

Potential measures that would be considered in Idaho Power's Tributary Habitat Enhancement Plan include: (1) construction of irrigation diversion screens; (2) conservation easement agreements; (3) construction of riparian corridor fences (implementation of this measure would also depend on landowner maintenance agreements); (4) purchase or lease of water rights from willing sellers (these water rights would have to be those that can be demonstrated to provide improved instream flow in critical areas, especially those extending the coldwater refuge potential near the upper portions of streams that serve as spawning and rearing areas, and would apply only in Oregon tributaries); (5) land acquisition along key riparian corridors; and (6) instream habitat enhancement measures in critical spawning and rearing areas.

Idaho Power proposes two other measures targeted to benefit bull trout within the project area: brook trout eradication efforts and conducting a presence/absence survey in Eagle Creek. We summarize Idaho Power's proposed measures, as well as the recommendations of ODFW, IDFG, Interior, and AR/IRU, in table 61.

Table 61. Tributary habitat enhancement recommendations. (Source: Staff)

Component	Idaho Power	ODFW	IDFG	Interior	AR/IRU
General	Prepare and implement a Tributary Habitat Enhancement Plan within Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the Hells Canyon Project. Assemble an advisory committee to identify, prioritize, and recommend such measures as conservation easements, land acquisition, riparian corridor fences, purchase or lease of water rights, culvert passage improvements, screening of irrigation diversions, and instream habitat enhancement.	ODFW-38. Adopt measures proposed by Idaho Power, but include measures in the Powder River and Burnt River basins. Identify, evaluate, and implement actions to reduce negative effects of irrigation diversions in the Pine Creek, Powder River, and Burnt River basins.	IDFG-16. Adopt measures proposed by Idaho Power, but include a mechanism for re-allocating funds not used if fish passage and other proposed measures in Pine Creek, Indian Creek, or the Wildhorse River would not be successful or possible to implement. Idaho Power would re-allocate such funds to tributary enhancement projects in Hells Canyon and Weiser core recovery units. Expand geographic scope to allow habitat enhancement projects in Weiser River drainage.	Interior-37a, 38a, 39a, 59. Adopt measures proposed by Idaho Power. Complete an action plan and implementation schedule to correct fish passage barriers at road crossings and culverts described in Idaho Power's application (tables 11-12, technical appendix E.3.1-7, Chapter 4).	AR/IRU-11a. Adopt measures proposed by Idaho Power, but include tributaries downstream of the project, the Powder River basin, other tributaries above Brownlee reservoir, and any additional tributary or measures recommended by the advisory committee.
Brook trout eradication	Evaluate feasibility of, and possibly implement, a brook trout suppression program in Indian Creek. Such a program could be applied to the Wildhorse River in the future.		IDFG-20. Adopt measures proposed by Idaho Power.	Interior-37d, 38d, 39d. Determine whether the presence of brook trout limits bull trout populations in Pine Creek, Indian Creek, and the Wildhorse River, and if necessary, develop and implement appropriate control activities.	AR/IRU-9b. Implement a brook trout eradication program for tributaries into which bull trout would be moved - particularly Indian Creek and the Wildhorse River.

Component	Idaho Power	ODFW	IDFG	Interior	AR/IRU
Surveys and monitoring	Conduct surveys and operate a temporary weir to determine the presence/absence of bull trout in the Eagle Creek Basin. Design, construct, and monitor a permanent weir at Pine Creek.	ODFW-24, 41. Evaluate effects of anadromous fish reintroduction on resident fish populations. Monitor bull trout migration through the project and redband trout populations in Pine, Eagle, Goose, and Daly creeks. Conduct presence/absence surveys for bull trout in Eagle Creek Basin. Operate weir at mouth of Eagle Creek.	IDFG-18. Conduct surveys for bull trout in the Hells Canyon Project	Interior-37c, 38c, 39c, 40. Monitor bull trout populations in Pine Creek, Indian Creek and the Wildhorse River. Conduct presence/absence surveys, evaluate habitat conditions, and determine reintroduction feasibility for bull trout within Eagle Creek.	

Our Analysis

Several bull trout populations within the Hells Canyon Project are at risk of extinction because of low abundance, isolation, and limited suitable habitat (Pratt, 2003). Based on this assessment, any action taken to reestablish connectivity among populations and increase available habitat and population sizes would benefit and improve the viability of bull trout populations. Such measures would concurrently benefit redband trout populations.

The bull trout populations that constitute the Hells Canyon Recovery Unit include the Pine-, Indian-, and Wildhorse core area and the Powder River core area (FWS, 2002a). These core areas contain local populations, and are areas identified as containing potential spawning and rearing habitat. Chandler et al. (2003a) and others documented bull trout in Pine Creek, Indian Creek, and the Wildhorse River, and found evidence of at least small fluvial populations. However, brook trout and hybridized fish were also observed in all drainages containing bull trout. Buchanan et al. (1997) characterized the status of bull trout in the Pine Creek Basin as fragmented, extremely low in abundance, and at “moderate risk,” citing increased water temperatures, riparian habitat loss, siltation of spawning and rearing areas, channel alteration, and loss of instream structure as factors limiting bull trout survival. Pine Creek, in particular, may be negatively influenced by habitat degradation caused by irrigation diversions, as well as land-use activities such as grazing, timber harvest, and mining (Chandler et al., 2003a). Pratt (2003) found that bull trout populations in Pine and Indian creeks are at risk of extinction due to low abundance, isolation, and limited suitable habitat. Indian Creek and the Wildhorse River are also listed as key watersheds in the Idaho Bull Trout Conservation Plan (State of Idaho, 1996).

Bull trout are extremely sensitive to environmental change because of their specific habitat requirements. Water temperature, in particular, may be the most critical factor affecting the suitability of habitat for bull trout (Chandler et al., 2003d). For this reason, water- and land-use practices that alter stream temperatures likely have the greatest adverse effect on bull trout habitat in tributaries to the Hells Canyon Project. The prospective habitat enhancement measures proposed by Idaho Power and recommended by the agencies would reduce the effects of these practices. Purchase or lease of water rights would increase instream flows, and conservation easements, land acquisition, and riparian corridor fences would increase shading by restoring and protecting riparian cover; both of these mechanisms would directly stabilize stream temperatures. Depending on the scope of the measures taken, curtailing certain land-use practices and increasing instream flow would also indirectly enhance physical instream habitat by increasing woody debris contribution and vegetative cover, reducing erosion and sedimentation, enhancing natural geomorphological processes, and increasing wetted area.

Idaho Power also proposes, and the agencies recommend, considering additional measures targeted directly toward instream habitat enhancement. While the measures described above would alleviate some of the causes of habitat degradation, efforts directed at restoring instream habitat would provide a more immediate benefit by directly increasing the amount of spawning, rearing, and adult habitat available to bull trout. Although redband trout have generally less-specific habitat requirements, the proposed and recommended physical habitat enhancement measures would similarly enhance habitat for this species.[74]

In addition to the barriers to native salmonid migration created by the Hells Canyon Project dams, culverts, alluvial deposits, and irrigation diversions can prevent movement between or within tributaries. Such barriers can restrict the fluvial life history component of redband trout and bull trout populations and prevent access to spawning and rearing habitat, forage, and thermal refugia. In addition, and of particular

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[74] These measures could also improve the prospects for any future program to reintroduce anadromous salmonids to the Snake River upstream from the Hells Canyon dam.

importance to small, isolated bull trout populations in the Hells Canyon Project area, barriers prevent gene flow between tributary populations. Reduced connectivity among tributary populations thus increases the risk of extinction among these populations. Irrigation diversions can also increase mortality by entraining fish into unsuitable habitat associated with irrigation canals. Reestablishing connectivity among tributary populations by eliminating barriers and reducing entrainment by screening irrigation diversions would improve the health of the fluvial component and reduce the risk of extinction among resident bull trout subpopulations.

Interior (Interior-59) recommends that Idaho Power complete an action plan and implementation schedule to correct barriers at the road crossings and culverts listed in Idaho Power's application (Chandler et al., 2003a). Although the elimination of these barriers would improve the potential for fish migration, the benefit for native resident salmonids would be dependent upon the suitability of habitat to which they would consequently gain access. In developing a tributary habitat enhancement plan, selecting and prioritizing tributary barriers for removal based on the suitability of surrounding habitat for native resident salmonids would maximize the potential of such efforts to benefit bull trout and redband trout. Idaho Power's proposal to work with agencies and landowners to identify and prioritize measures would help to direct efforts toward removal of the barriers that would provide the greatest benefit to bull trout populations.

Based on a population viability assessment conducted by Idaho Power (Pratt, 2003), enhancing movement between bull trout populations within the project was found to have the greatest chance of increasing population persistence, compared with any other management activity. Annual immigration rates of as little as one to six mature females into each subpopulation would significantly reduce the risk of extinction for these populations. Providing access to additional forage and spawning and rearing habitat could also increase growth, fecundity, and egg deposition, and consequently, abundance. In addition to the removal of physical barriers, the habitat enhancement measures described above could eliminate barriers caused by poor water quality or low flows.

Hybridization and competition with nonnative brook trout pose a serious risk to overlapping bull trout populations. These species overlap in many tributaries to the project, have similar habitat requirements, and spawn at similar times, which increase the probability of hybridization. Hybridization reduces the fertility and survival of progeny (Kanda et al., 2002) and brook trout may out-compete and displace bull trout when resources are limited (Gunckel et al., 2002). For this reason, hybridization with brook trout may be the most serious risk for bull trout populations within the Hells Canyon Project (Chandler et al., 2003a). Any action that effectively limits hybridization by eliminating or reducing brook trout numbers would reduce the risk of extirpation of bull trout populations. However, in tributaries to the project, the feasibility of various methods of brook trout suppression or eradication remains unknown. Undertaking an experimental approach in which the scope is initially limited to a single basin, such as Idaho Power proposes in Indian Creek, would help to identify the feasibility of such measures and assess the utility of expanding efforts to the Wildhorse River and Pine Creek basins.

ODFW (ODFW-38) and AR/IRU (AR/IRU-11a) recommend that tributary enhancement measures include the Powder River basin (including Eagle Creek). The Powder River core area contains several isolated bull trout populations in the upper part of the basin, as well as one presumably unoccupied area (Eagle Creek) with potential spawning and rearing habitat (FWS, 2002a; Buchanan et al. 1997). Idaho Power did not propose tributary habitat enhancement measures in the upper Powder River basin because these populations are isolated in headwater areas above Thief Valley dam and are not affected by the Hells Canyon Project. Idaho Power does propose an intensive survey to determine whether bull trout are present in Eagle Creek, including (1) surveys of all major tributaries and operation of a temporary weir during the fall months to monitor for any remnant fluvial fish in the Eagle Creek basin, and (2) genetic sampling to examine the extent of hybridization with brook trout. Because of its proximity to the inundated portion of the Powder River, bull trout populations in Eagle Creek, if they occur, are more likely to be affected by the project than are populations in the upper watershed.

Determining the location of any bull trout populations in Eagle Creek would help the management agencies and Idaho Power develop and implement appropriate protective measures for any populations that are found to be at risk.

ODFW also recommends that these efforts include the Burnt River basin. FWS includes the Burnt River basin as part of the Hells Canyon Recovery Unit but does not currently consider it a core area (FWS, 2002a) because bull trout have not been observed in the Burnt River basin. However, it has not been intensively surveyed and its potential to support bull trout is unknown.

Although bull trout have not been found in the Powder or Burnt River basins, both of these basins include tributaries that provide habitat for redband trout, and restoration of redband trout has been identified as an important management objective by the state resource agencies and tribes. It is also clear that habitat in the lower portions of these tributaries has been adversely affected through inundation, and that poor water quality conditions in the reservoirs during the summer months adversely affect connectivity between populations of redband trout. Much of the habitat in these basins has been degraded. However, given the large drainage area of the basins and the presence of redband trout in some tributaries, there are likely to be areas within the basin where enhancement efforts could expand the abundance and distribution of redband trout in habitat adjacent to areas that currently support this species.

IDFG (IDFG-16) recommends that tributary habitat enhancement measures include the Weiser River, which is also designated as a core area in the FWS Bull Trout Recovery Plan and a key watershed in the Idaho Bull Trout Conservation Plan. Although the proposed and recommended enhancement measures would similarly benefit bull trout (and redband trout) populations if implemented in the Weiser River basin, it is considered a separate recovery unit from the Hells Canyon Recovery Unit. In addition, the Weiser River has not been as directly affected by the project as the other tributaries under consideration for enhancement.

3.6.2.11 Marine-Derived Nutrients

Construction of the project and the failure of initial attempts to provide passage for anadromous fish eliminated anadromous fish carcasses as a source of marine-derived nutrients to aquatic habitats upstream of Hells Canyon dam. This reduced the productivity of tributary habitats that are used by bull trout and redband trout. Idaho Power proposes, and others recommend, specific measures to address the lack of marine-derived nutrients in the system We summarize Idaho Power's proposed measures, as well as the recommendations of ODFW, IDFG, Interior, and AR/IRU, in table 62.

Table 62. Recommendations for providing marine-derived nutrients. (Source: Staff)

Idaho Power	ODFW	IDFG	Interior	AR/IRU
Distribute carcasses or alternative nutrient supplements within known bull trout rearing areas in the Pine-Indian-Wildhorse core area.	ODFW-39. Investigate, fund and implement nutrient supplementation in all tributaries to the project	IDFG-17. Supplement nutrients for resident salmonids using spawned carcasses or carcass analogs. Consider focusing initial nutrient supplementation efforts in the Weiser River core area until brook trout suppression efforts in Indian Creek and the Wildhorse River have been effective.	Interior-41. Develop and implement a program to provide bull trout within the project area access to anadromous fish as prey by providing access for anadromous fish to Pine and Indian creeks	AR/IRU-11b. Reintroduce anadromous salmon and steelhead to restore marine-derived nutrients. Carcass outplants may be beneficial in streams where anadromous fish are not reintroduced, but only if nutrients are needed to benefit native species.

Our Analysis

In unobstructed systems, the return of Pacific salmon can represent an important source of nutrients for local biota, particularly in otherwise nutrient-poor systems. Native resident salmonids can benefit from marine-derived nutrients through increased primary production or direct consumption of eggs, fry, and carcasses, (Cedarholm et al., 1999). As proposed by Idaho Power and recommended by ODFW and IDFG, efforts to provide supplemental nutrients to replace those from naturally spawning salmon that have been lost would increase the growth rates, and consequently fecundity, of bull trout and redband trout. Fish populations in tributaries currently receiving considerable nutrient loads from natural sources or due to human activities would experience little benefit from nutrient supplementation. However, because bull trout populations are largely restricted to relatively pristine tributary reaches in the project area, nutrient supplementation targeted toward tributaries that currently support bull trout would likely benefit these populations.

Studies show that carcass outplants increased growth in juvenile coho salmon and steelhead (Bilby et al., 1998) and in resident trout and char (Wipfli et al., 2003). Nutrient supplementation methods other than carcass outplants, however, have not been evaluated. Regardless of the supplementation method, monitoring would be required to determine the effectiveness and utility of continued efforts.

Although fish populations in project tributaries may benefit from supplemental contributions of nutrients, the poor water quality in project reservoirs, particularly in Brownlee reservoir, is largely a result of high nutrient loads (see section 3.5, *Water Quality*). Carcass outplants or other methods of nutrient supplementation would contribute additional nutrient loads to project reservoirs. However, the magnitude of this effect would depend on the scope of tributary supplementation efforts. Considering the discharge volume of the Snake River, the relatively small loads resulting from point-source carcass outplants would likely have a minimal effect on reservoir water quality. Further, because it would be contingent upon the bulk of the nutrient load remaining in tributaries for organism uptake, a successfully implemented nutrient supplementation program would, by definition, contribute minimally to nutrient loads in project reservoirs.

As discussed in section 3.6.2.10, *Tributary Habitat Improvements*, the presence of brook trout adversely affects resident bull trout populations through competition and genetic introgression. In nutrient-poor basins where resources are limited, the re-establishment of marine-derived nutrients could similarly benefit brook trout populations, resulting in increased hybridization and competition with bull trout. Therefore, to maximize the net benefit for bull trout populations, carcass outplants could be targeted for habitats occupied by bull trout, and could avoid areas that are occupied by brook trout. This approach would provide benefits to bull trout without causing an associated increase in brook trout numbers. In addition, if bull trout are found in Eagle Creek, nutrient supplementation could be implemented in this drainage as part of habitat enhancement efforts.

Rather than relying on carcass outplants or other artificial means of nutrient supplementation, Interior and AR/IRU recommend the re-establishment of marine-derived nutrients by facilitating the passage and spawning of steelhead and spring Chinook salmon in tributaries to the project. This approach would distribute marine-derived nutrients more widely and in a more natural manner than carcass outplants. The spawning of anadromous fish would also directly provide forage for resident salmonids in the forms of eggs, fry, and juvenile steelhead and salmon that would otherwise be unavailable. Chandler et al. (2003a) also state that optimal foraging temperatures for bull trout historically coincided with smolt migration, providing an important early season forage base for adult bull trout at a time when energy reserves are depleted. The energy and growth accumulated from this food source likely allowed bull trout to return to tributary habitat as temperatures rose in the summer. Chandler et al. (2003a) also postulate that the additional forage provided by anadromous fish is important for the maintenance of the fluvial life history of resident salmonids. However, as discussed in section 3.6.2.6, *Anadromous Fish Restoration,* Idaho Power's analysis of restoration options concluded that establishing self-sustaining runs of anadromous fish is not likely to be feasible at this time due to several factors, including degraded habitat conditions and low rates of adult returns associated with migration losses during passage through eight mainstem reservoirs and dams in the lower Snake and Columbia rivers. Similarly, NMFS elected not to prescribe fishways for anadromous fish based on the degraded water quality and habitat conditions in both mainstem and tributary habitats.

It is possible to transport and release live surplus adult fish into Hells Canyon reservoir, and IDFG has done this in the past to provide opportunities for a recreational fishery for steelhead. Between 1987 and 1997, IDFG stocked an estimated 3,761 adult steelhead into Hells Canyon reservoir (see table 30). Continuation of this practice, while not expected to produce self-sustaining runs of anadromous fish, would increase forage opportunities for bull trout from the eggs, fry, and carcasses of any fish that spawn in Pine and Indian creeks.

During prospective efforts to eradicate brook trout in tributaries to the project (see section 3.6.2.10, *Tributary Habitat Improvements*), IDFG recommends carcass outplants be distributed in the Weiser River basin. Carcass outplants to this basin would benefit bull trout populations in the Weiser River core area. However, because of the distance of this basin from the Hells Canyon Recovery Area, it is unclear how such a measure would directly benefit bull trout populations in tributaries that have been directly affected by the project.

Regardless of whether marine-derived nutrients are supplied to tributaries through introducing live anadromous fish into Hells Canyon reservoir, as IDFG has done in the past, or through carcass outplants, there are risks associated with the introduction of fish pathogens. Several pathogens have the potential to adversely affect salmonid populations, in and upstream of, the project if they are introduced via upstream passage or carcass vectors (see section 3.6.2.9, *Fish Pathogen Assessment*). Whether these risks are outweighed by the potential benefits associated with the reestablishment of marine-derived nutrients requires careful consideration by management agencies and other stakeholders.

3.6.2.12 Hatchery Production

Idaho Power's hatchery system has been in operation since initial attempts to provide passage were discontinued several years after Brownlee and Oxbow dams were constructed. The intent of the hatchery production was to mitigate for the loss of upstream production of salmon and steelhead and provide fish for harvest. According to the terms of the 1980 Hells Canyon Settlement Agreement and the existing license, current hatchery production goals include annually releasing 1 million fall Chinook salmon, 4 million spring/summer Chinook salmon, and 400,000 pounds of steelhead smolts annually.

Genetic interactions between hatchery and wild stocks may have a negative effect on wild stocks by decreasing their genetic diversity and fitness. Hatchery-produced fish may compete with naturally-spawned fish for prey and habitat in spawning and rearing areas and in migration corridors. This competition may be increased in areas where density is greatest, such as smolt-release areas, or areas where natural spawning habitat is limited. Operational guidelines for producing and releasing hatchery fish, however, would minimize potential negative interactions with wild fish. For example, fish releases can be timed to decrease the potential interactions with wild fish that may be present in the release area.

Marking hatchery releases can allow for selective recreational fisheries that target hatchery fish. In addition, marking would aid in returning natural fish to the river to spawn rather than adding them to hatchery brood stock, thereby decreasing mortality of naturally-spawning stocks.

Idaho Power proposes to continue anadromous fish production at hatchery facilities at the same levels specified in the 1980 Hells Canyon Settlement Agreement and the current license. This includes producing 3 million spring Chinook salmon smolts at the Rapid River Hatchery, 1 million summer

Chinook salmon smolts at the Pahsimeroi Hatchery, 1 million fall Chinook salmon smolts at the Oxbow hatchery, and 400,000 pounds of steelhead smolts[75]. Idaho Power also proposes to make improvements to their hatchery facilities and to hire a full-time biologist to conduct monitoring and evaluation studies of their hatcheries' performance.

We describe Idaho Power's proposed measures for each hatchery below.

- **Pahsimeroi Hatchery**—To control pathogens, particularly *Myxobolus cerebralis*, which causes whirling disease, Idaho Power proposes to develop a pathogen-free source of water for the hatchery by constructing groundwater wells. Idaho Power also proposes to develop a locally-adapted steelhead brood stock that may better survive conditions in the upper-Salmon River-Pahsimeroi Basin. Idaho Power also proposes to monitor and evaluate the performance of hatchery-produced fish relative to state, tribal and federal management goals.
- **Oxbow Hatchery**—Idaho Power proposes to make improvements to the Oxbow fish hatchery by constructing an adult holding pond and spawning facilities, expanding the fall Chinook rearing program to accommodate rearing 1 million smolts annually, and completing general upgrades to the hatchery facilities. Idaho Power also proposes to distribute carcasses to tributaries within the Hells Canyon Project, remove the existing floating barge trap, and conduct studies to monitor and evaluate hatchery performance for smolt-to-adult survival, straying rates, harvest contribution, and other criteria.
- **Niagara Springs Hatchery**—Idaho Power proposes to make improvements to the Niagara Springs hatchery by expanding the hatchery to accommodate rearing up to 2.1 million 2.5-inch steelhead, and upgrading employee housing to accommodate four employees. Idaho Power also proposes to acquire an additional smolt tanker to transport spring Chinook salmon, fall Chinook salmon, and steelhead to various release sites, acquire a fish marking unit capable of clipping adipose fins and tagging fish with coded wire, and monitor and evaluate the performance of hatchery-produced fish relative to state, tribal and federal management goals.
- **Rapid River Hatchery—**Idaho Power proposes to make improvements to the Rapid River Hatchery by upgrading employee housing, constructing an adult holding pond and spawning facilities, and generally upgrading hatchery facilities to improve operational efficiency and safety. Idaho Power also proposes to distribute carcasses above and within known bull trout rearing areas in the Pine-Indian-Wildhorse core area, construct an offsite smolt acclimation/adult collection facility on the Little Salmon River near Stinky Springs (RM 18.6 to RM 21.1), and monitor and evaluate hatchery performance relative to state, tribal and federal management goals.

We summarize agency recommendations pertinent to hatchery production and operations in tables 63 and 64, below.

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[75] The original target production of 4 million spring Chinook salmon was changed (in compliance with rules set out in the 1980 Settlement agreement) by IDFG in 1985 to 3 million spring Chinook salmon and 1 million summer Chinook salmon. This change was meant to focus Idaho Power's hatchery programs on propagation of indigenous Pahsimeroi River summer Chinook salmon rather than the Rapid River spring Chinook salmon, which was not native to the drainage.

Table 63. Hatchery recommendations. (Source: Staff)

Component	Idaho Power	NMFS	ODFW	IDFG	AR/IRU	Nez Perce Tribe	Interior
Production	IPC-9 Continue current production levels: 3 million spring Chinook at Rapid River Hatchery; 1 million fall Chinook at Oxbow Hatchery, 1 million spring/summer Chinook at Pahsimeroi Hatchery, and 400,000 pounds steelhead smolts at Niagara Springs Hatchery.	NMFS-13 Same as Idaho Power.[a]	ODFW-30 Ensure production of current hatchery goals proposed by Idaho Power. Modify production goals to be based on adult returns and societal use.	IDFG-3 Continue current level of smolt production, but identify broader goals for adult return and societal use that can be incorporated in hatchery planning documents	AR/IRU-10 Hatchery program should support naturally reproducing, harvestable anadromous salmonids, to facilitate reintroduction above project. Modify production goals to include adult returns.	NPT-10, 11, 12 Develop management agreement with Nez Perce Tribe, ODFW, IDFG, and NMFS for hatchery production at each hatchery.	Interior-48 Modify production goals to be based on escapement or returns to sport and commercial fisheries.
Planning, monitoring, and evaluations	IPC-8, 9, 10, 11 Monitor and report hatchery performance relative to management goals, including analysis of straying, optimal smolt release size and timing, harvest contributions. Improve operations as necessary to minimize identified negative effects on natural and ESA-listed populations.	NMFS-15 Provide funding to develop or update HGMPs for each hatchery, and operate hatcheries according to the HGMPs. Fund monitoring and evaluation program to evaluate smolt survival, contribution to fisheries, straying to natural spawning areas.	ODFW-25, 26 Develop Hatchery Production Plan that complies with *US v. Oregon* and provides enough Chinook and steelhead to conduct studies and implement reintroduction. Develop long-term monitoring and evaluation program with ODFW and FPRC consultation and approval.	IDFG-3,4,5 Fund fish health monitoring and testing. Monitoring and evaluation should have adaptive management component. Develop monitoring and evaluation program that identifies Idaho Power's mitigation objectives and responsibilities	AR/IRU-10 Develop adaptive management hatchery program Conduct annual assessments. Update every 5 years. Independent consultant evaluate every 5 to 10 years.	NPT-10 Coordinate Snake River fall Chinook production and releases through *US v. Oregon*	

Component	Idaho Power	NMFS	ODFW	IDFG	AR/IRU	Nez Perce Tribe	Interior
		Assess and implement actions to minimize impacts of hatchery steelhead to ESA-listed ESUs.		relative to harvest and recovery goals. Implement identified actions. Fund studies to assess potential adverse effects of hatchery program on ESA-listed steelhead.			
Marking		NMFS-13 Mark all releases with adipose fin clip.		IDFG-6 Fund marking programs that support ESA recovery evaluations and programs			
Staff levels	IPC-8,9,10,11 Fund full-time Idaho Power hatchery evaluation biologists		ODFW-29 Fund full-time hatchery evaluation biologist	IDFG-5 Fund additional staff to conduct monitoring and evaluation evaluations, may require more than one full-time hatchery evaluation biologist.			
Broodstock	IPC-10 Develop locally adapted steelhead broodstock for Pahsimeroi Hatchery over 10-year period.			IDFG-3 Develop locally adapted steelhead broodstock over 10-year period after analyses of hatchery and			

Component	Idaho Power	NMFS	ODFW	IDFG	AR/IRU	Nez Perce Tribe	Interior
				natural steelhead returning to hatchery is completed.			
Hatchery facilities	IPC-8, 9, 10, 11 Upgrade and improve efficiencies of hatchery facilities. Expand Oxbow hatchery to accommodate 1 million fall Chinook production goal.	NMFS-13 Screen all hatchery intake facilities to meet NMFS juvenile screen criteria.	ODFW-30 Upgrade hatchery facilities. Expand Oxbow hatchery to accommodate 1 million fall Chinook production goal.	IDFG-3 Supports Idaho Powers proposal to upgrade and improve to hatchery facilities and programs and expansion of Oxbow hatchery.			
Fish transport	IPC-8 Acquire fish transport vehicle.			IDFG-7 Acquire fish transport vehicle.			
Rapid River trapping/release site	IPC-11 Investigate development of new Rapid River hatchery trapping/release site near Stinky Springs.			IDFG-7 Supports Idaho Power proposal.			

Notes: FPRC – Fish Pass and Reintroduction Committee to be established
HGMP – Hatchery and Genetic Management Plan

[a] NMFS's recommendation letter stated it supported Idaho Power's proposed protection, mitigation, and enhancements for hatchery production. However its recommendation also states that Idaho Power should produce 200,000 steelhead smolts rather than 400,000 smolts, as was proposed by Idaho Power and was agreed to in the 1980 Hells Canyon Settlement Agreement. We therefore assume the 200,000 was a typographical error, and that NMFS intended to recommend production of 400,000 steelhead smolts.

Table 64. Additional hatchery/surplus fish recommendations. (Source: Staff)

Component	Shoshone-Bannock Tribes	NMFS	ODFW
Surplus/additional production	SBT-2 Construct, maintain, and operate two hatcheries at Yankee Fork and Panther Creek for sockeye, Chinook, and steelhead propagation.	NMFS-21 Shoshone-Bannock, Shoshone-Paiute, Burns Paiute Tribes, IDFG, NMFS, and ODFW participate, with FERC acting as mediator, if necessary, to establish an agreement to share excess spring Chinook or steelhead adults returning to Idaho Power hatcheries.	ODFW-27 Consult with ODFW to investigate and supply alternative fisheries in Oregon

Our Analysis

Hatchery Production

Production from Idaho Power-funded hatcheries contributes to commercial, tribal, and recreational fisheries for Chinook salmon and steelhead in the Pacific Ocean and Columbia River basin. In the mixed-stock coastal fisheries of the Pacific Ocean, the presence of hatchery fish allows for higher harvest levels than if there were no hatchery stocks in the fishery. Because wild fish are harvested along with hatchery fish in these coastal commercial and recreational fisheries, higher harvest levels may ultimately affect escapement of wild stocks. Marking hatchery fish with adipose fin clips, together with harvest restrictions on un-marked fish, would help reduce harvest mortality of wild fish.

Hatchery production could also help in the recovery of ESA-listed stocks. Fall Chinook salmon from the Oxbow hatchery facility and summer-run Chinook salmon produced at the Pahsimeroi hatchery are both components of ESA-listed ESUs. Successful hatchery production of these fish would aid in the recovery of these stocks.

Idaho Power's proposal and IDFG and NMFS's recommendation to continue to produce a defined number of fish from its four hatchery programs would provide fish to support commercial, recreational and tribal fisheries in the Columbia River basin and Pacific Ocean. Interior, ODFW, and AR/IRU recommend that Idaho Power hatchery production continue, but that smolt production goals be replaced with adult escapement goals or returns to sport and commercial fisheries, although they did not state specifically what those goals should be.

Measuring performance by escapement to the hatchery allows for evaluation of benefits of hatchery production in enhancing fish populations affected by the project and in meeting management goals of providing fish for harvest and population recovery purposes. However, replacing hatchery production goals with escapement goals would require Idaho Power to be more responsive to annual changes in factors that influence escapement such as ocean conditions, as well as, commercial and recreational harvest management, in addition to factors affecting the survival of hatchery fish they produce. These are factors Idaho Power has no control over. This would potentially require variable production in any given year to meet escapement goals. Such variable production would present challenges in management of production facilities, staffing, and budgeting. Additionally, such goals would be difficult to enforce given the external management and environmental factors that affect escapement success in any given year. However, there is merit to IDFG's recommendation that Idaho Power work with the agencies to develop broader goals on adult returns, which may be useful for developing refinements in broodstock selection and in production or release strategies to improve attainment of management goals and objectives. This recommendation would serve to guide hatchery operations, but would not replace the existing smolt production targets.

ODFW's recommendation to develop a hatchery production plan that complies with revised *United States v Oregon* production plans would help ensure that there are enough summer/spring Chinook salmon, fall Chinook salmon, and summer steelhead to support reintroduction programs and support any fish passage studies that may be included in a new license. This is similar to the AR/IRU and the Nez Perce Tribe's recommendation that they, along with ODFW, IDFG, and NMFS, develop a management agreement for hatchery production, management, and release protocols. Funding the development of a hatchery genetic management plan in consultation with state and federal resource management agencies and the Nez Perce Tribe, (which have management authority as prescribed in *United States v Oregon*), would help minimize conflicts among various agency actions and goals for use of hatchery fish.

Hatchery and Genetic Management Plans

To address the potential take of listed species, NMFS requires that IDFG, as the operator of Idaho Power's hatcheries, develop an HGMP for each of Idaho Power's hatcheries. The elements that are required to be included in an HGMP are defined in the final 4(d) rule issued by NMFS on July 10, 2000 (65 FR 42,425). The final 4(d) rule requires that:

- The HGMP has clearly stated goals, performance objectives, and performance indicators that indicate the purpose of the program, its intended results, and measurements of its performance in achieving those results.
- Listed salmonids are purposefully taken for broodstock purposes only if the donor population is currently at or above the viable threshold and the collection will not impair its function, if the sole objective of the current collection program is to enhance the propagation or survival of the listed ESU, or if the collection will not appreciably slow the attainment of viable status for that population.
- The HGMP takes into account health, abundance, and trends in the donor population, and broodstock collection programs reflect appropriate priorities, including reestablishing indigenous salmonid populations for conservation purposes. After the species' conservation needs are met and when consistent with survival and recovery of the ESU, broodstock collection programs may be authorized by NMFS for secondary purposes, such as to sustain tribal, recreational, and commercial fisheries.
- The HGMP includes protocols to address fish health, broodstock collection, broodstock spawning, rearing and release of juveniles, deposition of hatchery adults, and catastrophic risk management.
- The HGMP evaluates, minimizes, and accounts for the propagation program's genetic and ecological effects on natural populations, including disease transfer, competition, predation, and genetic introgression caused by the straying hatchery fish.
- The HGMP describes interrelationships and interdependencies with fisheries management, and artificial propagation programs and harvest management are designed to provide as many benefits and as few biological risks as possible for the listed species.
- Adequate artificial propagation facilities exist to properly rear progeny of naturally spawned broodstock, maintain population health and diversity, and avoid hatchery-influenced selection or domestication.
- Adequate monitoring and evaluation exist to detect and evaluate the success of the hatchery program and any risks that would potentially impair the recovery of the listed ESU.
- The HGMP provides for evaluating monitoring data and making any revisions of assumptions, management strategies, or objectives that the data indicate are needed.
- NMFS provides written concurrence with the HGMP and specifies the implementation and reporting requirements.
- The HGMP is consistent with plans and conditions set within any federal court proceeding with continuing jurisdiction over tribal harvest allocations.

Completion and implementation of an HGMP for each hatchery would ensure that Idaho Power's hatchery programs are managed in a manner that is in conformance with ESA recovery plans and would help to further efforts to increase populations of ESA-listed fish. Such plans would also ensure that any monitoring and evaluation efforts that are needed to measure effects on listed species are conducted and that appropriate adjustments are made if objectives are not met or additional measures are needed to protect listed ESUs.

The developed HGMPs should reflect goals and objectives that are consistent with Idaho Power's mitigation requirements and *United States v Oregon* production plans, as well as address the management goals of the fisheries management agencies and tribes. To ensure that this happens, it would be beneficial for Idaho Power to consult with the fisheries management agencies and interested tribes to define the appropriate goals and objectives of its hatchery program. This initial planning effort would form the basis for each HGMP. As noted above, the HGMPs are required to include clearly stated goals, performance objectives, and performance indicators that outline the purpose of the program and its intended results, as well as a means to measure performance in achieving those results. This consultation would provide all parties, including Idaho Power, an opportunity to provide input into defining the goals and objectives for each hatchery.

Hatchery Facilities

Idaho Power's proposals and agency and tribal recommendations to upgrade, modify, and in some cases expand its hatchery facilities or operations would increase efficiencies, capacities, and staff safety to better meet current and future production goals, as well as monitoring and evaluation requirements. Updating facilities with current technology would likely decrease fish handling stress and mortality. We assess hatchery-specific measures and facility upgrades/modifications below.

Pahsimeroi Hatchery

Idaho Power's proposal to develop a pathogen-free source of water by constructing groundwater wells would decrease the possibility of whirling disease caused by *Myxobolus cerebralis* found in current source water from the Pahsimeroi River. Currently hatchery fish can become infected, resulting in decreased survival of hatchery fish and/or a potential for infecting wild fish with whirling disease.

Idaho Power's proposal and IDFG's recommendation to develop a locally adapted steelhead brood stock would likely result in a steelhead population that is better suited to survive conditions in the upper Salmon and Pahsimeroi rivers. Such a stock would likely exhibit lower straying rates, potentially reducing negative effects of straying on other populations, and would ultimately lead to an increase in returns and survival of native steelhead in the Upper Salmon and Pahsimeroi rivers.

Oxbow Hatchery

Idaho Power's proposal to upgrade existing facilities and expand the hatchery to provide adult holding and spawning facilities, and to accommodate rearing up to 1 million fall Chinook smolts, would aid in stock recovery efforts. This would enable the hatchery to contribute more fish to the population. ODFW and IDFG also recommend these actions, which would aid in the development of a fall Chinook broodstock at the hatchery. This would eventually reduce the reliance on the Lyons Ferry Hatchery for fall Chinook broodstock for the hatchery.

Idaho Power's proposal and ODFW's recommendation to distribute carcasses from Oxbow hatchery to tributaries within the project would reintroduce a source of marine-derived nutrients and carbon that was lost historically. The presence of these nutrients contributes to the biotic productivity of a freshwater stream by increasing nutrients that enhance the aquatic macroinvertebrate and zooplankton forage base, which would benefit native fishes such as bull trout.

Niagara Springs Hatchery

Idaho Power's proposal to acquire an additional smolt tanker to transport spring Chinook salmon, fall Chinook salmon, and steelhead to various release sites would decrease the amount of time it currently takes to release fish from the hatchery (45 days) by increasing the transport capacity from two tanker-trailers to three. IDFG states that reducing transport time would help to optimize release timing for smolts, and help minimize residualism and maximize downstream survival (Dorman and Chapman, 2004).

All smolts currently released from Idaho Power's mitigation program are marked with an adipose fin clip, and some are also tagged with coded wire tags or passive integrated transponders (PIT tags). Acquiring a fish marking unit capable of clipping adipose fins and tagging fish with coded-wire tags would increase the efficiencies of this program, and allow for continued identification of hatchery fish from naturally-spawning fish. This would enable selective fishery management, as well as facilitate evaluations of interactions between hatchery and natural stocks.

Rapid River Hatchery

Distributing carcasses above and within known bull trout rearing areas in the Pine-Indian-Wildhorse core area would reintroduce a source of marine-derived nutrients and carbon that was lost historically. As noted above, the presence of these nutrients contributes to the biotic productivity of freshwater streams, which is expected to benefit native fishes such as bull trout.

Idaho Power proposes, and IDFG supports, constructing an offsite spring Chinook smolt acclimation/adult collection facility on the Little Salmon River near Stinky Springs (RM 18.6 to RM 21.1). Releasing fish at an additional site would help distribute adult returns to the Little Salmon River, potentially increasing harvest opportunities for recreational and tribal anglers who actively fish those areas. The collection site would also provide a contingency backup for the Rapid River hatchery for spring Chinook broodstock collection.

Additional/Surplus Fish

ODFW states that a disproportionate number of hatchery releases occur in Idaho, resulting in decreased opportunities for Oregon anglers. It recommends Idaho Power consult with ODFW to modify the hatchery program to address the loss of fishing opportunities for Oregon's anglers. Potential measures suggested by ODFW include developing a fall steelhead fishery in the Powder River below Mason dam or developing a rainbow trout supplementation program in Phillips and Brownlee reservoirs. Such programs would provide fish to increase opportunities for recreational harvest in Oregon.

IDFG and ODFW currently stock large numbers of fingerling and smaller numbers of catchable rainbow trout in project reservoirs, especially in Brownlee reservoir and several of the tributaries in the project area (table 30). Increased stocking of rainbow trout in Brownlee reservoir would adversely affect redband and bull trout through increased competition, introgression, and harvest. This could impede efforts to restore redband and bull trout populations through the tributary habitat improvement and fish passage measures that are proposed by Idaho Power.

NMFS recommends Idaho Power establish an agreement to share and distribute live adults that return to Idaho Power hatcheries and that are not needed to fulfill production or other obligations such as those stipulated in *United States v Oregon*. Also, during tribal consultation meetings held in March, 2007, the Burns Paiute and Shoshone-Paiute tribes expressed concerns that they had lost access to anadromous fish since the construction of the Hells Canyon Project. They stated concerns that restoration of anadromous fish to their historical fishing grounds may not take place for many years. The Burns Paiute Tribe expressed particular interest in anadromous fish restoration efforts on the Malheur River, and the Shoshone-Paiute Tribes expressed interest in restoration efforts (to establish subsistence and ceremonial fisheries) in the Owyhee River.

In the past, surplus adult spring Chinook salmon and steelhead returning to Idaho Power's hatchery system have been used to support tribal and recreational fisheries. Between 1985 and 1990, a total of 6,617 surplus adult spring Chinook salmon were released into tributaries in the Salmon River basin including the Yankee Fork, Panther Creek, and the Lemhi River (Abbott and Stute, 2003). Between 1966 and 2000, IDFG released a total of 45,588 surplus adult steelhead to support recreational fisheries in Hells Canyon reservoir and in the Boise and Payette rivers (Abbott and Stute, 2003). We have found no information in the record that indicates whether these practices have continued since 2000, or whether Idaho Power has borne the cost of transporting and releasing surplus hatchery spring Chinook salmon and steelhead in the past.

Multiple benefits could be realized by distributing surplus salmon and steelhead. First, placing surplus fish in the project reservoirs and select tributaries within the project area would add a source of marine nutrients to the system and improve forage for bull trout. Second, planting spring Chinook salmon and steelhead in Pine Creek would provide Idaho Power, the resource agencies, and the tribes an opportunity to evaluate spawning success, egg viability and survival, and smolt outmigration and survival. Third, planting surplus fish into tributaries in the project area would help support recreational fishery opportunities in the project area. Finally, the use of surplus hatchery fish to provide fisheries for the aforementioned tribes would allow the tribes to resume subsistence and ceremonial fisheries that are clearly of substantial cultural importance.

Yankee Fork and Panther Creek

The Shoshone-Bannock Tribes recommend Idaho Power develop hatcheries on the Yankee Fork and at Panther Creek for the purpose of recovering wild stocks of sockeye salmon, Chinook salmon, and steelhead. The Yankee Fork, a tributary to the Salmon River near Sunbeam, Idaho, historically supported populations of spring/summer Chinook salmon. Panther Creek flows into the Salmon River east of the confluence of the Middle Fork Salmon River. Runs of Chinook salmon and steelhead in Panther Creek were largely eliminated as a result of mining activities in the drainage beginning in the 1940s (Reiser, 1986). The tribes report that ongoing restoration activities have resulted in near complete restoration of these tributaries, and that they could again support native fish populations.

Since 1995, the Shoshone-Bannock Tribes have implemented a project using streamside egg incubators to supplement and improve the viability of natural populations of steelhead and spring/summer Chinook salmon in Salmon River tributaries. The program includes several incubator sites on Yankee Fork. The tribes have typically obtained approximately 1,000,000 eyed steelhead eggs from the Sawtooth and Pahsimeroi fish hatcheries for this program (IDFG et al., 2007). In addition, smaller numbers of spring/summer Chinook salmon have been supplied to the program from a captive rearing project funded by BPA (IDFG, 2002).

Streamside incubators are a low-tech, low-cost method for hatching eggs that provides hatch rates comparable to hatcheries. Eggs are incubated and hatched in a more natural thermal environment, and the fry then emigrate from the boxes and rear in the stream where they are exposed to selective pressures that favor attributes that are favorable for survival in the wild. Although survival rates during the freshwater rearing phase are lower than a hatchery environment, the surviving smolts are likely to be more genetically and physiologically fit than hatchery fish. They also have more opportunity to develop predator avoidance skills, which increases survival during out-migration. These factors are expected to result in comparable adult production for a given number of broodstock or eggs (Galindo and Rinehart, 1998), but at a much lower cost than hatchery production. Natural selection during rearing in the stream environment is likely to produce fish that are more suitable for rebuilding natural stocks and for promoting recovery of listed ESUs.

During tribal consultation meetings held in March 2007, the Shoshone-Bannock Tribes indicated that they are especially interested in establishing a hatchery on the Yankee Fork, due to extensive habitat restoration work undertaken there. The tribes reported that their enhancement programs have relied on obtaining fish and eggs from state and federal hatcheries, but that these are provided only when there are surplus eggs available. They indicated that recent requests for fish and eggs have been turned down. We also note that the 2005 HGMP for the Sawtooth/Hagerman summer steelhead A-run program indicates that the ability of these hatcheries to supply steelhead eggs to the streamside incubator program is uncertain. Developing facilities that would allow the Shoshone-Bannock Tribes to collect and spawn their own broodstock and incubate eggs to the eyed stage would increase the tribes' assurance of obtaining sufficient eggs to maintain their program, and contribute to rebuilding the Snake River steelhead and spring/summer Chinook salmon ESUs in Yankee Fork.[76]

Providing additional sources of fish in these tributaries would (1) contribute to restoration of the Snake River steelhead and spring/summer Chinook salmon ESUs, and (2) increase the potential for harvest opportunities for ceremonial, subsistence, and recreational purposes in this portion of the Salmon River drainage. Although habitat in the Yankee Fork and Panther Creek have not been directly affected by construction or operation of the Hells Canyon Project, the project does affect river flows and water quality conditions in the migratory corridor downstream of the confluence of the Salmon and Snake rivers, including elevated TDG levels during high spill periods and reduced flows during the smolt out-migration period caused by flood control operations at Brownlee reservoir.

3.6.2.13 Sturgeon Conservation Measures

Construction of the Hells Canyon Project and 10 other dams on the Snake River downstream from Shoshone Falls (figure 1, table 3) and other mainstem dams on the Columbia River eliminated upstream connectivity and gene flow among sturgeon populations over most of their historical range in the basin. Prior to development, this species could move freely between the ocean, estuaries, the Columbia River, and the Snake River upstream as far as Shoshone Falls (Idaho Power, 2003b). The loss of connectivity caused by dam construction contributed to a severe reduction in the abundance of white sturgeon in most river segments, many of which do not provide the type, quality and quantity of habitat required to maintain self-reproducing populations. Idaho Power's monitoring studies indicate that little or no recent recruitment has occurred in seven of the nine populations that are isolated by mainstem dams on the Snake River between Shoshone Falls and Lower Granite dam (Idaho Power, 2003b). Rebuilding sturgeon populations in these reaches would serve to restore recreational and tribal sturgeon fisheries, increase population resiliency, and conserve the genetic characteristics of Snake and Columbia River sturgeon. Rebuilding the Snake River populations would provide a source of broodstock that could be used to restore downstream populations if a catastrophic loss occurred in the lower Columbia River from factors such as disease, a chemical spill, or the long-term effects of contaminant accumulation.

Idaho Power established a technical committee to address sturgeon conservation issues associated with its mainstem hydroelectric projects within the historical range of the white sturgeon, which includes the Hells Canyon Project and five upstream developments (Upper Salmon Falls, Lower Salmon Falls, Bliss, C.J. Strike, and Swan Falls). In consultation with the technical committee, Idaho Power developed a conservation plan that identifies conservation measures to be implemented by Idaho Power in the reaches associated with each of these hydroelectric projects. The five sturgeon conservation measures proposed in the license application for the Hells Canyon Project are:

1. assessment of water quality-related impacts on early life stages of white sturgeon in the Swan Falls to Brownlee reach;
2. translocation of reproductive-sized white sturgeon to the Swan Falls to Brownlee reach;

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[76] Because of the extremely low number of sockeye salmon that currently return to the Salmon River Basin, we consider it unlikely that adult sockeye broodstock would be available for collection and spawning in the Yankee Fork.

3. development of an experimental conservation aquaculture program for the Swan Falls to Brownlee reach;
4. conducting population assessments and monitoring the genotypic frequencies of white sturgeon in Snake River reaches between Swan Falls and Lower Granite dams every 10 years; and
5. monitoring of genotypic frequencies..

Recommendations by agencies, tribes, and NGOs relating to sturgeon conservation are summarized in table 65, and are discussed below. Their recommendations focus on Idaho Power's proposed measures and several additional measures, including evaluating the need for passage or anti-entrainment measures, measures to improve water quality, and changes in operations to improve reproduction at Idaho Power's upstream projects.

Our Analysis

Conservation Plan Development

Idaho Power developed a White Sturgeon Conservation Plan that includes measures associated with each of its mainstem hydroelectric projects on the Snake River. The latest version of the plan (Idaho Power, 2005k) includes a proposed implementation schedule for measures proposed for each of the river segments delineated by Idaho Power's mainstem dams between Shoshone Falls and Lower Granite reservoir.

Regarding actions associated with the upstream Idaho Power projects, Article 407 of the licenses issued for the Upper Salmon Falls, Lower Salmon Falls and Bliss Projects and article 408 of the license issued for the C.J. Strike Project required Idaho Power to develop a white sturgeon conservation plan, including appropriate measures for the protection and enhancement of white sturgeon in the Snake River. Idaho Power filed the plan in compliance with these license articles in August 2005, and measures in the plan associated with the four upstream projects were approved by the Commission on May 31, 2006.

Several parties recommend that the conservation plan be updated to include their recommendations for the Hells Canyon Project. In addition, Interior recommends that Idaho Power develop an action plan to coordinate basin-wide implementation.

The existing White Sturgeon Conservation Plan provides a useful framework for evaluating measures associated with each of Idaho Power's projects located on the mainstem Snake River. We evaluate enhancement measures for the white sturgeon later in this section, including those proposed by Idaho Power in the conservation plan and the recommendations of other parties. Any new license issued for the project would include those measures deemed necessary by the Commission. The measures included in any license could include some or all of the measures that are proposed in the conservation plan for the project, and could also include other measures that have been recommended by stakeholders or developed by staff. The license articles would include any provisions that are needed to monitor the effectiveness of the adopted measures, to coordinate with measures that are associated with the upstream projects on the Snake River, and to facilitate adaptive management. Because these needs would be fulfilled through appropriate articles that would be included in the new license, we see little or no benefit in requiring Idaho Power to update the conservation plan.

Table 65. Recommended measures related to white sturgeon conservation. (Source: Staff)

Component	AR/IRU	IDFG	Interior	ODFW	Umatilla Tribes	Nez Perce Tribe
Conservation plan		IDFG-21. Use the White Sturgeon Conservation Plan to contribute to the long-term goal of restoring healthy white sturgeon populations.	Interior-51, 52. Promptly implement proposed conservation measures; implement a river-wide action plan, in consultation with FWS, state fish and wildlife agencies, and interested tribes.	ODFW-42. Update and implement measures identified in the White Sturgeon Conservation Plan.	CTUIR-13. Develop a plan that promotes rebuilding of white sturgeon populations within the area of potential effect.	NPT-18. Implement conservation measures to enhance population viability and persistence from Bliss dam to Lower Granite reservoir.
Conservation aquaculture	AR/IRU-12c. Develop conservation aquaculture program, examine genetic implications, consider expanding program to reaches other than Swan Falls after recruitment studies are completed	IDFG-24. Focus initial efforts on habitat restoration; evaluate genetic implications of hatchery supplementation on wild stocks before developing an experimental conservation aquaculture program.	Interior-53. Develop and implement a White Sturgeon Conservation Aquaculture Plan, including construction of an operational hatchery facility within 4 years.	ODFW-42. Focus initial efforts on habitat restoration; evaluate genetic implications of hatchery supplementation on wild stocks before developing an experimental conservation aquaculture program.	CTUIR-18. Supplement existing populations to rebuild them to pre-project levels and supply a harvestable surplus.	NPT-18. Begin to re-establish recruitment to populations where natural recruitment is severely limited; reestablish populations such that tribal harvest may occur.
Translocation	AR/IRU-12f. Do not translocate sturgeon until limiting factors have been determined and addressed, and effects on donor populations have been evaluated.	IDFG-23. Conduct feasibility studies prior to translocating reproductive-sized white sturgeon to the Swan Falls to Brownlee dam reach.		ODFW-47. Investigate opportunities for translocating sturgeon to the Swan Falls to Brownlee reach.		

Component	AR/IRU	IDFG	Interior	ODFW	Umatilla Tribes	Nez Perce Tribe
Passage and entrainment protection	AR/IRU-12d, 12e. Determine whether passage is a limiting factor; connect sturgeon populations; implement anti-entrainment and impingement measures at projects where sturgeon are at risk; reduce trash rack spacing at C.J. Strike.		Interior-50b, 55. Determine which Idaho Power dams need to have their trashracks replaced to protect juvenile sturgeon from entrainment; install protective trash racks at CJ Strike and Bliss dams.			
Water quality studies and improvements	AR/IRU-12b, 12g. Monitor success of sturgeon spawning and early life history stages; implement water quality improvement measures elsewhere in the basin to aid in sturgeon recovery.	IDFG-22. Assess effects of degraded water quality on early life stages and recruitment success in the Swan Falls to Brownlee reach as proposed by Idaho Power	Interior-50a. Implement water quality improvement measures elsewhere in the basin to aid in sturgeon recovery	ODFW-44, 46. Assess effects of degraded water quality on early life stages and recruitment success in the Swan Falls reach; implement water quality measures to aid in sturgeon recovery.		

Component	AR/IRU	IDFG	Interior	ODFW	Umatilla Tribes	Nez Perce Tribe
Operations at upstream dams, population monitoring	AR/IRU-12a. Implement run-of-river operations at Lower Salmon Falls Bliss, C.J. Strike projects during sturgeon spawning, incubation and early life stages.	IDFG-25, 26. Conduct long-term population assessments and genetic monitoring of white sturgeon as proposed by Idaho Power	Interior-50c. Determine the potential benefits of implementing a seasonal run-of-river operation at Lower Salmon Falls, Bliss, C.J. Strike and Hells Canyon dam to promote sturgeon spawning.	ODFW-45, 48. Conduct stock assessments and genetic monitoring between Swan Falls and Brownlee dams, in Oxbow and Hells Canyon reservoirs, and downstream of Hells Canyon dam		

Population Supplementation

Population sampling conducted by Idaho Power between Shoshone Falls and Lower Granite dam indicates that populations in seven out of the nine segments delineated by mainstem dams do not consistently support successful reproduction and thus are not self-sustaining. The results of Idaho Power's sampling program indicates that the sturgeon population is particularly depressed in the Swan Falls dam to Brownlee segment and in all three of the Hells Canyon Project reservoirs (figure 107).

Idaho Power proposes a phased approach to rebuilding the white sturgeon population in the Swan Falls to Brownlee reach, which would start with studies to evaluate the effects of water quality conditions on spawning success and survival of early life-stages. Based on the results of these studies, adult sturgeon would be translocated from a donor population, or, if current water quality conditions would not support natural reproduction, a conservation aquaculture program would be implemented to rebuild white sturgeon populations in the Swan Falls to Brownlee reach.

Idaho Power's proposal represents a logical stepwise approach to rebuilding white sturgeon populations in the Swan Falls to Brownlee reach. However, implementation of a conservation hatchery program could have several advantages as a means for rebuilding sturgeon populations. This approach would provide a much greater level of assurance that juveniles could be recruited to the recipient populations on a yearly basis. This would provide a much more rapid and certain path toward rebuilding sturgeon populations to levels that could support a tribal and non-tribal harvestable fishery, especially in shorter river segments such as the Brownlee to Oxbow dam reach and the Oxbow to Hells Canyon dam reach. These reaches do not include the full complement of habitats that are needed to support a self-reproducing population. Because sturgeon are a highly fecund species, collection and spawning of a small number of adult fish each year could provide sufficient juvenile production to simultaneously rebuild sturgeon populations in most, and perhaps all, of the interdam segments where population levels are depressed. The potential success for rapid population rebuilding is evident from results observed in the Shoshone Falls to Upper Salmon Falls reach, where IDFG stocked 1,588 juvenile sturgeon between 1989 and 2000, and the adult population has increased from very low levels to an estimated population of 777 sturgeon over 70 mm by 2001 (Idaho Power, 2005k). Only two out of the 251 sturgeon collected in Idaho Power's 2001 survey were of wild origin.

Although a conservation hatchery program would need to be carefully designed to ensure that it does not cause adverse genetic effects, several factors lead us to conclude that these risks can be addressed. First, a substantial amount of work has gone into designing the conservation aquaculture program that is being implemented to rebuild the ESA-listed sturgeon population on the Kootenai River (FWS, 1999). This work should provide a sound foundation for designing a conservation aquaculture program for the Snake River. Second, the population sizes of potential donor populations on the Snake River are substantially larger than the population on the Kootenai River. This means that a large number of reproductive adults and potential parental lines are available for incorporation into the program in any given year. Third, recent genetic work indicates that there is very little genetic differentiation between white sturgeon found in the Snake and Lower Columbia rivers (Idaho Power, 2003b). This suggests that a considerable degree of sturgeon movement occurred between the Snake and Columbia rivers prior to development.

Sturgeon are a very long-lived and late maturing species. Thus, it is unlikely that substantial selective adaptation has occurred in the time since the population was fragmented by dam construction. Because the smaller Snake River population was likely integral with the Columbia River population prior to development, using some brood stock from the robust sturgeon population in the lower Columbia River would help to restore gene flow and genetic variability in the white sturgeon populations that are now isolated in the interdam segments of the Snake River. However, we understand that IDFG and ODFW have concerns about potential genetic implications of stocking hatchery fish, and that the state agencies

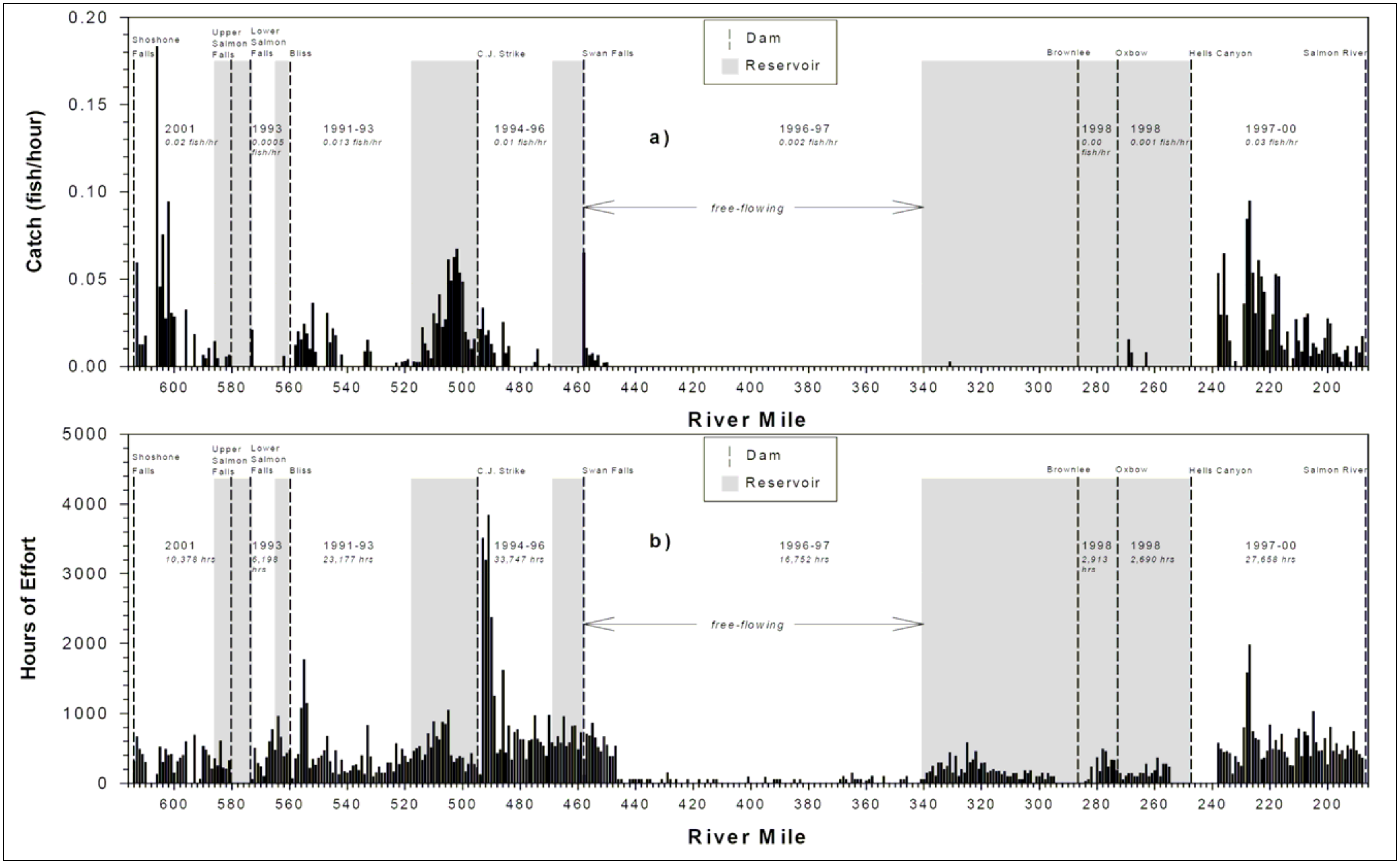

Figure 107. Catch rates and hours of effort expended sampling for white sturgeon with setlines in the Snake River between Shoshone Falls and the confluence with the Salmon River. (Source: Idaho Power, 2003b)

have the authority to regulate any stocking program that would occur. Developing a feasibility assessment that compares the risks and benefits of translocation versus a conservation aquaculture approach could assist with determining which approach may be appropriate and acceptable to the state management agencies in each reach.

Upstream Passage

Idaho Power conducted a review of passage alternatives, as well as constraints associated with passing white sturgeon upstream and downstream of the Hells Canyon Project (Wittmann-Todd et al. 2003). Idaho Power concludes that capture-and-transport represents the most reliable solution for providing upstream passage for sturgeon, and that all other options have biological uncertainties, particularly options that rely on volitional responses. Based on the uncertainty of effective upstream passage technologies, it does not appear that construction of upstream passage facilities is currently a viable means for restoring sturgeon populations or for maintaining the genetic variability of Snake River white sturgeon. Further, providing sturgeon passage, even if it were to become technically feasible, is not likely to be as effective as a conservation aquaculture program for rebuilding sturgeon populations to levels that would support viable recreational and tribal fisheries throughout the species' historical range in the Snake River.

At the 10(j) meeting, Idaho Power indicated that it intends to continue holding annual meetings of the White Sturgeon Technical Advisory Committee to report on the results of monitoring and studies, and to assist with guiding the implementation of measures contained in the White Sturgeon Conservation Plan. This provides an opportunity for discussion and consideration of any new information or approaches for restoring sturgeon passage that may be applicable to the Hells Canyon Project. If any potentially feasible measures are identified, their possible implementation could be addressed through a license amendment.

Entrainment Protection

The potential need for, and benefits of, implementing measures to protect sturgeon from entrainment and impingement, as recommended by AR/IRU and Interior, can be assessed by monitoring population responses after recruitment has been restored to the subject populations. Although Idaho Power's studies indicate that some sturgeon do move downstream and are vulnerable to mortality from injuries caused by turbine passage, the general health of populations in the Bliss and Hells Canyon reaches indicate that the number of fish that move downstream is not high enough to cause a substantial reduction in these populations. In addition, the radio telemetry studies conducted by Lepla et al. (2003) indicate that sturgeon in Brownlee reservoir tended to remain in the upstream third of the reservoir, suggesting that the entrainment potential at Brownlee reservoir may be quite limited. It is difficult to quantify the effects of downstream emigration and turbine mortality on population sizes in other reaches until recruitment to these populations has been restored. If recruitment were restored, periodic population monitoring could be conducted to determine the extent to which sturgeon populations in any specific reaches are affected by losses from entrainment or impingement. Only after the rate of loss at specific developments has been determined could an informed analysis be conducted of the potential benefits of implementing protective measures.

If reducing trash rack spacing were to be considered, the potential to increase mortality by impinging juvenile sturgeon on the trashracks would need to be addressed. Idaho Power reports that the clear opening between bars of the trashracks at the Brownlee, Oxbow and Hells Canyon intakes are 3.625 inches wide by 7.625 inches high, 4.75 inches wide by 20 inches high, and 5.5 inches wide by 17 inches high, respectively. Water velocities at the trash racks, as estimated by Idaho Power range from 3 feet per second at the Brownlee and Oxbow intakes, to 3.5 feet per second at the Hells Canyon intake. These velocities may exceed the swimming capability of fairly large sturgeon when water temperatures are low and swimming capability is reduced.[77] Given the length-to-width ratio of 4:1 reported by Scott and Crossman (1973), the largest sturgeon that could pass through the racks at Brownlee, Oxbow and Hells Canyon intakes would be 14.5, 19 and 22 inches, respectively. Because of the sturgeon's limited swimming capability, reducing the trash rack spacing by replacing the existing racks would increase the potential for impingement of any sturgeon that do not have sufficient swimming capability to fight the current approaching the trashrack and are too large to pass through the trashracks. Impingement could result in higher mortality rates than turbine passage, and would reduce recruitment that would otherwise occur to the downstream population from fish that survive turbine passage. Expanding the size of the intake and trashrack structure could reduce approach velocities and the potential for impingement, but would involve substantial capital costs, given the engineering challenges of constructing a large structure in a deepwater forebay environment.

Water Quality Enhancement

Implementing measures to improve water quality conditions in the basin could benefit sturgeon by improving reproduction and preventing water-quality related fish kills, especially in the Swan Falls to Brownlee reach. We note, however, that no water quality-related kills of adult sturgeon have been reported since the 1990 kill of 28 adult sturgeon that occurred in the transition zone of Brownlee reservoir. Furthermore, water quality conditions are expected to slowly start to improve over the next license term as TMDL implementation proceeds, which should reduce the potential for adverse effects of poor water quality conditions in the Swan Falls to Brownlee reach.

Mid-Snake Project Operations

Any changes to operation of the upstream Idaho Power projects, including changes designed to benefit white sturgeon, would be evaluated and implemented through a license amendment or through the Commission's license re-opener process for these projects.

Population Assessments and Genetic Monitoring

Periodic population monitoring, as proposed by Idaho Power, would provide information on population responses to implemented measures and to changes in environmental conditions, including improvements in water quality that should start to occur over the next license term with TMDL implementation. As noted above, periodic monitoring would be useful for determining the effectiveness of a conservation aquaculture or translocation program, if implemented, and the potential benefits of implementing additional protective measures to reduce entrainment or impingement. Given the late maturation and long lifespan of the species, monitoring at 10 year intervals in each reach should be sufficient to document changes in population status and the need for altering management or implementing additional conservation measures.

Given the migratory nature of the species and the results of recent genetic surveys, we conclude that there is a clear basis supporting the benefits of re-establishing gene flow from the lower Columbia River into the currently isolated sturgeon populations in the Snake River. These benefits would include restoring genetic variability to the Snake River populations and development of a robust population that could serve as a donor stock in the event that at catastrophic loss of downstream populations were to occur. Because of its greater exposure to contaminants from upstream sources and from shipping traffic, we consider the population in the lower river to be vulnerable to such a catastrophic loss from the

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[77] Studies of the swimming ability of lake sturgeon conducted by Peake et al. (1997) indicate that sustained swimming speeds at 14°C were approximately 25 and 85 cm per second (0.8 and 2.8 feet per second) for sturgeon 45 and 120 cm (17.8 and 47.2 inches) in length, respectively.

potential influence of disease, chemical spills, or the long-term effects of contaminant exposure. In addition, genetic monitoring would be useful for selecting the appropriate donor stock for a translocation or aquaculture program, and for monitoring the effects of the program on both donor and recipient populations.

3.6.2.14 Sediment Augmentation

Project-related effects on sediment transport may affect fall Chinook habitat by reducing: (1) the availability of gently sloping shorelines that provide favorable conditions for fall Chinook rearing habitat; (2) the availability of suitable gravel for spawning; and (3) turbidity levels during smolt outmigration, which may increase vulnerability to predation. In section 3.4.2.2, *Sediment Augmentation and Monitoring*, we provided a general evaluation of measures recommended by stakeholders to monitor sediment transport processes and to address project effects on sediment supply and transport. In this section, we provide a more detailed evaluation of measures that relate to effects on fall Chinook spawning and rearing habitat.

Our Analysis

Although we conclude in section 3.4.1.2, *Beaches and Terraces*, that the number and volume of sandbars in the upper Hells Canyon reach has been reduced, it is likely that the gently-sloping shorelines that provide favorable fall Chinook salmon rearing habitat were never prevalent in this reach because of its relatively high gradient, confined channel, and powerful hydraulic forces. Therefore, due to the channel characteristics, even restoring sandbar numbers and volume to pre-impoundment conditions would only slightly increase rearing habitat.

Restoring the sandbars to pre-impoundment conditions would require replacing the total volume of fine sediment trapped by the project reservoirs. Even if this could be accomplished, it is not likely to substantially improve rearing habitat. Juvenile fall Chinook salmon produced upstream of the Salmon River would tend to move downstream to seek out and use the more suitable and abundant rearing habitat that is provided in downstream areas. We anticipate that addition of smaller amounts of fine sediment, such as specified by the Forest Service in FS-4, would provide negligible benefits to fall Chinook salmon rearing habitat.

To determine the potential benefits of gravel augmentation, we reviewed recent trends in the abundance and distribution of fall Chinook spawning activity in the Hells Canyon reach to evaluate whether there is a need for additional spawning habitat.

Spawning-size gravel likely comprises a small proportion (on the order of 10 percent of the combined coarse sand and gravel component, or 1 to 2 percent of the total sediment load) that is trapped in project reservoirs each year. In addition, any gravel that is added downstream of Hells Canyon dam is likely to be retained within the Hells Canyon reach for a longer duration than fine sediments. To determine the potential benefits of gravel augmentation, we reviewed recent trends in the abundance and distribution of fall Chinook spawning activity in the Hells Canyon reach to evaluate whether there is a need for additional spawning habitat.

As previously discussed in *Anadromous Fish Spawning*, the number of fall Chinook spawning in the Hells Canyon reach has increased 4- to 5-fold since 1999, and the population may be approaching the capacity of available spawning and rearing habitat. In addition, the proportion of fish that spawn upstream of the Salmon River has been increasing in recent years (table 66), increasing the potential for adverse effects on eggs that are damaged or dislodged due to redd superimposition.

Table 66. Percentage of fall Chinook redds observed in the mainstem Snake River, by reach, 1991 to 2000. (Source: Groves, 2001, as modified by staff)

	Percentage of Redds Observed by Reach		
Year	**Hells Canyon Dam to the Salmon River**	**Salmon River to Grande Ronde**	**Grande Ronde to Lower Granite Reservoir**
1991	37	0	63
1992	34	0	66
1993	15	9	76
1994	55	31	14
1995	46	45	9
1996	50	40	10
1997	42	9	49
1998	74	12	14
1999	78	14	8
2000	66	22	12

In the draft EIS, we recommended that a small-scale pilot gravel augmentation study be implemented to evaluate the potential benefits of gravel augmentation on the quantity of spawning habitat available to fall Chinook salmon. We recommended that the scale and duration of the gravel augmentation pilot study be determined in consultation with state and federal resource agencies and tribes. We indicated that because the operation of Brownlee reservoir for flood control reduces the incidence and magnitude of peak flood events, the addition of as little as 10 percent of the amount of gravel that is trapped in the project reservoirs each year could provide a substantial increase in the amount of spawning gravel that is available to spawning fall Chinook salmon in the upper Hells Canyon reach. We also indicated that the pilot gravel augmentation program would provide an opportunity to evaluate the effects of turbidity on predation losses of outmigrating juvenile fall Chinook salmon.

Most of the comments we received on our recommended pilot gravel augmentation program noted that the quantity of gravel we recommended to be added would not be sufficient to have a noticeable effect. Idaho Power commented that there is no evidence that spawning gravel below Hells Canyon dam is deficient or in need of augmentation, noting that during each year of spawning surveys new spawning areas are being used and some areas that were heavily used in past years see little or no use. In addition, Idaho Power reports that neither it nor the FWS has noted significant superimposition of redds during their weekly aerial and ground surveys of spawning sites. As an alternative, Idaho Power filed a Fall Chinook Spawning and Gravel Monitoring Plan with its draft EIS comments. Idaho Power asks that FERC adopt the Fall Chinook Spawning and Gravel Monitoring Plan. If monitoring indicates that gravel augmentation may be necessary or appropriate, Idaho Power indicates that FERC can then instruct it to develop a plan to address the issue. We discuss the details of Idaho Power's proposed gravel monitoring study in section 3.4.2.2, and we conclude that the Fall Chinook Spawning and Gravel Monitoring Plan proposed by Idaho Power would provide an effective means of determining whether project-related effects on the quantity or quality of fall Chinook spawning habitat are having any adverse effect on the spawning and incubation success of fall Chinook salmon. We note that Idaho Power's proposed Fall Chinook Spawning and Gravel Monitoring Plan would benefit from annual consultation with NMFS, Interior, IDFG, ODFW, and the treaty tribes to report on monitoring results to date, and to guide monitoring efforts in the coming year.

3.6.2.15 Benthic Community Monitoring

The invertebrate community downstream of Hells Canyon dam includes a number of special status mollusk species. In addition, the composition of the aquatic invertebrate, periphyton and macrophyte communities serves as an indicator of water quality conditions, as well as the food resources that are available to native species of fish, including juvenile fall Chinook salmon, bull trout, redband trout, and white sturgeon. Long-term monitoring can be useful for tracking ecological responses to changes in basin conditions and project operations, and the implementation of environmental measures. Idaho Power reported the results of extensive invertebrate surveys in its license application and in its response to AIR AR-2, but does not propose any future monitoring efforts.

AR/IRU and Interior provided several recommendations related to benthic community monitoring. Interior (Interior-70, -71, -72, and -73) recommends several monitoring programs associated with a proposal to evaluate a series of three operational modes that would be maintained for a period of several years or more. The three operational modes would consist of: (1) continued peak-loading operations with a ramping rate of 12-inches-per-hour, measured within 1 mile downstream from Hells Canyon dam; (2) the same operations combined with supplemental enhancement of DO; and (3) if warranted, studying continued DO enhancement with run-of-river operations. Monitoring activities recommended by Interior to assess biological responses to the three modes of operation include: (1) biannual monitoring of benthic invertebrates, with emphasis on the Ephemeroptera, Plecoptera, and Trichoptera (EPT) index and species indicative of poor water quality or frequent disturbance; (2) biannual monitoring of benthic macrophytes and algae, emphasizing taxonomic groups useful in determining water quality; (3) zonal distribution surveys of keystone and sensitive benthic species to evaluate the effects of exposure to repeated dewatering and inundation; and (4) monitoring of known colonies of the Hells Canyon rapids snail and the short-faced limpet.

Interior (Interior-74 and -75) also recommends that Idaho Power establish and monitor experimental populations of Hells Canyon rapids snail and short-faced limpet within 10 miles downstream of Hells Canyon dam, and of western ridged mussels in appropriate habitat. Under Interior's recommendation, monitoring of the experimental populations would be conducted during the three operational test periods and continued, if needed, for the term of the license.

AR/IRU (AR/IRU-14) recommend that Idaho Power employ an adaptive management approach to assess and mitigate project effects to the benthic community in the Snake River within, and downstream of, the project. AR/IRU also recommend that Idaho Power undertake studies, designed by a Technical Advisory Committee, to evaluate the effects of habitat alteration caused by the project on the benthic community. Based on these results, the Technical Advisory Committee would determine what mitigation Idaho Power should undertake. AR/IRU indicate that mitigation could include changes in operation, and alludes to other actions such as replacing fine sediment.

Our Analysis

Although it is clear that the existence of the project reservoirs and changes in the flow regime caused by project operations affect the downstream benthic community, it is difficult to assess the potential benefits of AR/IRU's adaptive management recommendation without knowing what specific measures would be implemented. Some of the measures that could be undertaken to compensate for project effects would have adverse effects on important aquatic species. For example, restoring the historical load of fine sediments to the reach would likely adversely affect the spawning and incubation environment for fall Chinook salmon.

Interior recommends several monitoring efforts in conjunction with a multi-year program to evaluate the effects of DO augmentation and the elimination of flow fluctuations associated with load-following operations. As noted by Interior, continuation of invertebrate monitoring downstream of Hells Canyon dam would be useful to monitor the effects of project operations and environmental measures on invertebrate production and on populations of rare and sensitive mollusks, and for adaptive management of project operations based on monitoring results. We do not see the benefit, however, to Interior's proposal to establish specific study durations for baseline sampling and for sampling with DO enhancement measures in place and with run-of-river operations. We conclude that a well-designed study program with a year or more of baseline data should be sufficient to document changes in the invertebrate community prior to DO implementation, and we expect that the schedule for implementing DO enhancement measures will be established in the water quality certification. We also conclude that a well-designed monitoring program could assess the effects of load following operations without imposing a multi-year test period of run-of-river operations, by comparing and evaluating species composition and abundance in areas that have been dewatered at different frequencies over a range of hydrologic year-types.

In the draft EIS, we stated that we also saw little benefit in Interior's recommendation that Idaho Power establish experimental populations of Hells Canyon rapids snail, short-faced limpet, and western ridged mussel downstream of Hells Canyon dam because a wide range of variables could affect the success or failure of an experimental population. However, if water quality conditions improve to a point where habitat may support a species that is thought to have been extirpated, the monitoring program could include provision for attempts to re-establish the species in the rehabilitated habitat.

3.6.2.16 Effects of Other Measures on Aquatic Resources

Below, we discuss the effects that measures developed to address other resources would also have on aquatic resources.

Terrestrial Resource Measures

In sections 3.7.2.2 through 3.7.2.8, we discuss the effects that proposed and recommended terrestrial resource measures would have on plants and wildlife. As discussed in section 3.5.2.7, *Effects of Other Measures on Water Quality*, increasing the extent of woody plants and other riparian plants along the shoreline of the project reservoirs, Snake River, and islands in the Snake River would likely result in a slight reduction in water temperatures in and around shaded areas along the shoreline. This thermal effect is expected to be so small and localized that it would have negligible effects on fish and other aquatic organisms. However, restoring riparian vegetation would increase the available amount of cover in shoreline areas and, thereby, reduce predation on fish. Riparian enhancement measures would not involve any instream work, so no direct adverse effects on aquatic species are expected.

Recreation Measures

In section 3.10.2.3, *Recreation Site Improvements*, we discuss the effects that proposed and recommended recreation facility improvement measures (table 86) would have on recreation. As discussed in 3.5.2.7, *Effects of Other Measures on Water Quality*, improving boat launches and removing sediment buildup around docks and in-reservoir pumps would likely increase turbidity and resuspend sediments and any contaminants associated with them into the water column. Implementation of appropriate BMPs for these activities would limit the extent and duration of these adverse water quality effects, thereby limiting any adverse effects on fish, other aquatic organisms, and piscivorous wildlife to minimal levels.

3.6.3 Cumulative Effects

In this section we address cumulative effects on Pacific lamprey, redband trout, and white sturgeon. We address cumulative effects on listed anadromous salmonids and bull trout in section 3.8.3.

3.6.3.1 Pacific Lamprey

The distribution and abundance of juvenile Pacific lamprey in the Snake and Columbia River basins has been severely reduced due to impacts associated with hydropower development. The construction of numerous dams on tributaries has reduced the amount of habitat that is accessible for the freshwater spawning and rearing lifestages. Construction of the Hells Canyon Project blocked access to habitat upstream of Hells Canyon dam, contributing to a cumulative loss of accessible habitat. Although Pacific lamprey primarily spawn and rear in tributary streams, the project-related reduction in the delivery of fine sediments to the reach likely reduced the quantity and quality of potential habitat for Pacific lamprey in the mainstem Snake River downstream of Hells Canyon dam.

The number of lamprey that ascend above Lower Granite dam has declined to very low levels due to poor passage conditions at downstream dams on the Lower Columbia and Snake rivers. Pacific lamprey are poor swimmers, and adults tend to have difficulty migrating upstream through fish ladders; passage rates as low as 50 percent have been reported in recent studies at Bonneville dam (Close and Bronson, 2001, as cited in Groves et al., 2001). As a result of low numbers ascending past Lower Granite dam, it is unlikely that blocked access to habitat upstream of Hells Canyon dam affects the population size of lamprey because the tributaries to the Hells Canyon reach provide sufficient habitat to accommodate the current number of adult returns.

3.6.3.2 Redband Trout and White Sturgeon

The settlement and development of the Snake and Columbia River basins caused substantial adverse cumulative effects to resident fish species, including redband trout and white sturgeon. Habitat losses in the Snake River basin began primarily with placer mining, which took place throughout the basin, followed by development of the basin for agricultural production, timber harvest, and livestock production. Construction of numerous additional tributary dams and agricultural development of the basin reduced the recruitment of spawning gravel to historical redband trout habitats, altered river flows, and adversely affected water quality by increasing water temperatures and nutrient loads, reducing DO, and introducing pesticides. Construction of additional mainstem dams on the Snake and Columbia rivers, including eight mainstem dams downstream of Shoshone Falls that are owned by Idaho Power, substantially restricted the ability of white sturgeon and redband trout to migrate throughout the river system to access available habitats. Dam construction has also greatly reduced the availability of anadromous fish as a food source for white sturgeon downstream of Hells Canyon dam, and has eliminated this food source upstream of Hells Canyon dam. Thus, the population in many of the reaches between dams has been greatly diminished. Impediments to fish movement from project reservoirs and dams contribute to a cumulative loss of connectivity among populations of redband trout and white sturgeon in the project area.

Under Idaho Power's proposal, the sturgeon population in the Swan Falls to Brownlee reach would be increased by translocating sturgeon from a donor population, if water quality conditions are found to be suitable to allow reproduction. Alternatively, a conservation aquaculture program would be implemented if water quality conditions are found to limit reproduction. We also evaluate the concept of a conservation aquaculture program that would be used to augment sturgeon populations in the project reservoirs, as well as the Swan Falls reach. The conservation aquaculture program would be designed to ensure that population sizes are rebuilt to robust levels, that gene flow from downstream populations is restored, and that genetic variability is enhanced, thus, addressing the primary adverse effects associated with a loss of connectivity.

Under Idaho Power's proposal, upstream connectivity over Hells Canyon dam would be restored for redband trout. Also, installation of a permanent monitoring weir at Pine Creek would allow outmigrating trout to be transported past Hells Canyon dam without being exposed to the risk of turbine mortality. A second phase, which would occur at least 5 years later, would involve construction of a trap at Oxbow dam to provide upstream passage into the Wildhorse River. Idaho Power's proposal, however, would not provide a safe means of downstream passage for redband trout that emigrate from the Wildhorse River or from Indian Creek. Under Interior's preliminary fishway prescription and Idaho Power's alternative prescription, downstream passage would be provided from each tributary when tributary traps are installed, although these would be contingent upon meeting trigger criteria that would be identified in a bull trout passage plan.

Under any of the action alternatives, TDG levels are expected to exceed state standards when spills at the project exceed approximately 30,000 cfs, which has the potential to cause injury to redband trout that migrate from tributaries into the Snake River downstream of Hells Canyon dam. However, installation of spillway flow deflectors at Hells Canyon dam as proposed by Idaho Power, and at Brownlee dam under the Staff Alternative, would reduce the project's contribution to high TDG levels under most spill conditions.

The Hells Canyon Project contributes to the occurrence of low DO levels and elevated water temperatures in the late summer and early fall, which may adversely affect habitat conditions for redband trout downstream of Hells Canyon dam, although many redband trout probably move into tributaries prior to the onset of project-related increases in water temperature and reductions in DO. Developing and implementing a DO supplementation plan would reduce adverse effects from low DO levels downstream of Hells Canyon dam. During the spring and summer months, delayed warming caused by the project likely improves habitat conditions for redband trout downstream of Hells Canyon dam.

Ramping of flows associated with load following operation of the project may adversely affect redband trout rearing in the mainstem of the Snake River by adversely affecting the availability of invertebrates and forage fish, and through direct mortality from stranding. A stranding and entrapment management plan and an invertebrate monitoring plan could be used to evaluate, and if needed, develop and implement, approaches to protect and enhance rearing conditions for aquatic species.

3.6.4 Unavoidable Adverse Effects

The project reservoirs would continue to block sturgeon and anadromous fish from migrating through the project reach of the Snake River, and would continue to cause mortality to some sturgeon and redband trout that are entrained through the project turbines. The suitability of fish habitat in Brownlee reservoir would continue to be adversely affected by low DO levels, and fish habitat downstream of Hells Canyon dam would continue to be affected by gas supersaturation when spills exceed approximately 30,000 cfs.

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3.7 TERRESTRIAL RESOURCES

3.7.1 Affected Environment

3.7.1.1 Terrestrial Habitat Conditions

Idaho Power conducted terrestrial resource studies along 163 miles of the Snake River from Weiser, Idaho, to the confluence of the Snake and Salmon rivers near Lewiston. The study area included five study reaches: from the Weiser Bridge to Brownlee reservoir (about 12 miles); Brownlee reservoir, including the Powder River arm (about 55 miles); Oxbow reservoir (about 12 miles); Hells Canyon reservoir (about 25 miles); and the Snake River downstream of Hells Canyon dam (about 59 miles). The width of the study area varied, depending on specific study goals and objectives. For the vegetation studies, Idaho Power delineated cover types within 0.5 mile of the river and reservoir shorelines above Hells Canyon dam, and within 0.25 mile of the shoreline downstream of Hells Canyon dam (Holmstead, 2003a). This study area encompasses land and water within the FERC project boundary, and provides a larger ecological context for terrestrial resources.

Idaho Power found that upland vegetation is prevalent in the study area, with grasslands comprising a little over 35 percent and shrub cover types comprising almost 29 percent of the area. Forest, open woodland, and herbaceous cover types dominated by forbs or by very sparse forbs and grasses account for less than 2 percent of the study area. Riparian vegetation is also limited, comprising less than 5 percent of the study area.

Idaho Power mapped lands that do not support vegetation, such as cliffs, talus slopes, barren land, lentic (open water), and lotic (flowing water) cover types, as natural features. These natural features, including the Snake River and project reservoirs, account for about 22 percent of the study area.

Lands that were not classified based on vegetation or other habitat characteristics were mapped according to their land use. These cover types (which represent about 7 percent of the study area) include lands managed for agriculture, grazing, orchards, parks and recreation, residences, and project facilities.

Below, we summarize the major characteristics of upland and riparian habitat found in each of the five project reaches. We also summarize the characteristics of habitat found along the Pine Creek-Hells Canyon transmission line (#945).

Weiser Reach

The topography upstream of Brownlee reservoir is relatively gentle, the river gradient is low, and several island complexes are present. Agriculture is the predominant land use, and grassland is the predominant upland vegetation cover type. Bluebunch wheatgrass is the prevalent species in grasslands, but introduced annual grasses, such as cheatgrass, are also common.

Riparian habitat is more abundant in this reach than farther downstream because of the wider floodplain, lower gradient, finer soils and sediments, and higher rainfall. Riparian vegetation is primarily scrub-shrub wetland, with patches of forested and emergent wetlands. The most common trees and shrubs in these areas are introduced species (e.g., box elder, silver maple, American elm, green ash, false indigo, and tamarisk), but some native shrubs, such as peachleaf willow, coyote willow, and Wood's rose, are also present.

Brownlee Reservoir Reach

The topography is steeper around Brownlee reservoir, with large rock outcrops. Land is used primarily for agriculture and grazing, and grasslands and shrub savanna are the most abundant cover types. The most common grassland species are bluebunch wheatgrass, cheatgrass, and medusahead.

Cheatgrass is abundant, and medusahead is prevalent along the main pool. Big sage and gray rabbitbrush are the most common shrubs.

The transition between uplands and the reservoir pool is abrupt along most of the shoreline, and there is little riparian vegetation except at the upper end of the reservoir and at the mouths of tributary streams. These patches of riparian habitat support willows, water birch, white alder, black cottonwood, and mock-orange.

Shore and bottomland wetlands account for most of the riparian vegetation in the Powder River arm of Brownlee reservoir. Weedy annual species, such as common cocklebur, purslane, pigweed, and barnyard grass, colonize extensive areas of the shoreline that are exposed during drawdown periods.

Oxbow Reservoir Reach

The topography around Oxbow reservoir is steeper than it is around Brownlee reservoir, with talus slopes and basalt outcrops dominating the shoreline. About 124 acres are developed as parks, project facilities, and residences, but no land is used for agriculture, and very little for grazing. Upland vegetation is about evenly divided between grasslands and shrub savanna. Grassland plant assemblages are similar to those found along Brownlee reservoir, but shrub savanna includes more netleaf hackberry and more bitterbrush. Other upland shrubs include serviceberry and bitter cherry. A few small forested stands are present, characterized by Douglas fir or ponderosa pine with an understory of snowberry, ninebark, or both.

The most common riparian vegetation cover type along Oxbow reservoir is scrub-shrub wetlands, which occur in a narrow, patchy band around the reservoir and at the mouths of tributary streams. The most common plants in these wetlands are water birch, white alder, mock-orange, poison ivy, netleaf hackberry and black hawthorn.

Hells Canyon Reservoir Reach

Talus slopes and basalt outcrops also dominate the shoreline of Hells Canyon reservoir. Topography is very steep. No land is used for agriculture or grazing. Parks and recreation facilities occupy about 55.6 acres, while project facilities and residences account for about 83.7 acres. Shrub savanna, shrubland, and grassland characterize most of the landscape. In the shrub cover types, the most abundant species are netleaf hackberry and bitterbrush. Bluebunch wheatgrass is most common in grassland cover types.

Riparian vegetation comprises scrub-shrub wetlands but also includes small areas of forested wetlands. Scrub-shrub wetlands include the same species found at Oxbow reservoir. In addition to its presence in many scrub-shrub wetlands, netleaf hackberry is an important component of forested wetland cover types at Hells Canyon reservoir.

Snake River Downstream of Hells Canyon Dam

Downstream of Hells Canyon dam, the Snake River flows through a deep, narrow canyon confined by bedrock walls and steep cliffs. Because of both topography and ownership patterns, very little of this reach (less than 1 percent) is developed or disturbed.

Upland habitats are mostly grasslands dominated by bluebunch wheatgrass, with occasional stands of ponderosa pine. The netleaf hackberry/poison ivy plant assemblage characterizes many of the forested and scrub-shrub riparian habitats. Water birch, white alder, and mock-orange are also common. Idaho Power documented coyote willow at a few sites.

Netleaf hackberry dominates areas that were cover typed as shore and bottomland wetlands, as well as being the dominant in scrub-shrub and forested wetlands. In these settings, netleaf hackberry grows in cobbly substrate, with little, if any, herbaceous cover. Eaton's aster, a native forb, is prevalent at several other shore and bottomland wetland sites.

Transmission Line Right-of-Way

The 19-mile-long Pine Creek-Hells Canyon transmission line runs along a paved road from a substation at Oxbow dam to Hells Canyon dam. Most of the area occupied by the right-of-way is located on public land in either federal or state jurisdiction and is mapped as disturbed habitat (Dumas et al., 2003a). Where the right-of-way leaves the road, it passes through a mosaic of grasslands, big sage, riparian scrub-shrub, ponderosa pine forest, rock, and reservoir cover types. The right-of-way crosses several small drainages; the larger drainages include Allison, Eckels, and Kinney creeks. Small amounts of riparian forest are mapped at these crossings.

3.7.1.2 Special Status Plants and Plant Communities

Idaho Power conducted rare plant surveys within approximately 150 feet of the Snake River or each reservoir shoreline from Weiser to the confluence with the Salmon River (Krichbaum, 2000). Using a sub-sampling approach, botanists surveyed a 0.25-mile segment of each river mile in the study area, recording 47 occurrences of 6 rare plant species (Krichbaum, 2000). These include Oregon bolandra, Schweinitz flatsedge, porcupine sedge, Hazel's prickly phlox, stalk-leaved monkey flower, and American wood sage. Biologists observed three other rare plants (Back's sedge, shining flatsedge, and bartonberry) during general vegetation surveys, but these locations were upslope in tributary drainages, where project operations would not affect plants. Only one species—bartonberry—was documented during surveys of the transmission line and service roads (Dumas et al., 2003a). Dumas et al. (2003a) and Krichbaum (2000) indicate the species that were observed and their federal, state, and Natural Heritage Program status.

During each of the surveys, Idaho Power evaluated the occurrence of rare plant populations in relation to project features and project-related activities. Along the river corridor, Idaho Power recorded the elevation of the plant population above the mean high water mark (MHWM) in 6-inch increments, or height-classes.

Oregon bolandra is a perennial forb in the saxifrage family, producing small, purplish-brown flowers from May through June. Bolandra grows in wet, rocky habitats in the Snake River Canyon and the Columbia River Gorge, along the Imnaha-Snake Divide, and along the lower Willamette River in Oregon. Surveyors observed eight populations of bolandra in the study area. Four were observed downstream of Hells Canyon dam, one in the Hells Canyon reservoir reach, and three in the Oxbow reservoir reach. Two of the eight sites came to within seven and nine height-classes of the MHWM, but most began above the 20-height-class mark and all sites extended beyond this elevation. The lateral distance from the river varied. Six populations were located 80 feet or more from the MHWM. The other two were located within approximately 30 feet of the MHWM.

Porcupine sedge is a rhizomatous perennial sedge found in wet riparian habitats. Surveyors located 10 populations of porcupine sedge in the study area. Three were observed downstream of Hells Canyon dam, and seven were observed in the Oxbow reservoir reach. Generally, these species were found growing in wet, fine to cobbly silt loam soils on low to moderate slopes. Four populations were situated below the MHWM. The other six populations were located along tributary drainages, 90 feet or more in lateral distances above the MHWM, and well above the 20-height-class elevation. Two of the tributary populations extended onto steeper slopes, including one population that contained plants growing in bedrock at the base of a waterfall.

Schweinitz flatsedge is a rhizomatous perennial sedge. Surveyors observed 21 populations of this species growing in upland shrub savanna communities dominated by netleaf hackberry, mixed grasses, and weedy forbs on gentle to moderate slopes. Soils at each site consisted of dry, coarse, sandy loam soils. At three sites, populations extended below the MHWM of the Snake River into the flow zone.

Hazel's prickly phlox is a dwarf perennial shrub that is endemic to dry rock outcrops and talus habitats along the Snake River and lower Salmon River. Surveyors located six populations on cliffs above the MHWM, where 75 to 90 percent of the surrounding area consisted of bare rock. At three of the six sites, plants were located at least two height-classes above the MHWM. At the other three sites, plants were located at least 20 height-classes above the MHWM.

Surveyors observed one population downstream of Hells Canyon dam at Pleasant Valley Rapids and five populations in the Hells Canyon reservoir reach, scattered over a distance of about 2 miles along both shores of the reservoir from just south of Thirty-two Point Creek to just south of Squaw Creek.

Stalk-leaved monkey-flower is an annual forb that produces small yellow flowers from May through August. This species grows in damp soils, wet cliffs, and road cuts from the east slope of the Cascades in Oregon to the Snake River Canyon in Idaho.

Surveyors observed one population of stalk-leaved monkey-flower in the Oxbow reservoir reach, in a road cut along State Route 71. Surveyors observed an estimated 50 individuals scattered within an area of about 100 square feet of gently sloping, damp rocky ground. Most of the site is bare soil and rocks, with scattered weedy grasses and forbs. About 3 miles north of this population, there are four previously known occurrences.

American wood sage is a rhizomatous perennial of the mint family. Spikes of purplish flowers bloom from June through August. One population of this plant was found on the Oregon side of the river downstream of Hells Canyon dam, about 1,000 feet south of Temperance Creek, where 14 individuals are scattered within an area of about 65 square feet. This occurrence was observed on a gently sloping, moist, rocky site along the shoreline. Plants spanned the MHWM, from one height-class above to five height-classes below.

Back's sedge is a small tufted sedge that grows from lowlands to mid-montane elevations. In the Wallowa Mountains, it is found in uplands, growing on steep southerly aspects in open ponderosa pine savanna. In the project area, surveyors observed Back's sedge in one shrubland site and in one scrub-shrub wetland.

Shining flatsedge species is a grass-like, tuft-forming annual that occurs in wet, often gravelly shores of rivers, lakes and ponds at relatively low elevations. Surveys in the 1990s along the Payette, Boise, and Snake rivers indicated the species was more common than previously thought. During the general vegetation surveys project, surveyors observed shining flatsedge at three different wetland sites, including one scrub-shrub wetland, one emergent wetland, and one shore and bottomland wetland type.

Bartonberry is endemic to Hells Canyon, known only from Adams and Idaho counties in Idaho and Wallowa County, Oregon. It occurs in riparian communities along small to moderate-sized streams, and in rockslides along lower canyon slopes (Moseley, 1989). Idaho Power surveyors observed this species growing in two forested wetlands and one scrub-shrub wetland.

Bartonberry was the only rare plant species documented during surveys of the transmission line and service road rights-of-way. Ten populations were observed within the Payette National Forest along the Pine Creek-Hells Canyon transmission line.

Based on information provided by FWS, three federally listed plant species (MacFarlane's four-o'clock, Howell's spectacular thelypody, and Spalding's catchfly) may occur in the project area (letter from J.L. Foss, Supervisor, Snake River Fish and Wildlife Office, Boise, ID, to the Commission, dated November 28, 2005). We discuss these three plants in section 3.8, *Threatened and Endangered Species*.

3.7.1.3 Plants of Cultural Importance

Many of the plants found in the project area are important to Native American tribes in the region (Reed-Jerofke, 1999; Whipple, 2001; Nez Perce, 2006; Burns Paiute, 2006; Shoshone-Bannock, 2006). Plants provided food, medicine, and materials for clothing, baskets, tools, decoration, and ceremony. Plants are still an important part of any traditional menu, and many elders continue to use plants, such as juniper and lomatium species, for their medicinal benefits. Examples of other important plants include upland species, such as sagebrush and rabbitbrush; riparian shrub species, such as red osier dogwood and coyote willow; and wetland plants, such as cattail, tule, and nettles. The Nez Perce gathered pine nuts, sunflower seeds, and black moss for food, as well as bitterroot, wild carrot, wild potato, other roots, chokecherries, currants, and a wide variety of berries. The Shoshone-Bannock Tribes used roots and berries extensively during the winter.

3.7.1.4 Noxious Weeds and Invasive Exotic Plants

Idaho Power conducted surveys for noxious weeds and invasive weedy plant species concurrently with surveys for rare plants, using the same sub-sampling approach to cover the study area (Krichbaum, 2000). Botanists observed 1,905 separate weed populations and found that 98 percent of the survey units contained at least one weed population. The number of weed species per unit varied from 0 to 14.

The most abundant upland weeds were medusahead, common St. John's wort, Scotch thistle, and whitetop. The most abundant riparian weeds were perennial pepperweed, poison hemlock, tamarisk, and reed canarygrass.

The survey results showed the highest densities of weeds are present in the Weiser reach, where 70 percent of the survey units contained weeds. In this reach, the most common species were associated with riparian habitats, and included poison hemlock, perennial pepperweed, Scotch thistle and Canada thistle.

Weeds were present in 45 percent of the survey units in the Brownlee reservoir reach. False indigo, Scotch thistle, field morning glory, and perennial pepperweed were most abundant.

Weeds were present in about 30 percent of the survey units in both the Oxbow and Hells Canyon reservoir reaches. In the Oxbow reservoir reach, the most common species were houndstongue, false indigo, medusahead, Scotch thistle, and perennial pepperweed. Results in the Hells Canyon reservoir reach were similar, although puncturevine was one of the most common species, while false indigo was not as abundant.

Downstream of Hells Canyon dam, surveyors found weeds in only 10 percent of the survey units. The most common species were common St. John's wort, houndstongue, Scotch thistle, and field morning glory. Surveyors observed very few riparian-associated weeds.

In addition to surveying the Snake River corridor, Idaho Power conducted weed surveys along the Pine Creek-Hells Canyon transmission line (Dumas et al., 2003a). Surveyors documented weeds in about 88 percent of the survey units. Surveyors documented a total of 144 occurrences of eight noxious weed species. The most common weed was puncturevine, which surveyors found in 72 percent of the survey units. Scotch thistle was found in over half the survey units, and Dalmatian toadflax, whitetop, poison hemlock, field morning glory, and diffuse knapweed were also common. Canada thistle was present, but in only two of the survey units.

3.7.1.5 Key Wildlife Species

Idaho Power conducted a number of studies to identify wildlife species in the project area and to evaluate their relative abundance, distribution, and habitat associations. Below, we briefly summarize the findings of the studies to highlight species that are representative of habitats in the project area, or those that are especially important in terms of their ecological role or cultural or recreational values.

Mammals

Big Game

Idaho Power conducted detailed studies of mule deer and found that the project vicinity provides one of the most important winter ranges for mule deer in eastern Oregon and western Idaho (Christensen, 2003; Edelmann et al., 2003a; Edelmann, 2003). Most of the suitable winter habitat is located adjacent to Brownlee and Oxbow reservoirs. About 74 percent of the deer that occupy winter range in the project vicinity migrate to summer range in and around the Wallowa Mountains of Oregon and the Cuddy and Sturgill mountains in Idaho. Only about 25 percent of the deer are year-round inhabitants.

Idaho Power biologists counted a total of 10,864 mule deer in the survey area between Weiser and Hells Canyon dam in 1998, with even higher numbers in 2000 and 2001, when mule deer counts totaled 13,979 and 14,496, respectively (Edelmann et al., 2003a). Numbers of elk that winter in the project vicinity are difficult to estimate because data come from a variety of sources. Idaho Power reports that survey data for recent years indicate that elk populations on the Oregon side have been stable and that numbers of elk on the Idaho side are in the range of 1,400 to 2,329 animals. Like mule deer, elk numbers are expected to vary considerably from year to year, depending to a great extent on winter conditions (Edelmann, 2003).

The project area also supports mountain goats (Edelmann and Rocklage, 2003). Mountain goats are native to the Idaho side of Hells Canyon, and possibly to the Oregon side, as well. They were extirpated by the mid-1930s and reintroduced in the early 1960s into the Seven Devils Mountains in Idaho. Mountain goats are occasionally observed near the Hells Canyon reservoir and along the Snake River downstream of Hells Canyon dam during winter and spring, but surveyors observed most goats at high elevations, outside the project boundary. Based on recent habitat mapping, almost 100 percent of the currently occupied and potential habitat for this species is located on National Forest System lands. Idaho Power counted 117 goats during surveys in 1996 (Edelmann and Rocklage, 2003). Compared to numbers counted in 1993, Idaho Power suggests there may have been as much as a 30 percent decline in the 3-year period.

Bighorn sheep are also native to the region but were extirpated by about 1945 (Ratti and Lucia, 1998). The first reintroductions occurred in 1971, with several other transplants between 1971 and 1995. Fourteen herds now occupy the area around Hells Canyon, with an average herd size of 50 animals. Seven disease die-offs have been linked to transmission of disease from domestic sheep and feral goats.

Habitat for this species consists of steep slopes with good visibility, proximity to open water, and winter range relatively free of snow. About 68 percent of the suitable habitat for bighorn sheep in the project area is located on federal or other public lands.

Carnivores and Furbearers

Idaho Power conducted surveys for carnivores and furbearers along Brownlee, Oxbow, and Hells Canyon reservoirs (Edelmann and Pope, 2003). Using scent stations, it documented the occurrence of red fox, black bear, common raccoon, bobcat, weasel, and skunk. Surveyors observed coyote, bobcat, and raccoon throughout the study area. Idaho Power also observed red fox, black bear, long-tailed weasel, striped skunk, mountain lion, northern river otter, American badger, American beaver, and mink.

Small and Medium-sized Mammals

During focused surveys, Idaho Power trapped eight species of small mammals (Eshelman, 2003). The most common were deer mouse, montane vole, western harvest mouse, and vagrant shrew. Common medium-sized mammals in the project area are red squirrel and mountain cottontail. Small and medium-sized mammals are important as part of the prey base for larger mammals, raptors, and snakes (Holthuijzen, 2003a; Turley and Holthuijzen, 2003a).

Bats

Hells Canyon provides high-quality habitat for bats because of its low elevation; abundance of cliffs, caves, and mines; year-round open water in the river and reservoirs; and the variety of vegetation cover types (Anderson, 1998). Through a cooperative effort with the Forest Service, Idaho Power compiled the results of a number of surveys that had been conducted over the years, finding that 10 species of bats have been recorded from 46 sites in the vicinity and that 3 others have been recorded from nearby uplands. Based on their range and distribution, two other species may also be present.

Birds

During focused surveys and incidental to general field surveys, Idaho Power documented the occurrence of 223 bird species (Turley and Holthuijzen, 2003b). In summer, lazuli bunting, spotted towhee, black-capped chickadee, and western meadowlark were most common. In winter, dark-eyed junco, black-capped chickadee, and horned lark were most common. Neotropical migrants (e.g., yellow warbler and willow flycatcher) represented about half the total bird density in each cover type during spring and summer.

In addition to conducting point counts, Idaho Power conducted focused surveys to evaluate upland game birds, migrant shorebirds, waterfowl, colonial nesting waterbirds, and raptors. These species groups are described below.

Upland Game Birds

The upland game bird community includes both native and introduced species (Turley and Edelmann, 2003; Ratti and Guidice, 2003). The most common native is the mourning dove. California quail, chukar, gray partridge, wild turkey, and ring-necked pheasant were introduced to provide huntable populations, and surveyors frequently observed these species (except wild turkey) during field surveys (Turley and Edelmann, 2003). Surveyors also observed ruffed grouse and blue grouse. The most important species, in terms of recreation and economic value, is the chukar. Chukar and gray partridge are also important in providing a prey base for golden eagle, great horned owl and coyote.

Surveyors found no mountain quail in the study area, despite reports of its occurrence in the vicinity and the presence of habitat that appears suitable, based on GIS modeling (Rocklage and Edelmann, 2003a). The mountain quail is associated with open forests and woodlands where there is abundant brushy vegetation in the understory and in forest openings. It also occurs in riparian woodland, meadow edges, and brushy regeneration following fire and timber harvest.

Migrant Shorebirds

Seasonal drawdown of Brownlee reservoir exposes barren, sediment-rich mudflats that offer foraging opportunities for a variety of migrant shorebirds (Turley and Holthuijzen, 2003c). Killdeer were the most commonly observed species, followed by several species of sandpiper. The location of the project area outside any major flyway may explain the relatively low level of use the mudflats receive. Migration timing in relation to drawdown timing may also influence the level of use (i.e., the mudflats may not be exposed during peak migration periods).

Waterfowl

Seven species of waterfowl are known or suspected to nest in the area: Canada goose, mallard, northern pintail, American wigeon, green-winged teal, common merganser, and wood duck (Rocklage et al., 2003a). The Canada goose is by far the most common species, followed by mallard.

The most important areas for waterfowl production are located at the west end of the Powder River arm and between Weiser and Farewell Bend. Islands between Weiser and Farewell Bend are of particular importance. Lower Brownlee, Oxbow, and Hells Canyon reservoirs have steep slopes, rocky shorelines, and swift water that do not provide suitable habitat for breeding waterfowl.

The most important areas for wintering waterfowl are also located at the upper end of the project area, in the unimpounded reach above Farewell Bend and in the Powder River arm, with numbers per mile declining in a downstream direction (Holthuijzen, 2003b). During winter surveys, Idaho Power found that the most common species were mallard, goldeneye (both common and Barrow's goldeneye), common merganser, Canada goose, and bufflehead. Compared to other large reservoirs and wetland complexes to the southeast along the Snake River that are located within a mapped flyway, the project area receives very little use. In its comments on the draft EIS, Interior identified two more important habitats upstream from the Hells Canyon Project area: Deer Flat National Wildlife Refuge and Fort Boise Wildlife Management Area. The Deer Flat National Wildlife Refuge averages more than 5,000 shorebirds during migration (National Audubon Society, 2004), while surveys of Brownlee reservoir totaled less than 100 shorebirds per survey (Turley and Holthuijzen, 2003c). The Deer Flat National Wildlife Refuge also provides nesting habitat for several species of waterfowl, wading birds, and shorebirds during spring and summer. The Fort Boise Wildlife Management Area includes Gold Island, which was purchased by Idaho Power in 1959 and transferred to the State of Idaho as mitigation for the effects of Brownlee reservoir on goose nesting habitat. IDFG purchased adjacent lands, and the Wildlife Management Area now totals more than 1,600 acres, which provide nesting habitat for both waterfowl and upland birds (IDFG, 2007). The Fort Boise Wildlife Management Area also supports a very high diversity of waterfowl, wading birds and shorebirds during spring and fall migrations.

Colonial Nesting Waterbirds

Idaho Power conducted surveys to evaluate waterbird nesting colonies that might be present in the project area (Pope, 2003). Surveyors found three nesting species (great blue heron, double-crested cormorant, and black-crowned night-heron) at two colonies. Surveyors observed only great blue heron nesting at a colony along the upper Powder River arm. In 1998, this colony supported 16 nests. Peep Island, located above Brownlee reservoir, supported nesting by double-crested cormorant (43 nests) and black-crowned night-heron (5 nests), in addition to great blue heron (4 nests).

Raptors

Idaho Power conducted surveys to evaluate the raptor community in the project area, and found the golden eagle to be the most abundant nesting raptor, with 11 active territories (Pope and Holthuijzen, 2003). Biologists documented nesting territories of several other raptors, as well, including red-tailed hawk, prairie falcon, American kestrel, and peregrine falcon. Additionally, surveyors observed five territories occupied by common ravens, which are sometimes grouped along with raptors. Biologists observed Cooper's hawks, but did not confirm nesting by this species.

Idaho Power conducted a separate study to evaluate peregrine falcon occurrence in Hells Canyon (Akenson, 2000). Surveys documented one eyrie on a cliff in the Hells Canyon Creek drainage, almost 0.5 mile west of the Hells Canyon boat launch. The eyrie was located at about 3,900 feet in elevation (Akenson, 2000), more than 2,000 feet above the reservoir. The nest fledged one young in 1996. Occupancy behavior (copulation, prey delivery, patrolling the territory) was observed during surveys between 1997 and 2000, indicating that the site was active in all four years, but biologists could not confirm nesting success.

Biologists documented five owl species in the project area: great horned owl, common barn owl, western screech-owl, long-eared owl, and burrowing owl. Biologists documented nesting by burrowing owls near Brownlee reservoir.

Reptiles and Amphibians

Idaho Power conducted trapping surveys for reptiles, capturing 10 species and documenting the presence of 4 others (Beck et al., 2003). The most common species it observed included racer, gopher snake, western whiptail, western rattlesnake, and night snake.

During amphibian surveys, biologists found western toads at 24 sites, long-toed salamanders at 22 sites, Pacific tree frogs at 21 sites, bullfrogs at 6 sites, spadefoot toads at 2 sites, and Columbia spotted frogs at 1 site (Beck et al., 2003). Western toads, long-toed salamanders, and Pacific tree frogs were common throughout project-area wetlands, but bullfrogs, spadefoot toads, and Columbia spotted frogs were observed only in the southern portion of Brownlee reservoir.

All of the wildlife species described above may be valuable cultural resources for Native American tribes in the region (refer to section 3.9.1.5, *Traditional Cultural Properties, Sacred Sites, and Rock Art*).

3.7.1.6 Special Status Wildlife Species

In consultation with the agencies and tribes, Idaho Power developed a list of more than 100 special status wildlife species that are known to occur or may be present in the project area (Turley and Holthuijzen, 2003d). The list includes species that federal or state agencies have listed as threatened, endangered, proposed or candidates for listing, and those that have been designated as sensitive, rare or in need of special management. FWS indicated that four federally listed wildlife species (gray wolf, Canada lynx, Northern Idaho ground squirrel and bald eagle) may occur in the project area and should be addressed (letter from J.L. Foss, Field Supervisor, Snake River Fish and Wildlife Office, Boise, ID, to the Commission, dated November 28, 2005). We present additional information about these species in section 3.8, *Threatened and Endangered Species*.

To focus Idaho Power's evaluation of potential project effects (table 67), the parties narrowed the initial list of special status species to 34 species during further consultation. In addition to listed, proposed, and candidate species, the species were grouped roughly according to guild or use of habitat. Table 67 summarizes their occurrence in the project area, based on Idaho Power's surveys, or the likelihood of occurrence, based on their range and habitat associations.

Table 67. Special status species and species groups used to focus evaluations of project effects. (Sources: Idaho Power, 2003a; Rocklage et al., 2003b; Turley et al., 2003; Anderson, 1998; Edelmann and Copeland, 1999; Turley and Holthuijzen, 2003d; Csuti et al., 1997; Hemker, 2004; DAI, 2005; FWS, 2005a,b,c; Reynolds and Hinckley, 2005; TNC, 1999; ONHIC, 2004; IDFG, 2005a,b,c, as modified by staff)

Species or Species Group	Likelihood of Occurrence in Project Area
Threatened, Endangered and Candidate Species	
Bald eagle (*Haliaeetus leucocephalus*)	Documented: Nests known near Hells Canyon and Oxbow reservoirs; wintering concentrations at Oxbow reservoir and Powder River arm.
Peregrine falcon (*Falco peregrinus*)	Documented: Eyrie near Hells Canyon dam active in 1996; pairs observed 1997–1999.

Species or Species Group	Likelihood of Occurrence in Project Area
Yellow-billed cuckoo (*Coccyzus americanus*)	Low: Associated with mature cottonwood stands and dense understory. In Idaho, most historical records and current observations are from upper Snake River basin, but recently documented in Malheur County, Oregon.
Gray wolf (*Canis lupus*)	Documented sightings east side of Hells Canyon reservoir and near headwaters of Wildhorse River, a tributary to Oxbow reservoir.
Canada lynx (*Lynx canadensis*)	Low: One unconfirmed sighting on Idaho side of Snake River downstream of confluence with Salmon River.
Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*)	Documented near Barber Flat.
Southern Idaho ground squirrel (*Spermophilus brunneus endemicus*)	Documented at Cobb Rapids and Corral.
Columbia spotted frog (*Rana luteiventris*)	Documented in Powder River arm.
Upland Species	
Greater sage grouse (*Centrocercus urophasianus)*	Documented incidentally at several locations adjacent to south end of Brownlee reservoir and near Powder River arm.
Columbian sharp-tailed grouse (*Tympanuchus phasianellus*)	Documented: Rare observations in spring near Brownlee reservoir.
Loggerhead shrike (*Lanius ludovicianus*)	Documented at all three reservoirs during spring, summer, and fall; not observed above Brownlee or below Hells Canyon dam.
Sage sparrow (*Amphispiza belli*)	Moderate: Strongly associated with sagebrush and native grasslands; declines in Idaho and Oregon may be due to habitat fragmentation.
Brewer's sparrow (*Spizella breweri*)	Documented as uncommon at Brownlee, rare at Oxbow and Hells Canyon reservoirs; not observed above Brownlee or below Hells Canyon dam.
Open Water Species	
Trumpeter swan (*Cygnus buccinator*)	Low: No observations in project area; nests in eastern Idaho, introduced breeder in southeastern Oregon. Winters primarily along Pacific coast, but some may winter at Wallowa Lake.
Harlequin duck (*Histrionicus histrionicus*	Documented on Brownlee and Oxbow reservoirs, winter and spring.
Black tern (*Chlidonias niger*)	Moderate: No observations in project area. Migrates along Snake River corridor. Uncommon breeder in the Boise valley and south-central and southeastern Oregon, winters in South America and Africa.
Mountain quail (*Oreortyx pictus*)	High: None observed during surveys, but thought to exist in Hells Canyon.
Willow flycatcher (*Empidonax traillii*)	Documented: Rare throughout project area in spring, summer and fall.
Yellow warbler (*Dendroica petechia*)	Documented: Uncommon above Brownlee reservoir; common through the rest of the project area in spring, summer, fall.
MacGillivray's warbler (*Opopornis tolmiei*)	Documented: None above Brownlee; uncommon through the rest of the project area in spring, summer, fall.

Species or Species Group	Likelihood of Occurrence in Project Area
Townsend's warbler (*Dendroica townsendii*)	Documented: Rare along Brownlee, Oxbow and Hells Canyon reservoirs; absent above Brownlee reservoir and below Hells Canyon dam.
Wilson's warbler (*Wilsonia pusilla*)	Documented: None above Brownlee; uncommon through the rest of the project area in spring, summer, fall.
Solitary (plumbeus) vireo (*Vireo plumbeus*)	Documented: None above Brownlee reservoir; uncommon along Brownlee and Hells Canyon reservoirs and below Hells Canyon dam; common at Oxbow reservoir during spring, summer, and fall.
Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)	Documented: Uncommon above Brownlee reservoir, rare along Brownlee, Oxbow, and Hells Canyon reservoirs, absent below Hells Canyon dam.
Northern river otter (*Lutra canadensis*)	Documented: Observed on each reservoir and below Hells Canyon dam.
Amphibians	
Northern leopard frog (*Rana pipiens*)	Low: No observations, but known to breed at wetlands in the Snake River plain. No recent observations in Oregon.
Inland tailed frog (*Ascaphus truei*)	Documented: Brownlee, Dukes, Deep, Granite and Sheep creeks.
Western toad (*Bufo boreas*)	Documented: Common in wetlands throughout project area.
Bats	
Pale big-eared bat (*Corynorhinus townsendii pallescens*)	Documented at 22 of 46 survey sites in Snake River corridor, including 4 maternity colonies and 2 hibernacula.
Spotted bat (*Euderma maculatum*)	Documented in project vicinity.
Fringed myotis (*Myotis thysanodes*)	Documented at 1 of 46 survey sites in Snake River corridor.
Western pipistrelle (*Pipistrellus hesperus*)	Documented at 2 of 46 survey sites in Snake River corridor.
Big Game	
California bighorn sheep (*Ovis canadensis californiana*)	Low: Nearest observations are from Burnt River, approximately 30 miles west of Brownlee reservoir.
Forest Carnivores	
Fisher (*Martes pennanti*)	Low: No suitable habitat in the project area, due to absence of mature, closed-canopy conifer forest.
Wolverine (*Gulo gulo luteus*)	Low: No suitable habitat in the project area, due to low elevations, but known from Seven Devils Mountains, about 10 miles northeast of Hells Canyon dam.
Insects	
Johnson's hairstreak (*Mitoura johnsoni*)	Low: Strongly associated with Douglas fir and western hemlock stands. Confirmed records from Baker County, Oregon; not reported from Hells Canyon.
Silver-bordered fritillary (*Boloria selene*)	Low: Typically found in wet meadows, bogs and marshes. Confirmed records from Baker County, Oregon; not reported from Hells Canyon.
Yuma skipper (*Ochlodes yuma*)	Possible: Associated with ponds, streams, springs, seeps. Confirmed from Wallowa County, Oregon and Twin Falls County, Idaho; not reported from Hells Canyon.

Species or Species Group	Likelihood of Occurrence in Project Area
Columbia River tiger beetle (*Cicindela columbica*)	Possible: Associated with sandy beaches along Snake and Columbia rivers. Recently observed along lower Salmon River, but not known from Hells Canyon.

3.7.1.7 Game Species of Cultural Importance

Several wildlife species that still occur in the project area are of special importance to Native American tribes in the vicinity. For example, the Nez Perce and Shoshone-Bannock tribes hunted elk, deer and bighorn sheep (Nez Perce, 2006; Shoshone-Bannock, 2006). The Nez Perce hunted bear and mountain goats, as well. Hunting was especially important during times of the year when salmon were unavailable for food. The Shoshone-Bannock Tribes used elk horns to sharpen knives and arrow points, and turned buffalo and bighorn sheep horns into tools, from spoons to bows and shields. Big game also provided hides for clothing, and their bones, teeth, and hooves were used for decoration. Skins of smaller animals (e.g., beaver, ermine) also provided decoration. The Nez Perce hunted rabbit, squirrel, badger, and marmot when needed, and a variety of birds, including ducks, geese, grouse, and sage hens.

3.7.1.8 Land Management Practices

Idaho Power owns about 3,450 acres of land in fee within the FERC project boundary. Most of the land use is related to hydroelectric project operation, but Idaho Power also manages it for secondary residential use, general public recreation, and activities authorized by specific leases and permits. These activities influence wildlife and botanical resources in the project area.

Project-related use includes normal O&M activities associated with the hydroelectric plants, transmission lines, residential areas, access roads, a landing strip, and several recreational facilities that are part of Idaho Power's existing project license. Idaho Power defines secondary residential use as land uses associated with housing on project lands. Some employees who live in the project area graze livestock on project lands. Idaho Power indicates that grazing in well-irrigated pastures generally did not adversely affect vegetation or soils, while steeper, drier sites were more vulnerable to erosion, especially when overstocked.

Idaho Power allows dispersed recreation throughout most of the project area. The most common activities are fishing, boating, lounging, sightseeing, and hiking. Of 169 dispersed recreation sites in the project area, 55 are reported to be completely or partially on Idaho Power land. Vehicle and foot traffic has caused soil compaction and trampling of vegetation at these sites, leading to increased soil erosion and weed infestation. Damage to trees is apparent (e.g., branches cut for firewood, carving on trunks) where trees exist. Idaho Power indicates that the greatest problems are trash and human waste.

Idaho Power grants permits and leases for specific uses, including livestock grazing and agriculture, parks owned and operated by other entities (e.g., local governments, concessionaires, private recreation organizations), and private boat docks, cabins, and associated landscaping. Some unauthorized land uses also occur, whether intentional or accidental. Idaho Power indicates that the most common unauthorized use is cattle grazing where private lands abut Idaho Power property.

Currently, Idaho Power manages three agriculture and grazing leases on the Powder River arm of Brownlee reservoir. Two of these are within the FERC project boundary. The 10-acre Myers lease allows 35 animal unit months of grazing, beginning about March 1 and continuing through September, to assure 10 to 12 inches of grass re-growth by October 1 to provide winter forage for wildlife. In addition to irrigated uplands, this parcel includes high-quality riparian habitat and supports a bald eagle roost. The riparian area is fenced off from the irrigated pasture, but Idaho Power notes that the fence is in disrepair. The parcel is not fenced from the reservoir shoreline, and Idaho Power observed evidence of trespass grazing as cattle from nearby ownerships cross the Brownlee drawdown zone in early fall to access the Myers lease.

The 28-acre Wright lease also provides high-quality riparian habitat, and another bald eagle roost. This parcel has been used for cultivated crops (e.g., alfalfa). Like the Myers lease, the parcel is fenced from adjacent agricultural fields, but is not fenced along the reservoir, and trespass cattle grazing occurs.

Idaho Power has issued permits for four major parks. Hewitt Park's permit covers the boat ramp, docks, and the shoreline edge. The Holcomb Park permit covers day-use (parking and picnicking), the boat ramp, docks, and the shoreline edge. These two parks are heavily used for reservoir access and fishing, but do provide some habitat for wildlife.

At Steck Park, the permit covers the entire shoreline and a boat ramp and docks. The railroad separates the main park from the shoreline, so there is little recreation activity along the shoreline. This separation has provided some level of protection for riparian habitat at Steck Park. Limited access to a boat ramp and dock at Spring Recreation site (permitted to BLM) affords some protection for riparian habitat at this site, as well.

In addition to the leases and permits identified above, Idaho Power has issued a permit for gravel storage and crushing that covers an area of about 5 acres adjacent to the Huntington-Richland Road. Three permits cover communication lines and facilities, which are generally aligned within existing road rights-of-way. A commercial permit issued to Mountain Man Lodge and Marina, located at the mouth of Dennett Creek, has not been used for several years.

Most private residences, cabins, and accompanying docks permitted by Idaho Power are located at the upper end of Brownlee reservoir, outside crucial mule deer winter range and the migration corridor. Most of these structures are used in late spring, summer, and fall. They are vacant during the winter, when human activity could disturb wildlife.

The Powder River arm contains a number of floating house docks. These structures are also used primarily in late spring, summer, and fall, so although they are located within an area that is considered crucial winter range, Idaho Power reports that disturbance is unlikely. These structures may adversely affect terrestrial and aquatic resources, however, through their impacts on water quality; no sanitation standards are required by either Oregon or Idaho DEQ. Idaho Power's current policy is to permit no new floating house docks.

As mentioned above, the most common unauthorized land use in the project area is trespass grazing. This is of special concern along the north and west sides of the Powder River arm, where the receding reservoir allows animals to graze on project lands, where they damage riparian habitat. Trespass grazing is also a concern on the east side of Brownlee reservoir between Woodhead Park and Mountain Man Lodge, where damage to riparian habitat could also occur.

At the current time, Idaho Power's HCRMP provides guidance for management of Idaho Power's lands. The HCRMP contains 87 "common policies" aimed at protecting and improving environmental quality, recreation, aesthetics, and cultural resources, including 13 that specifically target botanical resources, and three that pertain specifically to wildlife resources. The HCRMP also contains three resource management classifications that designate areas where natural or cultural resources are of primary concern. These designations (special management, resource protection, and resource conservation areas) are intended to provide additional protection or management guidance to address specific concerns.

3.7.2 Environmental Effects

3.7.2.1 Effects of Project Operations on Terrestrial Resources

We describe Idaho Power's Proposed Operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on reservoir levels and project outflows in section 3.3.2, *Effects of Project Operations on Water Quantity*. In section 3.3.2.2, we identify operation-related recommendations filed by agencies, tribes, and other parties (table 9), and we describe three alternative operational scenarios that we use to assess the effects of the various operation-related recommendations. At our request (AIR OP-1), Idaho Power simulated project operations for these representative scenarios under various hydrologic conditions. Refer to section 3.3.2.2 for additional discussion of the scenarios and the modeling process used for the simulations. We use the results of these simulations to assess the effects of the operation-related recommendations.

In the following sections, we evaluate the effects of Idaho Power's Proposed Operations and operation-related recommendations received from agencies, tribes, and other parties on the following resources: (1) special status plants; (2) noxious weeds and exotic non-native plants; (3) riparian habitat and associated wildlife; (4) island and beach habitat and associated wildlife; (5) fish-eating wildlife species; (6) big game winter range and migration routes; and (7) plants and game species of cultural importance.

Special Status Plants

Reservoir fluctuations and flow fluctuations can alter hydrologic support for rare plant populations that may occur within fluctuation zones and can cause erosion and soil disturbance. In this section, we evaluate the effects that proposed and alternative operations would have on special status plants, based on studies conducted by Holmstead (2003a), Krichbaum (2000), and Braatne et al. (2002) and on Idaho Power's responses to AIR OP-1.

Our Analysis

Idaho Power documented the occurrence of several populations of six rare plant species. Three of these—stalk-leaved monkeyflower, Hazel's prickly phlox, and Oregon bolandra—grow at elevations above the influence of water level fluctuations. They are not affected by current operations, and no changes would be expected under Proposed Operations or any of the flow alternatives.

Populations of three other species—porcupine sedge, Schweinitz flatsedge, and American wood sage—grow near or below the MHWM. Krichbaum (2000) noted hydrologic disturbance at some of the sites where these species occur. Braatne et al. indicated that the source of the disturbance is occasional peak flows.

Porcupine Sedge

As mentioned in section 3.7.1.2, *Special Status Plants and Plant Communities*, one population of porcupine sedge is located below the MHWM in the Oxbow reservoir reach. Modeling provided in response to AIR OP-1(g) indicates that none of the modeled flow alternatives would result in much change in the pattern of reservoir fluctuation at Oxbow reservoir. For this reason, disturbance effects on this porcupine sedge population would likely be the same under any alternative.

The three populations downstream of Hells Canyon dam are also located below the MHWM. Surveyors noted disturbance within the flow zone at these sites. None of the flow alternatives would alter spring peak flows, so none would increase disturbance to these populations. However, Proposed Operations would reduce flows during July and August, thus reducing the irrigation effect that now provides hydrologic support to riparian vegetation growing along the shoreline. We discuss this effect in more detail in *Riparian Habitat and Associated Wildlife* below.

The Scenario 1a (Reregulating) would eliminate flow fluctuations due to load following and reduce ramping rates. This alternative would reduce hydrologic support for plants growing along the MHWM to a slightly greater extent than under Proposed Operations.

Under the Scenario 2 (Flow Augmentation Alternative), daily flow fluctuations would be reduced from March through May, but average flows and flow fluctuations during the summer would be about the same as under current conditions. Effects on existing porcupine sedge populations would likely be about the same as they are under current conditions.

The effects of the Scenario 3 (Navigation) would likely be about the same as Proposed Operations. Slight differences would occur in extremely low water years, when the Navigation Scenario would require less flow fluctuation in June and July, and more flow fluctuation in August.

Schweinitz Flatsedge

Three populations of Schweinitz flatsedge extend into the flow zone along the Snake River downstream of Hells Canyon dam. Under existing conditions, annual peak flows may disturb these three populations. Implementation of Proposed Operations or any of the other flow scenarios could adversely affect these three occurrences, as well, for the same reasons discussed above with regard to porcupine sedge. Implementation of the Flow Augmentation Scenario would have the least effect.

Surveyors observed 18 populations of Schweinitz flatsedge growing above the MHWM in upland shrub savanna communities, extending away from the river for 20 or more meters. Braatne et al. (2002) studied the distribution of six randomly selected populations of Schweinitz flatsedge and found they were located at the upper end of the facultative riparian zone, where they would be only rarely inundated by peak flows. Their occurrence primarily in upland shrub savanna communities also suggests that this species is tolerant of drier upland conditions, as well as moist riparian conditions. Proposed Operations or any of the flow scenarios would reduce the area of upland shrub savanna by reducing the irrigation effect associated with load following. Idaho Power predicts that with drier conditions, shrub savanna would convert to tree savanna. Changes under the Flow Augmentation Scenario would be very small (2.5 acres), with larger areas of conversion under the Reregulating Scenario (24.9 to 41.2 acres, depending on ramping rates) or the Navigation Scenario (18.2 acres).

American Wood Sage

Surveyors documented one population of American wood sage growing along the Snake River downstream of Hells Canyon dam. This population spans the MHWM, and some plants grow within the flow zone. Surveyors recorded heavy disturbance at this site because of its location in the flow zone. Implementation of Proposed Operations or any of the flow scenarios would be likely to adversely affect this occurrence of American wood sage, again, by reducing hydrologic support that now occurs as a result of load following.

Our evaluation indicates that annual peak flows cause some disturbance to several populations of rare plants growing near the MHWHM along the Snake River. None of the flow scenarios would modify the magnitude, timing or duration of peak flows, so this type of disturbance would be expected to continue.

All of the flow scenarios would slightly reduce the area of riparian vegetation and the area of shrub savanna because they would reduce the magnitude of stage fluctuations. For this reason, implementation of any of the flow scenarios would be likely to affect the rare plant populations described above.

In addition to hydrologic disturbance, Krichbaum (2000) recorded disturbance from recreation and livestock trampling or grazing at sites occupied by rare plants. This finding indicates that protective measures could be needed under any flow scenario that would be implemented. We discuss these measures in section 3.7.2.2, *Special Status Plant Protection*.

Noxious Weeds and Invasive Exotic Plants

Changes in project operation, including reservoir fluctuations and river flow fluctuations downstream of Hells Canyon dam, may disturb soil, creating conditions that promote the establishment and spread of noxious weeds and invasive exotic plants. Changes in Project Operations may also alter the hydrologic regime that supports plants growing along the reservoir and river margins. In this section, we evaluate the effects that proposed and alternative operations would have on existing weed populations and their potential to spread. Our evaluation is based on information provided in Holmstead (2003a), Krichbaum (2000), and Braatne et al. (2002), and on Idaho Power's response to AIR OP-1 items c (Navigation), f (Aquatic Resources), and g (Terrestrial Resources).

Our Analysis

A number of factors likely influence the pattern of weed distribution in the project area. Adjacent lands provide an abundant seed source and vehicle traffic, livestock grazing, road maintenance, and recreational activities can serve as vectors for weed introduction and spread. Riparian habitats are especially vulnerable because they are exposed to ground disturbance through flood events, scouring, and erosion. Roots, plant fragments, and seeds may be carried downstream, and readily establish in moist shoreline soils.

Some riparian weed species appear to be especially suited to establishing and thriving in reservoir and riverine fluctuation zones. Krichbaum (2000) identified seven species (purple loosestrife, salt cedar, false indigo, perennial pepperweed, reed canarygrass, yellow nut sedge, and common horsetail) as being positively associated with water level fluctuations, i.e., apparently benefiting from a variable moisture regime.

Braatne et al. (2002) modeled the effects of Proposed Operations and a run-of-river scenario (in which all three project reservoirs would be held at full pool) on proliferation and dispersal of 20 species, including most of seven plants identified by Krichbaum (2000) as benefiting from a variable moisture regime. The results of the study were inconclusive regarding the effects of project operation on purple loosestrife, and indicated that Proposed Operations would have little effect on dispersal of the other species, with the exception of salt cedar. Braatne et al. (2002) concluded that seasonal drawdown of Brownlee reservoir may be very important in preventing the downstream dispersal of salt cedar. Seedlings that might establish in the drawdown zone during mid-summer would not survive subsequent drought, followed by inundation. Braatne et al. (2002) also concluded that Proposed Operations would limit the proliferation and dispersal of at least three other perennial species (white top, leafy spurge, and possibly Russian olive). The same is likely true of many riparian weed species that were not included in the modeling study.

Braatne et al. (2002) did not find any correlation between reservoir operations and the dispersal of upland weeds, with the exception of puncture vine. The study results indicated that Proposed Operations would favor increased occurrence and expansion of this species.

Idaho Power's modeling in response to AIR OP-1(g) resulted in essentially the same findings for Proposed Operations, the Reregulating Scenario, the Flow Augmentation Scenario 2, and the Navigation Scenario. Few weed species would survive the seasonal pattern of inundation and desiccation to be transported downstream, and operations at Brownlee would continue to provide some protection for downstream reaches.

However, some increase in the area of weed coverage could occur under the Flow Augmentation Scenario because more area would be exposed from August through October or November than under any of the other scenarios. Weedy annuals (e.g., puncturevine) could establish at elevations between full pool and 2,050 feet msl as reservoir elevations fell during July. These plants could mature and set seed before the reservoir began to fill again in the fall.

Proposed Operations and all the flow scenarios would return Oxbow and Hells Canyon reservoirs to full pool on a daily or near-daily basis. For this reason, no changes would occur within the fluctuation zone or along the shorelines, compared to existing conditions.

None of the flow scenarios would be likely to result in measurable changes in the abundance or distribution of noxious weeds and exotic invasive plants along the Snake River downstream of Hells Canyon. However, reduced ramping rates that would occur under the Reregulating and Flow Augmentation scenarios could reduce erosion. Because weeds often colonize disturbed soils, any reductions in erosion could be of benefit in limiting the establishment and spread of weeds.

A review of Krichbaum (2000) indicates that several human activities and land uses are causing disturbance along the river corridor. These sources of disturbance have a greater potential to influence weed patterns than any of the flow regimes under consideration. We discuss the importance of weed monitoring and control measures in section 3.7.2.3, *Noxious Weed and Exotic Invasive Plant Management*.

Plants of Cultural Importance

Many of the plants that occur in the project area and that may be affected by project operations are important to Native American tribes in the region. In this section, we evaluate project effects on some of these, based on Idaho Power's technical studies (Reed-Jerofke, 1999; Whipple, 2001) and response to OP-1, as well as publicly available information about plants used by tribes in the vicinity.

Our Analysis

As described in section 3.7.1.3, *Plants of Cultural Importance*, vegetation in the project area includes a number of species that are important to Native American tribes for food and medicine. Plants also provide materials for clothing, basketry, decoration, and ceremonial purposes. Plants of importance are found in both upland and riparian habitats in the project area.

Shrub-steppe and grasslands dominate the landscape. In these cover types, important plants may include sagebrush, rabbitbrush, yarrow, desert parsley, and biscuit root. As discussed in section 3.7.2.5, *Upland and Riparian Habitat Acquisition*, project operations preclude the establishment of about 5,761 acres of upland vegetation within the fluctuation zones of Brownlee, Oxbow, and Hells Canyon reservoirs. A review of Idaho Power's response to OP-1 indicates that none of the modeled flow scenarios would affect upland vegetation associated with the project reservoirs, and there would be no change in habitat conditions.

Riparian habitats and wetlands are very limited in the project area because of the steep canyon walls, rocky soils, and dry climate. Culturally important species along the Snake River and its tributaries include coyote willow, serviceberry, and poison ivy. Wetland plants, such as tule and cattail, are uncommon. Project operations preclude the establishment of about 731 acres of riparian habitat within the fluctuation and shoreline zones of Brownlee, Oxbow, and Hells Canyon reservoirs (see section 3.7.2.5).

We discuss the effects of Proposed Operations and other flow scenarios on riparian and upland habitat along the Snake River downstream of Hells Canyon dam in *Riparian Habitat and Associated Wildlife*, below. Mitigation measures that protect or improve these habitats would similarly be expected to benefit culturally important plants, as well as more broadly classified riparian and upland plant communities. Mitigation measures that address completion of ethnographic studies might also be useful in pin-pointing species of importance and identifying measures to protect or enhance them.

Game Species of Cultural Importance

As described in section 3.7.1.7, *Game Species of Cultural Importance*, several big game species, smaller mammals, waterfowl, and game birds were important sources of food, clothing, or decoration to Native Americans tribes in the area, and several continue to be important. In the following section, we evaluate project effects on some of these, based on Idaho Power's technical studies (Reed-Jerofke, 1999; Whipple, 2001) and response to AIR OP-1, as well as publicly available information about culturally important wildlife species.

Our Analysis

Animals of cultural importance include many of the wildlife species that occur in the project area. For this reason, negative or positive project effects on wildlife would in turn affect cultural resources. We discuss project effects on waterfowl and big game below, in *Island and Beach Habitat and Associated Wildlife* and *Big Game Winter Range and Migration Routes*. Project effects on smaller mammals (such as rabbits and squirrels) and game birds were not identified as a specific issue during scoping, but the loss of upland habitat within the fluctuation zone of Brownlee reservoir has reduced habitat availability for many species that were hunted by several Native American tribes when deer and elk were unavailable.

Mitigation measures that protect or improve habitat conditions for these species would benefit cultural resources, as well as wildlife in general. Mitigation measures that call for completion of ethnographic studies might also be useful; as in the case of culturally important plant species, additional information could help to identify species that are of particular interest, which could be enhanced through implementation of specific measures.

Riparian Habitat and Associated Wildlife

Current project operations prevent the development of riparian habitat within the fluctuation zones of Brownlee, Oxbow, and Hells Canyon reservoirs and limit the development of perennial riparian vegetation along the full pool shoreline of Brownlee reservoir. Load following operations downstream of Hells Canyon dam also affect riparian habitat. In addition to altering the amount of habitat available for wildlife, project operations may contribute to riparian habitat fragmentation. In this section, we evaluate the effects of Proposed Operations and alternative flow scenarios on riparian habitat and associated wildlife, based on Idaho Power's technical studies (Turley and Holthuijzen, 2003b; Rocklage and Edelmann, 2003a; Holthuijzen, 2003a; Eshelman, 2003; Turley and Holthuijzen, 2003a; Edelmann and Pope, 2003; Blair et al., 2003; Rocklage and Edelmann, 2003b; Holmstead, 2003a; Braatne et al., 2002) and Idaho Power's response to AIR OP-1.

Our Analysis

Many studies show the importance of riparian habitat in the arid west. More wildlife species use riparian habitats than any other vegetation type (Kauffman et al., 2001; Thomas et al., 1979; Knopf et al., 1988). Riparian habitat provides a wetter, cooler microclimate and supports higher levels of primary productivity than surrounding, drier shrub-steppe and grassland cover types. Riparian plant communities have higher levels of species and structural diversity, which in turn provide unique food resources, nesting opportunities, and hiding and thermal cover for wildlife. Riparian plant communities also function as travel corridors that allow for daily movements, seasonal migration, and juvenile dispersal.

In the Hells Canyon study area, Holmstead (2003a) found that riparian habitat accounts for less than 5 percent of the study area and occurs along less than 9 percent of the shoreline between Weiser and the Salmon River confluence. Several factors influence the extent of riparian vegetation. These include the topography, soils and climate of the region, in addition to project operations. Because of these factors, riparian habitat may never have been extensive in the project vicinity and would not be likely to expand significantly under any project alternative.

With the exception of the Powder River arm, the shoreline of Brownlee reservoir is mostly steep, rocky, and bare of vegetation. Riparian habitat is restricted to small patches at the mouths of tributary drainages. Under existing conditions, seasonal drawdown of Brownlee reservoir precludes the establishment of 372 acres of riparian habitat within the fluctuation zone and 343 acres of riparian habitat along the shoreline.

The shorelines of Oxbow and Hells Canyon reservoirs are also steep, but without extensive seasonal drawdown, both reservoirs support a narrow band of riparian vegetation along the high water mark. Relatively small reservoir fluctuations prevent the establishment of 7 and 9 acres of riparian habitat, respectively.

Idaho Power estimates that the effects of project operations on riparian vegetation would be minor under any of the modeled flow scenarios. There would be no change in riparian habitat at Brownlee reservoir. Riparian habitat along the shoreline at Oxbow reservoir would be reduced by less than 1 acre under any of the flow scenarios, with a corresponding increase in upland habitat. At Hells Canyon reservoir, Proposed Operations would reduce riparian habitat along the shoreline by 0.82 acres. Losses under the Reregulating Scenario would range from 0.84 to 1.51, depending on ramping rate. The loss under the Flow Augmentation Scenario would be 1.57 acres, and under the Navigation Scenario 3, the loss would be 1.47 acres.

Proposed Operations and all the flow scenarios would result in larger changes in riparian and upland habitats along the Snake River downstream of Hells Canyon dam. This reach currently supports 242 acres of riparian vegetation. Under current conditions, load following results in average daily stage changes (as measured at the Hells Canyon gage) measuring from more than 1 foot to more than 4 feet. Stage fluctuations occur within the scour zone, where rocky substrate and annual peak flows prevent the establishment and long-term survival of a dense riparian plant community (Braatne et al., 2002). In its comments on the draft EIS, the Forest Service estimated that flow fluctuations combined with the loss of fine-grained sediments has prevented the establishment of native willows (primarily sandbar willows) on about 49 acres of shore and bottomland wetland. However, stage elevations influence soil moisture above the scour zone on the side slopes, providing daily or almost-daily irrigation to shoreline vegetation (Braatne et al., 2002).

Proposed Operations and all of the modeled flow scenarios would reduce the irrigation effect. With reduced hydrologic support, plant assemblages within the area influenced by project operations would transition to drier cover types, following a continuum related to soil moisture on the riverbanks.

Table 68 shows the existing acreage of riparian and upland cover types along the Snake River downstream of Hells Canyon dam, and the change in acreage that would occur as a result of implementing each of the flow scenarios. The table omits natural features (e.g., cliffs) and developed sites (e.g., campsites) because it is assumed they would not change as a result of Proposed Operations or other flow scenarios.

Table 68. Acres of existing upland and riparian cover types along the Snake River downstream of Hells Canyon dam, and the change in acreage that would result from implementation of various flow scenarios.

Cover Type	Existing Conditions	Proposed Operations	Scenario 1a (Regulating)	Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate)	Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate)	Scenario 2 (Flow Augmentation)	Scenario 3 (Navigation)
Uplands							
Other upland	30.5	11.30	22.50	20.20	13.6	1.30	9.90
Grassland	196.9	–10.40	–20.60	–18.50	–12.50	–1.20	–9.10
Tree savanna	16.9	22.8	45.30	40.60	27.40	2.70	20.00
Shrub savanna	412.0	–20.80	–41.20	–36.90	–24.90	–2.50	–18.20
Shrubland	52.9	12.00	23.70	21.30	14.40	1.40	10.50
Riparian Cover types							
Forested wetland	33.6	–2.00	–3.90	–3.50	–2.30	–0.30	–1.70
Scrub-shrub wetland	226.6	–13.00	–25.80	–23.10	–15.60	–1.50	–11.40
Emergent herbaceous wetland	1.7	–0.10	–0.20	–0.20	–0.10	0.00	–0.10
Shore/bottom-land wetland	329.1	56.20	111.40	99.80	67.40	6.80	49.30
Water	2,009.7	–56.20	–111.40	–99.80	–67.40	–6.80	–49.30
Total Change in Riparian Habitat (wetland and water)		–15.10	–29.90	–26.80	–18.00	–1.80	–13.2

Most changes would occur in scrub-shrub wetland, which grows closest to the existing MHWM and which accounts for most of the existing riparian vegetation. Scrub-shrub wetland would transition to shrubland. Some shrubland would convert to shrub savanna, but there would be a net loss in shrub savanna with some of this cover type becoming tree savanna. Netleaf hackberry would likely remain a dominant component of all these plant assemblages because it is tolerant of a variety of conditions. Coyote willow, which accounts for only about 17 percent of the scrub-shrub plant assemblages, is less tolerant of dry conditions, and would likely be reduced under all flow scenarios except Scenario 2 (Flow Augmentation).

Relatively large acreage changes would occur in water and shore and bottomland wetland cover types, also. Spring flooding would continue to scour rocky substrates within the flow zone. However, reduced load following would likely allow some perennial vegetation, such as netleaf hackberry, to colonize the newly exposed substrate. Coyote willow would likely be less successful, but Braatne et al. (2002) notes that interstitial sands and fine sediments required for its establishment remain trapped between larger rocks and underlying coarse layers. Idaho Power assumed that any perennial riparian vegetation that would establish in the larger area of shore and bottomland wetland would not provide significant habitat for wildlife.

Available information does not allow for specific predictions of how wildlife use patterns might change in response to changes in habitat availability. Idaho Power conducted numerous studies to evaluate the species-habitat associations of birds, mammals, amphibians, and reptiles and found that the characteristics of the canyon landscape complicate the interpretation of results. The size of habitat patches is relatively small and patches are well interspersed. For this reason, many wildlife observations may have been of animals moving between preferred habitats. In addition, many species that occupy Hells Canyon are generalists that use a variety of habitats, and others are associated with edge habitats.

In general, the changes shown in table 68 mean that less habitat would be available for species that use or rely on scrub-shrub wetland, forested wetland, emergent herbaceous wetland, shrub savanna, and grassland. More habitat would be available for species that use or rely on shore and bottomland wetland, shrubland, tree savanna, and desertic cover types.

The Terrestrial Resources Work Group (TRWG) identified several species and species groups as being associated with riparian shorelines, and potentially affected by project operations. These include mountain quail, neotropical migrants (e.g., willow flycatcher, yellow warbler, MacGillivray's warbler, Townsend's warbler, Wilson's warbler, plumbeous vireo, and yellow-headed blackbird), and the northern river otter. The TRWG did not identify inland tailed frog and western toad as being associated with riparian shorelines, but they are also of interest because of their association with riparian habitats. Based on species-habitat associations identified in the Draft Conservation Plan for Mountain Quail (Sands et al., 1998) for Idaho, mountain quail are strongly linked to riparian habitats characterized by tall shrub cover, medium canopy (25 to 50 percent coverage), and relatively sparse understory vegetation. Rocklage and Edelmann (2003a) used a landscape-level habitat model to calculate habitat suitability for mountain quail. They found that values were fairly high in scrub-shrub riparian habitat along the Snake River downstream of Hells Canyon dam (0.81 to 0.82 on a scale of 0 to 1.0). Suitability of shrubland and shrub savanna was much lower (0.02), while tree savanna was moderate (0.56 to 0.58). Based on the model, flow alternatives that would reduce scrub-shrub wetland may reduce the area of habitat available for mountain quail. Reductions in scrub-shrub wetland along the river would also reduce connectivity between tributaries.

All of the neotropical migrant bird species identified by the TRWG use a variety of habitats during spring migration, and changes between scrub-shrub wetland and shrubland would not be likely to affect their movement through the canyon. During the breeding season, the willow flycatcher, yellow warbler, Wilson's warbler, and MacGillivray's warbler usually nest in mesic to wet deciduous riparian habitats, usually dominated by willow, cottonwood, and alder shrub (Sedgwick, 2000; Lowther et al., 1999; Ammon and Gilbert, 1999; Pitochelli, 1995). The loss of scrub-shrub wetland and forested wetland could reduce available nesting habitat for these species. However, all of these species are currently either uncommon or were not documented along the Snake River downstream of Hells Canyon dam (Turley and Holthuijzen, 2003b).

Changes in project operation would not likely affect nesting habitat for the plumbeous vireo, Townsend's warbler, or yellow-headed blackbird. The plumbeous vireo and Townsend's warbler are generally associated with conifer forest during the breeding season (Curson and Goguen, 1998; Wright et al., 1998). The yellow-headed blackbird typically nests in emergent herbaceous wetlands (Twedt and Crawford, 1995).

River otters are present throughout the project area. Although optimal habitat is sometimes described as slow-moving water with deep pools, dense riparian vegetation, and abundant prey, studies in the Payette and Clearwater River systems indicate that otters use a variety of habitats in Idaho (Mack and et al., 1994; Melquist and Hornocker, 1983). River otters in the Clearwater used rock cavities more than any other den type in areas that were either not vegetated or were characterized by a sparse shrub cover with a sparse herbaceous understory. Over half of the latrine sites were located in similar settings.

The Snake River downstream of Hells Canyon dam has a higher gradient, steeper slopes, and much less development than the study reach of the Clearwater River described above, but it is also dominated by rocky banks and relatively sparse riparian vegetation. Assuming otter use of Snake River habitats would be somewhat similar to use of the Clearwater River habitat, the change from scrub-shrub wetland to shrubland as a result of implementing Proposed Operations or any of the flow scenarios would not likely affect river otters. Reducing load following during the summer could increase the availability of suitable den sites, and any measures that would lead to more abundant fish populations would benefit otters in this reach.

It is important to note that the Clearwater study indicated that otters used sandy substrates more than would be expected, given its limited distribution. The authors suggested that a typical location for either a den or a latrine site would be a large rocky outcrop projecting into the river channel that would form an eddy with an associated sandy beach on the downstream side of the outcrop. Sand would continue to be limited in the Snake River downstream of Hells Canyon dam under any flow scenario.

Inland tailed frogs are typically associated with cold, clear, high-gradient streams (Leonard et al., 1993), and Beck et al. (2003) documented their occurrence in three tributaries to the Snake River downstream of Hells Canyon dam. Beck et al. (2003) also observed a tailed frog on the Snake River shoreline at the mouth of Granite Creek, noting that this was an unusual occurrence. Changes in project operation would not affect breeding habitat in tributary streams, but reductions in scrub-shrub wetland could interfere with dispersal. This species does not usually move far from streams, remaining in moist vegetation or debris along the banks, and drier conditions could reduce habitat connectivity along the Snake River between tributaries.

The western toad breeds in backwater ponds along the Snake River downstream of Hells Canyon dam. As described in section 3.7.2.8, *Special Status Wildlife*, surveyors noted that the availability of these ponds likely varies from year to year, depending on flows. In the Snake River Canyon, the western toad may breed as late as July in response to lower flows following annual peaks in May and June. There is no evidence that load following provides hydrologic support to these ponds, so reducing load following in July and August would not be likely to affect reproduction. The western toad is capable of long overland movements through dry forests and shrub (Leonard et al., 1993), so conversion of scrub-shrub wetland to shrubland would not likely interfere with dispersal.

Sections 3.7.2.5, *Upland and Riparian Habitat Acquisition*; 3.7.2.6, *Cooperative Wildlife Management Projects*; and 3.7.2.7, *Wildlife Management on Idaho Power Lands* describe several proposed or recommended measures that are intended to offset the adverse effects of ongoing project operations on riparian habitat. Based on our evaluation of the various flow scenarios, additional measures could be useful in addressing the effects of implementing any new flow regime.

Island and Beach Habitat and Associated Wildlife

Construction of Brownlee dam inundated about 95 acres of islands (BLM, 2002), and reservoir fluctuations affect some remaining islands within the project boundary. Flow fluctuations may also affect sandbars and beaches along the Snake River downstream of Hells Canyon dam. In this section, we evaluate the effects of proposed and alternative operations on species that are often associated with islands and beaches, including waterfowl, colonial nesting waterbirds, and river otter, based on Idaho Power's technical studies (Rocklage et al., 2003a; Pope, 2003; Turley and Holthuijzen, 2003a; Edelmann and Pope, 2003) and on Idaho Power's response to OP-1.

Our Analysis

Riverine islands and beaches are important elements of the landscape for many wildlife species that use both terrestrial and aquatic habitats. Both are intermediate or transitional zones for species that nest or den on land and forage in water. Islands afford security from terrestrial predators; geese, ducks, terns, and other ground-nesting waterbirds may reach their highest densities on islands (Johnson, 2001). Tree-nesting waterbirds also reach high densities on islands, where nests can be located within clear view of foraging areas in the water. Islands may function as stepping stones during wildlife migration or dispersal. Typically clear of vegetation, riverine beaches have the potential to provide access both up and down the river corridor, and into shallows along the river margin.

To evaluate the potential effects of Proposed Operations or any of the flow scenarios on waterfowl, colonial nesting waterbirds, and river otters, we compared their current distribution and habitat use with the types of changes that would be expected in reservoir elevations or flow regimes downstream of Hells Canyon dam.

Waterfowl

Idaho Power conducted waterfowl surveys to evaluate project effects on nesting and brooding habitat. As described in section 3.7.1.5, *Key Wildlife Species,* the results indicated that in general, waterfowl use of the project waterbodies is low. Most use occurs along the shorelines and islands between Weiser and the headwaters of Brownlee reservoir, and in the Powder River arm. Surveyors observed very few waterfowl in the Oxbow and Hells Canyon reservoir reaches, and even fewer along the Snake River downstream of Hells Canyon dam. Idaho Power concludes that conditions at the upper end of the project area, including the low gradient of the river, more extensive floodplain, and wider riparian zone, are more compatible with waterfowl nesting and brooding requirements.

A comparison of seasonal reservoir elevations under current conditions, Proposed Operations, the Reregulating Scenario, the Flow Augmentation Scenario, and the Navigation Scenario indicates riparian habitat would not change within the Brownlee reservoir fluctuation zone or along the shoreline under any of the flow scenarios because extensive seasonal drawdowns would continue to occur during the spring and fall of medium and extremely wet years. The area of exposed substrate and the percent cover of vegetation within the drawdown zone would likely vary somewhat between flow alternatives, due to changes in the timing and extent of drawdown, but the only substantial changes would occur under the Flow Augmentation Scenario from August through October or November, when the reservoir would be fairly constant at a lower level from mid-summer through the fall than would be the case under the other flow scenarios. As described above in section 3.7.2.1.2, *Noxious Weeds and Exotic Invasive Plants*, weedy annual plants could establish between full pool and elevation 2,050 feet msl during this period. Cover would likely be sparse, and this late summer weed crop would not likely provide a significant source of forage for waterfowl.

Idaho Power's modeling indicates that very little change in operation of Oxbow or Hells Canyon reservoirs would occur, and we would anticipate no change in habitat availability or suitability for waterfowl. Waterfowl use of these reservoirs would likely continue to be very low. However, waterfowl could benefit from implementation of proposed habitat enhancements at Porter, Patch, Hoffman, and Gold Islands, as described in section 3.7.2.6, *Cooperative Wildlife Management Projects*.

Colonial Nesting Waterbirds

Several species of colonial nesting waterbirds occur in the project vicinity during spring and summer, including American white pelican, double-crested cormorant, great blue heron, black-crowned night-heron, great egret, western grebe, ring-billed gull, California gull, and Caspian tern. Several other colonial nesters (e.g., snowy egret, white-faced ibis, Franklin's gull, Bonaparte's gull, and mew gull) are present in spring or summer. Many of these species nest on 94 islands that are managed as part of the Deer Flat Wildlife Refuge, located on the Snake River about 70 miles upstream of Weiser.

Idaho Power conducted surveys for colonial nesting waterbirds between Weiser and Hells Canyon dam. Surveyors documented two previously unknown nesting colonies, both in unimpounded reaches of the Snake River. Peep Island is located upstream of Brownlee reservoir at approximately RM 348, outside the project boundary and outside the area of project influence. The Powder River site is located adjacent to the project boundary at the confluence of Eagle Creek and the Powder River with Brownlee reservoir, also outside the influence of reservoir fluctuations. Both colonies support nesting double-crested cormorants, great blue herons, and black-crowned night-heron. Biologists observed one adult great egret at the Powder River site but did not document any nesting.

Habitat for colonial nesting waterbirds would not be likely to change under Proposed Operations or any of the flow scenarios because no substantial changes would occur at Brownlee reservoir or upstream. Colonial waterbirds could benefit from habitat improvements at Patch, Porter, Hoffman, and Gold islands.

Not all colonial nesting waterbirds are piscivorous, but all depend on aquatic organisms as the mainstay of their diet. Any protection, mitigation, or enhancement measures that lead to increased fish populations would benefit many of the birds in this group, and any measures that are implemented to improve water quality would benefit all of them.

Northern River Otter

As described above, biologists observed northern river otters incidentally at several locations throughout the project area, including each of the reservoirs and along the Snake River downstream of Hells Canyon dam. Also as described above, river otters use a variety of habitats across their range, but a study in the Clearwater River suggests that a combination of rocky outcrops and sandy beaches would provide for secure den sites near open grooming and latrine areas and easy access to forage across gently sloping shorelines (Mack et al., 1994). Gently sloping shorelines also provide important habitat for slow-moving resident fish and rearing juvenile salmonids that serve as prey items for river otters.

Beaches and sandbars in river systems are not static habitat features but change in size and shape from year to year. The analysis presented in the *Beach and Terrace Erosion* section shows that implementation of the Reregulating Scenario would have the greatest effect in terms of reducing the risk of sandbar mobilization and erosion. This change would likely benefit river otters that use the Snake River downstream of Hells Canyon dam.

Measures that would increase fish populations would benefit river otters throughout the project area, and improvements in water quality would be especially important. As a top predator in the aquatic food chain, river otters are heavily exposed to contaminants. We discuss this concern in more detail in the *Fish-eating Wildlife Species* section below.

Fish-eating Wildlife Species

The Hells Canyon Project may affect fish-eating wildlife species in several ways: by affecting anadromous fish populations in the Snake River downstream of Hells Canyon dam, blocking anadromous fish from the Snake River upstream of the dam, and contributing to the accumulation of contaminated sediments in Brownlee reservoir. In this section, we evaluate the effects of Proposed Operations and other flow scenarios on fish-eating wildlife species, based primarily on Idaho Power's response to AIR OP-1 and a review of pertinent literature.

Our Analysis

Numerous studies over the past decade have investigated the relationship between salmon and terrestrial ecosystems (Bilby et al., 2003; Cedarholm et al., 2001; Naiman et al., 2002). In general, researchers are finding that salmon contribute substantially to terrestrial systems through several pathways (Gende et al., 2002). Studies in western Washington indicate that salmon directly or indirectly affect more than 100 wildlife species. At least 22 species of birds and mammals prey on salmon eggs or live salmon, or forage on salmon carcasses in freshwater systems. Salmon consumption may improve fitness (i.e., growth rate, litter size, reproductive success), suggesting that salmon play an important role in population dynamics of species, such as river otters, black bears and bald eagles.

Under current conditions, salmon provide a forage resource for fish-eating wildlife species along the Snake River downstream of Hells Canyon dam, but load following may limit their abundance. As discussed in section 3.6.2.1, *Effects of Project Operation on Aquatic Resources*, several changes in project operation could improve conditions for fall Chinook salmon, which would increase the forage base for fish-eating wildlife. There is no evidence that fall Chinook salmon populations affect otter, bear, or eagles in the Snake River System under current conditions, but no survey data are available to show population trends for fish-eating species other than for bald eagles. As described in section 3.8.1, *Threatened and Endangered Species*, bald eagle populations have increased substantially since 1998, with four new nests discovered between 2003 and 2004. In general, however, measures that would improve conditions for fish would also improve conditions for wildlife that prey on them. Indirect benefits to riparian plant and animal communities may also occur, as nutrients are transported to terrestrial habitats along the river corridor. Measures addressing a phased approach to restore anadromy upstream of Hells Canyon dam, improve fish habitat in project tributaries, and distribute salmon carcasses to increase bull trout forage measures to improve fish habitat in tributaries which would also benefit fish-eating wildlife, over time. We evaluate these measures prospective measures in sections 3.6.2.6, *Anadromous Fish Restoration*, 3.6.2.10, *Tributary Habitat Improvements*, and 3.6.2.11, *Marine-Derived Nutrients.*

Our analysis of project effects on anadromous fish rearing (in 3.6.2.1, *Effects of Project Operations on Aquatic Resources*) indicates that increasing habitat stability would benefit rearing fall Chinook salmon. Implementation of the Reregulating Scenario would result in the highest level of stability. Proposed Operations, the Navigation Scenario, and higher ramping rate scenarios (e.g., 6 inches per hour) would provide the least stable habitat conditions. Lower ramping rates would also result in less dewatering, which would result in higher production of aquatic macroinvertebrates that supply forage to rearing Chinook salmon. Finally, lower ramping rates would result in less stranding of juvenile Chinook salmon. Reducing stranding could improve survival for a number of other fish species, as well, that serve as prey for river otters and other animals. Stranding surveys identified substantial numbers of steelhead, smallmouth bass, carp, and Cyprinids in entrapment pools.

As discussed in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, continuing to maintain a stable flow regime would be more protective of Chinook salmon redds than a variable flow regime. Stable flows between 8,000 cfs and 15,000 cfs would likely be optimal, based on the relationship between habitat capacity and flow.

Another issue related to project effects on fish-eating wildlife is the accumulation of contaminated sediments in Brownlee reservoir; these contaminated sediments are passed up the food chain to top predators, such as bald eagles, great blue heron, and river otters. Bioaccumulation of contaminants in birds and mammals that prey on fish may affect their behavior, impair reproduction, or cause death. To evaluate the potential effects of contaminants in Brownlee reservoir, Idaho Power reviewed a 1998 USGS study that focused on organochlorine compounds and trace metals found in bottom sediments and in tissues of fish captured in Brownlee reservoir (Dombrowsky et al., 2000). These authors compared the levels of contaminants found in these fish with national and regional findings, and modeled the potential exposure concentrations in great blue heron and river otter. Based on these comparisons, concentrations of DDT/DDE far exceeded ecologically based benchmarks (threshold concentrations below which adverse effects are considered unlikely to occur) for great blue heron and river otter.

A more recent study of bald eagle exposure to contaminants in southern Idaho indicates that nestlings in the Hells Canyon Project area are being exposed to relatively high levels of DDT, as the Snake River drains agricultural lands across southern Idaho (Bechard et al., 2006). However, the average level of 0.06727 ppm DDE in the blood of eagle nestlings was well below the 2.7 ppm DDE threshold considered to cause observable adverse effects.

The Bechard et al. (2006) analysis of adult bald eagle feathers from Hells Canyon showed high levels of mercury, as well, with levels exceeding 25 ppm. These levels are comparable to those found in eagles in other studies in other parts of the country (e.g., Georgia), but higher than the accepted level of concern of 7.5 ppm (Eisler, 1987). The significance of the higher levels is difficult to interpret, for example, Bechard et al. (2006) noted that all the eagles included in the southern Idaho study were breeding successfully.

Idaho Power monitored one bald eagle nest in 1998, which produced one young. Two nests were monitored between 1999 and 2001. Both nests produced one young in 1999, and two young in 2000 and 2001. Idaho Power monitored productivity at five of the six eagle nests in the project area in 2004 and 2005. It found the average number of young fledged was 2.4 in 2004 and 1.4 in 2005. Although productivity in each year of monitoring between 1998 and 2005 exceeds the recovery plan target of 1.0, the drop between 2004 and 2005 suggests that monitoring productivity, as well as occupancy, may be necessary to determine long-term trends. IDFG's 2006 report on annual bald eagle surveys recommends continued productivity monitoring on a state-wide basis, noting a downward trend in 2005 and 2006. In 2006, the percentage of nests failing to produce young was among the highest on record, and the number of young fledged per occupied nest fell below one, only the third time numbers have been below one since 1979 (Sallabanks, 2006).

Big Game Winter Range and Migration Routes

Because of its size, location, and the formation of ice in winter, Brownlee reservoir may function as a block to migrating mule deer, elk, and bighorn sheep, as well as reducing the availability of low-elevation winter range. In this section, we evaluate the effects of Proposed Operations and other flow scenarios on big game winter range and reservoir crossings, based on Idaho Power's technical studies (Ryel et al., 2003; Edelmann, 2003; Edelmann et al., 2003a, Ratti and Lucia, 1998; Edelmann et al., 2003b) and Idaho Power's response to OP-1.

Our Analysis

Idaho Power estimated populations of mule deer, elk, and bighorn sheep during surveys in 1998, 2000, and 2001 (Edelmann et al., 2003a). These authors observed mule deer throughout the rim-to-rim survey area, from the Weiser Bridge to Hells Canyon dam. Elk were present in about half the survey units, and bighorn sheep were reliably seen in very few of the survey units.

Densities for mule deer ranged from 1.6 to 20.1 deer per square kilometer. The highest densities occurred toward the north end of the reservoir, including the Powder River arm.

Elk densities were much lower, ranging from 0.02 to 8.2 elk per square kilometer. Elk tended to be scattered along the length of Brownlee reservoir, with slightly higher densities on the east side. Surveys did not identify important migration routes.

Bighorn sheep densities were also low, ranging from 0.01 to 1.2 sheep per square kilometer. The highest densities occurred just north of Brownlee dam in the Oxbow reservoir reach. Surveys did not identify any migration routes.

As discussed in section 3.7.1.5, *Key Wildlife Species*, the population surveys confirmed that the project area bisects some of the most important mule deer winter range in the region. For this reason, Idaho Power conducted several studies focusing on mule deer. The results of the studies indicated that Brownlee reservoir, in particular, limits winter habitat selection and increases winter mortality on about 86,408 acres of crucial winter range. Edelmann (2003) calculated that the project reduces habitat capability of winter range by 10 percent during average winters, and by an additional 9 percent during harsh winters.

Based on Idaho Power's modeling in response to AIR OP-1, none of the flow scenarios would alter habitat conditions for mule deer at Brownlee, Oxbow, or Hells Canyon reservoirs, and Brownlee reservoir, in particular, would continue to limit habitat capability. We discuss measures to offset project effects on habitat capability (e.g., acquisition, protection, and enhancement of land adjacent to the project, and implementation of specific habitat improvements on lands already in Idaho Power's ownership) in sections 3.7.2.5, *Upland and Riparian Habitat Acquisition*, and 3.7.2.7, *Wildlife Management on Idaho Power Lands*.

Results of the mule deer ecology study showed that the Powder River arm is an important migration corridor for deer that summer in the Wallowa Mountains and winter around Brownlee reservoir (Edelmann, 2003). Fall migrations occur into early January. Monitoring of radio-collared deer showed that migrating mule deer crossed the Powder River arm and the southern portion of the reservoir. Based on the number of deer that winter adjacent to Brownlee reservoir and the number of radio-collared deer that crossed, Edelmann (2003) estimated that from 1,000 to 1,500 deer likely move across the Powder River arm during fall migrations.

During 3 years of study, Edelmann (2003) reported 6 mortalities that likely were associated with reservoir crossings, either as a direct result of drowning or as a result of predation related either to water or ice crossings. Edelmann did not identify any significant correlation between the number of crossings and the elevation of Brownlee reservoir but did note a trend suggesting that more deer crossed the reservoir for short periods of time in the winter of 1999 when the reservoir was drawn down 80 feet than when the reservoir was kept at full pool during the winters of 2000 and 2001.

To further explore the effects of the project on mule deer migration and movement, Idaho Power conducted simulations of reservoir ice formation using the 2D CE-QUAL-W2 model (Ryel et al., 2003). The model simulated ice formation, thickness, persistence, and melting under Proposed Operations and a run-of-river scenario in dry, medium, and wet years (Ryel et al., 2003). The model compared icing patterns during December, January, and February, when ice is most likely to form, and then related icing patterns to the timing of big game migration.

Ryel et al. (2003) found that ice thickness and duration were about the same under Proposed Operations and the run-of-river scenario, suggesting that differences in lateral and vertical mixing of water within the reservoir would not be sufficient under either scenario to greatly alter the patterns of ice formation. Analyses described in section 3.5.2.1, *Effects of Project Operations on Water Quality*, indicate that none of the flow scenarios would involve greater mixing. For this reason, we do not anticipate that any of the flow scenarios would affect ice formation.

Ryel et al. (2003) found that ice is most likely to form in the Powder River arm and in the southern portion of Brownlee reservoir, both in the main channel and shallower, more protected embayments. Ice thickness and duration appeared to be greatest in the Powder River arm. Ice would be most likely to form in late December, with thawing and break-up in late February through early April. A comparison of the results of the icing study with deer movements indicates that about 25 percent of the reservoir crossings occurred during the winter (January and February) and 25 percent during green-up (late March-April). These periods coincide with times of the year when ice could be present, and some deer would encounter ice in crossing the Powder River arm or Brownlee reservoir.

In response to AIR OP-1(f), Idaho Power used CHEOPS to model reservoir elevations under Proposed Operations and three other scenarios (Reregulating, Flow Augmentation, and Navigation). The primary differences between these scenarios and actual conditions occur during spring, summer, and fall. Reservoir elevations during December, January, and February, when ice would be present, would be about the same under all scenarios. For this reason, we conclude that a small number of mortalities would continue to occur as a result of deer breaking through the ice and drowning as they attempt to cross the reservoir or because of increased vulnerability to predation as they cross the ice.

A review of Edelmann (2003) suggests that swimming across the reservoir also results in some mortalities for mule deer, as a result of drowning, exhaustion, and/or increased vulnerability to predation upon reaching the far shore. If there is a relationship between reservoir elevation and the number of crossings, the risk to mule deer may be highest during green-up (mid-March through mid-April), when most crossings occur.

A comparison of reservoir elevations in March and April shows that they would be about the same in dry and extremely wet years under existing conditions, Proposed Operations, and the three flow scenarios. In medium years, however, all of the flow scenarios would draw the reservoir down more slowly to a lower level than under existing conditions. Thus, any of the alternatives could result in a small benefit to mule deer, if they prefer to cross a narrower reservoir.

The major difference in elevations between the scenarios occurs during the summer and fall, under the Flow Augmentation Scenario. Under this scenario, the reservoir is drawn down more quickly and to a deeper level after the Fourth of July in all three water year types than it would be under Proposed Operations. However, Edelmann (2003) found that summertime reservoir crossings were less frequent than crossings in any other season, i.e., 0.21 per week, compared to 3.01 during green-up.

We conclude that Brownlee reservoir would continue to pose a risk to deer attempting to cross it, but that the risk of mortality related to either water or ice crossings is relatively small (i.e., less than 1 percent, assuming 6 mortalities in an estimated 1,000 to 1,500 crossings) and would not change under Proposed Operations or any of the modeled flow scenarios. The significance of this level of risk could increase in extremely harsh winters, or if predation increases as a result of growing cougar populations in the region. The significance could decrease if habitat improvements on adjacent lands are successful and hunting regulations result in lower predator populations.

3.7.2.2 Special Status Plant Protection

Idaho Power's survey documented the presence of several rare plant species in the project area. Project operations, project-related maintenance, management activities, and recreational activities have the potential to disturb rare plant populations or to disturb the habitat that supports them.

To address these issues, Idaho Power proposes to establish a rare plant advisory board that would coordinate the efforts of resource management agencies, local landowners and land managers, and other interested individuals and organizations (e.g., The Nature Conservancy) in protecting sensitive species within the river corridor between the headwaters of Brownlee reservoir and the Salmon River confluence. Idaho Power envisions that the advisory board's responsibilities would include establishing priorities and specific objectives for protection and monitoring; identifying opportunities for cooperative uses of resources and manpower; creating management zones to aid in effective treatments; identifying common inventory and mapping protocols; determining meeting and reporting frequency; and evaluating feasibility for introducing new rare plant populations. Idaho Power would also consider the goals and objectives of federal, state, and private land managers. Idaho Power notes that the rare plant advisory board should coordinate closely with the noxious weed advisory board (discussed in section 3.7.2.3) because the spread of noxious weeds and invasive exotic plants is one of the primary threats to sensitive species.

Interior-34 recommends that Idaho Power develop and implement a plan to manage threatened, endangered, and special status species on BLM-administered lands within the project boundary and on BLM lands affected by the project. Interior-34 recommends Idaho Power include specific provisions for three rare plants—porcupine sedge, Schweinitz flatsedge, and American wood sage.[78] At a minimum, the plan would identify goals and objectives, describe existing conditions, identify data needs, and provide for additional baseline surveys and for monitoring surveys (initially at 1-year intervals, and then every 5 years) to be conducted throughout the term of any new license. The plan calls for Idaho Power to consult with BLM and prepare a biological evaluation for any actions proposed on BLM lands that could affect sensitive species.

Interior-78 recommends that Idaho Power consult with federal and state agencies and tribes to develop and implement a sensitive plant species management plan. Interior-78 states that the plan should place special emphasis on protection and enhancement and additional surveys for four sensitive species (Hazel's prickly phlox, bartonberry, spacious monkeyflower, and stalk-leaved monkeyflower) and the federally listed MacFarlane's four-o'clock and Spalding's catchfly. Like the Threatened and Endangered Species Plan recommended in Interior-34, the sensitive plant species plan would identify goals and objectives, describe existing conditions, identify data needs, and provide for additional baseline surveys and for monitoring throughout the term of any new license. The plan calls for implementation of weed prevention and control measures in sensitive plant sites/habitats, consistent with the Integrated Weed Management Plan covered under Interior-77.

The Forest Service (FS-9) specifies that Idaho Power should develop a plan to manage Forest Service sensitive species on National Forest System lands affected by the project. Under this condition, Idaho Power would conduct surveys when new species are designated, conduct bi-annual monitoring for sites where sensitive species are confirmed by these surveys for the first 6 years of any new license term and at 3-year intervals thereafter, and re-evaluate after the 6th year to determine whether continued monitoring is necessary. Under this condition, Idaho Power would protect or restore confirmed sites if monitoring indicates they are declining in condition, and would update the plan to address any revisions to species' status.

IDFG-33 supports Idaho Power's proposal to establish a rare plant advisory board. IDFG further recommends that cooperative projects be designed to restore native plant communities, rather than focusing on individual sites or species.

ODFW-65 recommends that Idaho Power consult with ODFW and the TRWG to develop a sensitive species management plan to address species that are listed as threatened or endangered federally or in Oregon. ODFW-65 states that the plan is intended to provide long-term protection and enhancement

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[78] Interior-34 recommends that the Threatened, Endangered, and Sensitive Species Management Plan also address seven wildlife species; we address this recommendation in section 3.7.2.8, *Special Status Wildlife*.

of sensitive plants and their habitats in and adjacent to the project area.[79] The plan would identify goals and objectives, describe existing conditions, provide for coordination with noxious weed management, include effectiveness monitoring and modification of measures, as needed, and identify additional measures for research, mitigation, or enhancement opportunities if any new species are listed.

Our Analysis

Idaho Power documented 47 occurrences of 6 plant species during surveys of the Snake River corridor, 9 occurrences of 3 other rare plants during general vegetation inventories, and 10 occurrences of 1 rare plant along the Pine Creek-Hells Canyon transmission line. Assessment of the plant locations in relation to project-related activities indicates that 22 occurrences are at a moderate, high, or very high risk of disturbance. Without management, ongoing project operations (such as road maintenance) and project-related activities (such as trail use and dispersed recreation) are likely to disturb some existing occurrences of rare plants, and reduce the quality of native plant communities that could support additional populations. Implementing Idaho Power's proposal would improve protection over existing levels and help to support biodiversity in the region.

Addressing federally listed species within the same plan as other special status species, as recommended by Interior, could result in a more coherent, comprehensive plan for rare plants, maximize the efficiency of field efforts, and minimize the need for consultation that might otherwise be duplicative.

Idaho Power suggests that the rare plant advisory board would determine the most appropriate sites for plant protection or monitoring projects, but anticipates that locations would be within a 1-mile corridor along the Snake River. With this approach, Idaho Power could participate in projects outside the project boundary. Implementation of projects outside the project boundary could have substantial ecological benefits and would assist other landowners in meeting their own regulatory requirements for rare plant protection. We note that a 1-mile corridor along the river would include lands outside Idaho Power's ownership and would not necessarily link management measures with project effects. The same is true of the area specified in Forest Service preliminary 4(e) condition no. 9, which would encompass National Forest System lands within one-fourth mile of the project boundary, as well as National Forest System lands within the project boundary.

Interior-34 describes a more general scope for Idaho Power's management plan as it relates to BLM, i.e., that it should cover BLM-administered lands within the project boundary and BLM lands affected by the project. Interior-34 would specifically address BLM's regulatory requirements through a recommendation that Idaho Power prepare a BE to address potential effects of any proposed actions on its lands.

Interior recommends (Interior-34 and -78) that Idaho Power conduct additional baseline surveys in areas that were not previously surveyed for rare plant occurrences. Pre-licensing surveys covered about one-fourth of the land along the river corridor between Weiser and the confluence of the Salmon River with the Snake River. While Idaho Power's sub-sampling approach provided a thorough landscape-level inventory, additional baseline surveys at sites where ground-disturbance regularly occurs (e.g., existing recreation facilities) or is planned (e.g., new recreation facilities) could provide information that would be more useful in planning and implementing projects during any new license period.

Idaho Power's initial proposal indicates that the rare plant advisory board would determine the frequency of monitoring. Interior-78, IDFG-33, and ODFW-65 do not recommend how often monitoring should be conducted. The Forest Service (FS-9) and Idaho Power's alternative condition would both establish a uniform frequency of monitoring for rare plant occurrences. An alternative that allows for

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[79] ODFW-65 recommends that the Threatened, Endangered, and Sensitive Species Management Plan also address wildlife species, as mentioned in section 3.7.2.8, *Special Status Wildlife*.

determining an appropriate schedule based on site-specific threats to rare plant populations could prove both more effective and more economical.

3.7.2.3 Noxious Weed and Exotic Invasive Plant Management

Reservoir fluctuations and flow fluctuations can cause soil disturbance that creates conditions that promote the establishment and spread of noxious weeds and invasive exotic plants. Project maintenance, management activities, and project-related recreation can also cause soil disturbance, and act as vectors for the spread of weeds. Idaho Power has proposed a plan to monitor and manage weeds.

Idaho Power proposes to develop an integrated management plan to coordinate priorities and actions for preventing, eradicating, containing, and controlling non-native invasive plants and noxious weeds along the Snake River corridor from Weiser to the Salmon River confluence, focusing on riparian species and habitats in particular. Idaho Power would establish a noxious weed advisory board as the primary mechanism for coordination and implementation of weed management measures. Idaho Power would consult with federal and state resource management agencies in developing and implementing the plan, but would focus on cooperative efforts with local CWMAs, landowners, land managers, and other interested individuals and organizations.

Interior-23 calls for Idaho Power to submit to BLM a plan for use or application of pesticides on project lands or non-project lands adjacent to BLM-administered lands. Interior recommends that Idaho Power prepare an annual report detailing the use of pesticides.

Interior-77 calls for Idaho Power to consult with the federal and state agencies to develop and implement an integrated weed management plan for the prevention, suppression, and containment of exotic and/or invasive plant species, including noxious weeds. The plan would be incorporated into the IWHP and WMMP. The plan would include a weed inventory of project-affected and Idaho Power-owned lands; identification of criteria for determining where control activities would be carried out each year; evaluation of a full array of control methods; implementation of weed control actions in cooperation with affected public and private landowners and counties; implementation and effectiveness monitoring; and implementation of BMPs for facilities and land management. Interior specifies that Idaho Power should also apply BMPs to actions such as shoreline erosion control, soil stabilization, land acquisition, habitat restoration, and recreation, to promote establishment of native plants and prevent or slow invasions of non-native, noxious plants.

The Forest Service (FS-7) specifies that Idaho Power consult with the appropriate agencies, including the Forest Service, to prepare and implement an integrated weed management plan to apply to invasive non-native plant species, including noxious weeds, in the project area and on National Forest System lands affected by the project. The Forest Service condition is generally consistent with Idaho Power's proposal, but also specifies that Idaho Power create a Hells Canyon CWMA, in addition to a Noxious Weed Advisory Board. The plan would be updated at 5-year intervals.

IDFG-32 supports Idaho Power's proposed weed management measures. IDFG would cooperate with Idaho Power and other stakeholders to implement the weed management plan.

ODFW-66 recommends that Idaho Power should provide 5-year updates to the plan, and that the plan should include communication and coordination protocols, defined roles and responsibilities, schedules for annual reports, work plans, meetings, review and updates, definition of the land area for cooperative efforts, goals and objectives, a description of existing conditions and identification of data gaps. In addition to developing the management plan and establishing a Noxious Weed Advisory Board, ODFW recommends that Idaho Power establish a Hells Canyon CWMA.

Our Analysis

Noxious weeds and invasive non-native plants are a growing threat throughout the west. During Idaho Power's surveys of the riparian corridor from Weiser to the confluence of the Salmon River with the Snake River, biologists observed 1,905 separate weed populations and found that virtually every survey unit contained at least one weed population. Surveys of the Pine Creek-Hells Canyon transmission line corridor and service roads provided further indication that weeds are widespread throughout the project area.

Without management, weeds would continue to spread in the project area because of their abundance on adjacent lands, tolerance of a variety of soil and moisture conditions, and ability to out compete native plants. Project operations and human activity, in addition to wind, water, and animal transport, would continue to serve as vectors for weeds. Weeds will likely continue to spread, even with an appropriate management plan in place, but ongoing, coordinated efforts would help to slow this process.

Since 1999, Idaho Power has participated in several weed control projects initiated by CWMAs or others in the project vicinity, and has worked with ODFW and IDFG to implement pilot projects at Patch and Gold islands. Idaho Power's proposal to establish a Noxious Weed Advisory Board would formalize these activities and provide a systematic approach to long-term management.

For the most part, the agency modified terms, conditions and recommendations outline management plans that would be similar to Idaho Power's description of the purpose and function of the Noxious Weed Advisory Board. However, the Forest Service specifies (FS-7) and ODFW-66 recommends that Idaho Power establish a CWMA, in addition to the Noxious Weed Advisory Board.

Idaho Power anticipates that most cooperative projects would be implemented within approximately 1 mile of the project boundary. With this approach, management measures may not be directly linked to project effects. However, this approach recognizes the fact that weeds spread across ownership boundaries, and that in some cases, control measures outside the project boundary may be even more effective in preventing the spread of weeds than treatment inside the project boundary would be.

3.7.2.4 Road, Transmission Line, and Right-of-Way Management

Road and transmission line rights-of-way must be managed to maintain safe and efficient operating conditions, but management activities (e.g., brushing, mowing, herbicide treatment, removal of hazard trees) may adversely affect native plant communities and the wildlife species that use them. Management activities may promote the establishment and spread of noxious weeds and exotic plants, which, in turn, also adversely affect native plant communities.

Management activities have the potential to disturb wildlife. Disturbance during the winter can cause physiological stress to big game and communally roosting bald eagles. Disturbance during the breeding season can impair reproductive success of many bird species.

Idaho Power proposes to develop a transmission line O&M plan to address the effects of right-of-way management on botanical and wildlife resources. The primary components of the plan would include: (1) scheduling the timing and location of O&M activities so that they would occur outside critical periods for plants, raptors, nesting neotropical migrant birds and wintering big game; (2) restoring and revegetating disturbed sites; and (3) managing noxious weeds and invasive exotic plants. Idaho Power proposes specific monitoring programs for botanical and wildlife resources.

The Forest Service (FS-11) specifies that Idaho Power should consult with the Forest Service to develop a transmission line O&M plan. The goal of the plan would be to provide for communication and coordination regarding monitoring and adaptively managing all resource specific restoration, protection and management actions associated with segments of transmission line that occupy National Forest

System lands to conform to Forest Service standards. Although not specified in the preliminary condition, the Forest Service (FS-7) indicates in its justification statement that the plan should address avian collision and raptor electrocution, in particular, and disturbance of mountain quail habitat near Blue Creek and Big Bar.

ODFW-67 recommends that Idaho Power consult with ODFW and the TRWG to develop and implement an integrated transmission line O&M Plan to adaptively manage O&M activities within the transmission line and service road rights-of-way. Under this recommendation, Idaho Power would restrict the timing and location of O&M activities to protect certain wildlife species and botanical resources, including big game wintering range, sage and sharp-tailed grouse leks, nest sites of riparian birds, raptor nests, and bald eagle perching and roosting areas. In addition, ODFW recommends that the plan provide for Idaho Power to enhance and restore shrub-steppe habitat to mitigate for unavoidable impacts to sage and sharp-tailed grouse, and participate with ODFW and other state and federal agencies to enhance and restore shrub-steppe habitats in the Hells Canyon area. To provide further protection for grouse, Idaho Power would monitor sage and sharp-tailed grouse lek sites within 3 km of project transmission lines, annually inventory raptors nests, and provide annual reports of these monitoring activities to ODFW and TRWG.

ODFW-68 recommends that Idaho Power consult with ODFW and the Forest Service to develop and implement a detailed plan for guiding riparian and riverine vegetation management along the Oxbow-Pallette Junction Line (junction line 907). The plan would include measures to repair damage caused by routine, emergency and major O&M activities, including actions to reduce erosion, minimize the spread of noxious weeds, and mitigate for unavoidable impacts to riparian vegetation snags, and large trees.

ODFW-69 recommends that Idaho Power consult with ODFW and the TRWG to develop and implement a detailed monitoring plan, conduct monitoring for electrocution mortalities, and modify transmission lines if any species are reported electrocuted.

ODFW-70 recommends that Idaho Power implement measures to minimize the risk of bird collisions with transmission lines at known collision sites, conduct effectiveness monitoring, and modify measures, as needed.

ODFW-72 calls for Idaho Power to schedule O&M activities that use project roads so as to avoid crucial winter range during the winter months, and should initiate appropriate temporary road closures if human disturbance begins to negatively affect wildlife.

Our Analysis

As a result of the Commission's orders dated March 31, 2005, and October 25, 2005, the only transmission line remaining within the Hells Canyon Project boundary is transmission line 945. Transmission line 945 is located entirely within Hells Canyon. It runs along the eastern shore of Hells Canyon reservoir from Oxbow dam to Hells Canyon dam, a distance of about 22 miles. The line runs parallel to a paved road (Hells Canyon Road). Several short spur roads lead off the Hells Canyon Road to provide maintenance access to transmission line 945. Idaho Power's vegetation cover type mapping shows that more than 90 percent of the habitat within the right-of-way is classified as disturbed, with small amounts of shrub-steppe, perennial grassland, and rock also present. The line crosses several small, unnamed drainages that may support some riparian vegetation.

Idaho Power's surveys identified 10 occurrences of bartonberry within the right-of-way of transmission line 945 where it traverses the Payette National Forest. FWS (Snake River Fish and Wildlife Service Office) identifies bartonberry as a species of concern, and the Forest Service and BLM identify it as sensitive.

Idaho Power's surveys documented 114 occurrences of eight noxious weed species within the transmission line right-of-way. Weeds were widespread, with at least one species found in 50 of 57 survey units. Although several weed species were present in the same survey units where bartonberry occurred, they were not growing in proximity to rare plants and did not appear to pose an immediate threat.

A variety of wildlife species occur along or near transmission line 945, including small mammals, reptiles, songbirds, and raptors. Bighorn sheep use the steep cliffs above the right-of-way, and at least one mountain quail occurrence is documented above the right-of-way near Big Bar.

Under current conditions, Idaho Power conducts annual pole and line inspections, makes replacements and repairs as needed, and clears vegetation every 5 to 10 years. Idaho Power has no formal plan to prevent or reduce adverse effects of O&M on botanical or wildlife resources. However, Idaho Power annually monitors bird electrocutions along transmission line 45, maintains a database of all reported mortalities, and has modified pole structures within 0.62 mile of an active bald eagle nesting territory to reduce the risk of electrocution.

Idaho Power's evaluation of the effects of their routine inspections and maintenance pointed out that O&M could disturb nesting bald eagles and other raptors, roosting bald eagles, and wintering bighorn sheep. Evaluations of the effects of O&M on botanical resources indicated potential disturbance of bartonberry, and a high risk of spreading noxious weeds along service roads and at tower locations.

To address these concerns, Idaho Power proposes to develop BMPs for O&M of the transmission line and service roads. BMPs would be developed based on consultation with the Forest Service because transmission line 945 and the service roads traverse National Forest System lands. Idaho Power proposes to implement timing restrictions on O&M activities, based on the type of activity and on wildlife requirements and plant phenology; and rehabilitate habitat after ground-disturbing O&M. Idaho Power would use the results of annual raptor nest surveys and ongoing electrocution monitoring to identify any need to modify measures.

Idaho Power's proposal would benefit terrestrial resources by providing a formal framework for identifying, monitoring, and addressing potential adverse effects of O&M. Terrestrial resource concerns would also be addressed by Idaho Power's proposals for establishing a rare plant advisory board and a noxious weed advisory board, as well as implementing the project-wide IWHP and WMMP.

Idaho Power's proposal would likely meet the objectives of each of the federal and state agencies that submitted preliminary terms, conditions, or recommendations regarding project transmission lines, with the exception of those that pertain to transmission lines that are outside the project boundary. Those lines are outside the scope of this proceeding.

3.7.2.5 Upland and Riparian Habitat Acquisition

Continued operation of the Hells Canyon Project would adversely affect more than 20,000 acres of wildlife habitat. Idaho Power's studies indicated that most impacts would be associated with reservoir fluctuations. Reservoir fluctuations reduce the abundance and connectivity of riparian habitat, limit waterfowl brooding habitat, decrease the suitability of shoreline areas for many wildlife species, and contribute to shoreline erosion. The presence and operation of the reservoirs also reduces the habitat capability of mule deer winter range and increases annual winter mortality.

To address these ongoing project effects, Idaho Power (2003a) indicated that it would acquire and manage 23,582 acres of habitat for wildlife. Idaho Power worked with the TRWG between 1996 and 2001 to develop a process for identifying and prioritizing potential parcels of land for acquisition, and followed up on this process in response to the Commission's AIR TR-1, dated May 4, 2004. Idaho Power and the TRWG assigned the highest priorities for acquisition to large, contiguous blocks of land near the Hells Canyon Project that would provide riparian and/or upland habitat for threatened, endangered, candidate, and sensitive species; waterfowl; big game; upland game birds; aquatic furbearers; amphibians; and neotropical migrant birds.

In its response to AIR TR-1, Idaho Power proposed to manage 2,990 acres of land in its ownership for wildlife, and if possible, to acquire the Daly Creek Ranch, Cottonwood Creek (or Lawrence) property, Sturgill Creek property, and Rocking M Ranch. Since filing the response to TR-1 in 2005, Idaho Power has completed the purchase of the Daly Creek Ranch (10,212 acres) in Oregon and the Cottonwood Creek property (1,971 acres) in Idaho. Idaho Power has signed an agreement to purchase the Sturgill Creek parcel (6,115 acres), also in Idaho. Together, the Idaho Power lands, the two parcels acquired to date, and the land to be purchased at Sturgill Creek total 21,288 acres. Acquisition of the Rocking M Ranch is expected to bring the total to 24,191 acres, which would exceed Idaho Power's initial proposal to acquire and manage 23,582 acres.

Several agencies and tribes submitted preliminary terms, conditions, or recommendations regarding acquisition of mitigation lands. While similar in some respects, the recommendations reflect different conclusions about the amount of land the project affects; whether studies to date have been adequate to establish the amount of land affected; the difficulty of replacing affected habitats; and the length of time it would take for replacement habitat to provide equivalent functions and values for wildlife. Table 69 shows Idaho Power's proposal and the minimum acreage that would be acquired under each agency or tribal recommendation.

Interior-35 states that BLM's priority is to mitigate for project effects on BLM lands on site and in kind; thus, priority sites include low elevation riparian and upland habitats contiguous to the project reservoirs. Interior recommends a compensation ratio of 2:1 for fluctuation effects on uplands; 3:1 for fluctuation effects on riparian habitat (including islands); and 10:1 for erosion effects on riparian habitat. BLM's recommendation for compensation for project effects on mule deer winter range uses the same formulas developed by Idaho Power (Edelmann, 2003).

Under Interior-35, Idaho Power would also fund a planting feasibility assessment to determine if riparian plantings can successfully address shoreline erosion around the project reservoirs. If revegetation efforts were unsuccessful, this recommendation would have Idaho Power acquire 224 acres of riparian habitat. If efforts were successful, the amount of riparian habitat acquired could be reduced.

Interior-76 would address project effects throughout the project area. The recommendation specifies that Idaho Power consult with the agencies to develop and implement a plan that would provide for no net loss of habitat units or value due to the construction or operation of the project, and seek to establish or protect the same resource abundance and habitat productivity as existed prior to construction of the project and inundation of the habitat. Priorities for acquisition would be low elevation riparian habitat contiguous to Hells Canyon reservoir and the Snake River downstream of Hells Canyon dam to the Salmon River confluence.

Interior-76 recommends a compensation ratio of 2:1 for fluctuation and inundation effects on upland habitat and 3:1 for fluctuation and inundation effects on riparian habitat, including 591 acres downstream of Hells Canyon dam. Interior-76 recommends a ratio of 10:1 for erosion effects on shoreline habitat and 1:1 for loss of habitat capability and higher mortality on mule deer winter range. As an alternative to fixed compensation ratios, Interior recommends Idaho Power use (Habitat Evaluation Procedure (HEP) to determine appropriate mitigation levels. Like Interior-35, Interior-76 also calls for a riparian planting feasibility assessment, but would not recommend reducing the acreage acquired if planting were successful. In comments on the draft EIS, Interior indicates that higher compensation ratios may be needed only if Idaho Power is unsuccessful in acquiring all four target parcels within a reasonable period of time following license issuance.

Table 69. Minimum acreage proposed or recommended for acquisition to address project effects on terrestrial resources. Proposed or recommended mitigation ratios are shown in parentheses. (Source: Staff)

Entity	Upland Acres (ratio)	Riparian Acres (ratio)	Riparian Acres Downstream of Hells Canyon Dam (ratio)	Shoreline Erosion (ratio)	Low Elevation Mule Deer Winter Range (ratio)	Total Acreage Proposed or Recommended for Acquisition
Idaho Power: Addresses operational effects	5,761 (1:1)	731 (1:1)	--	90 (1:1)	17,000 (1:1 x 0.19)	23,582
Interior-35: Addresses operational effects on BLM-administered lands	3,010 (2:1)	594[a] (3:1)	--	224 (10:1)	16,578 (1:1 x 0.19)	20,406
Interior-76: Addresses construction and operational effects	16,694 (2:1)	5,619[a] (3:1)	1,773 (3:1)	900 (10:1)	16,761 (1:1 x 0.19)	41,747
FS-6: Addresses operational effects on National Forest System lands	5,761(1:1)	731 (1:1)	56.3(1:1)	90 (1:1)	17,000 (1:1 x 0.19)	23,638
IDFG-28: Addresses operational effects	5,761 (1:1)	731 (1:1)	--	90 (1:1)	17,000 (1:1 x 0.19)	23,582
ODFW-61: Addresses construction and operational effects	9,182 (1:1)	3,085[a] (1.5:1)	296 (1.5:1)	122 (1:1)	23,054[b] (1:1 x 0.19)	35,739
Nez Perce Tribe: Addresses construction and operational effects						Not indicated
Burns Paiute Tribe: Addresses construction and operational effects						Not indicated
Shoshone-Paiute Tribes: Addresses loss of anadromous fishery						10,000

[a] Includes mitigation for 285 acres of islands inundated as a result of project construction.

[b] In its comments on the draft EIS, ODFW notes that the 23,054 acres of mule deer winter range should include 1,452 acres of riparian habitat and 21,602 acres of upland habitat to mitigate for mule deer mortality associated with project reservoirs and operations.

The Forest Service (FS-6) reflects Idaho Power's proposal for land acquisition, as outlined in its response to AIR TR-1, while providing additional mitigation for effects on 49 acres of shore and bottomland wetland and 7.3 acres of riparian habitat on National Forest System lands downstream of Hells Canyon dam. Following discussions regarding alternative 4(e) conditions, Idaho Power agreed to FS-6. Like Interior's recommendations, the Forest Service specifies a riparian planting feasibility assessment. Under this condition, Idaho Power would coordinate with the Forest Service within 2 years of license issuance to design and install control measures to correct active erosion problems around the project reservoirs and along the Snake River downstream of Hells Canyon dam. Idaho Power would acquire additional land to mitigate for the loss of riparian habitat at sites where erosion control is deemed infeasible. Under this preliminary condition, Idaho Power would survey for new erosion sites at 5-year intervals.

IDFG-28 supports Idaho Power's proposal for acquisition and management. IDFG recommends that the newly acquired lands should be located adjacent to or contiguous with the project area, and should replace or create the same habitat types that have been adversely affected. IDFG indicates that the lands should be equitably distributed between Oregon and Idaho, and should remain available in perpetuity for public use. However, in its comments on the 10(j) meeting, IDFG suggested that the highest priority should remain high value lands, whether in Idaho or Oregon (letter from IDFG dated January 27, 2007).

IDFG-29 points out that more than 16,000 acres of public lands are attached as grazing allotments to the proposed private property acquisitions. IDFG suggests that improving grazing management on these allotments could substantially expand the benefits of acquiring the base properties alone.

IDFG-29 recommends that if lands are not available that would meet the criteria outlined in IDFG-28, Idaho Power should develop an alternate mitigation strategy that would allow for acquiring additional acreage. IDFG indicates that an appropriate compensation ratio would be at least 2:1, if acquired lands are off site or out-of-kind.

ODFW-61 recommends that Idaho Power consult with ODFW and the TRWG to develop and implement a land acquisition and management program. Under this recommendation, Idaho Power would employ mitigation ratios of 1:1 for the effects of reservoir inundation and fluctuation on upland habitat and 1.5:1 for effects on riparian habitat (including 197 acres below Hells Canyon dam), if lands are located within the 2,100 feet elevation contour. Under ODFW's recommendation, if lands could not be acquired at low elevations, but were still located around the reservoirs, the amount of upland habitat Idaho Power should acquire would remain the same, but additional riparian habitat would be acquired, to meet a mitigation ratio of 3:1. If lands could not be acquired around the reservoirs, mitigation ratios would be 3:1 for uplands and 5:1 for riparian habitat.

ODFW-61 calls for Idaho Power to consider parcels located around Brownlee reservoir, the Powder River arm, and the Lookout Mountain and Pine Creek Management Units for acquisition or easements. In setting priorities for acquisition, ODFW indicates that criteria should include numbers of species positively affected, habitat connectivity, habitat values, and public access for hunting, fishing, and observation, and proximity to other public lands or high value lands. Under this recommendation, properties that would benefit both aquatic and terrestrial species (e.g., riparian habitats) would be given a higher priority than would be assigned to those that benefit single species or species types.

ODFW-71 recommends that Idaho Power study the effects of a harsh winter and reservoir icing on mule deer. The study results would be used to determine whether the habitat coefficient Idaho Power has applied is adequate to account for reduced habitat capability and higher winter mortality, or whether additional mitigation would be needed.

The Nez Perce Tribe recommends that Idaho Power purchase lands to fully mitigate for impacts to wildlife habitat caused by the filling and operation of the project reservoirs. Under this recommendation, the acquired lands would closely resemble the types of habitat lost, focusing on low-elevation riparian habitat in particular. The tribe states that Idaho Power should give the highest priority for acquisition to lands that are already developed or are under threat of development, to allow for a net gain in habitat value. Under this recommendation, Idaho Power would give the second priority to in-holdings within the HCNRA, and third priority to other lands, spatially distributed between the northern and southern reaches of Hells Canyon.

The Burns Paiute Tribe recommends that Idaho Power establish a terrestrial resource task force. The role of the task force would be to assist in developing an initial, quantifiable assessment of wildlife losses associated with the construction, inundation, and operation of the project; identifying criteria for land acquisition; and annually reviewing Idaho Power's progress in mitigating wildlife losses. The tribe recommends use of HEP as a tool for assessing wildlife losses.

The Shoshone-Paiute Tribes also calls for establishment of a terrestrial resource task force. The tribe's recommendations specify that Idaho Power should use HEP to determine suitable habitat units for mitigation and that about 10,000 acres of lands acquired for mitigation should be located adjacent to or near the Duck Valley Indian Reservation, and should be held in fee title by the Shoshone-Paiute Tribes.

Our Analysis

Proposed and Recommended Acreage of Acquired Lands

Idaho Power's proposal would bring 20,592 acres[80] of land into the project boundary for management as wildlife habitat through any new license period, together with 2,990 acres already in Idaho Power's ownership. Idaho Power's proposal is based on the results of numerous studies to quantify ongoing project effects on botanical and wildlife resources. The proposal would replace acreages and habitat values that have been reduced as a result of reservoir operation with roughly the same amounts and types of habitats. Table 70 shows the acreage of various project effects, as identified in Idaho Power's terrestrial resource studies. Table 71 shows the acreage of project effects that may occur during any new license period, based on staff analysis.

Table 70. Acreage of current project effects, by habitat type. (Source: Edelmann et al., 2003b; USFS, 2006, modified by staff)

Location of Affected Acres	Riparian Acreage	Upland Acreage	Total Acreage
Brownlee reservoir fluctuation zone	372	5,448	5,820
Brownlee reservoir shoreline riparian	343	--	343
Brownlee reservoir shoreline erosion	79.07	--	79
Oxbow reservoir fluctuation zone	7	82	89
Oxbow reservoir shoreline riparian	--	--	--
Oxbow reservoir shoreline erosion	1.34	--	1.34
Hells Canyon reservoir fluctuation zone	9	231	240
Hells Canyon reservoir shoreline riparian	--	--	--

80 For consistency, we continue to refer to Idaho Power's proposal as including 20,592 acres that would be acquired, plus 2,990 acres of land already in their ownership that will be dedicated to wildlife. However, as mentioned above, the actual acreage of the four parcels acquired, plus the 2,990 acres already owned, will likely total 24,191.

Location of Affected Acres	Riparian Acreage	Upland Acreage	Total Acreage
Hells Canyon reservoir shoreline erosion	3.45	--	3.45
Shore and bottomland wetland downstream of Hells Canyon dam[a]	49		49
Shoreline erosion downstream of Hells Canyon dam	6.34	--	6.34
Mule deer winter range[b]	--	--	17,000
Total	869.7	5,761	23,630.7

[a] The Forest Service estimates that the combined project effects of load following and limited sediment supply prevent the establishment of about 49 acres of sandbar willows that could otherwise establish within the scour zone (shore and bottomland wetland) below Hells Canyon dam.

[b] Includes habitat coefficient of 0.19 applied to 86,408 acres of crucial mule deer winter range around Brownlee reservoir, plus habitat coefficient of 0.10 applied to 5,820 acres in the Brownlee reservoir fluctuation zone.

Table 71. Acreage of anticipated project effects resulting from change in flow regime and shoreline erosion). (Source: Edelmann and Huck, 2005; staff)

Location of Affected Acres	Riparian Acreage	Upland Acreage	Total Acreage
Brownlee reservoir shoreline erosion	59.3	0	59.3
Oxbow reservoir shoreline erosion	1.1	0	1.1
Hells Canyon reservoir shoreline erosion	3.3	0	3.3
Riparian/wetland habitat downstream of Hells Canyon dam[a]	13.2	0	13.2
Shoreline erosion downstream of Hells Canyon dam	6.1	0	6.1
Upland acreage associated with riparian habitat acquisitions	0	0	0
Total	83	0	83

[a] Acreage would depend on flow alternative; maximum area of effect would be 29.8 acres (see section 3.7.2.1).

Under its proposal, Idaho Power would acquire (and at this time, has acquired) parcels of private land that are located adjacent to or near the project reservoirs, at relatively low elevations. These parcels would provide on-site, in-kind habitat, similar to uplands and riparian areas affected by project operation, and would benefit the species identified by the TRWG as having high priority (e.g., big game, raptors, and threatened, endangered, candidate, and sensitive species).

Implementation of FS-6 would have the same effects as Idaho Power's proposal, with an additional 49 acres to compensate for ongoing effects of project operation on shore and bottomland wetland along the Snake River downstream of Hells Canyon dam that can no longer support native willows. In addition, FS-6 specifies that Idaho Power acquire 7.3 acres of riparian habitat to mitigate for predicted effects of implementing Idaho Power's proposed flow regime, as evaluated in the final license application. Idaho Power notes that about 25 acres of upland must be acquired for each acre of riparian habitat, which would bring the total acreage for these elements of the acquisition package to 1,408 acres.

Implementation of IDFG-28 would have the same effects as Idaho Power's proposal, assuming all acreage targets could be met near the project. Implementation of IDFG-29 would expand the area that could be improved beyond simple fee acquisition, by coordinating management on federal or state grazing allotments. Idaho Power's response to AIR TR-1 indicates it would consult with BLM to investigate the possibility of coordinated management of the Ruth Gulch and Daly Creek allotments, which are attached to the Daly Creek base property. IDFG-29 also calls for Idaho Power to acquire land at a 2:1 ratio, if target parcels are not available.

Interior (Interior-35 and -76) recommends that Idaho Power use a 3:1 ratio to compensate for project effects on riparian habitat and 2:1 for uplands. In its justification statement, Interior states that BLM has limited formal guidance regarding replacement ratios, but that precedents on various districts depend on the resource, the suitability of the replacement habitat, the distance from the project, and the acquisition of lands that serve a similar or suitable functional component, regardless of the size or dollar value of the land. More recently, in Interior's comments on the draft EIS, Interior indicates its objectives would be met if Idaho Power can acquire all four target parcels within a reasonable amount of time following license issuance. Interior recommends a higher mitigation ratio for lands not yet acquired, if Idaho Power is unsuccessful in purchasing all four parcels.

ODFW recommends ratios ranging from 1.5:1 to 5:1 for riparian habitat, and from 1:1 to 3:1 for uplands, depending on elevation and proximity to the reservoirs. ODFW states its mitigation policies are value-based, requiring no net loss of habitat quantity or quality for uplands, and net benefits of habitat quantity or quality for riparian habitat. Additionally, Interior and ODFW reference guidelines developed by several state and federal agencies to address wetland mitigation projects across the U.S. Wetland mitigation ratios are generally higher than 1:1, reflecting the technical difficulties and low rate of success in creating or re-establishing wetland functions and values under new soil and hydrologic conditions, and the length of time it takes to achieve the functions and values that were lost.

We find that acreage ratios based on typical wetland mitigation requirements would not apply to this project because Idaho Power's proposal and the agency recommendations target the acquisition and enhancement of uplands (including shrub-steppe and native grasslands) and riparian habitats (which may include wetlands), rather than wetland creation or re-establishment.

The mitigation value of the parcels within Idaho Power's proposal is based on several factors. These include: (1) locations contiguous with the reservoirs, with Idaho Power's existing ownership, and/or with large blocks of wildlife habitat on public lands; (2) large size; (3) existing and potential high-priority habitats (e.g., shrub-steppe, grasslands, wetlands, seeps and springs, cottonwood and willow stands); and (4) the documented presence of high-priority wildlife species. Idaho Power's response to AIR TR-1 indicates that all four parcels in its proposal provide important winter range for big game. Among the four parcels, they also support western toads, nesting raptors, neotropical migrant birds, upland game birds, burrowing owls, nesting and breeding waterfowl, migrating shorebirds, aquatic furbearers, and the southern Idaho ground squirrel.

To ensure that these parcels provide wildlife benefits that would offset project effects, Idaho Power proposes to develop and implement site-specific management plans.[81] Working with the IWHP workgroup (which would have functions similar to the TRWG), Idaho Power would measure baseline conditions, identify desired conditions, and implement treatments to improve conditions (e.g., grazing management, fencing to exclude livestock from riparian areas, weed control, riparian plantings, shrub-steppe seeding, and recreation restrictions).

Currently, grazing is the primary land use on each of the four parcels. Grazing and associated weed invasion have affected habitat quality on uplands and riparian habitats throughout the Snake River basin, and likely have affected habitat quality on the parcels included in Idaho Power's proposal.

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81 Site-specific management plans would be developed as part of a project-wide Wildlife Mitigation and Management Plan (WMMP). The WMMP would apply to lands already in Idaho Power's ownership and to lands acquired for mitigation. Section 3.7.2.7 provides a more detailed description of this plan, and how it relates to Idaho Power's proposed IWHP.

Riparian habitat responds positively and rapidly to livestock management and weed control (NRC, 2002; Mosley et al., 1999). Upland habitats also respond positively, but more slowly, depending on site-specific conditions, and often require aggressive enhancement measures to maximize benefits (Bunting et al., 2002). Expected improvements in habitat quality over time, together with the physical location of the parcels and the fact that they are contiguous to other lands that are being or will be managed for wildlife, should result in net benefits for both riparian and upland habitats.

Under Idaho Power's proposal, Idaho Power would monitor the effectiveness of treatments over time. Management plans would be adapted and updated at intervals through any new license period, based on the results of monitoring, availability of new management techniques, or changes in resource needs.

Under ODFW-61, Idaho Power would acquire a minimum of 35,739 acres; however, it is unlikely that all or even most parcels would lie at elevations meeting ODFW objectives, and additional land would have to be purchased to make up the difference. The Nez Perce Tribe does not specify a mitigation acreage, but under their recommendation, Idaho Power would acquire land to mitigate for original project inundation. The Shoshone-Paiutes Tribes recommends Idaho Power acquire at least 10,000 acres. The benefits of Idaho Power's acquisition of larger acreages under these agency or tribal recommendations would be that more land in the project vicinity would be protected and managed for wildlife than under Idaho Power's proposal.

As an alternative to fixed compensation ratios, Interior recommends that Idaho Power conduct a HEP to quantify project effects and determine the amount of habitat needed for compensation. The Burns Paiute and Shoshone-Paiute Tribes also recommend using HEP to quantify habitat losses and mitigation needs. The effect of conducting a HEP would be to provide additional, more detailed information about pre-project conditions in areas now occupied by project reservoirs and associated facilities. However, a review of Idaho Power's studies to date indicates that adequate information is already available regarding the effects of ongoing project operation, and the amounts and types of habitat needed for mitigation. As mentioned above, Idaho Power would work with the IWHP workgroup to conduct additional, detailed assessments of habitat quality on lands acquired for mitigation; identify habitat goals and objectives; implement appropriate enhancement methods; and monitor changes over time to measure progress toward desired conditions.

Geographic Distribution of Acquired Lands

In addition to low elevation, the TRWG identified proximity to project effects as being one of the highest priorities for selecting parcels of land for acquisition. This approach is consistent with most federal and state mitigation policies, which specify on-site, in-kind compensation as having the highest value for habitat replacement. Idaho Power's response to AIR TR-1 reflects this prioritization. All four of the major land parcels included in Idaho Power's proposal are located adjacent to Brownlee reservoir, where project effects are most evident. Proposed parcels are about evenly divided between the west and east sides of the reservoir, with adjustments to take advantage of specific opportunities (e.g., presence of high priority habitats, extending habitat connectivity).

Implementation of Idaho Power's proposal would not provide any enhancement for terrestrial resources downstream of Hells Canyon dam, where Idaho Power estimates that project operation has caused about 6 acres of erosion between the dam and the Salmon River confluence. Alternatives to address this issue include on-site stabilization and revegetation of 6 acres of existing erosion sites, plus purchase of 6 acres of riparian habitat on private land within the boundaries of HCNRA to mitigate for continued erosion effects during any new license period. Idaho Power identified, mapped, and evaluated several private in-holdings. These parcels ranked low, primarily because of their distance from the project. Idaho Power would have no effective means of managing lands located at about RM 208, about 40 miles downstream from any other Idaho Power ownership.

Implementation of Idaho Power's proposal would not provide any enhancement for terrestrial resources near the Duck Valley Indian Reservation, located approximately 170 miles south of upper Brownlee reservoir. Studies did not indicate any project effects on terrestrial resources in the vicinity of the reservation.

Mule Deer Winter Range

Review of pre-project aerial and oblique photographs, General Land Office records, and interviews with agency biologists indicated that land uses (primarily unrestricted grazing since the turn of the last century) had severely affected range conditions and virtually eliminated riparian vegetation by the time the Hells Canyon Project was built (Blair et al., 2003b). While conditions downstream of Hells Canyon dam have improved dramatically in response to changes in land management practices within the HCNRA and conditions along the Hells Canyon and Oxbow reservoirs are now stable, invasive non-native weeds and grazing on public and private lands continue to affect habitat around Brownlee reservoir.

The project affects mule deer primarily by reducing the availability of high-quality winter range at low elevations around Brownlee reservoir. Mule deer that winter at higher elevations experience higher rates of mortality. Mule deer have a special importance in the region because of their ecological role, cultural significance, and the recreation opportunity they provide. They also are an important economic resource. ODFW and IDFG estimate economic benefits ranging from $1.43 to $2.9 million annually in Oregon and $335,645 to $1,512,632 annually in Idaho (letter from ODFW dated February 21, 2007; letter from IDFG dated January 27, 2007). For these reasons, mitigation for mule deer is a high priority both in Idaho Power's proposal and as part of agency terms, conditions, and recommendations.

Based on a combination of field studies and modeling of mule deer use of winter range in the vicinity (Edelmann, 2003), Idaho Power found that mule deer concentrated around Brownlee reservoir, and that most mortalities occurred along the shoreline. Idaho Power estimated that a habitat coefficient of 0.10 would reflect reduced habitat capability and an additional factor of 0.09 would account for increased mortality in harsh winters (Edelmann et al., 2003b). Idaho Power proposes to acquire 17,000 acres to address ongoing project effects that contribute to mortality and decrease habitat capability of 86,408 acres of crucial mule winter range near Brownlee reservoir between full pool and 2,700 feet, and on 5,820 acres of low-elevation winter range that is precluded from establishing within the reservoir drawdown zone.

Interior-34 states that BLM agrees with Idaho Power's proposal. However, Interior-34 applies the habitat coefficient of 0.1 to high elevation winter range, as well as low elevation winter range, and calculates that Idaho Power should acquire an additional 160 acres to mitigate for effects on BLM-administered lands.

Interior-76 and IDFG-28 are based on the same calculations Idaho Power used to estimate project effects on mule deer winter range. Implementation of these recommendations would have the same effects as Idaho Power's proposal, in terms of mitigating project effects on winter range.

ODFW concludes that the Hells Canyon Project affects 121,337 acres of crucial winter range for mule deer around Brownlee, Oxbow, and the southern half of Hells Canyon reservoir, at elevations between full pool and 3,200 feet. Although ODFW states that the project may be responsible for 10 to 30 percent of annual winter mortality, application of the 0.19 habitat coefficient used by Idaho Power indicates that Idaho Power should acquire and manage 23,054 acres to mitigate for direct and indirect mortality caused by project operations and reservoirs. ODFW-61 recommends that the 23,054-acre total include 1,452 acres of riparian habitat and 21,602 acres of upland habitat to reflect the proportion of each habitat type that is prevented from establishing in the Brownlee fluctuation zone.

With implementation of ODFW-61, Idaho Power would acquire 6,054 more acres specifically to mitigate for project effects on mule deer than Idaho Power proposes. However, all four parcels of land within Idaho Power's 23,582-acre proposal provide winter range for mule deer. While Idaho Power's proposal contains less riparian habitat than ODFW recommends for acquisition, the mule deer studies indicated that deer concentrated in low elevation grasslands and shrublands during the winter, rather than in riparian habitat. For this reason, Idaho Power's proposal includes several measures intended to enhance uplands, as well as riparian habitat.

Implementation of some proposed and recommended aquatic resource measures would also help to support riparian habitat. Although designed to improve fish habitat, tributary enhancements in Pine, Indian, and Wildhorse creeks and several smaller tributaries and in the Powder and Burnt river basins would benefit wildlife, including mule deer.

ODFW-71 recommends additional field studies to verify that a habitat coefficient of 0.19 would accurately represent the project's direct and indirect contribution to mule deer mortality during a very harsh winter. Although Idaho Power's studies indicated that winter mortality since the filling of Brownlee reservoir does not appear to be reducing mule deer population viability, ODFW notes that predator-prey relationships have changed in recent years, as cougar numbers have increased. ODFW anticipates that the additional pressure of high predation rates during harsh winters could prevent mule deer populations from recovering, even during mild winters.

This situation points out the importance of managing predators, as well as improving habitat. ODFW has recently completed a draft Cougar Management Plan for the state (ODFW, 2006). In management units where mule deer herds have declined by 20 percent over the past 5 years or are 60 percent below the management objective for 3 years, ODFW would aim for more intensive cougar harvest. At the same time, implementation of Idaho Power's proposal would improve habitat capability for wintering mule deer through weed control, shrub-steppe and riparian plantings, and grazing management. Both of these approaches—predator management and habitat enhancement—would likely affect habitat coefficients under any winter conditions, but especially during harsh winters.

Riverine Riparian Habitat Downstream of Hells Canyon Dam

As described in section 3.7.2.1, *Riparian Habitat and Associated Wildlife*, load following operations downstream of Hells Canyon dam result in daily stage changes that influence soil moisture along the riverbanks above the scour zone and provide hydrologic support for riparian vegetation, while rocky substrates and annual peak flows prevent the development of significant perennial riparian vegetation within the scour zone itself (Braatne et al., 2002). Based on the results of modeling in response to the Commission's AIR OP-1(g), Idaho Power estimates that changes in the flow regime would result in the loss of 2 to 30 acres (approximately) of riparian habitat, depending on what flow regime is adopted because reductions in load following would reduce the irrigation effect on riparian habitat above the scour zone. Changes in the flow regime would also reduce the area of water, with corresponding increases in the area of shore and bottomland wetland within the scour zone. Changes would range from an increase of about 7 acres under the Flow Augmentation Scenario to about 111 acres under the Regulating Scenario (table 68). Idaho Power's acquisition proposal does not address changes in downstream riparian habitat that might occur during any new license period.

The basis for Interior-76 and ODFW-61 regarding mitigation for effects on riparian habitat is not entirely clear because each assumes a different area of impact. Interior-76 indicates 591 acres of riparian habitat are affected, attributing this estimate to the Forest Service, while the Forest Service states that 507.23 acres of shore and bottomland wetland are affected, based on Holmstead (2003a). ODFW indicates Idaho Power should mitigate for operational effects on 197 acres of riparian habitat downstream of Hells Canyon dam, also citing Holmstead (2003a). More recently, Forest Service comments on the draft EIS reflect their calculations that the current flow regime prevents the establishment of sandbar willow on 49 acres of the 329-acre shore and bottomland wetland zone (see table 70) (Braatne et al., 2002). The Forest Service estimates that Idaho Power's proposed project operations would affect 7.3

acres of a total 892 acres of forested, scrub-shrub, and emergent wetland above the scour zone. This estimate is based on assumptions described in the final license application regarding Idaho Power's proposed flow regime.

Implementation of Interior or ODFW recommendations would result in Idaho Power acquiring additional acreage as mitigation beyond the number of acres that Idaho Power has proposed. Acquisition and long-term protection of larger areas of land would provide incremental benefits to wildlife over Idaho Power's proposal, but such a program would not be clearly linked to project effects. Implementation of FS-6 would also result in Idaho Power acquiring additional acreage, but mitigation (49 acres) would be specifically linked to existing project effects on sandbar willows. As mentioned above, the Forest Service recommendation for 7.3 acres of land to mitigate for predicted effects on riparian habitat above the scour zone is based on information provided in the final license application. More recently, Idaho Power's response to AIR OP-1(g) indicated that implementation of Idaho Power's proposed flow regime would reduce riparian habitat by about 15.1 acres, rather than 7.3 acres. Implementation of other flow scenarios would reduce riparian habitat above the scour zone to varying degrees, ranging from approximately 2 acres to 30 acres.

Riparian Planting Feasibility Assessment

Idaho Power's shoreline erosion survey indicates that several factors contribute to erosion around project reservoirs and along the Snake River downstream of Hells Canyon dam (Holmstead, 2003b). In addition to reservoir fluctuations, these include wind and wave action, groundwater seeps, grazing, roads, and dispersed recreation activities. Reservoir operations do not have a strong influence on erosion processes that occur along the Oxbow or Hells Canyon reservoir shorelines because surface elevations are relatively stable. Idaho Power estimates a total of 1.34 acres of erosion at Oxbow reservoir and a total of 3.45 acres of erosion at Hells Canyon reservoir. By contrast, water level fluctuations at Brownlee reservoir are substantial, and Idaho Power estimates a total of 79.07 acres of erosion along the shoreline.

Idaho Power estimates a total of 6.34 acres of erosion along the river banks downstream of Hells Canyon dam. Idaho Power notes that most erosion sites are located upslope of the typical fluctuation zone, where they would be affected by boat-generated waves and dispersed recreation, as well as high flows.

Idaho Power's proposal would provide 1:1 mitigation for the acreage of erosion that has been documented to date along reservoir shorelines and the Snake River downstream of Hells Canyon dam (Holmstead, 2003b). In its license application, Idaho Power (2003a) concludes that the reservoirs are relatively recent features, and predicts that banks will continue to erode until shorelines reach equilibrium. Idaho Power concludes it may not be feasible to stabilize and revegetate most of the erosion sites because of the steep topography and remoteness of Hells Canyon. Idaho Power notes that managing human-caused factors that contribute to erosion (such as power boating, shoreline camping and hiking, vehicle access, and grazing) may be a more effective approach to erosion control.

Idaho Power's proposal does not take into account the acreage of erosion that is likely to occur during any new license period. Based on the age of each reservoir, the acreage of existing erosion, and an assumed constant rate of erosion, another 70 acres could be affected during the next 30 years.

Implementation of Interior-35, Interior-76, and FS-6 would provide a mechanism for systematically investigating the immediate causes of erosion at each existing site; evaluating soil and vegetation conditions; and designing site-specific treatments based on findings. The results could range from a confirmation of Idaho Power's earlier conclusions that on-site treatment would not be feasible at any of the sites to a finding that there would be a reasonable chance of success at all sites. If no treatments are successful, Interior specifies that mitigation should occur at a ratio of 10:1 for reservoir erosion. Interior-35 provides for reducing the amount of acquisition in proportion to the acreage of successful restoration. Interior-76 does not provide for any reduction. For sites where control measures are not feasible, FS-6 specifies that Idaho Power should add to its riparian acquisition program. Like Idaho Power's proposal, Interior and Forest Service measures would not address erosion likely to occur in the future.

ODFW does not recommend stabilizing and replanting erosion sites. ODFW-61 recommends a mitigation ratio of 1:1 for 84 acres of erosion around the project reservoirs, and 38 acres along the river downstream of Hells Canyon dam that ODFW indicates the Forest Service has documented. The effects of ODFW's recommendation would be that Idaho Power would not address erosion sites where they are occurring and would not address 70 additional acres of erosion that could occur during any new license period.

3.7.2.6 Cooperative Wildlife Management Projects

Reservoir fluctuations at Brownlee reservoir adversely affect riparian habitats along the shoreline and on several small islands at the upper end of Brownlee reservoir, reducing their ability to support nesting and brooding waterfowl. Reservoir fluctuations also contribute to riparian habitat fragmentation along the shoreline, reducing its suitability for mountain quail. Idaho Power proposes to implement cooperative projects with state or federal agencies, or both, to address project effects on these species.

Island Habitat Enhancement Projects

Idaho Power proposes to provide funding ($26,000 annually through any new license period), equipment, personnel, logistical support, and expertise to IDFG and ODFW to support habitat enhancement projects on four Snake River islands. Idaho Power purchased the islands as mitigation for the effects of project construction on waterfowl and then conveyed title to the states to manage them. IDFG owns and manages Gold Island (331 acres), while ODFW owns and manages Patch (about 100 acres), Porter (about 70 acres), and Hoffman (60 acres) islands. The states have managed the islands primarily to provide waterfowl and upland game bird habitat, but lack of funding for management activities has resulted in a gradual decline of habitat values. Currently, non-native invasive weeds are the dominant vegetation on all four islands.

In IDFG-31, IDFG recommends that Idaho Power provide one-time funding for installation of a center pivot irrigation system on Gold Island at a cost not to exceed $100,000, and a higher level of annual O&M funding. IDFG-31 recommends Idaho Power provide $32,000 annually for O&M for the four islands, including $8,000 for projects undertaken on Gold Island. IDFG also recommends that Idaho Power cooperate with IDFG to develop a monitoring program to ensure that mitigation goals for this measure are met.

ODFW-62 recommends that Idaho Power establish a dedicated fund for cooperative management and maintenance of habitat values on the four Snake River islands through the term of any new license, and work with ODFW and IDFG to develop an Island Management Plan. ODFW-62 recommends that Idaho Power provide capital improvements funding totaling $198,800 for islands in Oregon, and annual operation and maintenance funding of $32,000 for the four islands. More recently, ODFW recommended Idaho Power participate in projects such as installing nest platforms and boxes, seeding grain to provide forage for waterfowl, enhancement of willows and other shrubs, and weed control (letter from ODFW dated February 21, 2007).

Our Analysis

Idaho Power's studies of vegetation, shoreline erosion, riparian habitat fragmentation, and waterfowl habitat use indicate that the potential for improving waterfowl habitat in the project area would be limited by ongoing reservoir fluctuations. Some benefits could be achieved on lands Idaho Power has proposed to acquire adjacent to the project, along the Powder River arm for example, where reservoir fluctuations have less effect. However, island habitat is unique in its connectivity with flowing water and often provides safety for nesting birds from land-based predators. Neither of these characteristics can be replaced along reservoir shorelines. For this reason, it would be beneficial to implement cooperative projects on islands.

IDFG and ODFW have identified several projects that could be implemented on Hoffman, Porter, Patch and Gold islands to improve wildlife habitat. These include weed control, establishment of wildlife food plots, and planting of native riparian and upland trees, shrubs, and herbaceous vegetation. Idaho Power's participation in these projects could provide benefits to a variety of species, including waterfowl, colonial nesting waterbirds, raptors, neotropical migrant songbirds, and aquatic furbearers.

Idaho Power filed no information about the cost basis for its proposed level of funding at $26,000 per year (about $46 per acre for all four islands). IDFG did not indicate the basis for its recommendation of $8,000 per year ($24 per acre) for operation and maintenance on Gold Island, although IDFG mentions that it allocates $109 per acre for island management. ODFW did not indicate the basis for its recommendation of $32,000 per year for all four islands (about $57 per acre). However, IDFG and ODFW did provide itemized costs for capital improvements and equipment needed to initiate and continue enhancement projects.

As an alternative to Idaho Power's support for and participation in enhancement projects on the four state-owned islands, staff evaluated on-site options for island protection and enhancement. We found that reservoir fluctuations limit habitat suitability on islands within the project boundary. Staff also reviewed off-site options near the project, including Idaho Power's evaluation of two privately-owned islands upstream of Brownlee reservoir (Edelmann and Huck, 2005). Both islands (Westlake, 139 acres; and McCrea, 41 acres) support riparian habitat, but mitigation values were ranked as medium, based on the absence of high-value wildlife resources and low habitat diversity. Idaho Power's most recent estimate of $650 as an average per-acre acquisition cost indicates that purchasing these two islands would be relatively economical, but no information is currently available about existing conditions or the need for improvements, and consequently, about the cost of establishing or maintaining high quality wildlife habitat. Also, focusing Idaho Power's enhancement efforts on new acquisitions would represent a lost opportunity for enhancement of larger acreages, with known habitat concerns and known improvement costs, at the four islands that are already associated with Idaho Power's original license for the project. For these reasons, we conclude that Idaho Power's participation in enhancements at Porter, Hoffman, Patch and Gold islands, including annual operation and maintenance funding for equipment needed to initiate and maintain enhancement projects, would be a reasonable approach to providing mitigation for waterfowl.

Mountain Quail Habitat Enhancement

Project operation affects potential habitat for the mountain quail by preventing establishment of riparian vegetation along the Brownlee reservoir shoreline and limiting its extent along the shorelines of Oxbow and Hells Canyon reservoirs. Grazing on Idaho Power lands could reduce the cover of woody shrubs that provide important cover and forage for mountain quail, and project-related maintenance activities and recreation may cause some disturbance to this reclusive bird.

Idaho Power proposes to cooperate with state and federal wildlife management agencies to develop and implement a mountain quail restoration project by participating in enhancing low-elevation riparian habitat and reintroducing a mountain quail population. Idaho Power anticipates that state and federal wildlife management agencies would take the lead in identifying projects, and Idaho Power would provide funding, equipment, personnel, logistical support, and expertise to support them. Idaho Power would begin its participation within 1 year of license issuance, assuming a project or projects have been identified, and would continue participating through the next 5 years. If no projects have been specified at the time of license issuance, Idaho Power would participate as opportunities occur.

Forest Service (FS-10) supports Idaho Power's proposal. The Forest Service notes that any measures implemented on National Forest System lands would be subject to FS-1, which specifies that Idaho Power would notify the Forest Service prior to implementation of any habitat or ground-disturbing activities.

Under Interior-80, Interior recommended that Idaho Power develop a mountain quail management plan. Interior's comments on the draft EIS indicate that Interior's objectives would be met through Idaho Power's participation in mountain quail habitat enhancement and/or re-introduction projects led by the agencies. During the 10(j) meeting, Interior indicated that the Powder and Burnt River basins could provide important translocation sites.

ODFW-63 supports Idaho Power's proposal, as outlined by Idaho Power (2003a). ODFW recommends that Idaho Power should cooperate with an ODFW reintroduction study by providing personnel to assist with tagging, release, and monitoring of radio-marked quail in Hells Canyon. More recently, ODFW identified Spring, McGraw, and Fox creeks as potential sites for translocation projects (letter from ODFW dated February 21, 2007).

IDFG-30 supports Idaho Power's proposal for mountain quail habitat enhancement, as outlined in Idaho Power (2003a), but recommends that funding be directed toward assisting ODFW and IDFG with reintroduction efforts because other land acquisition and riparian habitat enhancement activities on new and currently owned lands should benefit future mountain quail population expansion and reintroduction. IDFG identifies several aspects of habitat enhancement that would be of particular benefit to mountain quail. These include increasing the extent and diversity of native woody plant species and the interconnectedness of riparian habitat, focusing on the use of plant species known to provide cover or food for mountain quail; evaluating the benefits of enhancing vegetation along the shorelines of Oxbow and Hells Canyon reservoirs, rather than Brownlee, where soil conditions and seasonal drawdown would prevent the establishment of suitable mountain quail habitat; and decreasing disturbance associated with recreation, roads, and project O&M activities. In comments on the 10(j) meeting (letter from IDFG dated January 27, 2007), IDFG indicates that several locations downstream of Oxbow dam, including Indian, Eckels, Allison and Deep creeks, should be considered high-priority sites.

Our Analysis

As summarized in the Habitat Conservation Assessment for Mountain Quail (Vogel and Reese, 1995), biologists noted declines in mountain quail populations in the intermountain west beginning in the early 1900s and the species has been nearly extirpated from eastern Washington, Oregon, Idaho and Nevada. The Conservation Assessment does not provide historical or current population numbers for populations, and Gutierrez and Delehanty (1999) and FWS (68 FR 14) note that lack of data about the historical distribution of the species makes it difficult to interpret population trends. The large number of translocation, reintroduction, and supplementation projects that have been implemented since the late 1800s further complicates this task.

Idaho Power biologists did not observe mountain quail during spring surveys for upland game birds, but did observe them incidentally at two locations downstream of Hells Canyon dam (Turley and Edelmann, 2003). Based on Idaho CDC records, Idaho Power also mapped one occurrence near Oxbow dam, one near Hells Canyon reservoir, and two near the Snake River downstream of Hells Canyon dam.

Idaho Power used GIS and a habitat suitability model for the mountain quail to assess habitat potential within one-half mile of reservoir shorelines and within one-fourth mile of the Snake River from Hells Canyon dam to the confluence with the Salmon River (Rocklage and Edelmann, 2003a). The assessment identified 2,500 acres of scrub-shrub wetland and forested wetland within this corridor that could likely provide high-quality habitat. Most of this is located along steep tributaries to Oxbow reservoir. Enhancement of existing riparian vegetation in the lower reaches of tributaries and along the reservoir shoreline could improve habitat quality and allow for secure movement of quail, if present, between tributaries. Habitat enhancement projects could also be implemented as part of Idaho Power's IWHP/WMMP to benefit a wide variety of riparian-associated wildlife species, including mountain quail.

Interior, ODFW and IDFG recommend several sites to be considered for possible translocation projects. Idaho Power's participation in translocation projects could provide specific benefits to mountain quail recovery.

Implementation of Idaho Power's proposal would direct $100,000 in funding over a 5-year period, plus contribution of equipment and personnel, to specific projects developed by federal or state agencies. Benefits during this time could include on-the-ground habitat improvements; collection of new information about quail habitat requirements and behavior; and/or establishment of new populations in the project area. We conclude that this approach would be a useful means of addressing project effects that are difficult to quantify because of the imprecise historical record and the number of factors that may have contributed to the decline of this species.

3.7.2.7 Wildlife Management on Idaho Power Lands

In addition to project-related O&M, Idaho Power manages a variety of other land uses, including residential areas for employees, recreation sites, and specific leases and permits for agriculture and livestock grazing. These activities influence the abundance, distribution, and quality of wildlife habitat. Livestock grazing, in particular, has the potential to damage soils and native plant communities, promote the establishment and spread of invasive weeds, and increase competition with native ungulates for forage.[82]

To address these project effects, Idaho Power proposes to consult with agencies, tribes, NGOs, and other entities (which together would function as a work group, similar to the TRWG) to develop and implement an IWHP. The IWHP would provide guidelines for general stewardship, including restrictions on grazing, recreation, and maintenance activities that would help protect habitat and minimize disturbance to wildlife.

The IWHP would tier to the HCRMP (see section 3.12, *Land Management and Use*). The IWHP would be the mechanism for administering Idaho Power's wildlife management policies, environmental measures, and stewardship activities. Idaho Power also proposes to develop a WMMP to implement the programmatic goals and objectives and BMPs outlined in the IWHP, and to develop site-specific management plans and cooperative projects.

Idaho Power would designate wildlife lands as special management areas (SMAs) or wildlife management areas (WMAs). Currently, SMAs are small and focused on protecting a specific resource. As new wildlife lands are acquired, Idaho Power would assemble parcels that are geographically close, with common management issues and settings, into larger SMAs. Idaho Power would designate lands as WMAs to provide a broader emphasis on more diverse wildlife resources on larger parcels of land.

Interior-35 recommends that Idaho Power fund development and implementation of a Habitat Mitigation and Management Program (HMMP) and incorporate it into the IWHP and WMMP. The HMMP would be the principal instrument for acquisition, management, implementation, and monitoring of mitigation lands. The program would include criteria for acquiring parcels and conservation easements and a schedule for land acquisition and habitat improvement, as well as outlining goals, objectives, and management and monitoring procedures.

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[82] Participants in scoping identified a concern about the role of domestic sheep and goats on Idaho Power lands in transmitting disease to wild bighorn sheep. Idaho Power has eliminated sheep and goat grazing from lands in its ownership, and indicates it would do the same on any lands that are acquired for wildlife in the future.

Interior-76 recommends that Idaho Power develop a plan outlining a comprehensive strategy for terrestrial mitigation. The plan would be developed in cooperation with the agencies and tribes.

Interior-79 recommends that Idaho Power consult and coordinate with the agencies and tribes to develop and implement the HCRMP, IWHP, and WMMP. The recommendation specifies that the plan should incorporate an adaptive management element to implement environmental measures based on results from monitoring and evaluation. The recommendation further specifies annual reporting and work plans, updating the plan every 5 years (at a minimum), establishing monitoring protocols and schedules, and review cycles before reports are filed with the Commission.

Prior to implementing site-specific monitoring actions, Interior-79 recommends that Idaho Power establish baseline biological conditions for the resources that will be managed and monitoring, including estimates of pre-construction habitat conditions, as a means of ensuring that the amount of mitigation will offset project impacts. Interior states that HEP is the preferred procedure.

Forest Service (FS-5) supports Idaho Power's proposal, as outlined in its response to AIR TR-1, for preparation of an IWHP and WMMP to apply to lands within the project boundary and National Forest System lands adjacent to the project boundary that are affected by the project. The Forest Service specifies that Idaho Power should coordinate with the Forest Service in developing the plans. Under this condition, Idaho Power would develop and implement: (1) a monitoring program, including a process to establish baseline biological conditions for the resources that will be managed and monitored; and (2) an adaptive management process, including protocols and schedules, tailored to specific mitigation or management actions.

Forest Service (FS-6) specifies that Idaho Power finalize and implement the HCRMP, IWHP, and WMMP as outlined in Idaho Power's response to the Commission's AIR TR-1.

IDFG-28 recommends that Idaho Power implement its proposals for land acquisition and management as described in Idaho Power's response to the Commission's AIR TR-1. IDFG points out that acquisition alone does not necessarily mitigate for adverse impacts on wildlife habitat, and provides a number of specific recommendations regarding wildlife management and enhancement measures. IDFG also highlights the importance of protecting any acquired lands to ensure that they are protected in perpetuity, and that they remain available for public use.

ODFW-59 recommends that Idaho Power consult with ODFW and the TRWG, described below in ODFW-60, to develop and implement a comprehensive Terrestrial Resources Management and Mitigation Plan. The Terrestrial Resources Management and Mitigation Plan would address implementation, monitoring, and adaptive management of all restoration, protection, and management strategies. Under this recommendation, Idaho Power would consult with ODFW and the TRWG to review and evaluate monitoring results and develop the next year's proposals; complete required monitoring, and prepare an annual report summarizing the results. In consultation with ODFW and the TRWG, Idaho Power would update the Terrestrial Resources Management and Mitigation Plan every 5 years.

ODFW-60 recommends that Idaho Power establish a TRWG for the purpose of consulting in development of the Terrestrial Resources Management and Mitigation Plan; design of restoration, protection, management, and monitoring plans; and development of adaptive management or other recommendations. Under this recommendation, Idaho Power would be responsible for maintaining records of TRWG consultation and making them public. The TRWG would comprise representatives of federal and state agencies, tribes, NGOs, and other stakeholders. ODFW provides several specific recommendations about the role of the TRWG.

As mentioned in section 3.7.2.6, the Burns Paiute Tribe also recommends establishment of a terrestrial resources task force. Under the tribe's recommendation, the task force would annually review Idaho Power's progress in meeting the terms and conditions developed to mitigate wildlife losses.

The Shoshone-Paiute Tribes recommends that Idaho Power convene a terrestrial resource task force to ensure that the requirements of all projects and implementation of the new license provide protection, mitigation and enhancement measures for acquired land. Under this recommendation, Idaho Power would fund Tribal participation in the task force.

The Shoshone-Paiute Tribes also recommends that Idaho Power fund the development and implementation of wildlife management strategies for appropriate species on acquired lands (i.e., bald eagle and mountain quail) in consultation with appropriate federal agencies and tribes.

Our Analysis

Idaho Power's proposal to implement an HCRMP, IWHP, and WMMP would benefit wildlife and botanical resources on lands in its ownership and lands the company would acquire as mitigation for project effects. Idaho Power's proposal would help support biodiversity; restore and enhance native shrub-steppe, grassland, and riparian habitat; improve riparian habitat connectivity; and reduce traffic and noise disturbance at sensitive sites. The geographic arrangement of the SMAs and WMAs (i.e., those already in Idaho Power's ownership and those Idaho Power would acquire) in relation to large habitat blocks in public ownership would further expand the area of benefits. Cooperative management of grazing allotments that may be attached to acquired lands would add to this network. However, public land management responsibilities and methods may not parallel IWHP/WMMP priorities. With conflicting goals and objectives for management, there would be no assurance that cooperative management would result in benefits to wildlife.

The effects of the management recommendations outlined in Interior-35 and -76, FS-5 and -6, IDFG-28, ODFW-59 and -60 would be generally similar to those that would occur under Idaho Power's proposal. Despite the variety of names for wildlife management plans, all of the measures contain similar goals and objectives for protection, management and enhancement; recognize the need for effectiveness monitoring; and propose to use the results of monitoring to adaptively manage habitat. All of the measures specify that schedules for work planning, implementation, and reporting should be included in the management plan. All of the measures provide for establishment of a cooperative work group, but they differ in defining specific roles and responsibilities.

The effects of most aspects of Interior-79 would be similar to Idaho Power's proposals for wildlife management and several of the other agency and tribal recommendations, including the recommendation to establish baseline biological conditions for resources that would be managed and monitored. However, Interior-79 also recommends that Idaho Power establish pre-project baseline conditions. Interior recommends using HEP to accomplish both these objectives.

Using HEP to establish baseline conditions on lands that would be managed for wildlife might or might not provide the type of information that would be needed for later monitoring. While HEP is a useful tool for estimating large changes in habitat area or value, it is generally not as useful for measuring incremental effects of specific habitat management applications. Tailoring Idaho Power's monitoring protocols to adaptive management proposals would be more likely to provide the specific information needed to evaluate and adjust restoration and enhancement efforts.

Conducting a HEP to establish pre-project baseline conditions would provide additional detail and quantification about the impacts of inundation on wildlife habitat. The information would have limited use, however, because the results of Idaho Power's terrestrial resource studies already provide the level of detail needed to determine the acreage of upland and riparian habitats that should be acquired to help offset ongoing project effects; the existing review of habitat conditions in the basin clearly indicates resource needs; and the TRWG has already identified priorities for acquisition, management, and enhancement.

3.7.2.8 Special Status Wildlife

Idaho Power identified 68 special status species in the project vicinity (Turley and Holthuijzen, 2003d), and evaluated potential project effects on sites where these species occur (Dumas et al., 2003b). Idaho Power concluded that activities associated with roads, recreation, and transmission line O&M could cause disturbance to some species. Idaho Power does not propose to develop focused management plans for any special status species, but proposes to implement cooperative measures for mountain quail and waterfowl, and has identified several specific projects needed to protect wintering big game, bald eagle nests and roosts, bat hibernacula, neotropical migrant songbirds, and colonial nesting waterbirds. Proposals to acquire and manage lands for wildlife would afford other opportunities for Idaho Power to manage special status species where they are present.

Two agencies—BLM and ODFW—recommend development of overall management plans for threatened, endangered, and sensitive species. The Forest Service recommends development of a plan to address threatened and endangered species, and a separate plan to address Forest Service sensitive species. FWS recommends that Idaho Power develop specific plans to protect the southern Idaho ground squirrel, bats, amphibians, and reptiles. We discuss these recommendations below.

Threatened, Endangered and Sensitive Species Management Plan

Under Interior-34, Idaho Power would need to develop and implement a Threatened, Endangered, and Sensitive Species Management Plan for BLM-administered lands within the project boundary and on other BLM lands affected by the project.[83] The plan would include specific provisions for osprey, peregrine falcon, great blue heron, Columbia spotted frog, Townsend's big-eared bat, spotted bat, and Idaho ground squirrel.

According to Interior-34, within 2 years of license issuance Idaho Power would need to conduct additional surveys in potential habitat that was not previously surveyed to evaluate project effects on special status species on BLM-administered lands. Idaho Power would annually monitor selected sites and habitats for 5 years following plan implementation, and every 2 years thereafter. Idaho Power would evaluate the effectiveness of management and enhancement actions, and would update surveys, monitoring and adaptive management, as needed. Finally, Interior 10(a) recommendation no. 34 calls for preparation of a biological evaluation if Idaho Power proposes any actions that would affect threatened, endangered, and sensitive species on BLM-administered lands. In commenting on the draft EIS, Interior recommended establishment of an advisory board to guide implementation of the Threatened, Endangered and Sensitive Species Management Plan, similar to Idaho Power's proposed rare plant advisory board.

The Forest Service (FS-9) specifies that Idaho Power consult with the Forest Service to develop a Sensitive Species Management Plan that would be incorporated into Idaho Power's WMMP. The purpose of the plan would be to protect, manage, enhance and monitor sensitive species and their habitat on National Forest System lands affected by the project. Under this condition, Idaho Power would conduct additional sensitive species surveys when new species are listed, if project-related activities could affect them. Idaho Power would monitor confirmed sites every 2 years for 6 years following issuance of any new license, and then every 3 years thereafter. The need for continued monitoring would be re-assessed after year 6 of any new license term. Idaho Power would protect and/or restore sensitive sites or habitats that are declining in condition, as determined through monitoring. Finally, Idaho Power would update the plan to address revisions to designations by the Regional Forester.

Under ODFW-65, Idaho Power would develop and implement a plan to protect and monitor threatened, endangered and sensitive species on project lands and within a one-fourth- to one-half-mile

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83 Interior-34 also identifies several special status plant species. We discuss this aspect of Interior's recommendation in section 3.7.2.2, above).

zone along the project reservoirs and the Snake River downstream of Hells Canyon dam. ODFW specifically recommends monitoring peregrine falcon, osprey, and great blue heron nest sites.

Our Analysis

Idaho Power's proposals for cooperative management projects, specific projects to be implemented on lands currently within its ownership, and long-term management of SMAs and WMAs as newly acquired lands are brought into the project boundary, would help protect and improve habitat that may support threatened, endangered, and sensitive species. Idaho Power proposes to develop monitoring, reporting, and review mechanisms to track the effectiveness of its measures, but does not propose specific plans or actions targeting threatened, endangered, and sensitive species.

The effect of implementing Interior-34 and FS-9 would be to provide a more structured framework for managing special status species and coordinating with BLM and the Forest Service. This would assist the agencies in meeting their internal management responsibilities. FWS recommends three additional plans, as discussed below, that would target protection for southern Idaho ground squirrel, bats, and amphibians and reptiles. Implementation of Interior, Forest Service, FWS, and ODFW recommendations would bring the total number of plans for special status wildlife to six, not including three other plans addressed in section 3.8.2,*Threatened and Endangered Species*.

Because of different agency authorities and responsibilities, each recommendation differs slightly in its focus of concern. However, developing a single, over-arching plan to address threatened, endangered and sensitive species could have several resource benefits. It would likely reduce the need for duplicative consultation, planning and reporting efforts, increase the efficiency of field efforts, and provide a consistent approach to developing and implementing agreed-upon protection, management and enhancement measures.

The plan could be applied to special status species at any sites where project operations or project-related activities could affect them, rather than prescribing a fixed distance for monitoring and management (such as a one-fourth or one-half-mile corridor). Exactly which species should be monitored could be determined as part of plan development, rather than pre-determining survey requirements for species such as peregrine falcon, which studies indicate are not affected by the project.

The plan could also incorporate a variable monitoring schedule, based on site-specific threats to special status species, rather than prescribing defined survey intervals (such as described in Interior 10(a) recommendation no. 34 and Forest Service preliminary condition no. 9). Intensive monitoring at sites with a high risk of disturbance and less frequent visits to remote sites would maximize protection where it is needed and minimize less productive efforts.

Southern Idaho Ground Squirrel

Project operations and project-related activities that affect shrub-steppe soils or vegetation (e.g., road maintenance, dispersed recreation, and recreation traffic associated with Steck Park), may adversely affect habitat for the southern Idaho ground squirrel. Interior-83 recommends that Idaho Power develop and implement a Southern Idaho Ground Squirrel Management Plan. The plan would provide for habitat enhancement and reintroduction of southern Idaho ground squirrels at two sites located along upper Brownlee reservoir (Cobb Rapids and Corral). The plan would be incorporated into Idaho Power's IWHP and WMMP.

Our Analysis

The southern Idaho ground squirrel is a candidate for federal listing under the ESA. It is endemic to southwestern Idaho, and currently occupies 294 known sites on rolling hills and flats at elevations ranging from about 2,200 to 3,200 feet in the Weiser River basin (FWS, 2004). Idaho Power's surveys in

1998 documented the occurrence of southern Idaho ground squirrels at Cobb Rapids and Corral near upper Brownlee reservoir, within the project boundary. In their response to AIR TR-1, Idaho Power indicates that southern Idaho ground squirrels also are present on the Rocking M Ranch parcel, which could be acquired as part of Idaho Power's terrestrial resource habitat package.

Given the lower limit of this squirrel's likely occurrence, Brownlee reservoir fluctuations would not affect its habitat, but land use and management activities that cause ground disturbance (e.g., road construction or maintenance) or affect vegetation (e.g., grazing, herbicide treatment) could in turn affect the southern Idaho ground squirrel. Enhancement of native shrub-steppe plant communities, translocations to reduce genetic isolation, predator (badger) control, and protection of occupied sites under conservation easements could benefit this species. Approximately 85 percent of occupied sites are located on private lands, so without implementation of such measures on private land, populations may continue to decline.

Bats

Project O&M could cause disturbance to bats where bats use project facilities such as dams, tunnels, houses, storage buildings, bridges, or other man-made structures. Project-related recreation could cause disturbance to bats that use caves, crevices, or mines. Interior preliminary 10(j) recommendation no. 82 recommends that Idaho Power incorporate three bat-related measures into its IWHP and WMMP: (1) monitor sites occupied by Townsend's big-eared bats, (2) protect maternity sites that are not already gated to prevent human access, and (3) protect and preserve Townsend's big-eared bat hibernacula within the project boundary.

Our Analysis

The Townsend's big-eared bat (also known as the pale western big-eared bat) is one of several special status bat species that occupy the Snake River corridor, including Hells Canyon. Anderson's (1998) compilation of bat survey results for the Snake River corridor reports that Townsend's big-eared bats were documented at 22 of 46 surveys sites, including four maternity colonies and two hibernacula.

In the justification for Interior-82, Interior notes that Hells Canyon provides abundant and secure habitat for bats, and a macroinvertebrate prey base that supports a bat community at "near historic or prehistoric levels." Anderson (1998) supports this conclusion, also noting that bats appear to use virtually every mine with a surface opening, and virtually every existing building in the canyon except those that have been sealed to prevent their access.

Ongoing project operations do not appear to affect bat habitat, but Idaho Power has not conducted focused surveys of the project facilities (e.g., dams, powerhouses, storage buildings, restrooms) to determine bat use of these structures. Unintended disturbance may occur as a result of project-related construction (e.g., new recreation facilities) or maintenance (e.g., dam, tunnel, or bridge inspections and repairs), or as visitors explore cliffs, caves, and mines. Disturbance during the winter can cause death because bats may leave hibernacula and use up energy stores that cannot be replaced because of the low availability of insect prey during colder months. Disturbance during the breeding season can cause abandonment of nurseries and loss of the year's young. Systematic surveys of project-related facilities or natural sites that could be disturbed by project-related maintenance or recreation would be useful in identifying sites that should be protected.

Human attitudes also pose a risk to bats. Anderson (1998) reported evidence of intentional shooting and "bat bashing" in the Snake River corridor. While relatively rare, such incidents also indicate a need for bat protection and visitor education.

Amphibians and Reptiles

Project-related recreation may affect special status amphibians as a result of traffic on roads that bisect wetland habitats, where passing vehicles can run over dispersing frogs and toads. Dispersed recreation along streams also has the potential to disturb amphibians and their habitat. Project-related recreation may affect special status reptiles. Recreation users may intentionally kill snakes or may unintentionally harm or kill them by chasing, capturing, or handling them. Idaho Power proposes no measures specifically intended to protect or manage amphibians or reptiles. Idaho Power documented the occurrence of four special status amphibians in the project vicinity, including the Columbia spotted frog, tailed frog, western toad, and Woodhouse's toad. The project vicinity contains suitable habitat for the northern leopard frog near Farewell Bend, but surveys did not reveal the presence of this species and it may be extirpated in Oregon. Surveyors observed only one special status reptile, the sagebrush lizard, although the project area contains abundant habitat and several special status species may be present.

For amphibians, Interior-85 calls for Idaho Power to maintain high spring flows downstream of Hells Canyon dam to maintain breeding habitat for western toads; locate, protect and enhance natural springs and seeps within the project boundary; and protect and acquire wetlands and springs outside the project boundary. Interior recommends Idaho Power map the northward progression of bullfrogs and develop and implement a plan to remove them from sites within the project boundary.

To protect reptiles, Interior recommends Idaho Power map all snake dens encountered within the study area. Interior-85 also recommends that Idaho Power discourage or restrict activities that affect known den sites.

Our Analysis

Surveyors found that western toads breed in backwater ponds along the Snake River downstream of Hells Canyon dam at sites where changes in project operation could affect them. Surveyors note that the availability of these ponds likely varies from year to year, depending on flows. In high-water years, some ponds may not be exposed until after the breeding season, while in low-water years, some ponds may dry up early in the season. This pattern would likely continue under all operating scenarios, somewhat modified by reduced ramping rates (see section 3.7.2.1).

Idaho Power has mapped wetlands and riparian habitats within the project area, and as described in the HCRMP, one of the objectives for terrestrial resource management is to protect these areas. Wetlands and riparian habitats are also a high priority in terms of ranking potential land acquisitions. Idaho Power proposes to consult with the TRWG to develop site-specific management plans for each parcel. Presumably, these plans would emphasize protection and enhancement of wetlands and riparian habitats.

Implementation of Interior's recommendation to map bullfrog occurrences throughout the project area would provide information that could be useful to federal and state agencies for planning and management at a regional level. However, implementation of control measures on a site-by-site basis, as part of the management plan for each SMA or wildlife management area, would focus Idaho Power's efforts where they would be most effective in protecting native amphibian populations, i.e., at known breeding sites for western toads. Bullfrogs are prolific, and readily repopulate ponds where even 90 percent of the individuals and egg masses have been removed. Draining ponds is temporarily effective in eradicating bullfrog populations, but bullfrogs are capable of moving long distances over land, and removal programs to date have not been effective where nearby source populations exist.

Idaho Power's license application (2003a) does not contain any information about snake dens, but given the abundance of reptile habitat, it is likely that they are present. Mapping and protecting any that are encountered would be effective as a general conservation measure, and could be included in the

IWHP and WMMP, as well as in any site-specific management plans that are developed for newly acquired lands.

3.7.2.9 Effects of Other Measures on Terrestrial Resources

Sediment Transport Measures

Under FS-4 (Sandbar Restoration), Idaho Power would establish a funding mechanism to support Forest Service restoration of 14 acres of sandbars on or adjacent to National Forest System lands downstream of Hells Canyon dam. Beach replenishment would increase habitat area for species such as river otters, black bears, mink, and raccoons. These species use sandy shorelines for travel, resting, and grooming, and use gently-sloped banks to access aquatic foraging areas. These species would also benefit from additional foraging opportunities if beach replenishment results in larger fish populations. However, one of the purposes of beach replenishment is to enhance recreation opportunities. Concentrated use of beaches for recreation would likely limit wildlife use during the summer.

Recreation Measures

Idaho Power's study of the influences of human disturbance on terrestrial resources (Dumas et al., 2003b) identified several sites where recreational access may currently disturb wildlife habitat, wildlife, and rare plants. Areas of special importance include habitat for Columbia spotted frogs and nesting waterfowl near Hewitt Park and Holcomb parks and at dispersed recreation sites nearby; tailed frogs at Kinney Creek, riparian-associated songbirds near Holcomb and McCormick parks, Carters Landing, Kinney Creek and Big Bar; bats at Big Bar, and bald eagles at Woodhead and McCormick parks, Bob Creek, Hells Canyon dam, and Big Bar. Wintering habitat for elk is present at Steck, Woodland, McCormick and Hells Canyon parks, and at Big Bar, Deep Creek, and Hells Canyon dam.

Dumas et al. (2003b) estimated a high or very high risk of disturbance to mule deer at McCormick, Woodland, Copperfield and Hells Canyon parks, and Carters Landing. The study found disturbance to be moderate at Holcomb and Hewitt parks and the Steck site. Holcomb and Hewitt parks and the Swedes Landing site are located within a mule deer spring migration corridor, but most recreation activity would occur after Memorial Day and would generally not conflict with deer use, which tapers off by early May (Edelmann, 2003).

Expansion and improvement of existing recreation facilities would remove small amounts of wildlife habitat and cause short-term disturbance during construction at each site. Over the long term, increases in recreational activity throughout the project area would cause increasing disturbance to wildlife, especially in the most confined reaches of Hells Canyon, and increasing competition for the limited amount of riparian habitat.

Several measures could be implemented to help minimize adverse effects. These include using the results of the Dumas et al. risk analysis to design recreation sites around wildlife habitat needs; reducing the footprint of recreation facilities planned for especially sensitive sites (e.g., Big Bar); and implementation of a program to educate visitors about ways they can minimize their impact on wildlife and wildlife habitat.

Dumas et al. (2003b) did not identify any rare plant occurrences associated with formal recreation facilities, but use of dispersed recreation sites (including trails) would have a moderate to very high risk of adversely affecting 14 populations. Species that could be affected include porcupine sedge, shining flatsedge, Schweinitz flatsedge, Hazel's prickly phlox, and bartonberry. To determine whether protective measures are needed at various sites, Idaho Power could use the results of the risk analysis to overlay proposed recreation measures onto known rare plant sites, using the GIS atlas developed for the project, to determine whether protective measures should be implemented at any sites.

3.7.3 Cumulative Effects

3.7.3.1 Riparian and Wetland Habitats

A variety of land uses and human activities, such as ranching, irrigation, mining, and hydropower development, have dramatically affected riparian habitat along the Snake River since the early 1900s. Together, these factors have reduced the extent and quality of riparian habitat in a region where climate and soils already limit the distribution of this important natural resource, including Hells Canyon. In addition to inundating riparian habitat and associated wetlands, construction of the Hells Canyon Project converted almost 90 miles of free-flowing riverine habitat to reservoir, accounting for almost half of the reservoir length that now exists between the Shoshone Falls and Ice Harbor dams. The primary effects of ongoing hydropower operation on riparian habitat and wetlands in Hells Canyon occur as a result of: (1) reservoir fluctuation; (2) trapping of sediments in project reservoirs; and (3) alteration of the natural flow regime in the Snake River downstream of Hells Canyon dam.

Under any of the action alternatives, effects on riparian habitat around project reservoirs would be minor. Oxbow and Hells Canyon reservoirs would continue to support narrow bands of riparian vegetation, and seasonal drawdowns at Brownlee reservoir would continue to prevent riparian habitat from establishing in the fluctuation zone and along the shoreline.

Under any of the action alternatives, changes in the flow regime would reduce the amount of riparian and wetland habitat along the Snake River downstream of Hells Canyon dam. Changes would range from about 2 acres under Scenario 3 (Flow Augmentation), to about 30 acres under Scenario 1 (Reregulating). The Brownlee impoundment would continue to trap large volumes of sediment, which would continue to limit the establishment of willows in this reach. Although they may never have been dense along the Snake River, willows are an important component of riparian plant communities, and their absence may reduce habitat quality for wildlife species that typically use willows for foraging, nesting, or cover.

These findings suggest that the Hells Canyon Project would continue to contribute to cumulative adverse effects that result from the operation of over 20 other hydropower facilities on the Snake River, including Shoshone Falls, Lower Salmon Falls, Bliss, and C.J. Strike. However, Idaho Power proposes to improve management of natural resources at Hells Canyon by implementing both project-wide BMPs and specific measures to protect and enhance riparian and wetland habitat within the project boundary. Idaho Power would also acquire, protect, and manage more than 800 acres of riparian habitat on lands adjacent to the project reservoirs to help mitigate operational effects and would support cooperative projects to protect rare plants, control invasive weeds, improve low-elevation riparian habitat for mountain quail, and enhance habitat on several Snake River islands for waterfowl and other riparian-associated species. These actions would complement similar measures that Idaho Power is implementing at the mid-Snake hydroelectric projects and contribute to the positive regional trends described in section 3.2.1.6, *Riparian/Wetland Habitat*.

3.7.3.2 Native Grasslands and Shrublands

Development and land uses in the Snake River basin since the early 1900s have adversely affected upland habitat, as well as riparian and wetland habitat. Of particular concern is the loss of large areas of low-elevation big game winter range as a result of inundation behind numerous dams; conversion to urban, residential, and agricultural uses; fragmentation; overgrazing; fire suppression; and the invasion of non-native weeds. Construction of the Hells Canyon Project inundated more than 10,000 acres of low-elevation winter range, and although inundation precludes restoration of this habitat, Hells Canyon continues to provide some of the most important winter range in the region (Christensen, 2003). Idaho Power's proposal to acquire and manage 23,582 acres would help mitigate the adverse effects on winter range. Parcels acquired for mitigation are located within areas mapped by Christensen (2003) as crucial winter range, and include the Daly Ranch, which borders the primary migration route for deer moving between summer range in Oregon and winter range near Brownlee reservoir.

To offset project effects on uplands, Idaho Power proposes to improve management of natural resources at Hells Canyon by implementing both project-wide BMPs and specific measures (e.g., fencing to exclude trespass grazing) to improve the condition of uplands within the project boundary. Idaho Power would also acquire, protect, and manage more than 20,000 acres of upland habitat on lands adjacent to the project reservoirs to help mitigate for operational effects and would support cooperative projects to protect rare plants and manage invasive weeds. These actions would complement similar measures that Idaho Power is employing at the mid-Snake hydro projects and contribute to the positive regional trends resulting from better management of public grazing lands and more emphasis on weed control in the region.

3.7.3.3 Noxious Weeds and Invasive Exotic Plants

Project operation and project-related activities that cause soil and vegetation disturbance (e.g., reservoir fluctuations, transmission line maintenance, dispersed recreation) create conditions that promote the establishment of weeds and invasive exotic plants. Although these factors contribute to cumulative impacts, the project's role is very small in comparison to the effects of 100 years of overgrazing in the project vicinity. Weeds are abundant and widespread, and the combined efforts of all landowners would be needed to provide even a moderate level of control.

Under current conditions, Brownlee reservoir impedes the downstream spread of weeds because weeds within the fluctuation zone cannot survive the alternating inundation and desiccation of seasonal drawdowns. Seasonal drawdowns would continue under any of the flow alternatives. None of the proposed flow alternatives would be likely to affect the abundance or distribution of weeds.

Idaho Power proposes to develop and implement an Integrated Weed Management Plan, which would include cooperative weed control projects on adjacent lands. Other proposed measures, including implementation of a transmission line O&M plan and project-wide BMPs would also address this issue. These actions would complement similar measures that Idaho Power is undertaking at the mid-Snake hydroelectric projects and contribute to positive regional trends that are anticipated to result from better management of public grazing lands and a stronger emphasis on weed control in the region.

3.7.3.4 Peregrine Falcons

Peregrine falcon surveys conducted in the project vicinity between 1997 and 2000 documented one eyrie near Hells Canyon dam. The eyrie is located about 2,000 feet west of the Hells Canyon boat launch, at about 3,900 feet. The elevation of the reservoir at full pool is 1,687 feet. At this distance from and height above the reservoir, the eyrie is remote from project operations and potential disturbance. We conclude that the project does not affect peregrine falcons, and would not contribute either positively or negatively to cumulative impacts on this species.

3.7.4 Unavoidable Adverse Effects

As mentioned above, operation of Brownlee reservoir would continue to prevent the establishment of riparian vegetation within the fluctuation zone and along the shoreline. Trapping of sediments within Brownlee reservoir would continue to starve the Snake River downstream of Hells Canyon dam of sands and sediments which, if present, would likely support colonization by willows. Brownlee reservoir would continue to accumulate organochlorine compounds and mercury from non-project sources, which may pose a risk to fish-eating wildlife (such as river otters, great blue herons, and bald eagles). Long-term increases in recreational activity would cause increasing disturbance to wildlife, especially in the most confined reaches of the canyon.

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3.8 THREATENED AND ENDANGERED SPECIES

3.8.1 Affected Environment

Five federally listed threatened or endangered fish species are known to occur in the project area. These include two evolutionarily significant units (ESU) of Chinook salmon (the Snake River fall-run Chinook salmon and the Snake River spring/summer-run Chinook salmon), the Snake River sockeye salmon ESU, the Snake River basin *O. mykiss* (steelhead) ESU, and bull trout. We provided information on the biology of these species in section 3.6.1.3, *Anadromous Fish Species*, and in section 3.6.1.4, *Native Resident Salmonids*, and we describe the status and critical habitat of these species below. According to the FWS, two federally listed threatened aquatic mollusks (the Bliss Rapids snail and Idaho springsnail), three federally listed plant species (MacFarlane's four-o'clock, Howell's spectacular thelypody, and Spalding's catchfly) and four federally listed wildlife species (gray wolf, Canada lynx, Northern Idaho ground squirrel, and bald eagle) may occur in the vicinity of the project area (letter from Jeffery L. Foss, Supervisor, Snake River Fish and Wildlife Office, Boise, ID, to the Commission, dated November 28, 2005).

We provide additional information on the rangewide distribution and status of bull trout from FWS (2005d) in appendix F, and we provide additional information on the rangewide distribution and status of all Columbia River salmon and steelhead ESUs from NMFS (2005) in appendix G.

3.8.1.1 Fall Chinook Salmon

The Snake River fall-run Chinook salmon (*Oncorhynchus tshawytscha*) ESU was listed as threatened on April 22, 1992, and its status was reaffirmed on June 28, 2005. The ESU includes all natural populations of fall Chinook salmon in the mainstem Snake River and in the Tucannon, Grande Ronde, Imnaha, Salmon, and Clearwater rivers. NMFS considers the Lyons Ferry hatchery stock to be part of the listed ESU, including fish reared by Idaho Power at the Oxbow Hatchery and those released from acclimation sites by the Nez Perce Tribe (discussed below). Critical habitat for the listed ESU includes river reaches currently or historically accessible in the Columbia River upstream to the confluence of the Columbia and Snake rivers; the Snake River from its confluence upstream to Hells Canyon dam; the Palouse River from its confluence upstream to Palouse Falls, the Clearwater River from its confluence upstream to its confluence with Lolo Creek, and the North Fork Clearwater River from its confluence upstream to Dworshak dam. Critical habitat also includes river reaches currently or historically accessible (except reaches above impassable waterfalls or above Dworshak and Hells Canyon dams) to Snake River fall-run Chinook salmon in the following hydrologic units (drainages): Clearwater, Hells Canyon, Imnaha, Lower Grande Ronde, Lower North Fork Clearwater, Lower Salmon, Lower Snake, Lower Snake-Asotin, Tucannon, and Palouse.

Since 1996, the Nez Perce Tribe has undertaken a program funded by BPA to increase the natural spawning population of Snake River fall Chinook salmon upstream of Hells Canyon dam. Yearling and subyearling fall Chinook salmon are acclimated at two sites on the mainstem Snake River (Captain John Rapids and Pittsburg Landing) and at one site on the Clearwater River (Big Canyon). Records of the number of hatchery fall Chinook smolts released into the Snake River from the Lyons Ferry hatchery (located between Little Goose and Lower Monumental dams) and from acclimation sites upstream of Lower Granite dam from 1985 to 2001 are shown in table 72. The total number of fall Chinook salmon released from acclimation sites upstream of Lower Granite dam has averaged 443,814 yearlings and 1,812,209 subyearlings per year from 2002 to 2004 (McLeod, 2006).

Table 72. Releases of fall Chinook hatchery smolts into the Snake River basin. (Source: NMFS, 2003)

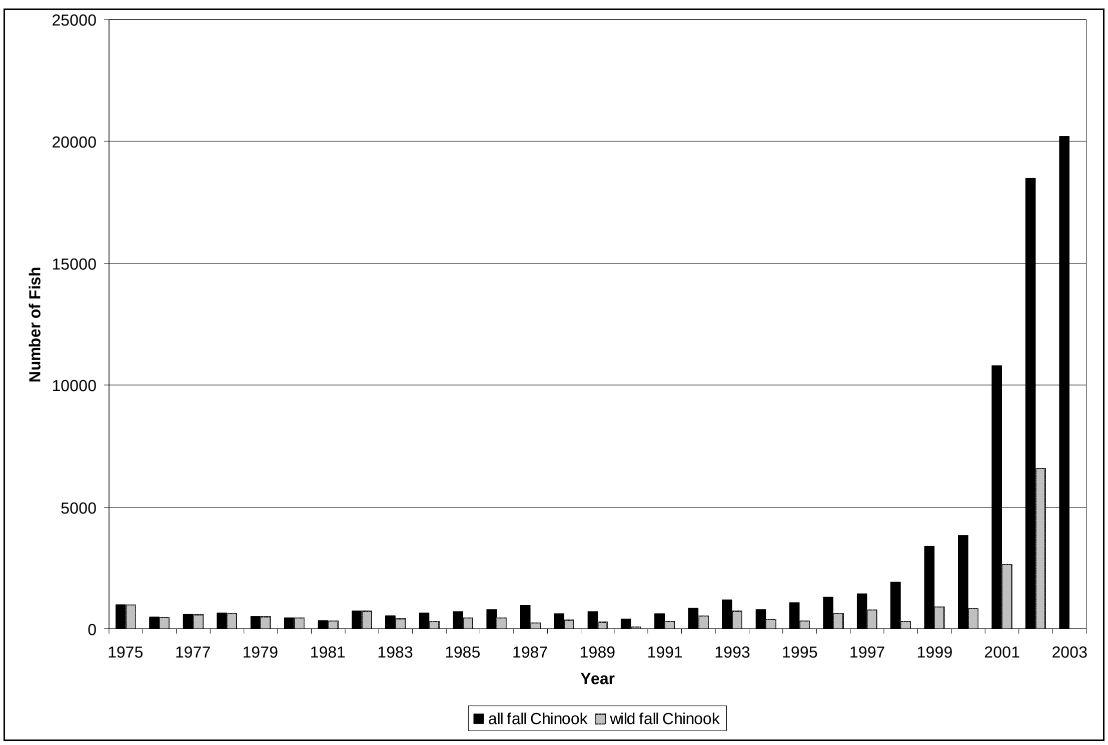
	Acclimation Sites									
	Lyons Ferry (direct)		Pittsburg Landing		Captain John		Big Canyon (Clearwater River)		Hells Canyon Dam[a]	
Release Year	Yearling	Sub-yearling	Yearling	Sub-yearling	Yearling	Sub-yearling	Yearling	Sub-yearling	Yearling	Sub-yearling
1985	650,300	539,392	--	--	--	--	--	--	--	--
1986	481,950	1,789,566	--	--	--	--	--	--	--	--
1987	386,600	1,012,500	--	--	--	--	--	--	--	--
1988	407,500	4,563,500	--	--	--	--	--	--	--	--
1989	413,017	1,710,865	--	--	--	--	--	--	--	--
1990	436,354	3,043,756	--	--	--	--	--	--	--	--
1991	224,439	--	--	--	--	--	--	--	--	--
1992	689,601	--	--	--	--	--	--	--	--	--
1993	206,775	--	--	--	--	--	--	--	--	--
1994	603,661	--	--	--	--	--	--	--	--	--
1995	349,124	--	--	--	--	--	--	--	--	--
1996	407,503	--	114,299	--	--	--	--	--	--	--
1997	456,872	--	147,316	--	--	--	199,399	252,705	--	--
1998	419,002	--	141,814	--	133,205	--	61,172	--	--	--
1999	432,166	204,194	142,885	--	157,010	--	229,608	347,105	--	--
2000	456,401	196,643	134,709	400,156	131,186	892,847	131,306	890,474	--	--
2001	338,757	199,976	103,741	374,070	101,976	501,129	113,215	856,968	--	115,251

[a] Hells Canyon dam releases increased to 500,000 in 2002.

Recent counts of fall Chinook salmon passing Lower Granite dam are shown in figure 108. The total number of adult fall Chinook salmon passing Lower Granite dam has increased from a low of 385 fish in 1990 to approximately 1,000 fish per year from 1993 to 1997, followed by steady increases up to 20,213 fish in 2003. Marked fish have comprised about 75 percent of the run since 1998, but the number of unmarked fish has been trending upward from 2000 through 2002. However, in its comments on the draft EIS, the Nez Perce Tribe reports that large numbers of unmarked fall Chinook salmon released from acclimation sites has complicated the estimation of natural production rates.

3.8.1.2 Spring/Summer Chinook Salmon

The Snake River spring/summer Chinook salmon ESU was listed as threatened on April 22, 1992, and its status was reaffirmed on June 28, 2005. The ESU includes all natural populations of spring/summer Chinook salmon in the mainstem Snake River and in the Tucannon, Grande Ronde, Imnaha, and Salmon River subbasins. NMFS includes 15 artificial propagation programs within the listed ESU, including the Pahsimeroi summer Chinook salmon stock. The Rapid River spring Chinook salmon stock is not included in the ESU, and is not listed. Critical habitat for the listed ESU includes the Columbia River upstream to the confluence of the Columbia and Snake rivers and the Snake River upstream to Hells Canyon dam. Critical habitat also includes river reaches currently or historically accessible (except reaches above impassable natural falls and Dworshak and Hells Canyon dams) to Snake River spring/summer Chinook salmon in the following hydrologic units: Hells Canyon, Imnaha, Lemhi, Little Salmon, Lower Grande Ronde, Lower Middle Fork Salmon, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, Middle Salmon-Chamberlain, Middle Fork Salmon, Upper Middle Fork Salmon, Upper Grande Ronde, Upper Salmon, and Wallowa.



Note: Wild count for 2003 was not available.

Figure 108. Estimated total and wild escapement of fall-run Chinook salmon at Lower Granite dam, 1975–2003. (Source: NMFS, 2004, as modified by staff)

Counts of adult spring/summer Chinook salmon passing Lower Granite dam have fluctuated widely over the last several decades, including an exceptionally strong return in 2001. Total counts of spring/summer Chinook salmon ranged from a low of 1,797 fish in 1995 to a high of 185,693 fish in 2001 (figure 109). Wild fish typically comprise about 20 to 40 percent of the run, and the number of wild fish has trended upward from 2000 through 2003. The run size of spring Chinook salmon returning to the Snake River over the past 20 years has likely been affected by steelhead produced through the Lower Snake River Compensation Program, which includes increased production of salmon and steelhead at 12 hatcheries located throughout the basin.

3.8.1.3 Sockeye Salmon

The Snake River sockeye salmon (*Oncorhynchus nerka*) ESU was listed as endangered on November 20, 1991, and its status was reaffirmed on June 28, 2005. Critical habitat for this ESU includes river reaches currently or historically accessible (except reaches above impassable waterfalls or above Dworshak and Hells Canyon dams) in the Columbia River upstream to the confluence of the Columbia and Snake rivers. It also includes all Snake River reaches from its confluence with the Columbia River upstream to its confluence with the Salmon River; all Salmon River reaches from its confluence with the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellow Belly, Pettit, and Alturas lakes (including their inlet and outlet creeks); Alturas Lake Creek and the portion of Valley Creek between Stanley Lake Creek and the Salmon River.

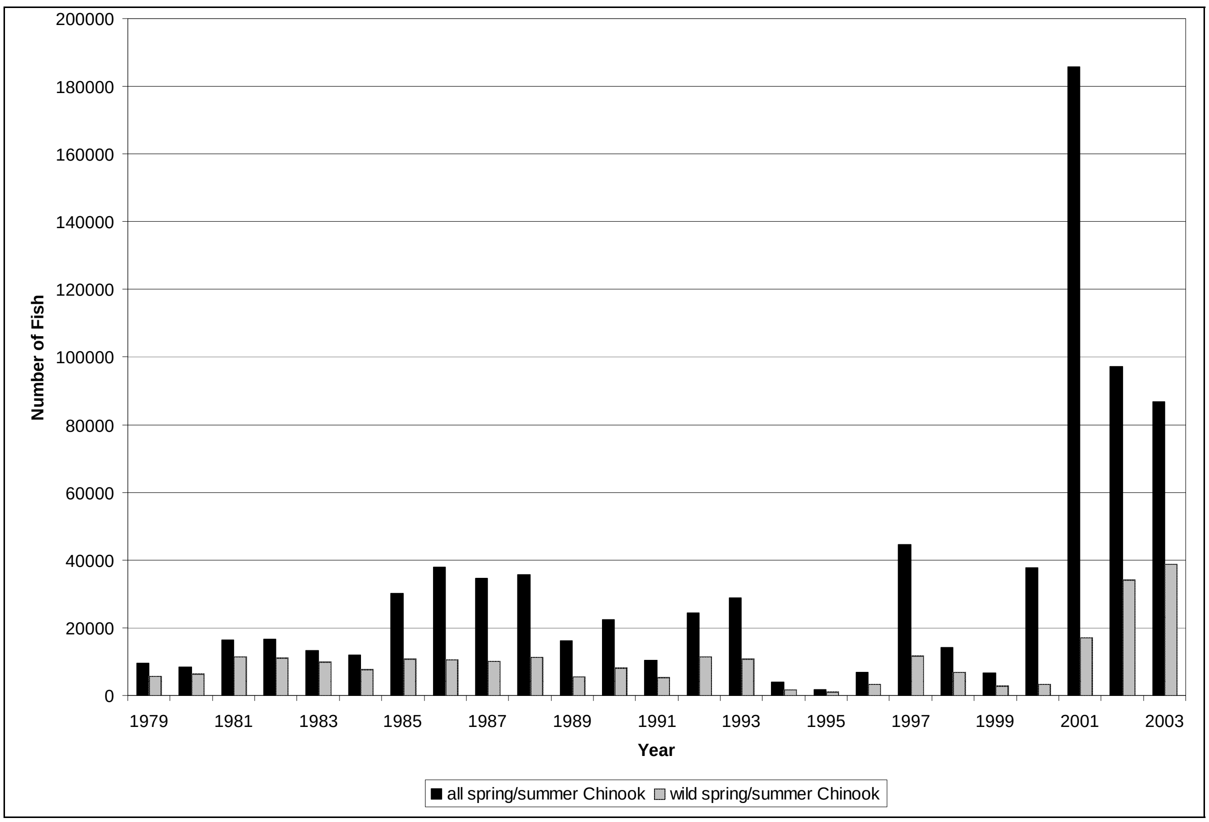


Figure 109. Estimated total and wild escapement of spring/summer Chinook salmon at Lower Granite dam, 1975–2003. (Source: NMFS, 2004, as modified by staff)

Historically, sockeye salmon spawned in the Payette, Wallowa, and upper Salmon River basins. NMFS estimates that about 25 percent of sockeye salmon major population groups in the Snake River basin were located upstream of the Hells Canyon Project (McClure et al., 2005). The construction and presence of Sunbeam dam between 1910 and 1934 blocked sockeye salmon from Redfish Lake and other lakes in the upper Salmon River basin. After the dam was breached in 1934, it is believed that smolts produced from kokanee populations re-established the sockeye salmon runs by the late 1940s (Chapman et al., 1990). An irrigation diversion blocked sockeye salmon from Alturas Lake, and Idaho Fish and Game Department (IDFG) poisoned and eradicated kokanee and sockeye salmon populations in several other lakes in the upper Salmon River basin to convert the lakes to trout production. Currently, the Snake River sockeye salmon are reduced to a remnant population in Redfish Lake.

The Redfish Lake sockeye salmon population is currently being enhanced through a captive broodstock program. All Redfish Lake sockeye salmon are captured, and the fertilized eggs are used to support the program. Some juveniles are also captured for the broodstock program (BOR, 1998). Annual counts of adult sockeye salmon passing Lower Granite dam ranged between 0 and 14 fish from 1989 through 1999. Returns of adult sockeye salmon have increased somewhat over the last 5 years, but they are highly variable from year to year (figure 110).

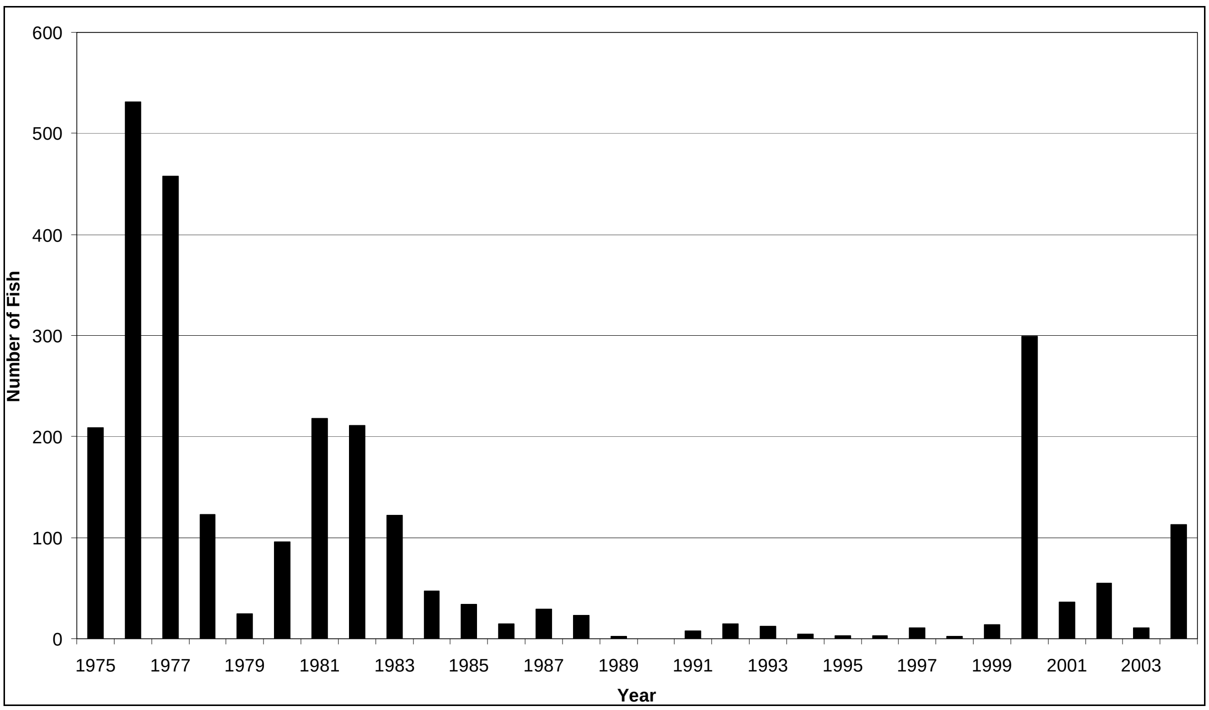


Figure 110. Sockeye salmon passage counts at Lower Granite dam for years 1975–2004. (Source: FPC, 2005, as modified by staff)

3.8.1.4 Steelhead

The Snake River steelhead (*O. mykiss*) ESU was listed as threatened on August 18, 1997, and its status was reaffirmed on January 5, 2006. The ESU includes all naturally spawned populations of steelhead (and their progeny) in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho. NMFS designated critical habitat for steelhead on February 16, 2000, but the designation was later withdrawn via consent decree on April 30, 2002. Critical habitat for Snake River steelhead was re-designated on September 2, 2005. Of the 8,225 miles of habitat within this ESU, NMFS excluded 134 miles of stream because the economic benefits of exclusion outweighed the benefits of designation, and 39 miles of stream were excluded because they overlap with Indian lands.

On January 5, 2006, NMFS re-affirmed the threatened status of the anadromous Snake River steelhead population (excluding resident rainbow trout) as a distinct population segment (DPS) and also re-affirmed their designated critical habitat. NMFS determined that the following hatchery populations of summer-run steelhead are included within the listed DPS: Tucannon River, Dworshak National Fish Hatchery, Lolo Creek, North Fork Clearwater River, East Fork Salmon River, and Little Sheep Creek/Imnaha River.

Recent counts of Snake River steelhead passing Lower Granite dam are shown in figure 111. The total number of adult steelhead passing Lower Granite dam generally ranged between 50,000 and 130,000 fish from the 1984/1985 to the 2000/2001 run years, and has exceeded 150,000 adult fish from the 2001/2002 run year through the 2003/2004 run year. The total run peaked at more than 250,000 adult fish with the 2001/2002 run, and has trended downward in the last several years. Wild steelhead comprised about 15 to 20 percent of the total adults passed at Lower Granite dam through most of the 1990s, increasing to 20 to 25 percent of the run in the last several years (figure 111). Like the spring Chinook salmon, the run size of steelhead returning to the Snake River over the past 20 years has likely been affected by steelhead produced through the Lower Snake River Compensation Program, which includes increased production of salmon and steelhead at 12 hatcheries located throughout the basin.

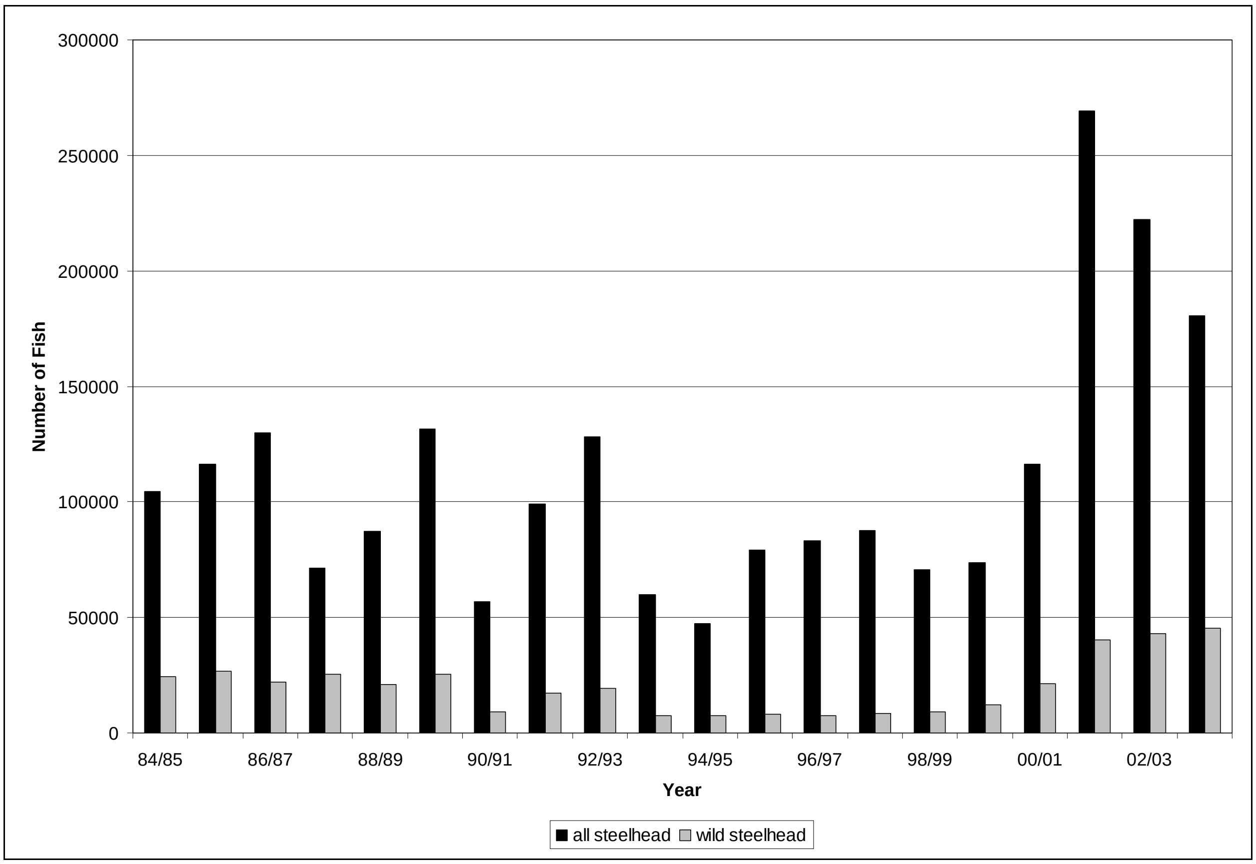


Figure 111.   Estimated total and wild escapement of steelhead at Lower Granite dam for the 1984–1985 through 2003–2004 run years. (Source: NMFS, 2004, as modified by staff)

3.8.1.5 Bull Trout

Bull trout are estimated to have once occupied about 60 percent of the Columbia River basin; they currently occur in about 45 percent of the watersheds in their historical range, which amounts to approximately 27 percent of the basin (Quigley and Arbelbide, 1997). Reasons for the decline in the distribution and abundance of bull trout include habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced non-native species (FWS, 2002a).

The populations of bull trout in the Columbia and Klamath rivers were listed as threatened by the FWS in 1998 (63 FR 31,647). The Jarbridge River population was listed on April 8, 1999 (64 FR 177,110), and the Coastal-Puget Sound and St. Mary-Belly River populations were listed in 1999 (64 FR 58,910), which resulted in all bull trout in the coterminous United States being listed as threatened. The five populations noted above are listed as distinct population segments; that is, they meet the joint policy of FWS and NMFS regarding the recognition of distinct vertebrate populations (61 FR 4,722).

FWS published a draft Bull Trout Recovery Plan in 2002, and critical habitat was designated in 2005 (70 FR 56,212). The critical habitat designation includes currently or historically occupied habitat that was found to be essential to the conservation of the species. Critical habitat in the vicinity of the project includes 308 stream miles in the Grande Ronde River basin, 92 stream miles in the Imnaha River basin, 125 stream miles within the Hells Canyon Complex Unit (including tributaries to the Powder River and Pine Creek) and 17 stream miles in the Snake River Unit, which consists of multiple river segments located between Pine Creek and the Weiser River that were not subject to exclusion. Areas excluded from the designation included Tribal lands, lands managed under the Anadromous Fish Habitat and Watershed Conservation Strategy (PACFISH), the Inland Native Fish Strategy (INFISH), the Northwest Forest Plan Aquatic Conservation Strategy, the Southwest Idaho Land and Resource Management Plans, the Southeast Oregon Resource Management Plans, lands subject to the SRBA, and waters impounded by dams with primary purposes of flood control, energy production, or water supply for human consumption.

3.8.1.6 Bliss Rapids Snail

The Bliss rapids snail was first collected live and recognized as a new taxon by Dwight Taylor in 1959; however, it was not described until Hershler et al. (1994) placed the snail in the new genus *Taylorconcha* and in the new species *serpenticola*. FWS listed the Bliss Rapids snail as threatened on December 14, 1992 (57 FR 59,244–59,257), but chose not to designate critical habitat for the species. In its final rule, FWS stated that the species was known to exist only in discontinuous populations in the Snake River and associated spring habitats between King Hill (RM 546) and RM 749.8, above American Falls reservoir. Since that time, Idaho Power has found the species to be widely distributed within the Snake River between Lower Salmon Falls dam (RM 573) and Bliss dam (RM 560) (Cazier, 1997).

As discussed in section 3.6.1.2, *Benthic Macroinvertebrates*, one snail that was field-identified as a Bliss Rapids snail (*Taylorconcha serpenticola*) was collected during Idaho Power's general invertebrate survey near RM 227, about 20 miles downstream of Hells Canyon dam. A follow-up survey of this area conducted in 2002 resulted in the collection of three more individuals that were field-identified as Bliss Rapids snails. These specimens were sent to Dr. Robert Hershler at the Smithsonian Institution, who first described the species, for taxonomic identification. The results were inconclusive, and Dr. Hershler indicated that additional specimens were needed to resolve the taxonomic uncertainty (Myers and Foster, 2003). Additional specimens were collected during a subsequent survey targeting rare and sensitive species (Richards et al., 2005), which found *Taylorconcha* to occur in 36 percent of all sites surveyed between RM 183.5 and RM 235.5, reaching densities in excess of 100 individuals per square meter in 9 percent of the survey locations. Based on genetic analysis of these specimens, Dr. Hershler's preliminary findings indicate that the *Taylorconcha* that inhabit the Hells Canyon reach and the Owyhee River represent a separate species that is distinct from the Bliss Rapids snail (Richards et al., 2005). In its comments on the draft EIS, Interior stated that based on this species' limited and disjunct distribution, it should be regarded as sensitive, and notes that its presence in the Snake River is significant to the continuing survival of the species.

3.8.1.7 Idaho Springsnail

FWS identified the endangered Idaho springsnail (*Pyrogulopsis idahoensis*) as a species that may occur in the vicinity of the Hells Canyon Project. The results of Idaho Power's macroinvertebrate surveys in the project area found this species in a single reach between RM 365 and RM 370, about 25 miles upstream from the headwaters of Brownlee reservoir (Myers and Foster, 2003). Although this species is reported to be widely distributed in the reach between C.J. Strike and Swan Falls dam, no specimens were found downstream of RM 365 during surveys conducted in all three of the project reservoirs and in surveys of riverine habitat that extended downstream to the confluence with the Grande Ronde River at RM 168.5, 79.1 miles downstream of Hells Canyon dam (Myers and Foster, 2003; Richards et al., 2005).

3.8.1.8 MacFarlane's Four-o'clock

FWS listed MacFarlane's four-o'clock (*Mirabilis macfarlanei*) as an endangered plant species in 1979 (44 FR 209) and prepared a recovery plan in 1985. Because additional populations were discovered and some populations were being actively managed and monitored according to the recovery plan, FWS downlisted the species to threatened status in 1996 (61 FR 52). FWS completed a revised recovery plan in 2000 (FWS, 2000). No critical habitat has been designated.

MacFarlane's four-o'clock is an herbaceous perennial that produces bright pink flowers from May through June. During wet years, plants are generally large and flower abundantly. The thick taproot may extend up to 8 feet deep, and the root system may extend 6 feet beyond the stems. Vegetative reproduction may be important in this species, since seed germination is variable from year to year. Because different clones that are produced vegetatively may overlap in distribution and vary in size, it is difficult to determine the extent of a particular clone (FWS, 2000), and therefore, the size of a population.

Macfarlane's four-o'clock occurs in grassland habitats along river canyons where warm, dry conditions prevail. Occupied sites are typically dominated by bluebunch wheatgrass. Forbs that may also be present include yarrow, pale alyssum, and cheatgrass. Associated shrubs include netleaf hackberry, smooth sumac, and gray rabbitbrush. MacFarlane's four-o'clock grows on flat to steep slopes, in soils that vary from sand to talus, at elevations between 1,000 and 3,000 feet msl (FWS, 2000).

The only known populations of MacFarlane's four-o'clock are located in the Salmon, Imnaha, and Snake River basins (61 FR 52). In the Salmon River basin, FWS indicates that 8 sites, supporting about 1,660 plants, occur along 18 miles of river bank and canyonland slopes. Only 2 localities, with a total population of about 800 plants, have been documented in the Imnaha River basin, located along a 3-mile stretch of the river corridor. FWS describes 7 localities in the Snake River unit, occurring within a 6-mile stretch of the river (61 FR 52) that starts about 30 miles downstream of Hells Canyon dam. These include Kurry Creek, West Creek, Kurry Creek-West Creek divide, Tryon Bar, Cottonwood Landing, Island Gulch, and Mine Gulch. FWS estimates the seven localities support more than 4,750 plants. None of these sites are located within the Hells Canyon Project boundary.

As described in section 3.7.1, Idaho Power's rare plant surveys covered habitat within approximately 150 feet of the MHWM along each reservoir and on both sides of the Snake River from Hells Canyon dam to the confluence of the Salmon River (Krichbaum, 2000). Idaho Power used a sub-sampling approach to evaluate a representative proportion of the study area. Biologists divided each river mile into four segments and surveyed one segment of each river mile. Surveys were conducted in early September 1998 and in May 1999. Surveys focused on habitats along the river that could be affected by project operations (e.g., flow releases) or project-related activities (e.g., maintenance, recreation). Surveyors observed no MacFarlane's four-o'clock in either year, although the species would be readily identifiable in May if it were present.

Idaho Power also conducted rare plant surveys along transmission lines and service roads, covering a corridor that extended about 150 feet from each edge of a right-of-way or tower pad location

(Dumas et al., 2003a). Surveys were conducted in spring and summer of 1999 and 2000. Surveyors observed no MacFarlane's four-o'clock in either year.

3.8.1.9 Howell's Spectacular Thelypody

FWS listed Howell's spectacular thelypody (*Thelypodium howellii* ssp. *spectabilis*) as a threatened plant species in 1999 (64 FR 101) and completed a recovery plan in 2002 (FWS, 2002b). FWS has not designated critical habitat for this species.

Howell's spectacular thelypody is a member of the mustard family that typically blooms from late May through July, bearing showy pink-to-purple flowers in a loose spike. It grows in moist meadow habitats on alkaline clays and silts. Species commonly associated with occurrences of Howell's spectacular thelypody include greasewood, alkali saltgrass, and alkali cordgrass.

Howell's spectacular thelypody is endemic to the Baker-Powder River valley in northeastern Oregon; the only existing populations occur within a 13-mile radius of Haines, Oregon (64 FR 101). Haines is located approximately 40 miles west of the Powder River arm of Brownlee reservoir. Idaho Power's rare plant surveys did not detect any occurrences of Howell's spectacular thelypody (Krichbaum, 2000; Dumas et al., 2003a). Because of the low likelihood that this species would occur in the project area, we do not discuss it further in this document.

3.8.1.10 Spalding's Catchfly

FWS designated Spalding's catchfly (*Silene spaldingii*) as a threatened plant species in 2001 (66 FR 196). ICDC completed a conservation strategy for FWS in 2004 that will serve as the basis for a recovery plan (Hill and Gray, 2004). FWS has not designated any critical habitat for this species.

Spalding's catchfly is a member of the carnation family with sticky leaves and small, greenish-white flowers. It blooms from mid-July through September, and occasionally into October (Hill and Gray, 2004). Throughout its range, Spalding's catchfly occupies several different grassland, shrub, and forested habitat types. In canyon grasslands, such as those in the Snake River basin, Spalding's catchfly is associated with Idaho fescue-dominated plant communities on north-facing slopes between 1,380 feet and 4,000 feet (Hill and Gray, 2004).

Spalding's catchfly occurs at a total of 66 sites in British Columbia, Montana, Oregon, Washington, and Idaho. Several populations are known from the Snake River Canyon, including sites at Garden Creek Ranch and Craig Mountain, and from the lower Imnaha, Salmon, and Grande Ronde watersheds (Gray and Lichthardt, 2003). None of the known sites are within the Hells Canyon Project boundary.

The analysis presented in the conservation strategy for Spalding's catchfly indicates that suitable habitat for this species is present along the Snake River between Brownlee dam and Lewiston. However, Idaho Power's vegetation mapping did not identify any of the three plant communities (Idaho fescue/snowberry, Idaho fescue/rose, and Idaho fescue/junegrass) that are known to support this species in canyon grassland settings. Rare plant surveys conducted within the riparian study corridor and along project-related roads and transmission lines did not detect any occurrences of Spalding's catchfly, although surveys in 1998 were conducted at a time of year (September) when this species would be readily identifiable (Krichbaum, 2000; Dumas et al., 2003a).

3.8.1.11 Gray Wolf

After near-total eradication, FWS listed the gray wolf (*Canis lupus*) as an endangered species in most of the United States in 1978 (43 FR 47). FWS continues to consider wolves in Washington and Oregon as endangered, but classifies wolves in areas of Idaho south of I-90 and west of I-15 (which includes the project area) as a Nonessential Experimental Population (70 FR 4). FWS prepared a recovery plan for wolves in the northern Rocky Mountains in 1987, but did not designate critical habitat in the western United States (FWS, 1987). Currently, IDFG manages recovering populations in Idaho according to a plan that focuses on ensuring long-term species viability, while minimizing wolf-human conflicts (Idaho Legislative Wolf Oversight Committee, 2002). FWS approved the plan, effective February 7, 2005 (70 FR 4). On February 8, 2007, FWS proposed to establish a northern Rocky Mountain Distinct Population Segment, which would include wolves in the project area, and remove it from the list of threatened and endangered species (72 FR 26).

The historical range of the gray wolf includes most of North America. Wolves are highly adaptable, and habitat suitability appears to comprise almost any unoccupied territory where prey (primarily big game) is abundant, secluded den sites are available, and humans tolerate their presence (65 FR 135).

ODFW and WDFW have documented reports of wolves in eastern Oregon and eastern Washington from time to time, probably as the result of dispersal from established populations in British Columbia, western Montana, and Idaho (ODFW, 2005; Palmquist, 2002). FWS reintroduced wolves into Montana and Idaho in 1995 and 1996. Populations have steadily increased since that time, and as of 2004, biologists had documented more than 40 packs in central Idaho, with a total population of from 420 to 500 wolves (70 FR 206).

Maps of wolf activity in Idaho in 2004 show one pack located about 15 miles east of Hells Canyon reservoir and several observations of individuals near Brownlee and Oxbow reservoirs (IDFG, 2005b). Idaho Power reports incidental observations of gray wolves on the Idaho side of Hells Canyon reservoir near Allison Creek and near the headwater of the Wildhorse River, a tributary to Oxbow reservoir. Idaho Power also reports that radiotracking data show that wolves occasionally cross the Snake River, most likely through Hells Canyon (Idaho Power 2003a, section E.3.2.1).

3.8.1.12 Canada Lynx

FWS listed the Canada lynx (*Lynx canadensis*) as a threatened species in 2000, due in large part to the inadequacy of regulatory mechanisms to protect them on federal lands, which comprise most of the suitable habitat for this species (65 FR 58). In September 2005, FWS issued a recovery outline to serve as an interim strategy for management until critical habitat is designated and a formal recovery plan has been prepared (FWS, 2005c). FWS designated critical habitat on November 9, 2006 (71 FR 217). No critical habitat is designated in Idaho, Oregon, or Washington.

Canada lynx are medium-sized cats, with large feet adapted to walking on snow. In the western United States, lynx are typically associated with Douglas fir, spruce-fir, and fir-hemlock forest at elevations ranging from about 5,000 feet to 6,600 feet, although FWS considered fir and spruce forest above 4,000 feet in proposing critical habitat (70 FR 216). Most of the dens that have been documented in Washington have been located in mature or old-growth lodgepole pine, spruce, or subalpine fir stands (McKelvey et al., 1999). Lynx forage in younger stands, where greater understory structures support higher populations of its primary prey, the snowshoe hare.

FWS considers lynx in the U.S. (outside Alaska) to be part of a metapopulation with its core in central Canada (McKelvey et al., 1999). Populations in the U.S are at the southern edge of the species range, and were likely never as large as those farther north. At the current time, viable populations are known only in north central Washington, western Montana, and Maine, although there are numerous reports of sightings from northern Idaho, western Wyoming, Wisconsin, and Michigan.

The preliminary lynx recovery outline identifies three classifications of lynx recovery areas for the Rocky Mountain (FWS, 2005c). “Core” areas currently support lynx. “Secondary” areas have fewer and more sporadic records of lynx, and reproduction is not documented. “Peripheral” areas have few historical or recent records of occurrence, and habitat consists of small patches that are not well-connected to larger patches of high quality habitat. Based on the preliminary mapping, the Hells Canyon Project area lies between a secondary recovery area in the Wallowa and Blue mountains of northeastern Oregon/southeastern Washington and a peripheral recovery area in Idaho that encompasses the Salmon River and Clearwater mountains and extends eastward into Montana. The nearest proposed critical habitat lies more than 200 miles to the northeast, in northwestern Montana (71 FR 217).

Three lynx specimens were collected in southeastern Washington in 1931, 1962, and 1963. Lynx were present in northeastern Oregon in the late 1800s and early 1900s, but there have been few verified occurrences since that time (McKelvey et al., 1999). One specimen was collected in Wallowa County in 1964, in the Imnaha Basin; this is the last confirmed occurrence in northeastern Oregon, although sightings have been reported on the Wallowa-Whitman National Forest (Forest Service, 2003). Winter tracking surveys for lynx on the Wallowa-Whitman between 1992 and 1994 and hair pad surveys between 1999 and 2001 did not result in any lynx detections. However, Idaho Power reports an unconfirmed sighting on the Idaho side of the Snake River below the confluence with the Salmon River, approximately 70 miles downstream of Hells Canyon dam (Idaho Power, 2003a, section E.3.2.1.4.13.1).

3.8.1.13 Northern Idaho Ground Squirrel

FWS listed the northern Idaho ground squirrel (*Spermophilus brunneus brunneus)* as a threatened species in 2000 (65 FR 66). Researchers attribute a dramatic population decline since 1985 to habitat loss, poisoning, recreational shooting, and competition with the larger Columbian ground squirrel (FWS, 2003b). FWS did not designate critical habitat, but completed a recovery plan for this species in 2003 (FWS, 2003b).

The northern Idaho ground squirrel is associated with dry montane meadows surrounded by ponderosa pine and/or Douglas fir forest, at elevations between 3,280 and 5,600 feet (IDFG, 2005c). This species forages primarily on grass seeds, but also takes roots, bulbs, stems and flower heads. It emerges from burrows in late March or early April and remains active until mid-July to early August, when it returns underground.

The northern subspecies of the Idaho ground squirrel is endemic to west-central Idaho, occurring only in Adams and Valley counties. As of 2004, IDFG survey results indicated that the total population is about 850 individuals, located in fewer than 40 colonies. Idaho Power conducted surveys for this species at Barber Flat and Indian Creek, both located east of Oxbow reservoir, outside the project boundary (Turley et al., 2003). Biologists documented one active burrow and heard a whistle near Barber Flat, but recorded no evidence of northern Idaho ground squirrel occurrence at Indian Creek.

3.8.1.14 Bald Eagle

In 1978, FWS listed the bald eagle (*Haliaeetus leucocephalus*) as an endangered species in almost every state in the U.S. Declines in bald eagle populations were due primarily to egg-shell thinning caused by the widespread use of DDT. With legal protection of birds and their habitat, banning of DDT, and implementation of a recovery plan (FWS, 1986), populations began to rebound, and bald eagles were down-listed to threatened status in 1995 (60 FR 133). Populations have continued to thrive, and on June 28, 2007, FWS announced its decision to remove the bald eagle from the list of threatened and endangered species, effective 30 days following publication in the Federal Register (FWS, 2007a). FWS will work with other federal agencies, tribes, and the states to monitor bald eagle populations at 5-year intervals over a 20-year period after de-listing, and could re-list the species if results indicate it is again in need of ESA protection.[84] No critical habitat is designated for the bald eagle.

Throughout its range, bald eagles are found near open water, including lakes, reservoirs, rivers, and coastal shorelines, where prey is abundant. Their primary prey is fish, but eagles are opportunistic, and also prey on waterfowl and small mammals, and scavenge for carrion and refuse.

For nesting, bald eagles tend to choose large-diameter, canopy-dominant trees within clear view of the water. In the western U.S., the most common nest trees are ponderosa pine, Douglas fir, and black cottonwood (FWS, 1986). Breeding territories vary in size from less than 2 square miles to over 10 square miles. The size and shape of a territory depends to a great extent on food availability.

Bald eagles generally begin courtship and nest-building activities in January and February. They are most sensitive to disturbance during nest-building, incubation (in March), and brooding (late April through early May). Disturbance can cause reproductive failure (Anthony and Isaacs, 1989). However, some pairs of eagles habituate to human activity, and individual birds respond differently to human disturbance (Watson and Pierce, 1998).

In winter, bald eagles tend to congregate around ice-free water where forage is abundant. In addition to large trees that afford sturdy perches near open water, bald eagles need thermal cover that offers protection from wind, rain, snow, and cold temperatures. Disturbance of bald eagles during the winter is of concern because it can cause physiological stress (Stalmaster and Kaiser, 1998).

Bald eagle populations have been increasing throughout the United States: the number of nesting pairs increased from 1,188 in 1981 to 6,471 in 2000 (FWS, 2005a). Trends in Idaho and Oregon are also rising. FWS data show that the number of bald eagle nests in Idaho increased from 53 in 1990 to 128 in 2002 (FWS, 2005a). In Oregon, the number of nests increased from 175 in 1990 to 405 in 2003 (FWS, 2005a).

The number of bald eagle nests within or near the Hells Canyon Project boundary reflects similar upward trends (table 73). Idaho Power conducted surveys between 1995 and 1999, but did not locate any active nests until 1998 (Pope and Holthuijzen, 2003). Idaho Power found one bald eagle nest along Hells Canyon reservoir in 1998. The pair successfully fledged one young in 1998 and 1999, and two young in 2000 and 2001. Surveys located a second nest in 1999, at Oxbow reservoir. This pair successfully fledged one young in 1999, and two in 2000 and 2001. Idaho Power recently filed a bald eagle survey report that documents the discovery of four new nests in the project vicinity since 2003 (Carpenter and Holthuijzen, 2006). With these new nests, the Hells Canyon management zone (Zone 14 of the Pacific Bald Eagle Recovery Area) has reached the recovery plan target of six territories.

Table 73. Bald eagle nests in the Hells Canyon Project area, as of 2005. (Source: Idaho Power)

Nest Site	Land Ownership	Location	Nest Tree	First Reported
Birch Creek	Private	Brownlee reservoir	Black cottonwood	2003
Eagle Creek	Private (conservation easement)	Brownlee reservoir	Black cottonwood	2004
Cottonwood	Idaho Power	Oxbow	Ponderosa pine	1999

[84] Bald eagles are also protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. These laws will continue to provide protection for the bald eagle at the federal level when it is removed from listing under the ESA. State laws will also continue to provide protection in Oregon and Idaho, where the bald eagle is listed as threatened.

Nest Site	Land Ownership	Location	Nest Tree	First Reported
Airport	BLM	Hells Canyon	Ponderosa pine	1998
Hibble Gulch	Forest Service	Hells Canyon	Ponderosa pine	2003
Lamont Springs	Forest Service	Snake River below Hells Canyon dam	Ponderosa pine	2005

Idaho Power monitored productivity at five of the six nests in 2004 and 2005. As shown in table 74, they found an average of 2.54 young fledged in 2004 and an average of 1.4 fledged in 2005, exceeding the recovery plan target of 1.0 in previous years.

Table 74. Annual productivity for bald eagle nests in the Hells Canyon Project vicinity. (Source: Carpenter and Holthuijzen, 2006)

Year	Birch Creek	Eagle Creek	Cottonwood	Airport	Hibble Gulch	Lamont Springs	Total (not including nests with no numerical data)	Young Fledged per Successful Nest
1998	--	--	--	1 (N)	--	--	1	1.0
1999	--	--	1 (N)	1	--	--	2	1.0
2000	--	--	2	2	--	--	4	2.0
2001	--	--	2	2	--	--	4	2.0
2002	--	--	S	S	--	--	S	S
2003	S (N)	--	S	S	S (N)	--	S	S
2004	3	S (N)	3	2	2	--	10	2.5
2005	2	S	1	1	1	2 (N)	7	1.4
Total	5	--	9	9	3	2	28	NC

Note: -- – no nest at this site in this year

S – successful; no numerical data on number of fledglings

N – new nest NC – not calculated

Based on mid-winter surveys, the number of bald eagles that winter in Idaho and Oregon increased by about 1.9 and 1.4 percent, respectively, between 1986 and 2000 (Steenhof et. al., 2004). Idaho Power's mid-winter aerial surveys from 1993 through 1998 found that the total number of eagles in Hells Canyon ranged from 152 in 1994 to 68 in 1998, with an average of 102.5 (Holthuijzen, 2003c). Numbers varied from year to year, and did not appear to show any trend. Idaho Power observed most wintering bald eagles along Oxbow reservoir and the Powder River arm of Brownlee reservoir. Idaho Power noted that areas of concentration seemed to be those with reliable food resources, including fish, waterfowl, and winter-killed mule deer (Holthuijzen, 2003c).

3.8.2 Environmental Effects on Threatened and Endangered Species

3.8.2.1 Snake River Fall Chinook Salmon

The numbers of fall Chinook salmon that return to the Hells Canyon reach of the Snake River has increased approximately 20-fold since the early 1990s. While part of this increase is from hatchery supplementation, the escapement of wild fish has also shown a progressive increase in recent years (figure 108). The reach between Hells Canyon dam and lower Granite reservoir is the largest spawning area that remains accessible to the ESU.

The primary effects of the project on the Snake River fall Chinook salmon ESU include: (1) blocked access to historical spawning and rearing habitat upstream of the project; (2) effects on spawning habitat including provision of a beneficial flow regime during the spawning and incubation period, interruption of spawning gravel transport and recruitment to downstream spawning habitat and low DO and high temperature levels that extend into the early part of the spawning season; and (3) effects on rearing habitat including the occurrence of gas supersaturation during spill periods, suboptimal water temperatures during the early rearing period, and flow fluctuations associated with load following operations.

Idaho Power proposes the following measures that should benefit the Snake River fall Chinook salmon ESU:

- Continue reservoir operations in the fall, winter, and early spring for protection of fall Chinook spawning and salmon incubation
- Continue fall Chinook salmon redd and temperature monitoring to avoid the risk of dewatering developing salmon embryos, but discontinue deep-water redd monitoring until fall Chinook escapement increases significantly
- Install spillway flow deflectors at Hells Canyon and Brownlee dams, and install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam
- Implement in-reservoir aeration or upstream phosphorus trading to meet the 1,125 tons per year DO load allocation in Brownlee reservoir and aerating turbines at Hells Canyon or Brownlee dam to add 1,500 tons per year DO below Hells Canyon dam
- Implement watershed measures (which may include hydrologic measures or restoration of riparian vegetation or channel morphology) or a bubble upwelling system in Brownlee reservoir to compensate for the project's contribution to elevated water temperatures.

Resource agencies, tribes, and NGOs filed numerous recommendations that have the potential to benefit the ESU, including measures to improve the quality of, and restore access to, habitat within and upstream of the project, maintain the quality of spawning and rearing habitat downstream of the project, and to improve outmigration survival during the juvenile outmigration period.

Our Analysis

Blocked Access to Historical Habitat

The most recent assessment of the historical population structure of Snake River fall Chinook salmon prepared by NMFS (McClure et al., 2005) concludes that the Idaho Power projects extirpated two of the three major population groups of Snake River fall Chinook salmon that existed historically: the Salmon Falls major population group (extirpated by the Swan Falls Project in the early 1900s) and the Marsing Reach major population group (extirpated by the Hells Canyon Project in the early 1960s after efforts to provide fish passage failed). NMFS states that continued long-term blockage of access to the remaining upstream habitat prevents both the increase in numbers and productivity of these fish and the development of a population structure and genetic diversity that would reduce the risk of extinction of this ESU.

Idaho Power conducted a comprehensive analysis of the condition of anadromous fish habitat upstream of the project and restoration alternatives that included a provision for fish passage at the project, passage at upstream Idaho Power dams, and passage at other man-made migration barriers in the basin. In its analysis of reintroduction alternatives, Idaho Power concluded that restoring fall Chinook salmon to areas upstream of the project was not likely to be feasible without extensive hatchery supplementation due to the degraded condition of historical spawning and rearing habitat and loss rates of juvenile and adult salmon during passage through the lower Snake/Columbia River migratory corridor (Chandler and Chapman, 2003b). As a result, Idaho Power did not propose any measures related to the restoration of fall Chinook salmon to habitat upstream of the project.

In section 3.6.2.6, *Anadromous Fish Restoration*, we evaluate a range of agency recommendations related to restoration of access to blocked habitat upstream of the project. These encompassed funding of water quality improvements in the upper basin to expedite habitat recovery, monitoring the condition of spawning gravels upstream of the project to determine when habitat conditions would warrant the initiation of reintroduction studies, and studies to evaluate the feasibility of collecting and transporting fall Chinook smolts past the project or to provide instream passage through the project. We conclude that water quality conditions in the intragravel incubation environment are too compromised to warrant reintroduction studies to the Swan Falls to Brownlee reach at this time, but that conditions could improve over time. We include in the Staff Alternative a proposal to track water quality conditions upstream of the project to determine when conditions would warrant reintroduction. Under this approach, any license issued for the project would include a mechanism to proceed with re-introduction studies and other efforts once water quality conditions have improved sufficiently.

Effects on Downstream Spawning Habitat

Idaho Power proposes to continue its fall Chinook spawning flow program, which provides a stable flow regime during the spawning season and prevents dewatering of any redds during the incubation season. This program is supported by the agencies and tribes, and we conclude that it is likely that this program has contributed to the substantial increase in the numbers of adult fall Chinook salmon that return to the Hells Canyon reach. Idaho Power also proposes to continue redd surveys and temperature monitoring to determine the timing and location of spawning activity, and to estimate the timing of emergence to determine the duration that redds must be protected from dewatering to avoid mortality. NMFS recommends monitoring survival-to-emergence of fall Chinook salmon at two sites in the Hells Canyon reach every 5 years. In its draft EIS comments, Idaho Power proposed a fall Chinook spawning and gravel monitoring program that includes detailed mapping of spawning substrate and incorporates monitoring of survival-to-emergence every 5 years, consistent with NMFS's proposal. Measures and recommendations associated with spawning flows are addressed in detail in section 3.6.2.1, *Effects of Project Operation of Aquatic Species*, and measures regarding spawning and gravel monitoring are discussed in 3.6.2.14, *Sediment Augmentation*.

Idaho Power does not propose any measures to augment or monitor the quantity of spawning gravel in the Hells Canyon reach. Our analysis of the sediment budget presented in section 3.4, *Sediment Supply and Transport*, indicates that the quantity of gravel trapped by the project reservoirs is relatively large compared to the amount contributed by tributaries in the upper Hells Canyon reach, suggesting that some reduction in the availability of spawning gravels may be occurring. In section 3.6.2.14, *Sediment Augmentation*, we concluded that the Fall Chinook Spawning and Gravel Monitoring Plan proposed by Idaho Power would provide an effective means of determining whether adverse effects on fall Chinook spawning habitat are occurring, and whether gravel augmentation or other measures to protect spawning habitat are warranted.

As shown in figures 48, 49, and 50, DO levels that are unsuitable for salmonids extend at least 3 miles downstream from Hells Canyon dam from July through October in extreme low flow years. Conditions in this reach also are below optimal over the same distance and time period even in extreme high flow years. In its license application, Idaho Power proposed to supplement DO into Brownlee reservoir; however, this measure is not expected to improve low DO levels that occur downstream of Hells Canyon dam. In its application for water quality certification, Idaho Power proposes to implement an in-reservoir aeration system or an upstream phosphorus trading program to meet the 1,125 tons per year DO TMDL load allocation in Brownlee reservoir. Idaho Power also proposes to aerate the turbines at Hells Canyon or Brownlee dam to add 1,500 tons per year DO below Hells Canyon dam. Measures are also included to compensate for the project's contribution to thermal load, which would decrease water temperatures near the start of the spawning season. Implementing the measures included in Idaho Power's application for water quality certification should help to alleviate high water temperature and low DO conditions that currently occur during the first several weeks of the spawning period, and is likely to improve gamete viability for early spawning fish.

Effects on Downstream Rearing Habitat

Idaho Power does not propose any operating constraints to stabilize outflows from the project during the fall Chinook rearing period after fry have emerged from the gravel, other than its current 12-inch-per-hour ramp rate as measured at Johnson Bar. Other stakeholders recommended a range of ramping rate and other operational restrictions that would serve to stabilize flows during the fall Chinook rearing season. In section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, we evaluate the effect of Idaho Power's proposed operations and agency proposed operations on fall Chinook salmon rearing habitat in terms of food production, habitat stability, and the potential for losses due to stranding or entrapment. We also discuss the potential benefits of a staff-developed measure of a 4-inch-per-hour ramping rate restriction from March 15 to June 15, which would increase the prey base available to rearing fall Chinook salmon by improving aquatic invertebrate production in shallow areas, and would reduce the potential for stranding juvenile fall Chinook salmon. We evaluate Idaho Power's analysis of 2005 entrapment monitoring studies, which indicate that a 4-inch-per-hour ramping rate would have reduced entrapment mortality by 93 percent under the flow conditions that occurred in 2005. We also discuss the potential benefits of continuing entrapment monitoring to evaluate stranding and entrapment losses in other hydrologic year types to determine whether operations need to be further modified or fish salvage operations undertaken to reduce mortality due to stranding and entrapment of juvenile fall Chinook salmon and other aquatic species. We also discuss an Invertebrate Monitoring Plan that would be designed to evaluate the effects of project operations on invertebrate production, and would include adaptive management process to address adverse effects on the invertebrate food base available to aquatic species.

Idaho Power proposed in its license application to install spillway flow deflectors at Hells Canyon dam and to continue preferential use of the upper spillgates at Brownlee dam during spill periods to reduce TDG concentrations in the Snake River downstream of Hells Canyon dam. In its application for water quality certification, however, Idaho proposes to install spillway flow deflectors at Brownlee dam and to install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam. These measures would reduce TDG levels downstream of Hells Canyon dam during most spill periods, and would thereby reduce the incidence of injuries to rearing juvenile fall Chinook salmon caused by gas supersaturation. Although the use of air-blowers as a means to increase DO levels downstream of Hells Canyon dam may increase TDG levels, Idaho Power proposes to conduct a pilot testing program where a blower would be rented for a finite period of time and tests completed with the blower in operation. This testing would ensure that DO objectives can be met and that the 110 percent TDG limit is not exceeded.

In section 3.5.2.1, *Effects of Project Operations on Water Quality*, we conclude that anoxic conditions in Brownlee reservoir result in the production, accumulation, and discharge of ammonia and trace metals (including mercury) that contribute to bioaccumulation of methylmercury and organochlorine compounds (including dieldrin, DDT/DDE, and PCBs) in fish in the project area. While the potential bioaccumulation of these materials in rearing fall Chinook salmon is limited by the relatively short duration in which they rear in the Snake River, the potential for sublethal effects is unknown. The concentration of these toxic materials would likely be gradually reduced over time as nutrient inputs are reduced through implementation of the phosphorus TMDL and anoxic conditions are reduced. However, full implementation of the TMDL is not expected to be attained within the term of the next license. In addition, summer flow augmentation would tend to expedite the discharge of ammonia and trace metals from Brownlee reservoir, and outflows during the fall would be expected to have lower concentrations of ammonia and trace metals.

Effects on the Downstream Migration Corridor

As we discussed in section 3.6.2.1, *Effects of Project Operation on Aquatic Resources*, Idaho Power does not propose any specific measures to benefit outmigrating juvenile fall Chinook salmon, but several stakeholders recommend measures that are intended to improve juvenile migration survival by increasing flows during the summer outmigration. We concluded that summer flow augmentation is one of three substantive measures (in addition to hatchery supplementation and Idaho Power's fall Chinook spawning and incubation flow program) that, in combination, have contributed to a 20-fold increase in fall Chinook salmon returns over the last decade. While we conclude that it is not possible to definitively evaluate the benefits of flow augmentation based on the available information, we outline a staff-developed measure that would continue Idaho Power's participation in the flow augmentation program. This program would be reviewed 6 years after license issuance to determine whether new information on the efficacy of flow augmentation warrants any adjustment in the timing or volume of flow augmentation water that is delivered from Brownlee reservoir.

3.8.2.2 Snake River Spring/Summer Chinook Salmon

The number of Snake River spring/summer Chinook salmon migrating past Lower Granite dam has fluctuated widely over the last several decades, but returns of both wild and hatchery-origin fish have been increasing over the last several years (figure 109). This ESU spawns in tributaries to the Snake River including the Imnaha and Salmon rivers. Their primary use of the mainstem Snake River is as a migratory corridor to access these tributary habitats.

The primary effects of the project on the Snake River spring/summer Chinook salmon ESU include: (1) blocked access to historical spawning and rearing habitat upstream of the project; (2) effects on the migratory corridor, including gas supersaturation during spills that coincide with the juvenile and adult migration periods, and (3) alteration of river flows during the juvenile migration period.

Idaho Power proposes the following measures that could benefit the Snake River spring/summer Chinook salmon ESU:

- Implement a tributary enhancement program that would improve habitat conditions for salmonids in Pine Creek and in the Wildhorse River.[85]
- Install spillway flow deflectors at Hells Canyon and Brownlee dams, and install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam.

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[85] Although tributary enhancement measures would also be implemented in Indian Creek, this stream is not known to have produced spring/summer Chinook.

- Implement in-reservoir aeration or upstream phosphorus trading to meet the 1,125 tons/year DO load allocation in Brownlee reservoir, and install aerating turbines at Hells Canyon or Brownlee dam to add 1,500 tons per year DO downstream of Hells Canyon dam.
- Implement watershed measures (which may include hydrologic measures or restoration of riparian vegetation or channel morphology) or a bubble upwelling system in Brownlee reservoir to compensate for the project's contribution to elevated water temperatures.

Resource agencies, tribes, and NGOs filed numerous recommendations that have the potential to benefit the ESU, including measures to improve the quality of, and restore access to, habitat within and upstream of the project and to improve flow and water quality conditions in the migratory corridor during the juvenile and adult migration periods.

Our Analysis

Blocked Access to Historical Habitat

NMFS estimates that about 37 percent of spring/summer Chinook salmon major population groups in the Snake River basin were located upstream of the Hells Canyon Project (McClure et al. 2005). NMFS[86] states that construction of Swan Falls Project in 1901 eliminated whatever was left of at least five spring/summer Chinook salmon major population groups, and that construction of the Hells Canyon Project eliminated whatever remained of up to eight major population groups of spring/summer Chinook salmon.

Idaho Power conducted a comprehensive analysis of the condition of anadromous fish habitat upstream of the project and restoration alternatives that included a provision for fish passage at the project, passage at upstream Idaho Power dams, and passage at other man-made migration barriers in the basin. In their analysis of reintroduction alternatives, Idaho Power concluded that restoration of self-sustaining runs of spring/summer Chinook salmon populations to habitat upstream of Hells Canyon dam was not likely to be feasible due to the degraded condition of historical spawning and rearing habitats and loss rates of juvenile and adult salmon during passage through the lower Snake/Columbia River migratory corridor (Chandler and Chapman, 2003-E.3.1-2, chapter 11). As a result, Idaho Power did not propose any measures related to the restoration of spring/summer Chinook salmon to habitat upstream of the project.

In section 3.6.2.6, *Anadromous Fish Restoration*, we evaluate a range of agency recommendations related to restoration of access to blocked habitat upstream of the project. These encompass funding of water quality and habitat improvements in tributaries and in the upper basin to expedite habitat recovery, studies to evaluate habitat capacity and the feasibility of collecting and transporting spring/summer Chinook smolts at tributary traps or to provide instream passage through the project. In the draft EIS, we concluded that water quality and habitat conditions are too compromised to warrant reintroduction studies upstream of the project at this time, but that conditions could improve over time. We include in the Staff Alternative a proposal to track water quality conditions upstream of the project to determine when conditions would warrant reintroduction. Under this approach, any license issued for the project would include a mechanism to proceed with re-introduction studies and other efforts once water quality conditions have improved sufficiently.

Comments received on the draft EIS indicate that habitat and water quality conditions in some of the tributaries may be sufficient to support anadromous fish at this time, particularly in Pine Creek and in

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86 Letter from D.R. Lohn, Regional Administrator to M. Salas, Secretary, Federal Energy Regulatory Commission, dated January 24, 2006, submitting preliminary recommended terms and conditions for the Hells Canyon Project.

some of the tributaries to the Powder River. In this final EIS, we evaluate measures that would (1) explore the potential for anadromous fish restoration by continuing the release of surplus adult hatchery steelhead into Hells Canyon reservoir, and (2) construct the Pine Creek weir in a manner that would support restoration studies by allowing operation during the spring smolt outmigration. We also evaluate a measure that would expand the stocking program for surplus adult hatchery fish into the reservoir to include the stocking of spring Chinook salmon, which have also been released to support put-and-take recreational fisheries in the basin upstream of Hells Canyon dam.[87] Information gained from these efforts would help inform decisions for, and evaluate the prospects of, implementing a successful restoration effort in other suitable tributaries, including tributaries in the Powder River basin.

Effects on the Downstream Migration Corridor

As described above, Idaho Power proposes several measures to reduce TDG levels downstream of Hells Canyon dam. Because TDG levels exceeding 120 percent of saturation currently persist up to 60 miles downstream from Hells Canyon dam, the measures proposed by Idaho Power may benefit spring Chinook salmon smolts migrating from the Imnaha and Salmon river basins.

As we discuss in section 3.6.2.1, *Effects of Project Operation on Aquatic Resources*, Idaho Power does not propose any specific measures to benefit outmigrating juvenile salmon and steelhead, but several stakeholders recommend measures that are intended to improve juvenile migration survival by increasing flows during the spring outmigration of yearling smolts. These include measures to ensure that Brownlee reservoir is not drafted any more than is needed to meet flood control requirements, and that it is refilled as early as possible to avoid reducing outflows during the spring yearling smolt outmigration period. Maintaining higher flows during the smolt outmigration period would speed migration and should increase the survival rate of smolts passing through the lower Snake/Columbia River migratory corridor.

3.8.2.3 Snake River Sockeye Salmon

The number of Snake River sockeye salmon migrating past Lower Granite dam has started to increase in the last several years from previous near-extinction levels as the result of an intensive conservation aquaculture program (figure 110). Although the species historically occurred in Payette Lake upstream of the project, the only remaining population exists in Redfish Lake in the Salmon River basin. These fish use the mainstem Snake River downstream of its confluence with the Salmon River as a migratory corridor to and from the Pacific Ocean.

The primary effects of the project on the Snake River sockeye salmon ESU include: (1) blocked access to historical spawning and rearing habitat upstream of the project; and (2) effects on the migratory corridor including gas supersaturation during spill periods and alteration of river flows during the juvenile and adult migration periods.

Idaho Power proposes the following measure that would benefit the Snake River sockeye salmon ESU:

- Install spillway flow deflectors at Hells Canyon and Brownlee dams, and install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam.

[87] During the section 10(j) meeting, Interior stated that surplus spring Chinook salmon have been released into the Payette River, which enters the Snake River between Swan Falls and Hells Canyon dams.

- Implement watershed measures (which may include hydrologic measures or restoration of riparian vegetation or channel morphology), or a bubble upwelling system in Brownlee reservoir to compensate for the project's contribution to elevated water temperatures.

Resource agencies, tribes, and NGOs filed several recommendations that have the potential to benefit the ESU, including measures to improve flow and water quality conditions in the migratory corridor during the juvenile and adult migration periods.

Our Analysis

Blocked Access to Historical Habitat

Idaho Power conducted a comprehensive analysis of the condition of anadromous fish habitat upstream of the project and restoration alternatives that included provision of fish passage at the project, passage at upstream Idaho Power dams, and passage at other man-made migration barriers in the basin. In their analysis of reintroduction alternatives, Idaho Power concluded that restoration of self-sustaining runs of salmon and steelhead was not likely to be feasible due to the degraded condition of historical spawning and rearing habitats and loss rates of juvenile and adult salmon during passage through the lower Snake/Columbia River migratory corridor (Chandler and Chapman, 2003b). As a result, Idaho Power did not propose to restore passage for anadromous fish species to habitat upstream of the project. In addition to passage at the Hells Canyon Project, restoring sockeye salmon to Payette Lake would require passage at Cascade reservoir on the Payette River. No agency, tribe, or NGO made any specific recommendations to restore sockeye salmon to habitat upstream of the project.

Effects on the Downstream Migration Corridor

As described above, Idaho Power proposes several measures to reduce TDG levels downstream of Hells Canyon dam. Because TDG levels exceeding 120 percent of saturation currently persist up to 60 miles downstream from Hells Canyon dam, the measures proposed by Idaho Power may benefit sockeye salmon smolts migrating from the Salmon River basin.

As we discuss in section 3.6.2.1, *Effects of Project Operation on Aquatic Resources*, Idaho Power does not propose any specific measures to benefit outmigrating juvenile salmon and steelhead, but several stakeholders recommend measures that are intended to improve juvenile migration survival by increasing flows during the spring outmigration of yearling smolts. These include measures to ensure that Brownlee reservoir is not drafted any more than is needed to meet flood control requirements, and that it is refilled as early as possible to avoid reducing outflows during the spring yearling smolt outmigration period. Maintaining higher flows during the smolt outmigration period would speed migration and should increase the survival rate of smolts passing through the lower Snake/Columbia River migratory corridor.

3.8.2.4 Snake River Steelhead

The number of wild and hatchery-origin Snake River steelhead migrating past Lower Granite dam has increased two to three-fold from the run sizes that predominated in the 1990s (figure 111). This ESU spawns in tributaries to the Snake River including the Imnaha and Salmon rivers. Their primary use of the mainstem Snake River is as a migratory corridor to access tributary habitats.

The primary effects of the project on the Snake River steelhead ESU include: (1) blocked access to historical spawning and rearing habitat upstream of the project; and (2) effects on the migratory corridor including gas supersaturation during spills that coincide with the juvenile and adult migration periods, and alteration of river flows during the juvenile migration period.

Idaho Power proposes the following measures that could benefit the Snake River steelhead ESU:

Implement a tributary enhancement program that would improve habitat conditions for salmonids in Pine Creek, Indian Creek and in the Wildhorse River.

Idaho Power proposes the following measures that could benefit the Snake River steelhead ESU:

- Implement a tributary enhancement program that would improve habitat conditions for salmonids in Pine Creek, Indian Creek and in the Wildhorse River.
- Install spillway flow deflectors at Hells Canyon and Brownlee dams, and install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam.
- Implement in-reservoir aeration or upstream phosphorus trading to meet the 1,125 tons/year DO load allocation in Brownlee reservoir, and install aerating turbines at Hells Canyon or Brownlee dam to add 1,500 tons/year DO below Hells Canyon dam.
- Implement watershed measures (which may include hydrologic measures or restoration of riparian vegetation or channel morphology) or a bubble upwelling system in Brownlee reservoir to compensate for the project's contribution to elevated water temperatures.

Resource agencies, tribes, and NGOs filed numerous recommendations that have the potential to benefit the ESU, including measures to improve the quality of and restore access to habitat within, and upstream of, the project and improve flow and water quality conditions in the migratory corridor during the juvenile and adult migration periods.

Our Analysis

Blocked Access to Historical Habitat

NMFS estimates that about 38 percent of steelhead major population groups in the entire Snake River basin were located upstream of the Hells Canyon Project and have been extirpated (McClure et al., 2005). NMFS[88] states that the construction of the Swan Falls Project in 1901 eliminated three steelhead major population groups, and that construction of the Hells Canyon Project eliminated four major population groups of steelhead and the core production center of one additional steelhead major population group.

Idaho Power conducted a comprehensive analysis of the condition of anadromous fish habitat upstream of the project and restoration alternatives that included a provision for fish passage at the project, passage at upstream Idaho Power dams, and passage at other man-made migration barriers in the basin. In their analysis of reintroduction alternatives, Idaho Power concluded that restoring self-sustaining runs of steelhead to habitat upstream of Hells Canyon dam was not likely to be feasible due to the degraded condition of historical spawning and rearing habitats and loss rates of juvenile and adult salmon during passage through the lower Snake/Columbia River migratory corridor (Chandler and Chapman, 2003-E.3.1-2, chapter 11). As a result, Idaho Power did not propose any measures related to the restoration of steelhead to habitat upstream of the project.

In section 3.6.2.6, *Anadromous Fish Restoration*, we evaluate a range of agency recommendations related to restoration of access to blocked habitat upstream of the project. These encompassed funding of water quality and habitat improvements in tributaries and in the upper basin to expedite habitat recovery, studies to evaluate habitat capacity and the feasibility of collecting and

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[88] Letter from D. Robert Lohn, Regional Administrator to Magalie Salas, Secretary, Federal Energy Regulatory Commission, dated January 24, 2006, submitting preliminary recommended terms and conditions for the Hells Canyon Project.

transporting steelhead smolts at tributary traps or to provide instream passage through the project. We conclude that water quality and habitat conditions are too compromised to warrant reintroduction studies upstream of the project at this time, but that conditions could improve over time. We include in the Staff Alternative a proposal to track water quality conditions upstream of the project to determine when conditions would warrant reintroduction. Under this approach, any license issued for the project would include a mechanism to proceed with re-introduction studies and other efforts once water quality conditions have improved sufficiently.

Comments received on the draft EIS indicate that habitat and water quality conditions in some of the tributaries may be sufficient to support anadromous fish at this time, particularly in Pine Creek and in some of the tributaries to the Powder River. In this Final EIS, we evaluate measures that would (1) explore the potential for anadromous fish restoration by continuing the release of surplus adult hatchery steelhead into Hells Canyon reservoir, and (2) construct the Pine Creek weir in a manner that would support restoration studies by allowing operation during the spring smolt outmigration. Information gained from these efforts would help inform decisions for, and evaluate the prospects of, implementing a successful restoration effort in other suitable tributaries, including tributaries in the Powder River basin.

Effects on the Downstream Migration Corridor

As described above, Idaho Power proposes several measures to reduce TDG levels downstream of Hells Canyon dam. Because TDG levels exceeding 120 percent of saturation currently persist up to 60 miles downstream from Hells Canyon dam, the measures proposed by Idaho Power may benefit steelhead smolts migrating from the Imnaha and Salmon River basins.

As we discuss in section 3.6.2.1, *Effects of Project Operation on Aquatic Resources*, Idaho Power does not propose any specific measures to benefit outmigrating juvenile salmon and steelhead, but several stakeholders recommend measures that are intended to improve juvenile migration survival by increasing flows during the spring outmigration of yearling smolts. These include measures to ensure that Brownlee reservoir is not drafted any more than is needed to meet flood control requirements, and that it is refilled as early as possible to avoid reducing outflows during the spring yearling smolt outmigration period. Maintaining higher flows during the smolt outmigration period would speed migration and should increase the survival rate of smolts passing through the lower Snake/Columbia River migratory corridor.

3.8.2.5 Other Columbia River Basin Salmon and Steelhead ESUs

In addition to the four Snake River salmon and steelhead ESUs addressed above, NMFS indicated in its November 28, 2005 letter to the Commission that the Hells Canyon Project, or its operations, are likely to affect nine other Columbia Basin salmon and steelhead ESUs or their designated critical habitat. These are the Upper Columbia River spring Chinook salmon, Middle Columbia River steelhead, Lower Columbia River Chinook salmon, Columbia River chum salmon, Lower Columbia River coho salmon, Lower Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River Chinook salmon, and the Upper Willamette River steelhead.

The primary effects of the project on these ESUs involve direct effects on water quantity and primarily indirect effects on water quality in the lower Columbia River migratory corridor. The magnitude of direct effects on water quality is small due to the substantial distance between Hells Canyon dam and the confluence of the Snake and Columbia rivers (247.6 river miles). Such direct effects on TDG, DO, and water temperatures would likely equilibrate with ambient conditions by the time the water leaving the project area reaches the Columbia River. Also, the relatively small proportion that flow passing Hells Canyon dam constitutes of the total flow in the Lower Columbia River at McNary dam (about 12.3 percent) likely minimizes such effects.[89] However, flood control operations at Brownlee reservoir, when combined with flood control operations at other reservoirs in the basin, contribute to a substantive overall reduction in the spring flow freshet.

NMFS (2005) describes both adverse and beneficial effects from reduction of the spring freshet on fish survival. The adverse effect is a reduction in mainstem Federal Columbia River Power System dam and reservoir passage survival, particularly for spring migrants that traverse the system in-river (that is, they are not transported). The beneficial water quality effects are associated with water temperature and TDG effects. Reducing Snake River spring flows at Brownlee reservoir increases the influence of cooler tributary inflows (e.g., the Salmon and Clearwater rivers) on downstream water temperatures. Also, reducing the magnitude of the spring freshet reduces the frequency and magnitude of involuntary spills through the eight mainstem Federal Columbia River Power System projects. When river flows exceed a project powerhouse's hydraulic capacity, the dam is forced to spill (termed "involuntary spill"). High rates of involuntary spill can create adverse TDG conditions in downstream waters. Elevated TDG levels (i.e., above the State of Oregon's or Washington's water quality standard waiver level of 120 percent in tailraces and 115 percent in forebays of mainstem Federal Columbia River Power System dams) can adversely affect all life stages of fish. The beneficial effects of reduced spill would occur only in high flow years.

To assess the timing and magnitude of the effect of Idaho Power's proposed operations on flows downstream of Hells Canyon dam, we compared simulated outflows for three representative water years under Idaho Power's proposed operations with flows that would occur under run-of river operations at two locations, one below Hells Canyon dam, and one at Anatone, WA, just upstream of Lower Granite reservoir (figures 112, 113, and 114). The largest difference in outflow occurs during the flood control season in medium and extreme high flow years. During these year-types, outflows are typically increased by 2,000 to 3,000 cfs in January, February and March as the reservoir is drafted to meet target elevations specified by the Corps, and then flows are reduced in May and June by as much as 10,000 to 15,000 cfs in medium and high flow years during the spring freshet. In October, outflows are typically increased by about 2,000 to 3,000 cfs during October to vacate space to manage flows for the fall Chinook spawning period, when outflows are typically reduced by about 7,000 to 8,000 cfs from peak flows that would otherwise occur between November through December.

The provision of 237,000 acre-feet of flow augmentation from Brownlee reservoir over a 41-day period from June 20 to July 31 as recommended by NMFS would increase flows by an average of 2,914 cfs, which represents a 1.5 percent increase over the average July flow at McNary dam of 199,351 cfs. Similarly, while flood control operations at Brownlee reservoir have the capacity to substantially reduce the magnitude of peak flows for several days or weeks, refilling the reservoir at the end of the flood control season typically occurs over a longer period and has less effect on downstream flows. For example, refilling from a 200,000 acre-foot draft over a 30-day period in May would reduce the flow contribution from the Snake River by an average of 3,361 cfs, or 1.2 percent of the average May flow at McNary dam of 285,560 cfs. Drafting Brownlee reservoir to control flows as part of Idaho Power's fall Chinook spawning and incubation flow program may have a more notable effect due to lower prevailing flows in the fall. For example, drafting 200,000 acre feet over a 30-day period in October would reduce flow contributions from the Snake River by 3,361 cfs, or about 3.0 percent of the average October flow of 112,344 cfs at McNary dam, and refilling the reservoir over a 30-day period in November would reduce flows by about 2.7 percent.

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[89] Based on comparison of mean annual flow data from 1971 to 1980 at USGS gage 14019200 at McNary dam and USGS gage 13290450 at Hells Canyon dam.

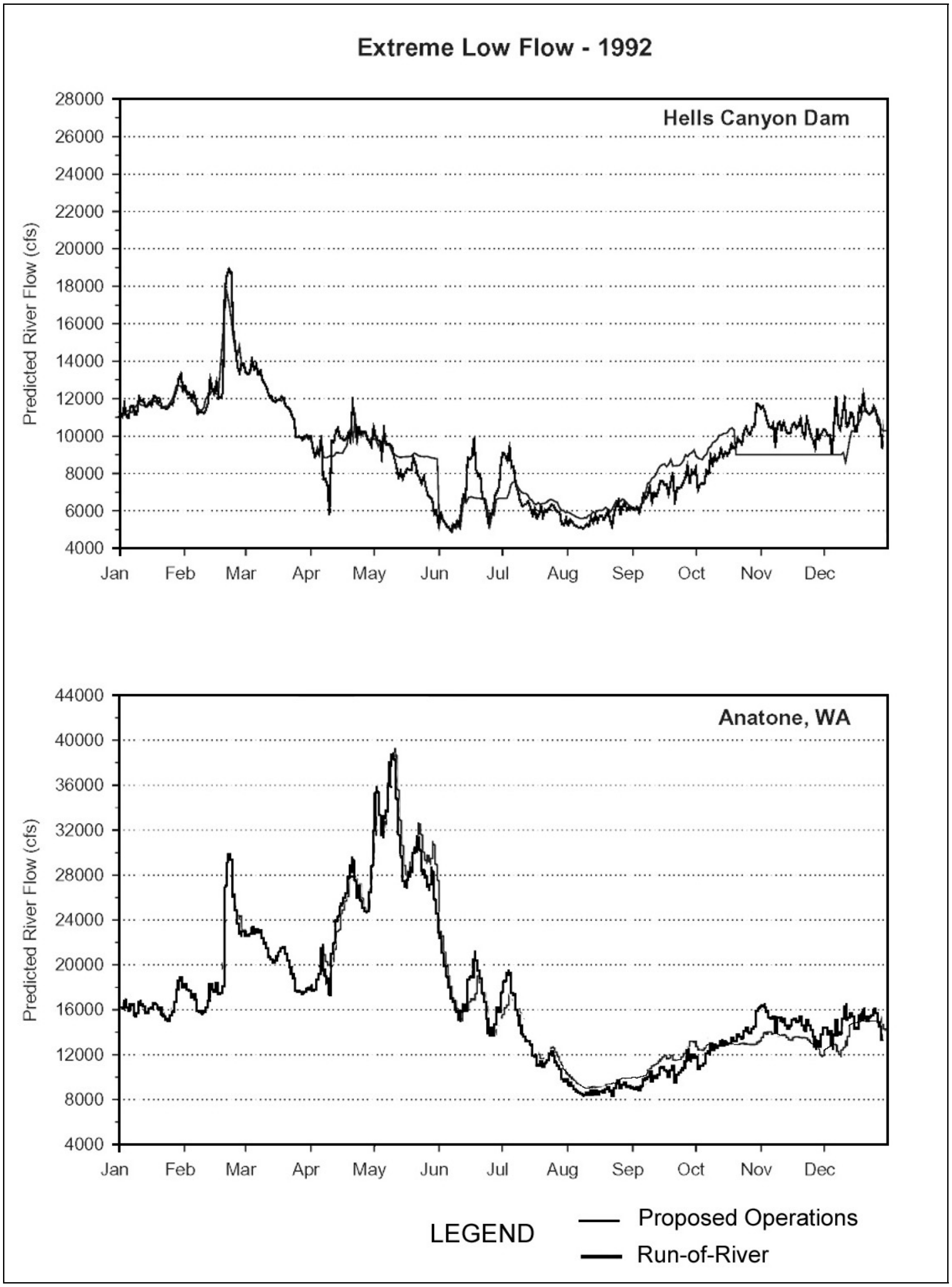

Figure 112. Simulated flows below Hells Canyon dam and at Anatone, WA for a representative extreme low flow year (1992) for proposed operations (scenario 1d used as surrogate) and with Brownlee reservoir held at minimum operating pool (scenario 5). Scenario 1d was used to remove diurnal fluctuations caused by load following operations to facilitate the visual comparison of daily average flows. Source: (Brink and Chandler, 2005)

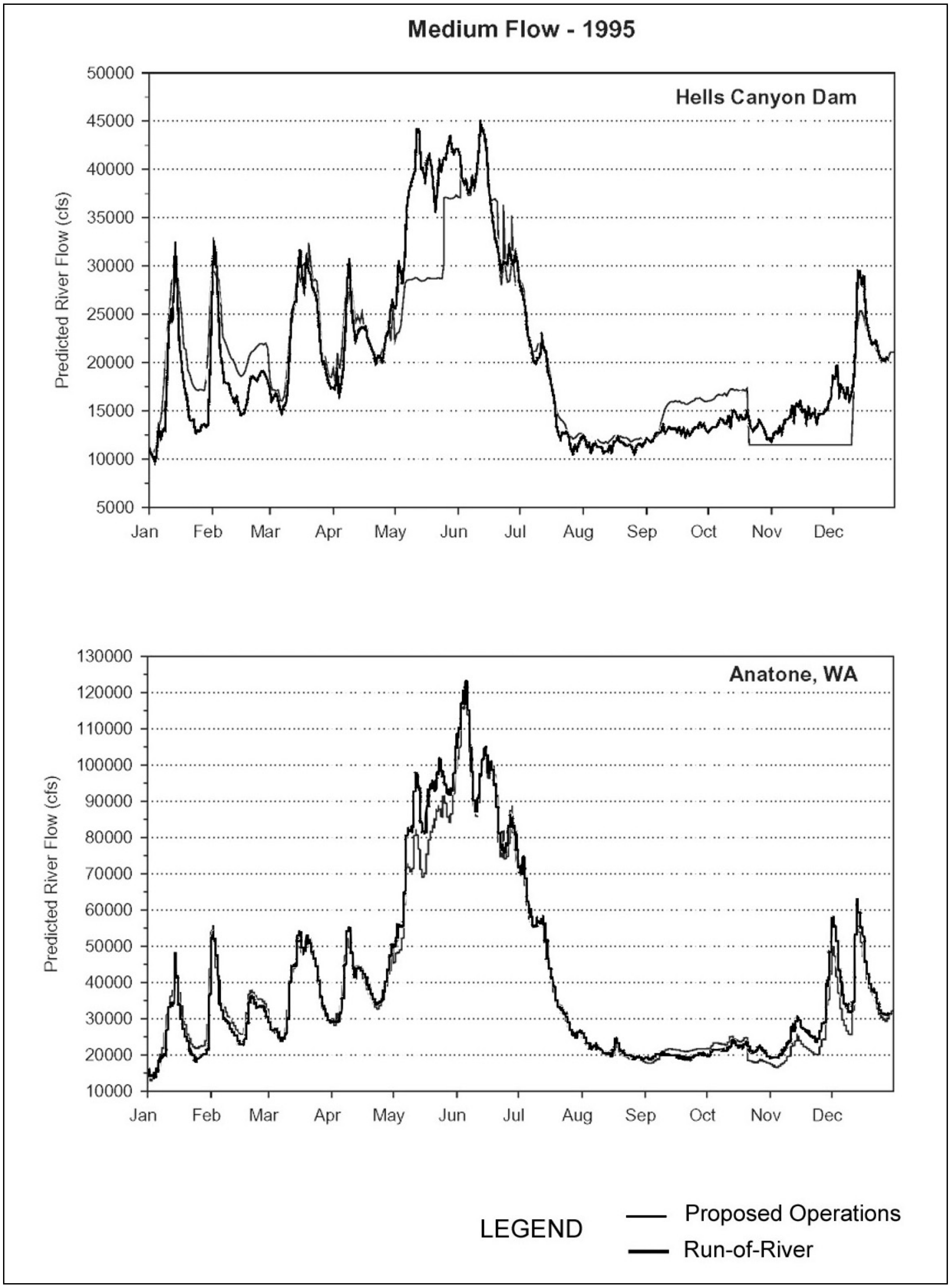

Figure 113. Simulated flows below Hells Canyon dam and at Anatone, WA for a representative medium flow year (1995) for proposed operations (scenario 1d used as surrogate) and with Brownlee reservoir held at minimum operating pool (scenario 5). Scenario 1d was used to remove diurnal fluctuations caused by load following operations to facilitate the visual comparison of daily average flows. (Source: Brink and Chandler, 2005)

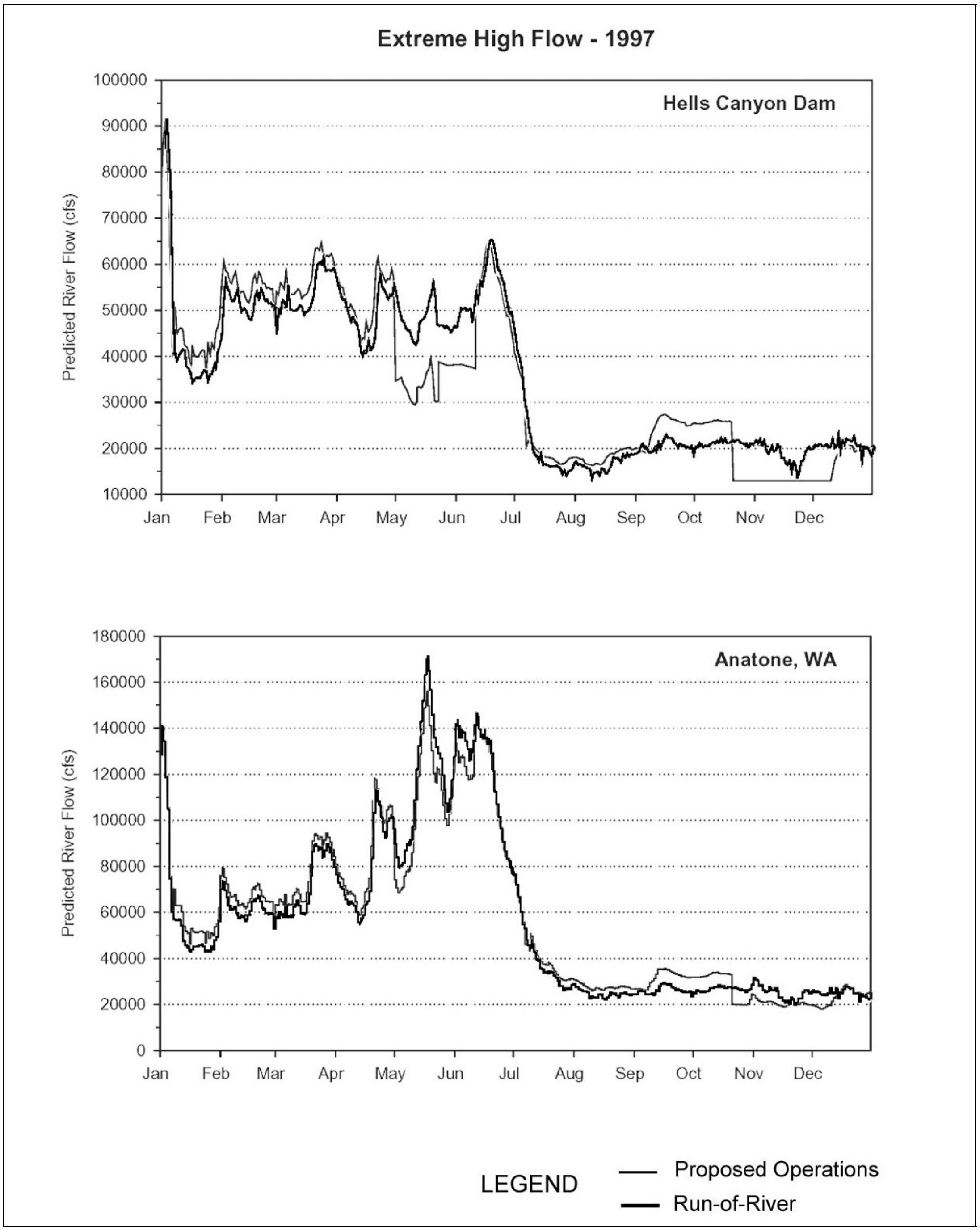

Figure 114. Simulated flows below Hells Canyon dam and at Anatone, WA for a representative extreme high flow year (1997) for proposed operations (scenario 1d used as surrogate) and with Brownlee reservoir held at minimum operating pool (scenario 5). Scenario 1d was used to remove diurnal fluctuations caused by load following operations to facilitate the visual comparison of daily average flows. (Source: (Brink and Chandler, 2005)

3.8.2.6 Bull Trout

Bull trout populations in tributaries to the project reservoirs are small, occur primarily in headwater areas, and are isolated from each other by impediments to passage and scarcity of the fluvial life form. The fluvial form is important for providing gene flow between sub-populations and maintaining population stability. Downstream of Hells Canyon dam, the fluvial life form is more prevalent and populations in the Imnaha and Salmon River basins are comparatively robust. Competition and hybridization with brook trout represent major threats to bull trout populations in the reservoir tributaries, but these threats are less prevalent in the populations downstream of Hells Canyon dam.

The primary effects of the project on bull trout are: (1) partial or complete barriers to movement through migratory corridors formed by project dams and reservoirs; (2) loss of the anadromous fish prey base upstream of Hells Canyon dam; and (3) effects on downstream rearing habitat including gas supersaturation during spill periods and flow fluctuations associated with load following operations. As we discussed in section 3.6.1.4, *Native Resident Salmonids*, it is possible that some mortality may occur from entrainment of bull trout through project turbines. However, no evidence of turbine entrainment was observed among the 7 bull trout and 132 redband trout whose movements were monitored using radio telemetry techniques after they were released into the three project reservoirs.

Idaho Power proposes the following measures that would benefit bull trout:

- Prepare and implement a plan to allow for the capture of resident salmonids and other species migrating upstream and for their transfer to areas above Hells Canyon and Oxbow dams, including a survey to assess the risk of spreading disease pathogens.
- Design, construct, and monitor a permanent monitoring weir at Pine Creek to establish a long-term monitoring program of fluvial fish migrating upstream and downstream in the Pine Creek System.
- Supplement marine-derived nutrients to enhance the forage base within the Pine, Indian, and Wildhorse core area.
- Implement a tributary enhancement program that would improve habitat conditions and population connectivity within Pine Creek, Indian Creek the Wildhorse River, and other smaller tributaries.
- Evaluate the feasibility of, and possibly implement, an experimental brook trout suppression program in Indian Creek.
- Conduct a presence/absence survey to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek Basin.
- Install spillway flow deflectors at Hells Canyon and Brownlee dams, and install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam.
- Implement in-reservoir aeration or upstream phosphorus trading to meet the 1,125 tons/year DO load allocation in Brownlee reservoir, and install aerating turbines at Hells Canyon or Brownlee dam to add 1,500 tons/year DO below Hells Canyon dam.
- Install and operate a destratification system in the Oxbow bypassed reach at the deep pool just upstream of the Indian Creek confluence to prevent anoxic conditions at this location.
- Implement watershed measures (which may include hydraulic measures or restoration of riparian vegetation or channel morphology) or a bubble upwelling system in Brownlee reservoir to compensate for the project's contribution to elevated water temperatures.

Resource agencies, tribes, and NGOs filed numerous recommendations that have the potential to benefit bull trout, including measures to improve the condition of rearing habitat and connectivity between populations, increase the available food supply, and improve habitat conditions in the mainstem Snake River downstream of Hells Canyon dam. We analyze the proposed and recommended measures below.

Our Analysis

Population Connectivity and Marine Derived Nutrients

Idaho Power's proposed measures to provide upstream passage for bull trout at Hells Canyon and Oxbow dams, and install and operate a permanent monitoring weir at Pine Creek, have the potential to improve connectivity between bull trout populations in Pine Creek and downstream of Hells Canyon dam. Implementing upstream passage at Oxbow dam would allow upstream gene flow to the Wildhorse River to be restored, but without making provisions for downstream passage it would increase the potential for losses from mortality during turbine passage, risking losses to the small fluvial component of the Pine Creek bull trout population.

We evaluate Idaho Power's proposed measures to restore connectivity among bull trout populations and related agency recommendations in section 3.6.2.8, *Resident Salmonid Passage*. There was widespread support for modifying the Hells Canyon trap to accommodate the collection of bull trout and enable on-site sorting to reduce stress on bull trout and other federally listed salmon and steelhead. Most parties supported construction of an adult trap at Oxbow dam, although IDFG expressed reservations about the potential effects of upstream transfers on bull trout on populations in Pine and Indian creeks. Most parties also supported the installation of migrant traps at the mouths of key tributaries, including Pine and Indian creeks, the Wildhorse River, and several tributaries to the Powder River. FWS filed a preliminary fishway prescription that included trap modifications at Hells Canyon dam and the installation of a weir trap at Pine Creek, with other facilities including a weir on Indian Creek, an adult trap at Oxbow dam and a weir on the Wildhorse River to be constructed on a schedule that would be controlled by habitat-based triggers. Idaho Power filed a similar alternative prescription, but included a more specific set of trigger criteria based on the status of bull trout within these tributaries (e.g., abundance, the potential for hybridization with non-native brook trout, the potential of the fishways to contribute toward recovery, and habitat conditions necessary to support bull trout). Interior subsequently filed a modified prescription that included the more specific set of triggers. The modified prescription also specified that the Pine Creek weir would be constructed within 2 years and that flows needed to provide bull trout passage through the Oxbow bypassed reach would be examined if and when the Oxbow adult trap is constructed.

In section 3.6.2.11, *Marine-derived Nutrients*, we evaluate Idaho Power's proposal to supplement marine-derived nutrients by distributing hatchery carcasses or carcass analogs into Pine and Indian creeks and the Wildhorse River. We conclude that while Idaho Power's proposed measure would benefit bull trout, restoring access for anadromous fish could yield a greater benefit by distributing carcasses more widely and by providing access to rearing and migrating juvenile anadromous salmonids. While we also conclude that it is unlikely that self-sustaining runs of anadromous fish can be developed at this time, this would not preclude the release of surplus hatchery adults into Hells Canyon reservoir when they are available. Finally, we also conclude that the disease risks associated with this practice should be evaluated through Idaho Power's proposed pathogen risk assessment.

Tributary Habitat Enhancement

Idaho Power's proposal to implement habitat enhancement measures in Pine Creek, Indian Creek and the Wildhorse River would benefit bull trout populations in these basins, and this proposed measure is widely supported by the agencies, tribes and NGOs. In section 3.6.2.10, *Tributary Habitat*

Improvements, we evaluate the potential benefits of the measures proposed by Idaho Power and by others. We conclude that tributary enhancement measures could help to increase the number of bull trout and connectivity among populations in the Pine-Indian-Wildhorse core area. Several entities recommend implementing additional tributary enhancement measures in other watersheds, including the Powder, Burnt, and Weiser River basins. These measures could facilitate restoration of bull trout to additional habitat in these watersheds.

Idaho Power also proposes to conduct an intensive, 3-year survey effort to determine whether bull trout are present in the Eagle Creek watershed. This proposal would help to identify potential opportunities for habitat enhancement efforts in this important Powder River tributary.

Downstream Rearing Habitat

Idaho Power does not propose any new operating constraints to stabilize outflows from the project outside of the fall Chinook spawning and incubation period, other than its current 12-inch-per-hour ramp rate as measured at Johnson Bar. Other stakeholders recommended a range of ramping rate and other operational restrictions that would serve to stabilize flows downstream of the project. In section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, we evaluate the effect of Idaho Power's proposed operations and agency recommended operations on bull trout rearing habitat in terms of food production, habitat stability, and the potential for losses due to stranding or entrapment. We also discuss the potential benefits of a 4-inch-per-hour ramping rate restriction from March 15 to June 15 to protect rearing fall Chinook, which is a staff measure. The latter ramping rate would provide some benefit to bull trout during the spring months. We also discuss the potential benefits of expanding entrapment monitoring to evaluate stranding and entrapment losses of other species including bull trout, and a separate program to evaluate effects of load following on invertebrates. Both measures would include adaptive management provisions to determine whether operations need to be further modified or fish salvage operations undertaken to reduce mortality due to stranding and entrapment of juvenile fall Chinook and other aquatic species.

In its license application, Idaho Power proposed to install spillway flow deflectors at Hells Canyon dam and continue preferential use of the upper spillgates at Brownlee dam during spill periods to reduce TDG concentrations in the Snake River downstream of Hells Canyon dam. In its application for water quality certification, however, Idaho Power proposes to install spillway flow deflectors at Brownlee dam and to install the most effective, safe and economically feasible measure designed to reduce TDG levels at Oxbow dam, based on effectiveness monitoring of the proposed Brownlee dam spillway deflectors. Idaho Power also proposes to monitor the effectiveness of these measures and to implement additional measures if needed to meet the TDG criterion or to protect aquatic life. These measures would reduce TDG levels downstream of Hells Canyon dam during most spill periods, and would thereby reduce the potential for injuries to bull trout that use the mainstem Snake River as overwintering habitat.

As shown in figures 48, 49, and 50, DO levels unsuitable for salmonids extend at least three miles downstream from Hells Canyon dam from July through October in extreme low flow years. Also, conditions in this reach are below optimal over the same distance and time period in extreme high flow years. In its license application, Idaho Power proposed to supplement DO into Brownlee reservoir; however, this measure is not expected to improve low DO levels that occur downstream of Hells Canyon dam. In its application for water quality certification, Idaho Power proposes to implement in-reservoir aeration or upstream phosphorus trading to meet the 1,125 tons/year DO TMDL load allocation in Brownlee reservoir. Idaho Power also proposes aerating turbines at Hells Canyon or Brownlee dam to add 1,500 tons per year DO downstream from Hells Canyon dam. The application for water quality certification also outlines measures to compensate for the project's contribution to thermal load, which would make water temperatures slightly more suitable for bull trout in early November. Implementing the measures included in Idaho Power's application for water quality certification would improve DO levels and benefit bull trout within the project reservoirs and downstream of Hells Canyon dam.

In section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, we estimate that flow fluctuations caused by load following operations may reduce the food base available to bull trout by approximately 10 to 20 percent, and could expose some bull trout to the risk of stranding or entrapment. We conclude that additional monitoring of the effects on invertebrate production, as well as on stranding and entrapment, would help to determine the extent of project effects on bull trout and to determine whether additional measures are warranted.

3.8.2.7 Idaho Springsnail

Because the Idaho springsnail was found to occur only upstream of Brownlee reservoir, we conclude that the project would have no effect on this species.

3.8.2.8 MacFarlane's Four-o'clock and Spalding's Catchfly

Ongoing project operations, changes in flow regime, and project-related ground disturbance would have the potential to adversely affect the federally listed MacFarlane's four-o'clock and Spalding's catchfly, if present in the project area. Idaho Power's surveys did not document any occurrences of these species within the survey area, and Idaho Power does not propose any specific protection measures. To address protection for rare plants (which would include MacFarlane's four-o'clock and Spalding's catchfly), Idaho Power proposes to formalize cooperative relationships with regulatory management agencies and neighboring landowners to provide for protection and management of rare plants. Idaho Power would establish a rare plant advisory board to coordinate monitoring and enhancement projects. The rare plant advisory board would coordinate with the noxious weed advisory board, as well, because the spread of non-native invasive plants is one of the most serious threats to rare plants at many sites.

Idaho Power also proposes to develop and implement a transmission line O&M plan, with BMPs to protect rare plants. The IWHP and WMMP would provide similar BMPs and site specific protection measures for rare plants on any newly acquired lands.

As discussed in section 3.7.2.2, *Special Status Plant Protection*, Interior-34 and Interior-78 call for Idaho Power to develop and implement plans to manage threatened, endangered and sensitive plants. Interior-34 would apply only to BLM-administered lands, while Interior-78 would apply to all lands affected by the project. Both recommendations call for that Idaho Power to conduct baseline surveys in areas not yet surveyed that could support rare plants and to monitor certain sites annually for 5 years following license issuance and then every 2 years thereafter. Idaho Power would use the results of monitoring to identify any site protection or restoration measures.

The Forest Service (FS-8) specifies that Idaho Power should consult with the Forest Service to develop a Threatened and Endangered Species Management and Monitoring Strategy to address federally listed terrestrial species and their habitats on National Forest System lands affected by the project. This strategy would address any measures required by FWS as a result of ESA consultation.

Our Analysis

MacFarlane's four-o'clock and Spalding's catchfly are known to occur along the Snake River downstream of Hells Canyon dam. Both species are typically associated with native grassland habitats. Changes in the flow regime would not be likely to affect potential habitat for these species because they are not associated with riparian plant communities. None of the flow alternatives we considered would reduce the availability or quality of native grasslands.

Idaho Power's surveys did not identify MacFarlane's four-o'clock or Spalding's catchfly at any sites within the project boundary, but it is possible that occurrences were overlooked during the field surveys because surveys covered only one-fourth of the river corridor. As mentioned in section 3.7.1.2, *Special Status Plants and Plant Communities*, Idaho Power used a sub-sampling approach in conducting the pre-licensing inventory. This approach provided adequate baseline data, given the extent of the study area, but would not allow Idaho Power to analyze the effects of ground-disturbing activities, such as construction of new recreation facilities, on a site-by-site basis.

Development and implementation of a Threatened, Endangered, and Sensitive Species Management Plan would provide a mechanism for identifying sites that should be surveyed for MacFarlane's four-o'clock and Spalding's catchfly, focusing survey efforts on sites where project-related activities could affect rare plants, rather than conducting an inventory of the Snake River Canyon. If project-related activities would cause ground disturbance outside Idaho Power's ownership, Idaho Power could identify and implement cooperative protection measures, as outlined in its proposal to establish a rare plant advisory board.

If Idaho Power's surveys identified MacFarlane's four-o'clock or Spalding's catchfly occurrences, the plan would also provide a mechanism for identifying appropriate monitoring schedules. Monitoring schedules could be based on site-specific characteristics. For example, monthly surveys during the summer for 2 years might be prudent at a high-use recreation site; annual surveys for 3 years might be reasonable at a site where weed control measures are implemented; and surveys at 10-year intervals might be adequate for remote sites where little habitat disturbance is anticipated.

3.8.2.9 Gray Wolf

Idaho Power's studies did not identify any project effects on the gray wolf (Dumas et al., 2003b). Non-essential experimental populations of gray wolves in Idaho have expanded dramatically over the past 10 years. Their numbers are likely to continue to increase, and wolf observations in the project area may become more common. Where wolves and people come into contact, wolves are often destroyed to reduce the risk of direct confrontation.

Idaho Power does not propose specific measures for protection or management of the gray wolf. Interior-34 and FS-8, as described above, would address the gray wolf within management plans or strategies for threatened, endangered, and special status species.

Our Analysis

Idaho Power's studies did not indicate any project effects on this species. The movement of radio-collared wolves between Oregon and Idaho indicates that the project reservoirs do not impede movement. Project O&M and project-related recreation activities would likely continue to prevent wolves from using portions of the project area where human activities are concentrated. More remote areas would provide suitable habitat for wolves. Idaho Power's proposals to acquire, protect, and enhance mule deer winter range are intended to improve habitat conditions for mule deer, an important prey species for the gray wolf. Wolves would benefit from any increase in mule deer populations.

Including this species within a project-wide Threatened, Endangered, and Sensitive Species Management Plan would provide a means of evaluating changes in wolf use of the project area and identifying protective measures, if needed. Including the gray wolf in a Threatened, Endangered, and Sensitive Species Management Plan would be especially valuable as a coordinating mechanism because of the differing status that various federal and state agencies assign the gray wolf.

3.8.2.10 Canada Lynx

Idaho Power's studies did not identify any project effects on the Canada lynx (Dumas et al., 2003b). Canada lynx populations in core areas may increase, if recovery measures are successful in protecting suitable habitat and reducing disturbance. Lands within the Hells Canyon Project boundary do not provide suitable denning or foraging habitat, due to low elevations and the absence of cold, moist forest. The dominant cover types are shrub-steppe and grassland.

Idaho Power does not propose specific measures for protection or management of the Canada lynx. Interior-34 and FS-8, as described above, would provide a means of addressing the Canada lynx within management plans for threatened, endangered, and special status species; however none of these recommendations identify the Canada lynx as being of concern in terms of potential project effects.

Our Analysis

Idaho Power's studies did not indicate any project effects on the Canada lynx. It is possible that lynx may use shrub-steppe in moving between forested areas (Ruediger et al., 2000), and lynx could occur in the project area as transients, from time to time. However, no proposed or recommended terrestrial resource measures would affect suitable habitat, and no project effects would be likely to occur as a result of relicensing.

3.8.2.11 Northern Idaho Ground Squirrel

Idaho Power's studies did not identify any project effects on the Northern Idaho ground squirrel (Dumas et al., 2003b). The northern Idaho ground squirrel occurs within a very restricted range. Only 34 sites are known to be occupied, with 13 of these located on private land. Protection of occupied sites and of connectivity habitat between sites will be critical to recovery of the subspecies.

Idaho Power does not propose specific measures for protection or management of northern Idaho ground squirrel. Interior-34 and FS-8, as described above, would address the northern Idaho ground squirrel within management plans for threatened, endangered, and special status species. None of the recommendations include any specific measures pertaining to the northern Idaho ground squirrel.

Interior-84 recommends that Idaho Power consult with FWS and the Northern Idaho Ground Squirrel Technical Team to develop and implement a northern Idaho ground squirrel management plan. The plan would focus on management and possible reintroduction of this species at the Barber Flats site.

Our Analysis

Mapping provided in the FWS recovery plan (FWS, 2003b) indicates that the probable historical distribution of the northern Idaho ground squirrel does not overlap with lands affected by the Hells Canyon Project. Suitable habitat for this subspecies occurs at higher elevations (i.e., generally between 3,000 and 6,000 feet) than those occupied by project reservoirs, roads, or transmission lines. Idaho Power owns a parcel of land east of Oxbow reservoir at Barber Flats that supports northern Idaho ground squirrels, but no suitable habitat is present within the project boundary.

As part of its IWHP and WMMP, Idaho Power may acquire lands that provide suitable habitat for the northern Idaho ground squirrel. Ground disturbance associated with habitat management and enhancement measures (such as burning, mowing, weed control or fence construction) could adversely affect this subspecies. If Idaho Power acquires lands with potential habitat for this species, including the northern Idaho ground squirrel within a project-wide Threatened, Endangered, and Sensitive Species Management Plan, as discussed above, would prove beneficial. At that point, consultation with FWS and the interagency technical team would be useful in developing site-specific measures that would contribute to recovery of this species.

3.8.2.12 Bald Eagle

The number of bald eagles that nest and winter in the Hells Canyon Project area is increasing, and the project does not appear to be adversely affecting this species. However, some ongoing project operations and proposed or recommended measures would have the potential to cause adverse effects. Noise disturbance caused by maintenance, traffic, land management activities and recreation has the potential to interfere with breeding and cause physiological stress to wintering birds. Contaminants that accumulate in bottom sediments of Brownlee reservoir may be passed up the food chain to bald eagles, which feed primarily on fish. The presence of the project transmission line may pose a risk of collision and electrocution.

In addition to potential adverse effects, relicensing the Hells Canyon Project may also positively affect bald eagle populations. Each of the eagle pairs currently nesting near the Hells Canyon Project boundary is likely reliant, to some degree, on perching habitat on reservoir shorelines and fish populations in the project reservoirs and Snake River downstream of Hells Canyon dam. Protection of riparian habitat, improvements in water quality, and increases in anadromous and/or resident fisheries could benefit bald eagles.

To protect bald eagles, Idaho Power proposes to monitor bald eagle nests and winter roosts and to implement timing constraints on O&M activities and recreation, as needed, to protect bald eagles from human disturbance. Idaho Power's current management guidelines are as follows:

- No transmission line or other major construction activities are implemented within 800 m of any occupied bald eagle nest between February 1 and July 15 (or July 31, depending on documented nesting chronology);
- No transmission line or service road maintenance activities, other than patrols, are implemented within 400 m of an occupied nest between February 1 and July 15 (or July 31, depending on documented nesting chronology);
- No helicopter or fixed-wing flyovers, unless the specific objective of the flight is to confirm incubation, are implemented within 100 m of an occupied nest.

Interior-34 would address the bald eagle as part of a management plan for threatened, endangered, and special status species. This recommendation would apply to BLM-administered lands affected by the project.

Under Interior-81 and ODFW-60, Idaho Power would consult with the appropriate agencies to develop and implement a bald eagle management plan and incorporate it into the IWHP and WMMP. The plan would include annual nesting and productivity surveys, development of nest site management plans, annual fall and winter communal roost surveys. Interior also recommends development of roost site management plans and winter surveys. ODFW recommends that Idaho Power fund habitat enhancement measures on its lands.

The Forest Service (FS-8) specifies that Idaho Power should consult with FWS to develop a Threatened and Endangered Species Management and Monitoring Strategy to be incorporated into the WMMP. This condition specifies that Idaho Power would comply with any measures identified during ESA consultation with FWS regarding listed species.

Our Analysis

The increase in the number of active and successful bald eagle nest territories in the project area is consistent with upward trends in bald eagle populations in Oregon and Idaho, and more generally, across the United States. These increases suggest that ongoing project operations are not reducing habitat availability or suitability for bald eagles, and that Idaho Power's existing timing constraints on maintenance activities are adequately protecting bald eagles from disturbance. However, monitoring through any new license period would be needed to identify adverse effects of new project-related facilities, increases in project-related recreation, reductions in water quality resulting from contaminant accumulations in Brownlee reservoir, increases in electrocution or collision with the transmission line as bald eagle numbers increase, or other changes from existing conditions, including establishment of new bald eagle nests.

Potential Disturbance

Construction of new facilities, implementation of mitigation measures in or near nest sites or foraging areas, or increases in recreation activity could directly affect bald eagles because many pairs are sensitive to noise, vehicle traffic, pedestrians, and boaters. The level of disturbance depends not only on the decibels of noise, but also its distance from a nest, its frequency and duration, the presence or absence of topographic or vegetative screening around the nest, and the time of year and time of day the activity takes place. Although bald eagles vary in their responses to human activity, the potential for disturbance is generally highest during courtship, nest building, egg laying, incubation and hatching. Disturbance during these phases of nesting chronology can cause bald eagles to abandon their nests permanently. Even temporary absence of adults can expose eggs or young to overheating, hypothermia, predation, and injury.

In the Pacific region (including Idaho), nest building usually begins in early January (FWS, 2007b). Idaho Power's 2006 report on nesting and productivity in the Hells Canyon Project area (Carpenter and Holthuijzen, 2006) found that bald eagle pairs began incubating between February 1 and March 21. Incubation typically lasts about 35 days, and nestlings may remain at the nest for another 8 to 14 weeks (Buehler, 2000). Idaho Power reported that juveniles fledged between May 22 and July 12 (Carpenter and Holthuijzen, 2006).

Idaho Power mapped the six bald eagle nests in the project vicinity in relationship to recreation sites, roads, transmission lines, development, jurisdictional boundaries, and lands proposed for wildlife habitat acquisition and management (Idaho Power, 2007b).[90] At FERC staff's request, Idaho Power mapped 330-foot, 660-foot, and 1-mile buffers around each nest and described vegetation types[91] so that we could evaluate potential sources of disturbance in relation to FWS national guidelines for bald eagle management (FWS, 2007b) that are likely to be implemented now that the bald eagle has been removed from the list of threatened and endangered species. Table 75 summarizes this information, and identifies potential sources of disturbance.

Table 75. Bald eagle nest sites, potential noise disturbance, and potential buffers. (Source: Idaho Power, 2007b, as modified by staff)

Nest Site	Distance from Existing Activities that Could Cause Disturbance	Proposed or Recommended Environmental Measures that Could Cause Disturbance	Screening Around Nest Sites
Lamont Springs	Within 330 feet of trail; within 660 feet of Snake River and dispersed recreation site; trail and dispersed recreation sites within 1 mile	Gravel augmentation and sandbar replenishment	No screening; steep slope above trail and river; shrub-steppe vegetation
Hibble Gulch	Within 330 feet of road, transmission line and reservoir shoreline; trail within 1 mile	Possible dispersed recreation enhancements or improvements to Hells Canyon Road turn-outs	No screening; steep slope above road, transmission line and reservoir; shrub-steppe vegetation

[90] These maps were filed with the Commission as confidential information to prevent disturbance of sensitive sites.

[91] Vegetation cover type mapping is not available for the Birch Creek nest site, which is located outside the terrestrial resource study area.

Nest Site	Distance from Existing Activities that Could Cause Disturbance	Proposed or Recommended Environmental Measures that Could Cause Disturbance	Screening Around Nest Sites
Airport	Within 660 feet of road and transmission line; airstrip, roads and several recreation sites within 1 mile	Recreation enhancements at Airstrip A, B, and C; possible dispersed recreation enhancements or improvements to boat moorage	No screening; steep slope above road and transmission line; shrub-steppe vegetation
Cottonwood	Within 660 feet of road; roads and several recreation sites within 1 mile	Possible fish habitat enhancements in Pine Creek; possible dispersed recreation enhancements or improvements to boat moorage	No screening; steep slope above road; shrub-steppe vegetation
Eagle Creek	Within 660 feet of reservoir shoreline; roads and rural/residential development within 1 mile	Possible fish habitat enhancements in Powder River and wildlife habitat enhancements in Powder River SMA	Relatively flat site; forested wetland may provide vegetative screening from some aspects.
Birch Creek	Within 330 feet of trail; within 660 feet of road; no other mapped development within 1 mile	None proposed or recommended within 1 mile (site is approximately 3 miles southwest of Brownlee reservoir)	Flat site; no screening; shrub-steppe vegetation

In general, the guidelines recommend construction timing restrictions that apply to blasting, clearing, grading, truck traffic, and operation of heavy equipment and motorized machinery (FWS, 2007b). They also apply to work that involves alteration of shorelines (e.g., boat launches) and installation of docks and moorings.

Based on the guidelines, eagles are unlikely to be disturbed by routine use of roads and other facilities; construction of roads, trails, and power lines; agriculture; alteration of shorelines; or installation of docks or moorings, where such activities pre-date successful nesting in a given area. If similar activities are planned for implementation within 1 mile of a nest, FWS recommends restricting activities within 660 feet (where topography or vegetation do not screen activities from view) or within 330 feet (where screening is present). FWS also recommends implementation of timing restrictions for temporary disturbance, including boating (FWS, 2007b).

Proposed or recommended recreation facility enhancements would be located at Carters Landing, Oxbow boat launch, Copperfield boat launch, Airstrip A and B, Bob Creek, Westfall, Hells Canyon Park, Copper Creek, Eckels Creek, Big Bar, Eagle Bar, Deep Creek, Hells Canyon Creek Launch, Old Carters Landing, McCormick Park, Hewitt Park, Holcomb Park, Swedes Landing, and Spring recreational site. Of these locations, only the Airstrip sites are located within 1 mile of an existing bald eagle nest. Improvements of Hells Canyon road pull-outs, dispersed recreation sites, and boat moorages on Hells Canyon, Oxbow, or Brownlee reservoir may also occur within 1 mile of existing nests.

Proposed or recommended aquatic resource measures that require in-water or near-water construction along Pine Creek or the Powder River could occur within 1 mile of nesting bald eagles. Beach replenishment or gravel augmentation downstream from Hells Canyon dam could also cause temporary disturbance within 1 mile of an eagle nest.

Land-based and water-based recreation activity clearly pre-dates successful nesting in the project area, and pairs that occupy existing nests appear tolerant of this activity. However, recreation activity may increase through any new license period, and the potential for disturbance could also increase. In the future, timing restrictions could be helpful in minimizing the risk of adverse effects if these activities occur near active eagle nests. A comparison of bald eagle nest site maps and data regarding nesting chronology at each nest site with proposed recreation and other enhancement activities would provide a useful foundation for determining where and when any timing restrictions may be needed, unless construction is scheduled outside the nesting season.

Idaho Power proposes to monitor nest and roost sites, but does not indicate how often monitoring would occur. Idaho Power does not propose to develop nest or roost site management plans, except where they would be needed on specific land parcels, as part of the IWHP/WMMP.

Interior-34 does not specify how bald eagles would be addressed within the Threatened, Endangered and Sensitive Species Plan. The Forest Service (FS-8) does not specify monitoring requirements, instead recommending that Idaho Power consult with FWS to define a management strategy. Interior-81 and ODFW-64 provide detailed outlines for development of bald eagle management plans.

Interior and ODFW are similar in their approach to monitoring schedules and requirements for development of nest site management plans, with more intensive productivity monitoring if problems are identified. However, Interior limits nest monitoring to pairs that use Hells Canyon reservoir and nest site management plans for pairs that nest adjacent to Hells Canyon reservoir. Interior and ODFW both call for annual monitoring of roost sites associated with project lands in February, March, October, and November. Interior calls for development of roost site management plans, while ODFW does not. Interior calls for winter monitoring of reservoir use in January, February and March, while ODFW does not.

Implementing Interior's recommendation to focus monitoring and nest site management plans on pairs that use Hells Canyon reservoir would not provide adequate information about pairs that are associated with Oxbow and Brownlee reservoirs. Implementation of ODFW's recommendation would encompass all project reservoirs.

Idaho Power could coordinate habitat protection, access control, and management of activities that could disturb nesting birds at nests that are located within the project boundary, or where project activities occur within 1 mile of a nest (e.g., Hibble Gulch, Airport, Cottonwood, and Eagle Creek). Idaho Power would not have control over activities or disturbance at nest sites on lands where it has no management authority or responsibility (e.g., Lamont Springs and Birch Creek), but could participate in the implementation of such plans because project reservoirs are a key element of bald eagle habitat in the vicinity.

Implementation of Interior and ODFW recommendations to monitor annually in March/April and June/July would enable Idaho Power to track trends in productivity. As mentioned in section 3.7.2.1, the average number of young fledged at 5 of the 6 nests in the project area dropped from 2.4 in 2004 to 1.4 in 2005. Two years of data have little significance, but these findings suggest a need for long-term monitoring, including more intensive monitoring if trends turn downward, as described in Interior and ODFW recommendations.

Disturbance during the winter can interfere with eagle foraging and increase their exposure to harsh weather conditions. Monitoring roost sites annually in February, March, October, and November (as Interior and ODFW recommend) would provide information needed to determine whether timing restrictions should be implemented around any roost sites and whether roost site management plans are needed. Fall surveys would be especially important if construction is planned outside the breeding season, in order to minimize disturbance during the nesting season.

Implementation of Interior's recommendation to annually monitor winter use of the project reservoirs in January, February, and March may be excessive, in that only one survey is needed to allow Idaho Power to track winter trends in the project area over time. Planning the winter survey to coincide with regional surveys would also allow Idaho Power to continue contributing to a large, region-wide dataset.

Bioaccumulation of Contaminants

As discussed in section 3.7.2.1, *Fish-Eating Wildlife Species*, predation on fish in Brownlee reservoir may expose bald eagles to contaminants that accumulate in bottom sediments. Bioaccumulation of mercury and organochlorine compounds can interfere with normal behavior patterns, impair reproduction, or cause death. An analysis of DDE in the blood of juvenile bald eagles from three Hells Canyon nests was found to be well below the threshold considered to cause observable adverse effects. The levels of mercury found in adults from these nests were much higher than the accepted level of concern (Bechard et al., 2006); however, levels of mercury were comparable to levels found in bald eagles in other states, where it has not appeared to adversely affect reproductive success.

The process of bioaccumulation would likely continue to occur during any new license period, even if TMDLs are implemented, because reversal of poor water quality conditions would take many years. In addition, installing a bubble upwelling system or temperature control structure to withdraw water from low levels in Brownlee reservoir could increase mixing of near-bottom water, which would increase the rate of discharge of contaminants into the water column, and thereby, into the food chain.

Under ODFW-57, Idaho Power would evaluate bioaccumulation of mercury, dieldrin, and DDT/DDE in Brownlee reservoir fish. Idaho Power could collect tissue samples of fish during routine population sampling efforts, if requested to do so by the state water quality management agencies, and submit them to IDEQ and ODEQ for analysis. The results of these analyses could be evaluated along with the results of annual nest productivity monitoring to help evaluate potential effects of contaminants on bald eagles. Implementation of Interior and ODFW recommendations to conduct more intensive analysis if productivity is found to decrease would also serve as a means of identifying any correlations between nesting success and contaminant levels in fish.

Transmission Line Interactions

Transmission lines often pose a risk of collision or electrocution for bald eagles, depending on siting and design. The 69-kilovolt (kV) project transmission line extends from Oxbow dam to Hells Canyon dam, a distance of about 22 miles. It runs parallel to a paved road adjacent to the Hells Canyon reservoir. Idaho Power's studies indicate that this line poses a high risk of collision because it is located downslope from an eagle nest territory (SAIC and Spatial Dynamics, 2000). However, Idaho Power has not identified any collision mortalities associated with this line. ODFW describes an undated personal communication attributing an eagle mortality on the east side of Oxbow reservoir to collision with the transmission line, but provides no specific information about this occurrence (ODFW-70). To reduce the risk of collisions, it would be beneficial for Idaho Power to evaluate installation of warning spheres on transmission line 945.

To reduce the risk of electrocution, Idaho Power modified power poles within 0.62 mile of the nest on Hells Canyon reservoir to make them raptor safe, including the only pole associated with an electrocution mortality (SAIC and Spatial Dynamics, 2003). Idaho Power proposes to re-evaluate all poles along transmission line 945 that are considered to be of medium to high risk to perching raptors.

Idaho Power annually monitors bird electrocutions and maintains a database of reported mortalities. Idaho Power proposes to continue to conduct annual inventories to identify new raptor nests along the transmission line, and document any electrocutions that may occur. To ensure an up-to-date approach to monitoring, Idaho Power could review its plans for consistency with current guidelines (APLIC, 2006).

Potential Benefits of Aquatic Resource Enhancement Measures

Several measures that are intended to improve aquatic resources in the project area would also benefit bald eagles through their effects on fish, the primary prey base for bald eagles. For example:

- Beach replenishment may result in small improvements to rearing habitat for juvenile Chinook salmon downstream of Hells Canyon dam, and could lead to increased adult returns over time.
- Gravel augmentation could increase the area of spawning habitat, and also increase the availability of salmon carcasses following spawning.
- Supplementation of DO and installation of spillway deflectors at Brownlee reservoir could slightly increase DO and reduce TDG, which would improve water quality, reducing the risk of gas bubble trauma.
- More restrictive ramping rates during the rearing period could reduce fall Chinook mortalities due to stranding and entrapment and increase food supplies for juvenile fall Chinook salmon.
- Continued flow augmentation would maintain suitable outmigration conditions for juvenile fall Chinook salmon, with potential increases in adult returns.
- Tributary enhancement for redband trout, bull trout, and anadromous fish, such as riparian corridor fencing, purchase or lease of water rights and conservation easements, and instream habitat improvements, could lead to increased fish populations, as well as increasing the potential for establishment and success of cottonwood stands that could provide suitable nest or perch trees.
- Release of surplus hatchery adults into Hells Canyon reservoir when available, plus possible outplanting of carcasses in Pine and Indian creeks and the Wildhorse River, could provide an additional forage resource.
- Limiting the extent of the Brownlee reservoir drawdown to enhance reproductive success of smallmouth bass, crappie and early spawning channel catfish could provide an additional forage resource.

Potential Benefits of Land Use Enhancement Measures

The HCRMP identifies broad terrestrial resource goals and objectives, which include protecting, maintaining, and enhancing existing riparian ecosystems and developing new riparian ecosystems in suitable areas, as well as minimizing adverse human impacts. Specific efforts to meet these goals and objectives (e.g., restrictions on shoreline development; land use designations to provide additional protection for sensitive sites, such as bald eagle nest sites; pre-disturbance surveys and mapping to identify sensitive resources and plans for carrying out protective actions and addition of survey data to the project GIS) would protect habitat currently used by bald eagles, as well as habitat that may develop in the future.

Potential Benefits of Terrestrial Resource Enhancement Measures

The increase in nesting activity in the project area since 1998 indicates that habitat is not limiting at the current time. As part of the IWHP and WMMP, Idaho Power would protect younger forest stands, in addition to known nests, roosts and perches. This approach would help ensure recruitment of suitable habitat on wildlife lands in the future, and help meet ODFW's objectives for increasing bald eagle habitat.

Enhancement of native shrub-steppe and grassland communities, in addition to riparian plant communities, would benefit a wide variety of birds and mammals. Many of these, including waterfowl and mule deer, may serve as important forage resources in addition to fish, or when fish are not available.

In summary, Idaho Power proposes and the agencies recommend a variety of measures for bald eagle management. Development of a bald eagle management plan would provide a coordinated mechanism for collecting, compiling, and mapping information about bald eagle populations and use of the project area. Overlaying this information with maps of proposed construction, maintenance activities, and potential sources of disturbance would help ensure rapid detection of resource conflicts, if any occur. However, it may streamline agency consultation, monitoring and reporting efforts to include the bald eagle management plan as one element of the Threatened, Endangered, and Sensitive Species Management Plan discussed above in section 3.8.2.2. As mentioned above, Idaho Power could take the lead in working with agencies and landowners to develop cooperative nest site management plans at locations where Idaho Power also has management authority and responsibility for activities that could affect nesting birds, i.e., at the Hibble Gulch, Airport, Cottonwood, and Eagle Creek nest sites. Idaho Power does not manage habitat, access, or recreation activities that could affect the Lamont Springs or Birch Creek nest sites. However, Idaho Power's participation in cooperative nest site management plans developed by others would help to protect birds that are likely reliant, to some degree, on reservoir fish populations.

3.8.3 Cumulative Effects

Development of the Snake and Columbia River basins has altered seasonal flow regimes, affecting rearing habitat and migration corridors for federally listed salmon and steelhead. The operation of storage reservoirs for flood control and irrigation have caused a substantial decrease in river flows from April through July, while average monthly flows have increased slightly from August through October in comparison to the historical flow regime. Since the late 1980s, river flows in the spring and summer have been augmented to meet flow objectives specified in NMFS Biological Opinions on operation of the mainstem Federal Columbia River Power System projects, with the goal of improving the migration survival of juvenile salmon and steelhead. As part of its strategy to maximize the attainment of flow objectives in the lower Snake and Columbia rivers, NMFS has also been seeking to optimize the allocation of flood storage space in the basin and to maintain reservoir elevations near their upper rule curves in order to maximize the amount of water that is available to augment river flows during the spring and summer migration seasons. As part of the flow management process, coolwater releases from Dworshak reservoir are used to compensate for warmer flows that are released from Brownlee dam and upstream BOR storage reservoirs, to meet temperature objectives in the lower Snake River.

Idaho Power owns and operates eight mainstem hydroelectric dams on the Snake River within the reach that was used by anadromous fish, which ascended the Snake River up to the base of Shoshone Falls at RM 614.7. Idaho Power's six upstream dams inundate 51.7 linear miles of river, or 33 percent of the mainstem Snake River between Swan Falls dam and Shoshone Falls. Brownlee, Oxbow and Hells Canyon dams inundate 89.3 miles or 43.4 percent of the mainstem habitat that existed between Hells Canyon and Swan Falls dams. Collectively, Idaho Power's eight dams and the four federal dams inundate 275.8 miles of the mainstem Snake River, 44.9 percent of the mainstem Snake River downstream from Shoshone Falls. Anadromous fish historically spawned and reared in nine major tributaries and a number of smaller tributaries that enter the Snake River in areas upstream of Hells Canyon (RM 247.6), including Salmon Falls Creek and the Bruneau, Owyhee, Boise, Malheur, Payette, Weiser, Burnt, and Powder rivers. Smaller tributaries within this reach include the Wildhorse River, Indian Creek, and Pine Creek, as well as a group of small creeks that are referred to collectively as the Rock Creek basins. Elimination of access to areas upstream of Hells Canyon dam has deprived the Burns

Paiute, Shoshone-Paiute and Shoshone-Bannock tribes of access to anadromous fish, and the loss of marine-derived nutrients and the eggs and young of anadromous fish has reduced the forage base that is available to bull trout within the basin upstream from Hells Canyon dam.

3.8.3.1 Snake River Fall Chinook Salmon

The settlement and development of the Snake and Columbia River basins has caused substantial adverse cumulative effects on the habitat and population size of Snake River fall Chinook salmon. Habitat losses in the Snake River basin began primarily with placer mining, which took place throughout the basin, followed by development of the basin for agricultural production, timber harvest, and livestock production. Construction of numerous additional tributary dams and agricultural development of the basin has reduced the recruitment of spawning gravel to historical habitats, altered river flows, and adversely affected water quality by increasing water temperatures and nutrient loads, reducing DO, and introducing pesticides. Construction of additional mainstem dams on the lower Snake and Columbia rivers has substantially reduced the survival rates of anadromous fish passing through the migration corridor due to mortality factors associated with reservoir and dam passage, although survival rates have been improving in recent years, as measures to improve survival have been implemented.

Access to prime historical fall Chinook salmon production areas upstream of RM 458 was blocked when Swan Falls dam was constructed in 1901, and another key production area known as the Marsing reach was blocked when Brownlee dam was constructed at RM 284.6 and attempts to maintain anadromous fish runs upstream of Brownlee dam were abandoned in 1964. Access to anadromous fish habitat upstream of RM 247.6 was precluded with the closure of Hells Canyon dam in 1967.

Applying a geomorphic spawning model to the entire Columbia River basin, Dauble et al. (2003) estimated that during the pre-hydro development period, the Snake River provided 52 percent of the fall Chinook spawning habitat in the Columbia River basin. Of the habitat in the Snake River that was available prior to development, 58 percent was located upstream of the current site of Hells Canyon dam. The habitat upstream of Hells Canyon dam includes the reach that was reported by Evermann (1896) to be the most important historical spawning grounds for fall Chinook salmon in the state of Idaho, which extended from Huntington (RM 328) to Auger Falls (RM 606.7). This section includes the Thousand Springs reach, where water temperatures are buffered by substantial spring inflows, providing a thermal regime that is well suited for fostering early emergence, rapid growth, and early migration of juvenile fall Chinook salmon, which likely contributed to the productivity of the population that spawned in this reach.

In addition to blocking passage to upstream habitat, construction of the Hells Canyon Project contributed to a reduction in the supply of spawning-sized gravels and finer sediments that are associated with fall Chinook rearing habitat downstream of Hells Canyon dam. Other project effects that may have contributed to the decline of fall Chinook salmon include the effects of ramping associated with load following operations on food production and fish stranding, low DO and high water temperatures during the start of the fall Chinook spawning season, and gas supersaturation when spill occurs.

Beneficial effects of the project on fall Chinook salmon include: (1) stable streamflows during the spawning season and sufficient flows to prevent dewatering of redds during the incubation season; (2) a warmer incubation environment in the Hells Canyon reach than existed pre-project; (3) cooler water temperatures during the spring and summer juvenile outmigration season; and (4) flow augmentation water releases from Brownlee reservoir to expedite juvenile fish migration. Other factors that have likely contributed to a recent increase in the number of fall Chinook salmon returning to the project area include: (1) the acclimation and release of a substantial number of yearling and subyearling fall Chinook salmon at three sites upstream of Lower Granite dam (see section 3.8.1.1, *Fall Chinook Salmon*); (2) augmentation of river flows during the spring and summer juvenile migration season using storage from Brownlee and Dworshak reservoirs, and from BOR storage reservoirs in the upper Snake River basin;

(3) measures implemented to improve migration survival of juvenile anadromous fish migrating through the lower Columbia River; and (4) favorable ocean conditions.

In addition to their role in extirpating anadromous fish runs upstream of Swan Falls dam, Idaho Power's mid-Snake projects likely contribute a slight increase in the warming of water passing through the project reservoirs and may increase the nutrient load that is delivered to downstream areas during algae blooms. However, the licenses for the Upper Salmon Falls, Lower Salmon Falls, and Bliss projects require Idaho Power to remove and dispose of aquatic vegetation that gathers at the project intakes, which removes nutrients from the river. These ongoing effects will likely play some role during the time that will be required before the mainstem habitat upstream of the project is capable of supporting the spawning, incubation, and rearing of fall Chinook salmon.

The upstream Idaho Power projects can potentially affect the success of any future fall Chinook restoration efforts through blocked fish passage, inundated river reaches, flow fluctuations associated with load-following, entrainment and turbine mortality, and reduced flows in bypassed reaches. Restoration of anadromous fish upstream of the Hells Canyon Project is not constrained by license conditions at the upstream projects. As part of future anadromous fish restoration efforts in the upper Snake River basin, however, additional measures may be required at the Idaho Power projects downstream of Shoshone Falls. It is premature to evaluate measures at those projects at this time given the uncertainty of the timing of restoration efforts. The Commission retains sufficient authority in those licenses to incrementally deal with those issues at the proper time.

It seems reasonable to expect that measures to improve survival through the downstream migratory corridor would continue to be developed, and TMDL implementation is likely to result in gradual improvements in water quality conditions over coming decades. Conversely, continuation of the current climate warming trend has the potential to reduce the amount of rearing habitat that is suitable to support salmonid species and to adversely affect survival rates in the migratory corridor.

Under any of the action alternatives, access to historical fall Chinook spawning habitat upstream of Hells Canyon dam would continue to be blocked for at least the near future. Under the Staff Alternative, the potential for restoration of access to upstream habitat would be monitored, and if conditions warrant, the question of whether to provide passage to this habitat would be addressed through a license amendment.

Under any of the action alternatives, TDG levels are expected to exceed state standards when spills at the project exceed approximately 30,000 cfs, which may cause injury or death to rearing fall Chinook salmon. However, installation of spillway flow deflectors at Hells Canyon dam and Brownlee dam and implementation of other measures at Oxbow dam as proposed in Idaho Power's application for water quality certification, would reduce the project's contribution to high TDG levels under most flow conditions. The water quality certification application outlines other measures to reduce the project's contribution to cumulative effects on fall Chinook salmon, including measures to increase DO levels and reduce water temperatures during the first several weeks of the fall Chinook spawning season.

3.8.3.2 Snake River Steelhead and Spring/Summer Chinook Salmon

Snake River steelhead and spring/summer Chinook salmon have been affected by many of the same cumulative factors as fall Chinook salmon. Because they use smaller tributary streams for spawning, habitat for these species has been more directly impacted by tributary development, especially from streamflow reductions and passage obstacles associated with irrigation diversions. Recent increases in adult returns of these species, though not as pronounced as those observed for fall Chinook salmon, are likely attributable to many of the same factors, except that these species do not benefit from controlled spawning and incubation flows downstream of Hells Canyon dam. Future effects of changes in water quality, water temperature, and conditions in the migratory corridor will likely be similar to those described for fall Chinook salmon.

Under any of the action alternatives, access to historical steelhead and spring/summer Chinook spawning and rearing habitat upstream of Hells Canyon dam would continue to be blocked for at least the near future, except that surplus adult steelhead, when they are available, may continue to be released into Hells Canyon reservoir to support recreational fisheries and to increase forage opportunities for bull trout, and this program may be expanded to include surplus spring Chinook salmon, and stocking of surplus hatchery fish of both species[92] in the Owyhee and Malheur rivers to support tribal ceremonial and subsistence fisheries. Under the Staff Alternative, the potential for restoration of access to upstream habitat would be monitored, and if conditions warrant, the question of whether to provide passage to this habitat would be addressed through a license amendment.

Under any of the action alternatives, TDG levels are expected to exceed state standards when spills at the project exceed approximately 30,000 cfs, which can cause levels to exceed state standards far enough downstream to adversely affect migrating juvenile and adult steelhead and spring/summer Chinook salmon produced in the Imnaha and Salmon River basins. However, installation of spillway flow deflectors at Hells Canyon dam and at Brownlee dam, as well as other measures at Oxbow dam, as proposed by Idaho Power, would reduce the project's contribution to high TDG levels under most spill conditions.

3.8.3.3 Snake River Sockeye Salmon

Snake River sockeye salmon have been affected by many of the same cumulative factors as the other anadromous salmonids. However, this species historically occurred only in Payette Lake and in several lakes and their tributaries in the Stanley Lakes area of the upper Salmon River basin. Construction of dams and diversions on the Payette River extirpated the species from Payette Lake prior to construction of the Hells Canyon Project.

Under any of the action alternatives, access to historical spawning habitat upstream of Hells Canyon dam would continue to be blocked for the term of the next license. TDG levels may also exceed state standards as far downstream as the Salmon River when spills at the project exceed approximately 30,000 cfs, which may adversely affect migrating juvenile sockeye salmon as they emigrate from the Salmon River basin. However, installation of spillway flow deflectors at Hells Canyon dam and Brownlee dam and implementation of other measures at Oxbow dam, as proposed by Idaho Power, would reduce the project's contribution to high TDG levels under most spill conditions. The project also acts to delay the cooling of water temperatures in the fall, which contributes to a cumulative increase in water temperatures that may adversely affect adult sockeye salmon migrating through the lower Snake River as they return to the Salmon River.

3.8.3.4 Other Columbia River Basin Salmon and Steelhead ESUs

Because the project acts to delay the cooling of water temperatures in the fall, the Project may contribute to a cumulative increase in water temperatures in the Lower Columbia River that could adversely affect adult fall Chinook salmon, but is unlikely to affect the spring migrating spring/summer Chinook salmon and steelhead ESUs. However, given the long distance between Hells Canyon dam and the confluence of the Snake and Columbia Rivers over which temperatures can equilibrate with ambient conditions, and the relatively small volume of flow that is contributed from the Snake River upstream of Hells Canyon dam, we conclude that the cumulative effect of the project on water temperatures in the Lower Columbia River is likely to be insignificant. However, as we discuss in section 3.8.2.5, flood control operations at Brownlee reservoir, when combined with flood control operations at other reservoirs in the basin, contribute to a substantive overall reduction in the spring flow freshet, which may have both positive and negative effects on conditions in the Lower Columbia River migratory corridor. Maintaining

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[92] Hatchery stocks of both species are not federally listed.

Brownlee reservoir levels within a foot or less of the Corps flood control rule curves would help to minimize adverse effects. Also, continued participation in the regional flow augmentation program would help to reduce the project's contribution to cumulative adverse effects.

3.8.3.5 Bull Trout

Bull trout in the project area have been affected by many of the same cumulative factors as the anadromous salmonid species. Because they use smaller tributary streams for spawning and rearing, habitat for these species has been more directly impacted by tributary development, especially from streamflow reductions and passage obstacles associated with irrigation diversions. In addition, because the species prefers very cold water, land use practices that contribute to increased water temperatures have restricted the amount of habitat that is suitable for the species, and the introduction of brook trout has resulted in extensive competition and hybridization.

Because the project reservoirs impede migration between tributaries and the dams block upstream migration, the project contributes to a cumulative loss of connectivity among the remaining tributary bull trout populations. Under Idaho Power's proposal, upstream connectivity over Hells Canyon dam would be restored, and installation of a permanent monitoring weir at Pine Creek would allow outmigrating bull trout to be transported past Hells Canyon dam without being exposed to the risk of turbine mortality. A second phase, which would occur at least 5 years later, would involve construction of a trap at Oxbow dam to provide upstream passage into the Wildhorse River. Interior's preliminary prescription and Idaho Power's alternative prescription, as well as Interior's modified prescription, would increase connectivity between bull trout populations in the Pine-Indian-Wildhorse core area. All of these proposals would help to compensate for cumulative impacts on bull trout.

Under any of the action alternatives, access to forage opportunities provided by anadromous fish would continue to be blocked for at least the near future, except that surplus adult fish, when they are available, may continue to be released into Hells Canyon reservoir to support recreational fisheries and to increase forage opportunities for bull trout. The reduction in forage opportunities would also be compensated for, to some extent, by distributing spawned salmon carcasses in Pine and Indian Creeks and in the Wildhorse River. The habitat enhancement measures proposed by Idaho Power for the Pine, Indian and Wildhorse basins, and recommended by other stakeholders in several additional basins, would help to address adverse cumulative effects on habitat conditions in these basins.

Under any of the action alternatives, TDG levels are expected to exceed state standards when spills at the project exceed approximately 30,000 cfs, which has the potential to cause injury to bull trout that migrate from tributaries into the Snake River downstream of Hells Canyon dam. However, installation of spillway flow deflectors at Hells Canyon dam and at Brownlee dam, as well as implementing measures at Oxbow dam, as proposed by Idaho Power, would reduce the project's contribution to high TDG levels under most spill conditions.

The Hells Canyon Project contributes to the occurrence of elevated water temperatures in the late summer and early fall, and to low DO levels in the first 7 to 10 miles downstream from Hells Canyon dam, which may adversely affect habitat conditions for bull trout. However, radio telemetry studies conducted by the applicant (Chandler et al., 2003a) indicate most bull trout move into tributaries prior to the onset of project-related increases in water temperature, and those that remain in the mainstem river appear to seek out thermal refugia near the confluence of tributaries, most of which are downstream of the section where the DO deficit occurs. In addition, measures proposed by Idaho Power in its application for water quality certification would improve DO levels within, and downstream of, the project, reducing the project's contribution to low DO levels downstream of Hells Canyon dam. During the spring and summer months, delayed warming caused by the project likely improves habitat conditions for bull trout downstream of Hells Canyon dam.

3.8.3.6 MacFarlane's Four-o'clock

Participants in scoping identified MacFarlane's four-o'clock as a resource that could be cumulatively affected by relicensing the Hells Canyon Project. MacFarlane's four-o'clock occurs at low elevations (i.e., 1,000 to 3,000 feet), and it is possible that populations have been inundated as a result of dam construction along the Snake River and its tributaries since 1904. Mining, road construction, and livestock grazing may also have affected MacFarlane's four-o'clock populations in the past. FWS indicates that threats to existing populations include invasive weeds, landslides and flood damage, herbicide and pesticide spraying, and recreational activity such as OHV use, trail construction and maintenance, and hiking, as well as continued livestock grazing (FWS, 2000).

Under current conditions, BLM and the Forest Service manage occupied MacFarlane's four-o'clock sites to prevent ground disturbance, including grazing. Management of these sites should be effective in making progress toward the recovery goal of a minimum of 11 secure populations with stable or increasing population trends for at least 15 consecutive years. Implementation of protective measures (e.g., focused surveys, with monitoring and management, as indicated) on lands within Idaho Power's ownership would help ensure that relicensing the Hells Canyon Project does not contribute to cumulative adverse effects on MacFarlane's four-o'clock.

3.8.3.7 Bald Eagle

Several factors have contributed to cumulative effects on bald eagles in the Snake River basin since the late 1800s and early 1900s. These include placer mining; livestock grazing; agriculture; and urban, residential, industrial, and commercial development, as well hydropower development and operation. Several of these land uses continue to cumulatively affect bald eagle habitat and prey.

Almost 23 million acres of land in Idaho are considered rangeland (Pease, 1993); BLM alone administers permits on about 11.6 million acres of public land in the state (BLM, 2007). Overgrazing on public and private rangeland since the turn of the last century has reduced the cover of native riparian vegetation, including cottonwoods that could provide eagle nest or perch trees, and reduced habitat quality for fish that could provide forage for bald eagles.

As of 2000, USGS estimated that approximately 3.75 million acres of land were irrigated to support agriculture in Idaho (Hutson et al., 2004). Water diversions for irrigated agriculture reduce natural streamflows and may impair cottonwood regeneration, thus reducing the availability of nest and perch trees for bald eagles. Water diversions may also impede fish passage and reduce fish abundance, thus reducing the availability of prey.

Irrigation return flows and run-off also adversely affect bald eagles through their impacts on water quality. Warmer temperatures, lower DO, and excess nutrients can adversely affect fish populations and reduce the forage supply for eagles. Contaminants such as organochlorines and metals accumulate in the bottom sediments of lakes and reservoirs, and can be transferred up the food chain where they may adversely affect behavior, reproduction, and survival. Aerial and ground applications of pesticides also introduce contaminants into the food chain.

Human populations in southern Idaho are growing rapidly; Idaho was the nation's third fastest-growing state between 2004 and 2005 (ICL, 2005), and this trend is likely to continue. Urban and rural development often encroaches into riparian habitats, reducing habitat availability for bald eagles as well as contributing pollutants, nutrients, and sediment that reduce water quality, which in turn affects the eagle prey base.

Development and operation of hydropower facilities in Idaho has resulted in both positive and negative effects on bald eagles. Many reservoirs support large resident fish populations, providing an accessible, year-round prey base for bald eagles. However, dams (including the Hells Canyon Project) also have inundated riparian forests, blocked anadromous fish runs, altered geomorphology and natural hydrographs that supported native fish populations, and allowed the accumulation of contaminants in sediments trapped behind the dams.

Despite cumulative adverse impacts, trends in bald eagle populations in the Snake River basin are positive. As discussed in section 3.8.2.12, the number of nests in the Hells Canyon Project area has increased dramatically since 1998, reflecting increases throughout the U.S. since enactment of the ESA and restrictions on the use of DDT. In 2006, bald eagles occupied 83 territories along the Snake River in Idaho (including bald eagle management zones 16, 18 and 20) upstream of Hells Canyon (Sallabanks, 2006), up from 51 in 1998 (Beals and Melquist, 1998). The BOR's Biological Assessment provides detailed information about bald eagle territories and nesting success along the Snake River and major tributaries from the Wyoming border to the Columbia River, reporting positive trends at BOR reservoirs and associated riverine reaches between 1995 and 2003 (BOR, 2004).

Some future actions that may be implemented by federal, tribal, state, or private entities would also benefit bald eagles. For example, the upper mid-Snake and Snake Hells Canyon Subbasin plans identify specific recommendations for improving wetland and riparian habitats, forests, and habitat conditions for anadromous and resident fish (Nez Perce and Ecovista, 2004). BPA and BOR fund numerous watershed improvement projects (e.g., removal of barriers to fish passage, installation of fish screens to prevent diversion of fish into irrigation canals, and restoration of riparian habitat) in the Snake River basin both upstream and downstream of the project that could also lead indirectly to benefits for bald eagles.

Under any of the project alternatives, the Hells Canyon Project would continue to allow the accumulation of sediments behind Brownlee dam, thus allowing continued bioaccumulation of contaminants and mercury that could adversely affect bald eagles. The project would continue to block upstream migration of anadromous fish. However, as discussed in section 3.5.2, *Water Quality*, implementation of TMDLs could improve the quality of the prey base for bald eagles over time, and implementation of an anadromous fish restoration plan could provide additional forage opportunities in the future.

Under any of the action alternatives, Idaho Power would implement measures that would directly benefit bald eagles during any new license period (e.g., BMPs to protect riparian habitat and minimize disturbance near nest sites), and contribute to positive cumulative effects in the region. Idaho Power would also implement measures that would indirectly benefit bald eagles by enhancing fish populations. These measures include improving tributary habitat for resident salmonids; replenishing sandbars and reducing ramping rates downstream of Hells Canyon dam to improve habitat for anadromous salmonids; implementing watershed measures or installing a Brownlee upwelling system to improve water quality; and limiting reservoir drawdown to improve spawning conditions for warmwater fish.

3.8.4 Unavoidable Adverse Effects

We identified no unavoidable adverse effects on threatened or endangered plants or wildlife species, but we identified several unavoidable adverse effects on listed fish species. The project reservoirs would continue to inundate historical anadromous fish habitat and bull trout migratory corridors, and would be likely to impede passage of bull trout, salmon, and steelhead to some extent even if state-of-the-art fish passage facilities were constructed. The suitability of bull trout habitat in Brownlee reservoir will continue to be adversely affected by low DO levels. Although we have found no direct evidence of turbine mortality, it is possible that some bull trout may be entrained into the project intake and may suffer mortality during turbine passage. Salmon, steelhead and bull trout will also continue to be adversely affected by gas supersaturation when spills exceed approximately 30,000 cfs. Altered water temperatures downstream of the project during the fall months would continue to adversely affect fall Chinook spawning and bull trout rearing habitat, but would improve conditions for the rearing lifestages of both species by lowering water temperatures during the summer months. Cooler than optimal spring temperatures would continue to provide a less favorable environment for fall Chinook salmon fry during the early rearing lifestage.

3.9 CULTURAL RESOURCES

3.9.1 Affected Environment

3.9.1.1 Area of Potential Effect

Section 106 of the National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended (section 106), requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register prior to an undertaking. An undertaking means a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. In this case, the undertaking is the proposed issuance of a new license for the project. Potential effects that may be associated with this undertaking include any project-related effects associated with the day-to-day O&M of the project after issuance of a new license.

Historic properties are cultural resources listed or eligible for listing in the National Register. Historic properties represent things, structures, places, or archeological sites that can be either Native American or European-American in origin. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register. Cultural resources also have to have enough internal contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archeological sites may not have enough contextual integrity to be considered eligible.

Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Officer (SHPO) on any finding involving effects or no effects on historic properties, and allow the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

Section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to resources in areas under the Commission's licensing jurisdiction. Indian tribes hold certain rights and privileges reserved under treaty, statute, and executive order. Courts have recognized the origins of certain treaty rights as being "reserved" by tribes from land cessions made by tribes to the United States, rather than as rights "granted" to tribes by the United States. Indian reserved rights continue to be exercised by tribes and their members today under tribal regulation, and remain enforceable under the supremacy clause of the Constitution until extinguished by express Congressional action.

The concept of a federal trust responsibility comes from early Supreme Court decisions that sought to interpret Indian treaties and to determine the relationship among Indian tribes, Indian property rights, and the federal government. These early cases determined that Indian tribes occupy a unique position as "domestic dependent nations"; that is, they are sovereign entities with authority to prohibit state intrusions but with a "ward-guardian" relationship with the federal government. The tribes trusted the federal government to fulfill its promises, and the government has thereby incurred a duty to protect the best interests of the tribes.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by a proposed new license within the project's area of potential effects (APE). The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. In this case, the APE for the project includes lands within the FERC project boundary as it is delineated in the current FERC license, plus lands outside the project boundary where project operations may affect the character or use of historic properties and/or TCPs.

As delineated by Idaho Power, the APE encompasses the likely extent of project operations and project-related environmental measures that could be undertaken during the term of the new license. The reservoir section of the APE includes both sides of the Brownlee, Oxbow, and Hells Canyon reservoirs from the drawdown zone to a line 0.1 mile upslope from the high-pool level. The APE for the reservoir section extends from the upstream margin of Brownlee reservoir (RM 343) to Hells Canyon dam (RM 247.0). The riverine section of the APE includes both sides of the free-flowing Snake River from the shoreline to 100 meters (328 feet) inland. The APE for the riverine section extends from Hells Canyon dam (RM 247.0) downstream to the mouth of the Salmon River (RM 188.2). The transmission line section of the APE encompasses the Pine Creek-Hells Canyon 69-kV line (Line 945) extending from the Oxbow switchyard to the Pine Creek substation and to the Hells Canyon substation, a distance of 22 miles. The right-of-way for the line is 50 feet wide.

3.9.1.2 Cultural History Overview

The Hells Canyon area is an area of both physiographic and cultural transition. Physiographically, the area marks an intersection of the Columbia Plateau and Great Basin provinces, and of the plant and animal communities commonly associated with those provinces. This diversity of natural resources attracted Native populations associated with both regions: Sahaptin-speaking Plateau cultures, such as the Nez Perce, Umatilla, Cayuse and Palouse; and Numic-speaking Great Basin cultures (Northern and Western Shoshone, Bannock, and Northern Paiute). The linguistic separation of Plateau and Great Basin peoples was reflected in ethnohistoric cultural differences in subsistence practices arising from environmental differences.

Archaeologists have proposed a number of cultural chronologies (e.g. Lower Snake, Developmental, Great Basin) based on radiocarbon dates; changes in artifact assemblages, traits and styles; and changes in site types that have applicability to the Hells Canyon area. Although the chronologies differ in terms of how each divides the period from about 11,000 years before present (BP) to the present, taken together they offer a useful approach to interpreting evidence from the past. All propose first occupation by small, highly mobile groups who primarily hunted large game, with lesser exploitation of smaller animals and plants. By about 8000 BP, a shift in settlement and subsistence was in process, in which Native populations made greater use of regionally variable, locally available plant and animal resources to diversify their subsistence, including increased use of roots, river mussels and salmon. Evidence of bulk food processing and storage, construction of house pits along the Snake River (suggesting winter occupation), and growing reliance on salmon and other fish point to a semi-sedentary foraging strategy among Native populations in the area beginning about 4200 BP. Important developments beginning about 1,000 years ago included establishment of large, permanent villages and introduction of the bow and arrow and pottery. Introduction of the horse and European-American goods followed, which augmented and partly replaced aboriginal goods beginning about 250 years ago. Adoption of the horse led to changes in economic and social organization to accommodate use of much wider foraging ranges and trade networks, and in some areas also to raiding, warfare and territorial displacement.

The first contact between Native Americans and European-Americans occurred in the region around A.D. 1750, but the effects of European disease, introduction of the horse, and trade goods arrived much earlier, possibly as early as A.D. 1600. Horses not only changed subsistence and trade patterns but likely caused shifts in social organization as a result of political alliances created with neighboring groups. By the time of first contact with European-Americans, Shoshone and Northern Paiute groups from the south and the Nez Perce from the north appear to have had access to or claimed some territorial prerogative over the general Hells Canyon area.

The mass European-American migrations into Oregon via the Snake River Plain in the 1840s (see below) bypassed Hells Canyon. Native resistance to European-American intrusion, however, led to U.S. military intervention and ultimately negotiation of treaties with the region's tribes. Plateau tribes relinquished most of their traditional lands in two treaties signed in 1855. One treaty established the Warm Springs reservation in north-central Oregon for the Warm Springs and Wasco tribes. The other established two reservations: one in northeastern Oregon for the Umatilla, Cayuse and Palouse, the other, including land in southeastern Washington, northeastern Oregon, and western Idaho, for the Nez Perce. The latter reservation extended south to encompass Hells Canyon and up the Snake River to just below the present location of Brownlee dam.[93] Tribal resistance to continued European-American encroachment, however, was substantial and ongoing for several decades. It was manifested in the numerous irregular conflicts of 1866–1868 known as the "Snake Wars," and in the Nez Perce (1877), Bannock (1878) and Sheepeater (1879) "wars" thereafter. In the course of these conflicts, reservations were established for the Shoshone-Bannock Tribes at Fort Hall in 1868, and for the Shoshone-Paiute Tribes at Duck Valley, Idaho in 1877. Although the Malheur reservation was established for Northern Paiutes in southeastern Oregon in 1874, the U.S. government subsequently designated it public domain and opened it to white settlement in 1883. Land farther north and west was acquired for the Northern Paiutes in 1934, but was not formally established as the Burns reservation until 1972.

Although European Americans explored the project area from the 1810s into the 1830s, it was not until the Oregon Trail was well established, by the early 1840s, that white settlers first appeared in great numbers. Thousands of emigrants brought wagons, cattle, and other stock across the Snake River on the Oregon Trail between c. 1840 and c. 1870. The emigrant trains often stopped for a time at former Indian camps, taking advantage of nearby grass, wood, and other natural resources. During the 1850s thousands of pioneers passed through southern Idaho, but few stayed in the region. It was the discovery of gold in southwestern Idaho in the 1860s that brought settlement to the area. People congregated near the mines and several boomtowns were established, including Centerville, Ruby City, Silver City, and Weiser. Miners dug numerous mines into the canyon walls and mountains of the Hells Canyon area.

The discovery of gold also was the stimulus to find a practical way to travel through Hells Canyon. Attempts with steamships and railroads failed to locate a suitable route. Ore was shipped over the mountains. Boats run by local operators did serve small ranching and mining operations and made it possible for settlements at Schoolman Gulch and Squaw Creek along with mines at Leep, Kinney, and Kirby. Towns were rare along the Snake River in the Hells Canyon area. Copperfield, Oregon was settled in the 1870s and Homestead was established with the opening of a post office in 1898.

The growth of regional mining communities spurred establishment of ranches and farms, initially at river crossings near mining operations. As settlers claimed public lands along the creeks and rivers, they established gardens and small ranching enterprises, raising produce and livestock for the mining "market." With the opening of the 1870s, intensive use of natural resources occurred in the Hells Canyon area and greatly accelerated landscape change. As the mining industry reached its peak, the European-American population swelled, augmented in the 1880s by Chinese immigrants seeking abandoned placer mines to rework. Road, railroad, and river transportation networks developed to serve the expanding population and industries, while a number of area mines evolved into major commercial and industrial operations with the introduction of new mining methods and technology; all of these developments altered the landscape, vegetation, and wildlife. Natural water sources were exploited not only for mining but also for livestock and, to an increasing degree by the late nineteenth century, for irrigating crops.

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[93] The Nez Perce were forced to relinquish much of their 1855 reservation in 1863, as a result of which the Hells Canyon area became part of the public domain.

Economic conditions remained strong for most Hells Canyon resource-based communities into the 20th century, as markets were enhanced at the beginning of World War I.

The postwar agricultural depression, coupled with the larger Great Depression of the 1920s and 1930s, saw a decline in the area's farming, ranching, and even mining communities, the latter as a result of low prices for copper and gypsum. Semi-subsistence placer mining and farming supported those residents who remained in the Hells Canyon area. After World War II, farm consolidation and increased mechanization led to larger farm sizes and a shrinking agrarian labor force, although ranching experienced something of a boom. Mining remained a part of the local economy, but was characterized chiefly by small-scale placer and dredging operations.

The first hydroelectric project in the Hells Canyon area was begun in 1908 at the "Ox Bow" on the Snake River. It operated for only a few years, and the business failed by 1913. In 1947, Idaho Power filed an application with the Federal Power Commission to build three new hydroelectric developments on the Snake River at and near Hells Canyon; this application overlapped in time with efforts by both the BOR and the Corps to build a single, high dam in Hells Canyon, and there was a great deal of controversy over which, if any, project to build. The Federal Power Commission issued a license for Idaho Power's proposed project in 1955, although three more years passed before Congress defeated the last of several bills calling for a single, high, government-owned dam. Idaho Power completed the Brownlee development in 1957 to 1958, Oxbow in 1961, and Hells Canyon in 1967.

3.9.1.3 Previous Cultural Resource Investigations

Almost forty different archaeological investigations have taken place in the Hells Canyon area since 1950 (Chatters et al., 2001b). They generally fall into three periods: reservoir surveys by the Corps of Engineers and Idaho Power in the 1950s and 1960s, inventory surveys by the Forest Service and for the HCNRA in the 1970s and 1980s, and Idaho Power's relicensing surveys in the 1990s. Survey results from the first two periods contributed toward the listing of four Hells Canyon area archaeological districts in the National Register between 1976 and 1986. The Snake River Archaeological District (listed l976) is located in Washington from China Gardens on the Snake River down to Asotin. That district, along with the Nez Perce Snake River Archaeological District (listed 1978) on the Idaho side of the river, were based on investigations conducted for the Corps' proposed Asotin reservoir. The Lower Salmon Archaeological District, extending along that river from Hammer Creek to the Snake River, was listed in 1986. The Hells Canyon Archaeological District, listed in 1984, extends along both sides of the Snake River from Hells Canyon dam to just below Cougar Rapids, its boundaries coinciding with that of the Wild and Scenic Rivers unit of the HCNRA. This district, much of which lies within the Hells Canyon Project's APE, encompasses 152 historic period sites (most mining-related) and 384 prehistoric sites comprising rock shelters, open sites, and other sites containing a mix of rock shelters, house pits, and other features.

Rock images in the Hells Canyon area have been the focus of a variety of studies, all but one undertaken since the middle 1960s. The first systematic corridor survey, however, did not occur until the late 1980s, when 177 rock art sites were documented between RMs 176 and 247. Idaho Power's archaeological surveys downstream of Hells Canyon dam in the 1990s (described in the following section) recorded numerous additional rock images associated with sites containing other manifestations of the Native American presence in the area.

3.9.1.4 Prehistoric and Historic Archeological Resources

The reservoir APE of the Hells Canyon Project and the Pine Creek-Hells Canyon 69-kV line APE contain no archaeological sites listed in the National Register. The riverine APE contains one historic district (the Hells Canyon Archaeological District) and one site (10IH538) listed in the National Register. As originally documented, the Hells Canyon Archaeological District contains 384 prehistoric and 152 historic sites. The prehistoric sites include open sites, rockshelters, and sites with a combination of rockshelters, housepits, and other features. The historic sites include mining placers, lode-mining properties, agricultural properties, and ranching properties. Site 10IH538 (Idaho Power-RR0109) consists of the remains of a historic homestead at Bernard Creek.

Idaho Power completed four archaeological surveys in association with the new license application for the Hells Canyon Project. In consultation with the Idaho and Oregon SHPOs, federal and state agencies, and other interested parties, Idaho Power conducted an intensive archaeological survey of the APE of the Brownlee reservoir drawdown zone in 1997 and the reservoir margin in 2000 (Mauser et al., 2001). The drawdown zone survey employed parallel transects at 5- to 20-meter intervals on river terraces and bars that were not silt-covered, and also included a thorough examination of cutbanks, mouths of drainages, and low terraces where possible. The reservoir margin survey used parallel transects at 15-meter intervals except in locations where slopes were greater than 30 percent. These two survey phases covered approximately 3,695 acres.

Also, in 1997, Idaho Power conducted an intensive archaeological survey of the APE for the Pine Creek-Hells Canyon 69-kV line (Mauser, 1997). The survey, which employed a single 10-meter interval transect in non-disturbed areas where slopes were less than 30 percent, covered approximately 128 acres.

The third intensive archaeological survey, from 1998 through 2000, was of the APE for the riverine section between Hells Canyon dam and the Salmon River (Druss and Gross, 2001). The survey, using parallel transects at 15-meter intervals except in locations where slopes were greater than 30 percent covered approximately 7.3 square miles.

In 1999 and 2000, Idaho Power conducted an intensive archaeological survey of the APE of the Oxbow and Hells Canyon reservoirs (Gross, 2001). This survey, employing parallel transects at 15-meter intervals except in locations where slopes were greater than 30 percent covered approximately 2,368 acres.

Idaho Power included the reports from all its cultural resources surveys as confidential technical appendices to its draft and final license applications. By letter dated June 26, 2003, Idaho Power filed its National Register eligibility determinations, which it made in consideration of comments on the draft license application received from the Idaho SHPO, the former Idaho State Archaeologists, and from BLM.[94]

The archaeological survey associated with the Pine Creek-Hells Canyon 69-kV line (Mauser, 1997) identified two sites. Site 10AM 1 is a prehistoric campsite and historic farm with two graves. Site 10AM 77 is a prehistoric lithic scatter. Idaho Power's June 26, 2003 eligibility determination lists both of these archaeological sites as eligible for inclusion in the National Register, following consideration of comments from the Idaho SHPO and BLM on the draft license application.

The Brownlee reservoir drawdown zone and margin surveys (Mauser et al., 2001) recorded 56 prehistoric, 31 historic, and 10 dual component sites; among these numbers were 20 isolates, all but two prehistoric. The prehistoric sites include lithic scatters, midden deposits, and a quarry area with shell, bone, fire modified rock (FMR), lithics, and ceramics. They also include prehistoric material recorded in historic sites, and special purpose sites such as talus pits, cairns, and other rock features. Sites were classified into types based on the numbers of material classes (lithics, ground stone, ceramics, shell, bone, and presence/absence of FMR). Complex or base camps were defined as having three or more material classes; temporary camps had FMR alone, and simple lithic scatters consisted only of lithics. The surveys noted artifacts that include chipped, battered, and ground stone objects, with projectile points, bifaces,

[94] Although the archaeological survey reports evaluated some sites as "potentially eligible" rather than "eligible," Idaho Power proposes to treat all "potentially eligible" sites as eligible for management purposes, unless and until determined otherwise through further field investigation.

cores, and flaked cobbles, though flakes are the most common artifact type. The survey recorded ceramics, found at one site, as Shoshone ware. Using projectile point styles and late period ceramics, the archaeologists could date 15 of the recorded sites. Of the sites with datable projectile points, all but two were between 3300 and 700 years old (variously exhibiting Columbia Corner-Notched, Columbia Side-Notched, Elko Corner-Notched, Rosespring, Cascade, Northern Side-Notched, and Elko styles. Sites that the archaeologists were unable to date included talus pit sites, isolated cairns, rock alignments, and rock enclosures.

Historic archaeological sites, or components of sites, recorded in the Brownlee reservoir APE include railroad stops, railroad features, roads, townsites, a cemetery, a railroad camp, a cabin, a historic rock alignment, and a historic irrigation ditch as well as debris scatters, dumps, and building foundations. All historic archaeological sites are associated with Euro-Asian settlement in the region. The oldest sites date to the 1880s.

Idaho Power's June 26, 2003, eligibility determination lists 42 of the 70 prehistoric and historic archaeological sites identified in the Brownlee reservoir area of the APE as eligible for inclusion in the National Register.

The Oxbow reservoir survey (Gross, 2001) identified 4 prehistoric sites, 2 dual component sites and 2 isolates. The prehistoric sites consist of lithic scatters. They also include prehistoric material recorded in historic sites. Artifacts noted include a possible projectile point, bifaces, and cores, though flakes are the most common artifact type. No datable artifacts were recorded. The projectile point cannot be definitively dated.

Historic archaeological components of sites recorded in the APE include a homestead and a debris scatter. Amethyst bottle glass from the debris scatter indicates an 1880s to 1915 date for the historic component of this site. No datable artifacts are recorded at the other site. No cultural affiliation was determined for either site.

Idaho Power's June 26, 2003, eligibility determination lists 5 of the 6 archaeological sites identified in the Oxbow reservoir area of the APE as eligible for inclusion in the National Register.

The Hells Canyon reservoir survey (Gross, 2001) identified 6 prehistoric sites, 3 historic period sites, and 1 dual component site, plus 7 isolates. The prehistoric sites consist of lithic scatters and rockshelters with pictographs. They also include prehistoric material recorded in historic sites. Artifacts noted include bifaces, a uniface, a used flake, and a modified flake, with flakes as the most common artifact type. No datable artifacts were recorded.

Historic archaeological sites, and historic components of sites, recorded in the APE include homesteads and a townsite as well as debris scatters and dumps. "Straw"-colored glass and milk cans at one site indicate a 1908 to 1913 date for the historic component of one homestead site. No datable artifacts were recorded at the other sites. No cultural affiliation was determined for any site.

Idaho Power's June 26, 2003, eligibility determination lists 10 of the 11 prehistoric and historic archaeological sites identified in the Brownlee reservoir area of the APE as eligible for inclusion in the National Register.

In the survey of the riverine section, archaeologists both re-located or revisited previously recorded sites, primarily in the Hells Canyon Archaeological District, and recorded heretofore unknown sites. The combined efforts of two archaeological consulting firms resulted in documentation of 856 sites (Druss and Gross, 2001).[95] The prehistoric sites include lithic scatters, habitation sites, lithic procurement

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[95] Of 446 sites recorded on the Oregon side of the river, 336 have Native American components, according to the survey report by Rain Shadow Research. The archaeological report by Applied

sites, rockshelters, rock art (petroglyphs), house pit complexes, and quarry areas with lithics, shell, bone, and fire cracked rock (FCR). They also included prehistoric material recorded in historic sites, and special purpose sites such as talus pits, cairns, and other rock features. Artifacts that were noted include chipped, battered, and ground stone objects, with projectile points, bifaces, and cores. Lithic debitage (flakes) is the most common artifact type.

Using projectile point styles, dates are known for 52 (15 percent) of the sites surveyed by Rain Shadow Research archaeologists. Of the sites with datable projectile points, the six oldest locations are from the Cascade phase (which is 8500–4000 years old). However, the Harder through Numipu phases (from 2500 to 150 years old) are the most common, represented at 26 (50 percent) of the datable sites. Applied Paleoscience archaeologists found similar trends, with most sites from late in the prehistoric period; they could date only 31 (10 percent) of their prehistoric sites. Harder through Numipu phases are present at 10 sites, 10 sites are identified as Harder Phase indeterminate, 6 sites as Early Harder phase, and 5 sites as Tucannon phase. The Tucannon phase points are the oldest at 4000 to 2000 years old.

Historic archaeological sites, or components of sites, recorded in the APE include ranches, farmsteads, placer mines, lode mines, dam construction features, graves, historic petroglyphs/pictographs, irrigation systems, and historic rock features as well as debris scatters, dumps, and building foundations. All historic archaeological sites are associated with European-American, European, or Chinese settlement in the region. The oldest sites date to the 1870s and1880s.

Idaho Power's June 26, 2003, eligibility determination lists 820 of the 868 sites inventoried in the riverine section as eligible for inclusion in the National Register. Most of these sites contain components that contribute to the significance of the Hells Canyon Archaeological District.

3.9.1.5 Historic Buildings and Structures

No buildings or structures in the Hells Canyon Project APE are listed in the National Register. Idaho Power conducted a reconnaissance-level survey of Brownlee, Oxbow, and Hells Canyon facilities and associated structures in 1999 (Gross, 2002). Project construction began in 1955 with Brownlee dam. Oxbow dam was completed in 1961 and the Hells Canyon dam was completed in 1967. The architectural reconnaissance inventory report described the various components of the project, including 129 structures distributed among 89 properties at the Brownlee, Oxbow, and Hells Canyon dams. The types of properties at Brownlee dam include operators' residences in Brownlee Village, station yard buildings, the Old Brownlee Trailer Court, McCormick Park, and Woodhead Park. Properties at Oxbow dam are located in six areas: the Oxbow Dam Village, Copperfield Park/trailer park fish hatchery, powerhouse and maintenance areas, Oxbow dam, and reservoir boat launches. Hells Canyon dam contains the dam, visitor's center, reservoir, and park.

The Idaho SHPO has determined that the three dams (Brownlee, Oxbow, and Hells Canyon) and their associated powerhouses are individually eligible for inclusion in the National Register (letter from K.C. Reid, State Archaeologist and Deputy SHPO, and S. Pengilly Neitzel, Compliance Coordinator and Deputy SHPO, Idaho State Historical Society, Boise, ID, to C. Jones, Hells Canyon Relicensing Project Manager, Idaho Power, Boise, ID, dated January 10, 2003). Additionally, three buildings at Brownlee and two buildings at Hells Canyon would be considered contributing elements to a potential Hells Canyon Complex historic district, as yet to be identified, that could include all buildings and structures associated with the project built prior to 1968. Although they were not included in the Idaho SHPO's list of eligible resources, Idaho Power considers two operators' cottages at Oxbow and a historic barn at Brownlee also eligible for the National Register (Druss and Gross, 2003).

Paleoscience does not provide equivalent information for the Idaho side of the river.

3.9.1.6 Traditional Cultural Properties, Sacred Sites, and Rock Art

Lands important to the Shoshone-Bannock Tribes, Shoshone-Paiute Tribes, Burns Paiute Tribe, the Confederated Tribes of the Warm Springs Reservation (Warm Springs Tribes), the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe are within the APE of the Hells Canyon Project. Idaho Power consulted with these tribes to identify issues related to tribal use of the area and sites of tribal importance. To this end, Idaho Power commissioned an anthropological literature review from an outside consultant (Myers, 2001) as well as separate oral history studies from each of the tribes (Druss, 2002).[96] The literature review concluded that there was little written ethnographic information specifically about Native occupation of the Hells Canyon Project area. Although none of the four oral history studies completed for the application discuss traditional cultural places in terms of National Register criteria or National Park Service guidelines for National Register evaluation of such resources, the studies provide information about types of natural resources and places that each of the tribes considers to be of cultural importance.

The Burns Paiute Tribe has traditionally used natural resources in the project area for gathering, hunting, fishing, and medicinal purposes. The tribe's oral history study offers a partial list of plants traditionally gathered by tribal members for food, "art and utility" (for baskets, mats, twine, duck decoys, cradleboards and dreamcatchers), and medicine. Tribal members seek redband trout in the Malheur River System and salmon on the Snake River. Year-round hunting provides food and also hides used to make clothing, saddles, and jewelry. The oral history does not identify specific locations of importance to the tribe, with the exception of Castle Rock, which the tribe has asked the Vale district of BLM to designate as an Area of Critical Concern

The Warm Springs Tribes' report includes a list of 41 plants ("cultural use items") recorded in the course of a 2000 field visit to the project and concurrent interviews with tribal members. The report indicates that "general" locations of "culture areas" (places of importance that the tribes define on the basis of activities that have taken place there) may be revealed only at the recommendation of the tribes' Cultural and Heritage Committee and with permission from the Tribal Council.

The report from the Umatilla Tribes identified 15 "areas" (primarily named according to river or tributary) in and in the vicinity of the project that the tribes consider TCPs by virtue of their connection to or association with traditional beliefs, customs and practices of importance to the people of the tribe. Within each area, the report lists native place names and activities and/or natural features associated with those locations.

The report from the Nez Perce Tribe offers a list of plants with cultural use that may occur in the Hells Canyon Project area. It also identifies 30 general and specific locations of camps, villages, and fishing areas associated with the Tribe's historical occupation and use of land and resources in the Hells Canyon area.

More than 200 of the archaeological sites contributing to the Hells Canyon Archaeological District feature rock art components, these being pecked, scratched or painted designs (and in a very small number of instances, written inscriptions of European-American origin) (Leo, 2001). Most are highly abstract, but a significant number feature representations of animals and anthromorphic figures. Anthropologists and ethnographers consider the spatial distribution, styles, and motifs of rock art such as those in the Hells Canyon area valuable sources of information about the distribution of ethnic groups in

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[96] Technical report appendix E4-13 presents results of the oral history studies conducted by the Warm Springs Tribes, Burns Paiute Tribe, and Confederated Tribes of the Umatilla Indian Reservation. The oral history study conducted by the Nez Perce Tribe and submitted to Idaho Power in 2005 was filed with the Commission in February 2007. According to Idaho Power, the Shoshone-Paiute Tribes and the Shoshone-Bannock Tribes declined to participate in the oral history study program.

the Canyon in the past. Anthropologists believe that the rock art was derived from and developed within shamanism, a basic aspect of the belief system among many hunting and gathering societies. As such, the geometric designs and pictographs may possess cultural and spiritual values for Native peoples as well as being of scientific interest.

3.9.2 Environmental Effects

3.9.2.1 Effects of Project Operations on Cultural Resources

We describe Idaho Power's Proposed Operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on natural landforms in *Beach and Terrace Erosion* in section 3.4.2.1, *Effects of Project Operations on Sediment Transport*. We assess the effects of the proposed operation on natural resources of concern to Native American tribes in *Game Species and Plants of Cultural Importance* in section 3.7.2.1, *Effects of Project Operations on Terrestrial Resources*.

In this section, we evaluate the effects of Idaho Power's Proposed Operations, and of operation-related recommendations received from agencies, tribes, and other parties, on the following resources: (1) prehistoric and historic-period archaeological resources; (2) historic buildings and structures; and (3) TCPs and sacred sites, including Native American rock art.

Prehistoric and Historic Archaeological Resources

Archaeological sites can be disturbed by any action (natural, animal, or human) that disturbs the soils or ground surfaces on which they occur. Archaeological sites are susceptible to disturbance from grazing, pedestrian and vehicular traffic, construction, vandalism, and wind erosion. Sites on shorelines are also susceptible to erosion by changes in water levels and by wind- or boat-induced wave action. In this section, we evaluate the effects that proposed and alternative operations would have on archaeological resources.

Archaeological surveys commissioned by Idaho Power included assessments of site conditions and descriptions of effects observed by the archaeologists during the surveys (Mauser et al., 2001; Gross, 2001). According to the archaeologists, siltation, erosion, and deflation are the primary agents affecting sites along the margins and in the fluctuation zone of Brownlee reservoir. At Oxbow reservoir, archaeologists reported evidence of erosion at three archaeological sites; they also recorded damage to sites from road use, recreational activities, and removal of artifacts exposed during a period of low water. Sites at Hells Canyon reservoir show effects from recreational activities and other human access; archaeologists recorded two sites as threatened by pool fluctuations that are causing cutbank erosion.

Archaeologists surveying the riverine section from Hells Canyon dam to the Salmon River confluence reported a wide range of impacts on archaeological sites, caused by various agents (Druss and Gross, 2001). These agents include bank and terrace erosion, deflation, grazing, road use, and damage (both inadvertent and deliberate) by recreational visitors.

In its license application, Idaho Power (2003a) stated that it has no control over recreational or other access downstream of Hells Canyon dam, and that adverse effects on archaeological sites from such activities are not attributable to project operations. Idaho Power modeled the geographic extent of four flow scenarios below the dam to the Salmon River: 9500–30,000 cfs; 30,000–50,000 cfs; 50,000–75,000 cfs; and 75,000–100,000 cfs, and overlaid the results on archaeological site location maps. According to Idaho Power, flow effects on archaeological sites located beyond the geographic range of flows exceeding the Hells Canyon dam's hydraulic capacity of 30,500 cfs are not attributable to project operations. Idaho Power maintains that sites within the 30,000-cfs flow range could be affected by operational flows, natural flows that rise above 30,000cfs, or a combination of both.

The Idaho State Historical Society states that all sites within the 30,000-cfs zone should be assumed to have experienced erosional effects from project operations. The Idaho State Historical Society and the Oregon SHPO also state that archaeological surveys completed after (and unrelated to) Idaho Power's license application indicate that the project currently adversely affects sites downstream of the Salmon River confluence, potentially as far as the Grande Ronde River.

The Umatilla Tribes state that boat use on the reservoirs is part of project operations and that effects from boat wakes on sites along the reservoir shorelines are attributable to project operations.

Our Analysis

Fluctuation of water levels can destabilize soils and lead to seepage failure that affects not only shorelines but also archaeological materials that may be present in those soils. Erosion of soils containing archaeological materials can result in displacement or loss of artifacts, and also to exposure of artifacts where they may be vulnerable to unauthorized collecting or inadvertent damage. Although shoreline erosion appears to have less effect on archaeological sites on Oxbow and Hells Canyon reservoirs than sites along Brownlee reservoir (perhaps in part due to the greater amount of stabilizing shoreline vegetation at Oxbow and Hells Canyon), continued project operation presents the possibility that sites on these reservoirs could experience erosion from water level fluctuations in the future. Idaho Power recognized this possibility early in the application process when it proposed Study 8.4.7, *Effects of Reservoir Water Level Fluctuations on Cultural Resources,* in its Formal Consultation Package. Consultation with the Cultural Resources Work Group led to Idaho Power's deferral of this study. In its draft HPMP, Idaho Power indicates its plan to obtain information to complete this study during its periodic monitoring of archaeological sites on the reservoirs. We analyze proposed measures and address erosion of archaeological sites on all three reservoirs in section 3.9.2.2, *Site Treatment*.

Regarding the Umatilla Tribes' statement about boat wakes, we acknowledge that requiring Idaho Power to provide boat access to the reservoirs creates a nexus between the project and erosion resulting from boat wakes. However, we also note that state and federal land management agencies provide boat access to the reservoirs as well.

Idaho Power's responses to comments made following the Commission's Ready for Environmental Analysis notice indicate that it discovered several flaws in the flow simulations it laid over archaeological site maps for the area downstream of Hells Canyon dam. Nevertheless, modeling of the geographic extent of various flows in the context of the dam's hydraulic capacity represents a reasonable baseline for attributing erosional effects on cultural resources to project flows (as stated by the Idaho SHPO) as well as to flows that exceed the project's turbine capacity. However, effects on soils containing archaeological sites downstream of Hells Canyon dam are generally attributable more to the extent of fluctuations in flow than to the amount or time of year of flow. This is applicable not only to the area between Hells Canyon dam and the Salmon River, but also in the areas downstream of the Salmon River. As noted in section 3.3.2.1, *Effects of Project Operations on Water Quantity*, flow fluctuations downstream of the Salmon River at Anatone mirror those at Hells Canyon dam, but are much reduced due to the inflow from tributaries entering the Snake River between the two locations. We also note that flow in the Snake River more than doubles with the addition of the Salmon River, and flow from the Grande Ronde River increases flow by another 13 percent. Although fluctuations at Hells Canyon dam are translated downstream to Anatone without dispersing, they constitute a substantially smaller fraction of the total flow. As a result, erosional effects below the Salmon River cannot reasonably be assigned to operation of the Hells Canyon Project.

Operational measures that reduce flow fluctuations downstream of Hells Canyon dam could reduce direct effects on archaeological sites, and also provide additional benefits through growth of riparian and beach habitat that would help to stabilize locations containing archaeological sites. Although reduced ramping rates would occur under all three of the operational scenarios modeled by Idaho Power, Scenario 1 is specifically designed to reduce the extent of flow fluctuation. In particular, Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate) would appear to have the greatest potential to reduce erosion and by extension to reduce adverse effects on natural and cultural resources in and immediately above the fluctuation zone. We describe the three operational scenarios in section 3.3.2.2, *Operational Recommendations and Alternative Evaluation Scenarios*, and in section 3.2.2.8, *Flow Fluctuations below Hells Canyon Dam*.

The surface visibility of many archaeological sites leaves them vulnerable to damage or destruction, both inadvertent and purposeful, by recreational and other users. To the extent of Idaho Power's obligations under the license, effects resulting from access to locations containing archaeological site may be attributable to project operations. Idaho Power's draft HPMP contains measures for monitoring and as necessary further treatment of archaeological sites within the APE, including those potentially subject to adverse effects from its proposed recreational measures (analyzed in section 3.10.2.3, *Recreation Site Improvements*), and by extension to those measures that may be ultimately required in a license. We analyze Idaho Power's proposed measures for treatment of archaeological sites and TCPs in section 3.9.2.2.

Historic Buildings and Structures

Buildings and structures require maintenance, repair, and sometimes replacement of components if they are to remain functional. However, such actions can result in alteration or loss of elements or characteristics that may qualify them for inclusion in the National Register. Underused historic buildings and structures are vulnerable to deterioration or even removal. In this section, we evaluate the effects that proposed and alternative operations would have on historic project facilities (e.g., dams, powerhouses) and on buildings and structures historically associated with these facilities.

In its draft HPMP, Idaho Power proposes to maintain and use historic buildings and structures where possible, with adaptive use preferred over destruction or removal of significant features of such resources. Idaho Power's draft HPMP also provides for maintaining historic buildings and structures in accordance with the Secretary of the Interior's Standards for Rehabilitation, and for consultation with the appropriate SHPO to resolve unavoidable adverse effects.

Our Analysis

Although project operations could beneficially affect historic project facilities through continued use and maintenance, necessary repairs and upgrades to the structures could degrade the character-defining elements that qualify these resources for inclusion in the National Register. Historic project facilities such as the dams and powerhouses would remain in active use, since they are integral to the functioning of the hydroelectric project. Other buildings and structures may become obsolete or simply unnecessary to project operation, potentially leaving them vulnerable to neglect or demolition. Continued use of historic buildings and structures, as proposed by Idaho Power, would enhance the likelihood that they would be repaired as needed and maintained in good condition. Use of maintenance techniques consistent with the Secretary of the Interior's Standards for Rehabilitation whenever possible, as proposed by Idaho Power, would ensure that significant characteristics of historic buildings and structures are not inadvertently damaged, inappropriately altered, or lost. When adverse effects on historic buildings or structures, such as alterations affecting their historical integrity or demolition, cannot be avoided, consultation with the SHPO as proposed by Idaho Power would ensure that such adverse effects are resolved in a manner consistent with the requirements of section 106 of NHPA.

We also considered the fact that over time, buildings evaluated in 2003 as ineligible for the National Register because they were at that time under 50 years of age would need to be reexamined to determine their eligibility under the standard National Register Criteria, potentially resulting in a large number of historic buildings that could be affected by project operations. Establishing and implementing, in consultation with the SHPOs, a schedule and methodology for re-evaluating buildings and structures as they reach 50 years of age would ensure that resources found eligible for the National Register in future years of the license term would be identified and subsequently managed in accordance with a finalized HPMP.

Traditional Cultural Properties and Sacred Sites, including Rock Art

The Hells Canyon Project area has been used by Native populations since prehistoric times, and their modern day descendants continue to do so today. Places and elements (including but not necessarily limited to archaeological sites and rock art) that tribes consider part of their traditional culture and history may be affected in various ways by project operation, depending on the kind of resource and source or agent of the effect. In subsection *Prehistoric and Historic Archaeological Resources* above, we discuss the effects of proposed and alternative operations on archaeological resources, including prehistoric sites and rock art that Native Americans also value as TCPs. In section 3.7.2.5, we analyze proposed measures for increasing upland and riparian habitats, both of which support indigenous species that Native Americans have traditionally used as food, medicine, or raw material for tools and household implements.

Archaeological surveys commissioned by Idaho Power in association with project relicensing have noted the presence of lichen on rock art in the project area. The biodeterioration of rock by lichen is a recognized natural phenomenon and the subject of continuing study worldwide. Air pollution (including nitrogen and sulfur deposition) can cause changes in lichen chemistry and lichen communities that have raised questions about whether such changes may affect the integrity of rock art on which such lichen communities are found. The Forest Service has expressed concern that elevated levels of ammonia and sulfur oxides attributable to the project are causing an increase in lichen on rock art in the Hells Canyon area.

Our Analysis

Hoelsher and Meyers (2003) note that nutrient processing within the Hells Canyon reservoirs (particularly in Brownlee reservoir) causes an increase in ammonia levels in discharges downstream of Hells Canyon dam. The absence of oxygen (anoxia) in near bottom waters causes the release of ammonia and can lead to an increased activity of anaerobic bacteria (i.e., bacteria that use energy sources other than oxygen, such as sulfur). The accumulation of ammonia occurs because water stagnates in the lower portion of the reservoir where much of the ammonia formation occurs. Idaho Power proposes an aeration system to supplement DO in the reservoirs (see section 3.5.2.2, *Dissolved Oxygen*). Aeration could eliminate anoxic conditions in portions of the reservoir, potentially increasing the pH and reducing the production and accumulation of ammonia in those areas. As a result, discharges from Brownlee and Hells Canyon Reservoirs could have higher pH levels and lower ammonia concentrations. However, the relationship between ammonia originating in the project reservoirs and atmospheric conditions affecting lichen communities in ways that could cause damage to rock art has not been adequately demonstrated. Monitoring the condition of all National Register-eligible archaeological sites and rock art in the APE would provide a continuous stream of data about resource conditions and provide a basis for Idaho Power to develop further treatments for sites and rock images affected by project operations. We analyze measures for treatment of archaeological sites and TCPs, including rock art, in section 3.9.2.2 below

3.9.2.2 Site Treatment

A first step in treatment of cultural resources is assessment of their existing condition and periodic monitoring thereafter to determine whether the condition of a given resource has changed, and if so, why. Monitoring may indicate that project operations do, or are likely to, adversely affect the condition of a resource. In that case, the next step is to develop and implement treatments to repair damage where possible, and prevent further deterioration or loss. Such treatments take into consideration the type and significance of the resource as well as the agent and extent of the effect. For historic buildings and structures, repairs or prevention of conditions causing adverse effects may be appropriate. For archaeological sites and TCPs, stabilization, fencing or barriers to access, and redirection of activities away from resource locations are examples of common treatments. Resources that are stabilized remain in place, protected by vegetative or other coverings from further harm.

Monitoring

Idaho Power proposes to develop and implement a program of regular monitoring and assessment of historic properties within the APE to annually monitor site conditions and determine the need for further treatment. To this end, Idaho Power proposes to monitor the conditions of selected eligible archaeological sites in the APEs of the project's three reservoirs, as well as the known burial site at Oxbow reservoir. In the APE below Hells Canyon dam, Idaho Power proposes an initial 3-year program, at the end of which the condition of historic properties sites in this portion of the APE would have been verified and, as necessary, updated. Idaho Power would use results of this initial program to determine appropriate schedules for monitoring over the next 3 years. This pattern would continue throughout the license term, with the monitoring program being reviewed and revised as needed every 3 years.

In FS-25, the Forest Service specifies that Idaho Power's HPMP should provide for periodic monitoring of all identified historic properties, including TCPs, within the APE, with special protocols for photographic documentation of selected rock images determined in consultation with the Forest Service. In Interior-5, BLM specifies that 13 known sites on BLM land in the APE should be included in the initial monitoring cycle.

The Umatilla Tribes and the Forest Service recommend that Idaho Power monitor the condition of TCPs, including rock art. For rock art, the Umatilla Tribes recommend scheduling visitations during periods of lowest water levels, and recording each rock art site under at least two different lighting conditions out of four lighting scenarios based on position of the sun at various times of the day. The tribes further recommend that a special Rock Image Panel Supplement form be appended to each existing site form, and that all information on physical characteristics and condition be updated or revised as needed. The Umatilla Tribes also recommend that Idaho Power develop a framework for monitoring TCPs in consultation with the tribes.

The Nez Perce Tribe's recommendation that all known historic properties in the APE be monitored to identify project-related effects is similar to Idaho Power's alternative Forest Service condition. The tribe also recommends that estimates of monitoring costs over the term of the license be increased to $10 million or justified at another level based on a reasonable method and scope.

The Idaho State Historical Society recommends that the monitoring program include confirmation of information on the archaeological site records Idaho Power submitted in association with relicensing, and that Idaho Power ensure that its cost estimates for monitoring are sufficient to cover this additional work.

Our Analysis

Not all archaeological sites may ultimately require monitoring with the same frequency, and changing circumstances may require adjustment in the frequency of monitoring at any given site over time. Because Idaho Power's archaeological field investigations were conducted more than 6 years ago (from 1997 to 2000), and because many of the archaeologists' site condition assessments were based on single visits, an initial 3-year program during which the conditions of all National Register listed and eligible sites in the APE were verified and updated (as proposed by Idaho Power and consistent with FS-25 and Interior-5) and existing site data were corrected or brought up to current conditions (as recommended by the Idaho Historical Society) would provide an informed starting point for the program. It would also provide the opportunity to rectify inconsistencies in assessment of effects that inadvertently resulted from differing approaches on the part of the two archaeological consultants contracted by Idaho

Power for its relicensing effort. Review of the program and its findings every 3 years, as proposed by Idaho Power, would provide Idaho Power with an opportunity to make any necessary adjustments to monitoring methods and frequencies.

Because resources may be significant under more than one National Register criterion, proper treatment of such resources may require consideration of measures other than those commonly employed for resources significant only for their information potential (Criterion D). Thus, employing monitoring methodologies that take key characteristics of a resource type and its significance into account, as recommended by the Umatilla Tribes, would enhance assessment of the resource's condition and inform Idaho Power's consideration of any necessary additional treatments. Because rock images frequently occur in association with Native American archaeological sites, a single overall monitoring program, appropriately designed to address a range of feature characteristics in a manner consistent with FS-25, would be more time-and cost-effective than separate monitoring efforts, and would ensure consistency of approach and analysis.

The Nez Perce Tribe has recommended that the estimate for monitoring be increased to $10 million (based on an estimate of $333,000 per year for 30 years), or adequately justified alternative amounts. The Idaho Historical Society's recommendation includes no basis for what the Idaho Historical Society would consider sufficient. Because of the long time frame, potential for changes in circumstances, and possibility that new monitoring methods may be developed and implemented over time, the total cost of monitoring hundreds of resources over multiple decades cannot realistically be determined.

Stabilization

Idaho Power proposes to stabilize seven archaeological sites on Brownlee reservoir that are affected by project operations. Idaho Power has also proposed to stabilize approximately 20 sites between Hells Canyon dam and the confluence with the Salmon River that show evidence of active erosion potentially attributable to project operation. Fifteen of the sites, all in Oregon, have already been selected; others remain to be determined. Consistent with a provision of FS-25 and provisions of Interior-5, Idaho Power proposes to coordinate with the appropriate SHPO, land management agency (or other landowner), and tribes to develop stabilization measures appropriate to each individual site as the need arises.

The Umatilla Tribes recommend that stabilized sites be maintained in perpetuity. The Idaho State Historical Society recommends that the list of sites for initial stabilization below Hells Canyon dam be finalized, and also that Idaho Power establish a fund to support archaeological testing to determine appropriate stabilization measures. The Nez Perce Tribe recommends that Idaho Power stabilize more sites than currently proposed.

Our Analysis

Neither Idaho Power's application nor its draft HPMP describes the criteria it used to select sites below Hells Canyon dam for stabilization. However, field notes from site visits conducted in 2005 by archaeologists from Idaho Power, the Forest Service, and both SHPOs, and filed with the Commission by Idaho Power (Baker, 2005a,b), indicate two major factors considered in Idaho Power's initial list of sites to be stabilized below Hells Canyon dam: (1) the site's location with respect to the 30,000 cfs level plus (2) evidence of active erosion. Decisions regarding stabilization need to be based on clearly articulated, measurable criteria to ensure that sites most in need of stabilization as a result of project operations will be identified and treated in a timely manner. Including such criteria in the final HPMP would help all concerned parties understand how Idaho Power is identifying sites for the initial stabilization efforts. Such criteria would also offer a sound basis for determining thresholds for stabilization in the future. Over the license term, periodic monitoring of all eligible sites in the APE would ensure that if project-related effects to other sites are identified, appropriate treatments could be developed and implemented in consultation with the tribes, agencies and SHPOs, as proposed by Idaho Power and specified in Forest Service 4(e) condition no. 25. While stabilization in place is a generally preferred treatment, the passage of time and changing circumstances during the license term could render stabilization measures ineffective. In such cases, it may not be possible to continue stabilization over the full term of the license, and other measures may be necessary.

Because stabilization is resource-specific, a variety of methods, including subsurface testing, may be used to determine the most appropriate way to stabilize a site. The costs of such subsurface testing would thus be included in the suite of actions taken to develop each stabilization plan. Establishment of a separate fund to support archaeological testing, as recommended by the Idaho State Historical Society, would therefore appear to offer no additional resource protection..

Mitigation

Idaho Power proposes to conduct data recovery at four archaeological sites on Brownlee reservoir because the sites lie partly below the usual reservoir level and Idaho Power therefore does not believe that stabilization in place would be effective. Two of the proposed sites are on BLM land, and Interior-5 specified these two sites for data recovery.

The Umatilla Tribes' recommendation that Idaho Power develop plans to mitigate effects to sites within 3 years is similar to Idaho Power's proposed timetable for monitoring and treatment. The Umatilla Tribes also recommend recognition of the fact that some sites may possess significance apart from their potential to yield scientific information.

Our Analysis

Idaho Power's proposed Data Recovery Plan recognizes that four archaeological sites on Brownlee reservoir, including the two on BLM land, are experiencing active erosion resulting from project operations. Idaho Power's proposed data recovery would be a beneficial step to take in this instance, where stabilization is not possible, and would be consistent with the provisions of Interior-5. As a result of annual monitoring over any new license term, other sites requiring further treatment (stabilization or other measures, including data recovery) may be identified, and in those instances Idaho Power's draft HPMP provides for consultation with the agencies, tribes, and SHPOs regarding appropriate treatments. Such consultation would ensure, as recommended by the Umatilla Tribes, that each site's significance and important characteristics are accorded the greatest consideration in the treatment plan.

3.9.2.3 Cultural Resources Interpretation

Protection of cultural resources can take many forms. One of them is interpretation, the main objectives of which are to increase public knowledge and appreciation of cultural resources and to enhance public awareness about threats to such resources. Idaho Power proposes to create, install and maintain 14 informational kiosks at various locations throughout the project. Six would focus on the Native American presence and land use in the project area. Four would describe aspects of European-American occupation, and four would cover the Asian-American experience. Idaho Power also proposes to provide financial assistance in the form of grants to local communities and organizations to support museum collections acquisition, display and curation, and for other public information and outreach projects focusing on the European-American and Asian-American presence in the Hells Canyon area.

The Idaho State Historical Society recommends that Idaho Power provide funding to student and professional/academic researchers to support study of archaeological materials recovered during previous investigations in the project area that have not been analyzed or formally reported on. The Idaho State Historical Society, the Forest Service and the Nez Perce Tribe recommend that Idaho Power update the

1984 National Register nomination for the Hells Canyon Archaeological District, to incorporate the numerous additional sites identified during the relicensing surveys. The Burns Paiute, Shoshone-Bannock, and Shoshone-Paiute Tribes recommend that Idaho Power build, operate and maintain a cultural center that would provide information, educational programs, and curation facilities to enhance public awareness of the area's Native American cultural traditions and resources

Our Analysis

Under the Advisory Council's regulations implementing section 106 of NHPA, the Commission, in consultation with other parties, is required to identify historic properties that may be affected by project operations; determine whether project operations would or could adversely affect historic properties; and resolve adverse effects through avoidance, minimization and/or mitigation. Programs and activities that most directly benefit historic properties enhance compliance with these priorities.

Informational/interpretive kiosks proposed by Idaho Power, placed in appropriate locations in the landscape, would be an effective way to introduce visitors to the cultural history and resources of the Hells Canyon area. They also could potentially contribute to resource protection by noting legal penalties for vandalism and looting, and by making visitors aware of activities that could inadvertently damage or destroy resources.

Actively engaging area communities in programs related to the historical, archaeological, and cultural values of the project and its resources could enhance public appreciation of the significance and fragility of these resources. Idaho Power's proposed grant program for local communities and organizations, if carefully targeted and administered, could be an effective way to achieve this objective. Establishment of a similar carefully targeted program or programs for the tribes would encourage cultural resource interpretation from the Native American perspective (see also section 3.9.2.4, *Support for Native American Programs*). This approach would have closer nexus to the project and project resources than Idaho Power's building and operating a cultural center as the tribes recommend.

The Commission requires applicants and licensees to conduct cultural resources surveys to accepted professional standards and to dispose of any artifacts in accordance with applicable laws, regulations and standards. Analysis and interpretation of archaeological materials removed from their original locations in the project during previous investigations by other parties, as recommended by the Idaho State Historical Society, could potentially enhance the state of knowledge concerning the cultural history of the project area. However, there is no regulatory basis for requiring Idaho Power to fund or support studies beyond those necessary to identify historic properties and appropriately resolve project-related adverse effects. Updating the 1984 National Register nomination for the Hells Canyon Archaeological District, as recommended by the Idaho State Historical Society, the Forest Service, and the Nez Perce Tribe, would increase the number of sites included in the National Register as contributing elements of the listed district. However, there is no regulatory basis for requiring Idaho Power to nominate resources to the National Register. Furthermore, nominating resources would not afford those resources any greater protection than would be required under any new license.

3.9.2.4 Support for Native American Programs

Encouraging broad-based participation in management efforts builds and sustains informed constituencies that can support management goals and contribute ideas and expertise toward effective treatment of cultural resources. In this section, we analyze a variety of proposals and recommendations regarding Native American participation in cultural resources management in the project area.

Participation, Education, and Training

In consultation with each of the tribes, Idaho Power proposes to provide support for tribal programs and tribal participation in resource management in the project. Specifically, Idaho Power proposes to: fund costs of tribal staff time and travel costs associated with tribal-related implementation of environmental measures; support educational development programs, including scholarship/training; and support ongoing and future cultural enhancement projects in consultation with each tribe. Idaho Power proposes to allocate $1 million in support of each tribe (total $6 million) over the term of the license.

The tribes have made recommendations similar to those proposed by Idaho Power. The Burns Paiute, Shoshone-Paiute, and Shoshone-Bannock Tribes have recommended generally that Idaho Power support tribal participation in natural and cultural resource management of the Snake River and its tributaries. The Umatilla Tribes recommend that Idaho Power provide $1 million to the tribes to facilitate consultation and coordination on matters pertaining to cultural resources. The Burns Paiute Tribe recommends establishment and continued funding of a tribal education scholarship fund that would be administered by the tribe, and also recommends that Idaho Power provide annual funding to support the tribe's participation in cultural resources management in the project.

The Shoshone-Paiute Tribes recommends that the funding measures for each tribe be increased to $10 million. The Nez Perce Tribe recommends that Idaho Power grant each tribe its share of the funds in a lump sum at the beginning of the license term, for the tribe to use for license-related programs.

Our Analysis

Informed participation by individuals and groups for whom project-area resources are of both historic and ongoing cultural importance could contribute significantly to management and protection of such resources. Reimbursement of travel costs would directly foster participation by those otherwise unable to attend meetings or programs associated with cultural resource management at the project. Educational and training opportunities specifically designed to equip interested persons with technical knowledge and skills necessary for active participation in design and implementation of project-related protection and enhancement efforts would support cultural resource management goals. As we discuss in section 3.9.2.3 above, a grant program to support the tribes' interpretation of their cultural heritage in the Hells Canyon area would enhance appreciation of the area's Native American cultural resources. Any such programs would need to be closely managed to ensure that their objectives are realized.

Ethnographic and Oral History Studies

Ethnographic and oral history studies compile and elicit from living Native Americans information about the culture of, and resources important to, the nation's indigenous peoples. The Shoshone-Paiute, Nez Perce, Burns Paiute, and Shoshone-Bannock Tribes have made generally similar recommendations that Idaho Power provide funding to undertake, expand, or complete ethnographic and oral histories of these tribes.

Our Analysis

As part of relicensing activities, Idaho Power funded a Hells Canyon-area ethnographic overview as well as oral history studies for each of the tribes. Oral histories from the Warm Springs Tribes, Umatilla Tribes, and Burns Paiute Tribe were included as technical report appendices in the draft and final license applications, and Idaho Power filed the Nez Perce Tribe's oral history in February 2007.

Idaho Power's funding of the ethnography and oral history studies offered the tribes the opportunity to identify TCPs and to provide information that Idaho Power could use in its management and protection of resources and places in the project that are of importance in the area's Native American cultural traditions. Completion of oral history studies by Shoshone-Paiute and Shoshone-Bannock Tribes, as well as appropriate dissemination of the Nez Perce Tribe's oral history study, would complement the studies by the other tribes, and would contribute additional information toward effective and appropriate management of TCPs and sacred sites in the project area. Tribal participation in resource management planning could provide opportunities for the tribes that have contributed oral history studies to refine and expand information from the studies in a continuing manner over the license term, to the benefit of the tribes and of Idaho Power's management efforts. We also note that revision of the HPMP consistent with Forest Service 4(e) condition no.25 would provide strategies for adaptive management and processes for determining when and under what circumstances additional cultural resource studies may be required.

Employment of Native Americans

The Nez Perce Tribe recommends that Idaho Power seek to employ qualified tribal members in all contracts and work performed under the license. In section 5.2, *Comprehensive Development,* under *Tribal Participation, Education, and Training*, we discuss the issue of agency jurisdiction over employment decisions.

Other Tribal Recommendations

The Umatilla Tribes recommend that Idaho Power develop a plan to increase access to tribal fishing sites in the APE. The Nez Perce and Burns Paiute Tribes recommend that Idaho Power establish a fund to acquire additional upland and riparian lands that would provide substitute fishing and wildlife harvesting opportunities for the tribes. The Burns Paiute Tribe also recommends establishment of a cooperative management area for the Snake River and its tributaries.

Our Analysis

In Native American communities with hunting-gathering traditions, food procurement sites are often integral elements of culture history, and may as such be considered potential TCPs. Continued or renewed use of locations such as traditional fishing sites, as recommended by the Umatilla Tribes, could support tribal efforts to maintain cultural traditions. In its draft HPMP, Idaho Power states that it will endeavor to provide access to TCPs identified within the APE where it is practical and safe to do so. Providing tribes with access to sacred sites and TCPs (which may include tribal fishing sites, locations of culturally significant plants, as well as other locations) is also specified as an action to be undertaken under Standard Procedure 1 of the draft HPMP.

The Nez Perce and Burns Paiute Tribes state that their recommendations arise from an insufficiency of aquatic and terrestrial resources available to the tribes. Idaho Power proposes to acquire, enhance and manage additional upland and riparian habitat as mitigation for anticipated impacts of project operations on wildlife. Lands acquired under this proposal would likely support terrestrial species of traditional cultural importance to the tribes. Additionally, such lands could potentially contain historic properties that could benefit from protective habitat management, as long as their presence was taken into account in any habitat restoration efforts involving ground disturbance. We analyze these land acquisition proposals in more detail in section 3.7.2.5, *Upland and Riparian Habitat Acquisition.* Additionally, in section 3.6.2 we analyze measures to improve the condition of aquatic resources that would benefit species of cultural importance to the tribes.

3.9.2.5 Management of Cultural Resources

The Commission typically requires applicants to prepare and submit a draft HPMP with their license applications. An HPMP contains measures, strategies and procedures for resource management and protection, and for resolving known or potential project-related adverse effects to historic properties over the term of the license. In previous sections, we have discussed measures proposed by Idaho Power or recommended by agencies and tribes with respect to treatment and interpretation of cultural resources and Native American participation in the process, all of which are integral components of an HPMP. In this section, we analyze other historic property management measures recommended by agencies and tribes.

Expansion of Area of Potential Effect

The Umatilla Tribes recommend that the APE be expanded to the confluence of the Snake and Clearwater rivers, and that the added land be surveyed for cultural resources. The Nez Perce Tribe recommends that the APE extend beyond the confluence of the Snake and Salmon rivers to the upper limit of the next downstream reservoir, near Asotin, Washington. The Idaho State Historical Society recommends that archaeological surveys be conducted along the reach of the Snake River between the Salmon and Grande Ronde rivers. The Oregon SHPO also recommends that the APE be extended downstream of the Salmon River. The Shoshone-Paiute Tribes recommends that the APE, and therefore the provisions of the HPMP, include all lands between the confluence of the Snake and Salmon rivers upstream to Shoshone Falls.

Our Analysis

In section 3.9.1.1, we describe Idaho Power's proposed APE and in section 3.9.2.1, we analyze the nature and extent of potential effects to archaeological resources from proposed and alternative project operations. As indicated in the latter section, flows from the Salmon, Grande Ronde and other tributaries below the Salmon River significantly attenuate water level fluctuations arising at Hells Canyon dam. While we note that geomorphologists do not appear to have yet developed a solid scientific methodology for distinguishing between project and natural flows in a riverine environment, the recommendations of the tribes, Oregon SHPO and the Idaho State Historical Society to expand the APE do not provide an empirical basis for attributing erosional impacts to cultural resources below the Salmon River to project operations.

Regarding the Shoshone-Paiute Tribes' recommendation to expand the APE upstream to Shoshone Falls, we note that there are a number of other hydroelectric projects above the Hells Canyon Project, each of which has a unique APE that represents the geographic extent to which actions under that project's license, whether operations, recreational enhancements, natural resource enhancements or other actions, could potentially affect historic properties. Each licensed project is also required to manage any historic properties within its APE in a manner consistent with section 106 of NHPA. Extension of the Hells Canyon Project's APE to Shoshone Falls, therefore, would not afford historic properties upstream of this project any greater protection than they now receive.

We do note, however, that changing circumstances, or emergence of new information, may make it necessary to revise an APE over time. Including provision for review, and as appropriate, revision, of the HPMP (including as necessary the APE) in Idaho Power's final HPMP would ensure that this possibility could be addressed should the need arise.

Cultural Resources Technical Subcommittee

The Idaho State Historical Society and the Umatilla, Nez Perce, Shoshone-Paiute, and Burns Paiute Tribes recommend formation of a standing organization (variously called a task force, advisory committee, or work group) specifically concerned with implementation of the HPMP for the project.

Our Analysis

A cultural resources technical subcommittee composed of representatives from all the tribes, land management agencies, other landowners, and SHPOs would give these directly concerned parties a voice in the management and protection of cultural resources in the project over the license term. There are many kinds of cultural resources in the project area; and committee members' contributions of knowledge and recommendations would inform Idaho Power's decision-making, and would facilitate Idaho Power's adaptation, as necessary, of the HPMP to address the changing circumstances inevitable over the period of any new license.

Law Enforcement

The Burns Paiute, Umatilla, and Shoshone-Paiute Tribes recommend that Idaho Power provide law enforcement as a measure to protect cultural resources from vandalism and looting. In *Comprehensive Development* under *Law Enforcement and Fire Protection*, we discuss the issue of agency jurisdiction over law enforcement.

Sensitivity Training

The Umatilla Tribes recommend that Idaho Power conduct periodic training sessions to enhance staff understanding of cultural resources and their importance to the tribes.

Our Analysis

In its draft HPMP, Idaho Power proposes to develop a company-wide education program, particularly for departments involved in construction and other potentially ground-disturbing activities. Such a program would appropriately include discussion of the different kinds and significance of cultural resources in the project area, as a way of enhancing employees' understanding of issues that would influence planning and implementation of project-related activities.

Re-survey of the APE

The Umatilla Tribes recommend that Idaho Power re-survey the APE every 10 years to identify cultural resources beyond those identified to date. In its condition no. 25, the Forest Service specifies that Idaho Power's HPMP include provisions for determining when and under what circumstances new survey, or resurvey of previously examined areas, may be required.

Our Analysis

We acknowledge that field conditions, methodologies, technology, and interpretations change over time, and may change over the term of a license. However, we do not see material benefit in arbitrarily re-surveying the entire APE every 10 years. Including provisions in Idaho Power's HPMP for determining the need for new survey or resurvey would ensure that these issues would be appropriately taken into account in the management of cultural resources over the license term.

Curation of Archaeological Materials

The Umatilla Tribes recommend that artifacts recovered in the APE as a result of project operations be reburied on site or curated at a federally recognized repository.

Our Analysis

Under federal law, disposition of archaeological materials recovered on federal land is the responsibility of the land-managing agency. Although Idaho Power has not indicated how it would treat archaeological materials recovered from state, county and private land, including such a provision in the final HPMP would ensure that such artifacts are disposed of, in consultation with the SHPOs and tribes, in a manner consistent with the federal standards specified in 36 CFR 79.

Treatment of Paleontological Resources

BLM recommends that Idaho Power evaluate, and then protect or mitigate, scientifically important paleontological resources discovered in the course of project operations.

Our Analysis

Idaho Power's draft HPMP provides for development and implementation of site-specific treatment plans for newly-discovered paleontological resources in consultation with BLM and in accordance with BLM's Paleontological Resources Manual. This would ensure that these resources are protected in the event of inadvertent discovery.

Revise and Finalize the HPMP

The tribes and Idaho State Historical Society recommend and Interior and the Forest Service specify (Interior-5, FS-25) that Idaho Power revise, finalize, and implement the HPMP.

Our Analysis

Finalizing the HPMP to include measures recommended in the Staff Alternative (see section 5.2, *Comprehensive Development*), followed by implementation, would ensure that historic properties are protected over the license term.[97] Prior to issuing a new license, the Commission would execute a programmatic agreement (PA) with the SHPOs and Advisory Council to implement the HPMP. Idaho Power, the tribes, the Forest Service, and BLM would be invited to participate in the PA as concurring parties.

3.9.2.6 Effects of Other Measures on Cultural Resources

Sediment Transport Measures

Implementation of measures to restore sandbars through sand augmentation, as specified in Forest Service 4(e) condition no. 4, would help maintain some current beaches and, most importantly, provide a buffer against terrace erosion. Because archaeological sites (and some TCPs) are frequently located on river terraces, sandbar restoration would contribute to protection not only of terraces but of any archaeological deposits that may be present. Maintenance and enhancement of beaches may also afford protection to sites on terraces at the water's edge.

Aquatic Resource Measures

Idaho Power's proposals to make improvements to anadromous fish hatchery facilities involve construction of holding ponds and other features. Such construction is likely to involve ground disturbance that could affect archaeological sites or TCPs if any exist at the hatchery locations. If these locations have not been surveyed to identify cultural resources, such survey would ensure that cultural resources were identified early in the planning process for the hatchery improvements. If these locations have been surveyed and no sites have been identified, Idaho Power's proposed hatchery improvements would be unlikely to affect historic properties.

Measures to improve the condition of aquatic resources (see section 3.6, *Aquatic Resources*, and relevant portions of section 3.8, *Threatened and Endangered Species*) could also benefit tribal fisheries and culturally important aquatic species.

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[97] The Commission is requiring Idaho Power to finalize the HPMP prior to issuance of a new license. The final HPMP must address the issues outlined in section 5.2.6 of this final EIS. The final HPMP would be attached to the final PA.

Terrestrial Resource Measures

Idaho Power proposes to acquire more than 20,000 acres of upland and riparian habitat to mitigate effects of project operations on wildlife. Idaho Power also proposes to enhance habitat on four Snake River islands and adjacent to the reservoirs. Habitat restoration measures could involve ground disturbance at locations containing significant archaeological sites or TCPs. However, we note that habitat restoration measures resulting in stabilization of ground surfaces could beneficially affect archaeological sites at such locations because the sites would be less subject to erosion or deflation. We also note that any lands acquired by Idaho Power under the license would automatically come under the provisions of the HPMP regarding treatment of any historic properties that may exist on such lands.

Measures to protect and enhance terrestrial resources, within the current project area and on any land acquired under mitigation proposals, could benefit terrestrial resources that are important to the tribes.

Recreation Measures

Idaho Power proposes a long list of actions to develop and/or enhance recreational sites, including dispersed sites. Agencies have also recommended or specified recreational improvements. Development or enhancement activities involving ground disturbance could potentially affect archaeological sites or TCPs if any exist at the recreational site locations. In its draft HPMP, Idaho Power has indicated that archaeological monitoring during construction would ensure that previously unknown resources would not be inadvertently destroyed, and that steps could then be taken to avoid adverse effects from recreational site development. However, we note that human access is perhaps the greatest cause of adverse effects on cultural resources in the APE, particularly given the resources' general high degree of visibility. Recreation enhancements are therefore expected to increase threats to cultural resources and require greater protective and management efforts on the part of both Idaho Power and agencies supporting such enhancements.

Project Boundary Revision

Exclusion of lands from the licensed project, as proposed by Idaho Power, would remove that land from the Commission's jurisdiction. However, the lands proposed for exclusion are federal lands managed by BLM and the Forest Service, and as a result they would continue to be subject to the protective and management requirements of NHPA. Exclusion of the approximately 3,800 acres of federal land from the project, as proposed by Idaho Power, would therefore have no effect on historic properties, should any be located on that land.

3.9.3 Unavoidable Adverse Effects

Execution of the PA and implementation of an HPMP over the term of a new license would ensure proper management of significant cultural resources within the APE of the Hells Canyon Project and also provide for resolution of any project-related adverse effects.

3.10 RECREATION RESOURCES

3.10.1 Affected Environment

3.10.1.1 Regional Recreational Setting

Recreational resources in the project vicinity are extensive and provide for a wide variety of outdoor activities. Lands adjacent to the upstream end of the project and surrounding Brownlee and Oxbow reservoirs are primarily publicly owned and managed by BLM or state agencies. These lands provide free public access to the mountains and rivers surrounding the upper and middle project area and are used, among other things, for hiking, hunting, snowmobiling, and off-road vehicle use.

The Forest Service manages the majority of land adjacent to the project around Hells Canyon reservoir. Much of the land west of the reservoir is included in the Hells Canyon Wilderness and is managed as part of the Wallowa-Whitman National Forest to provide non-motorized public recreational opportunities. Although much of this land is remote and relatively inaccessible, some visitors use informal trails and outfitter/horse-pack trails to support hunting and hiking trips into the wilderness area (Claycomb and Brown, 2003).

The Hells Canyon National Recreation Area (HCNRA) includes more than 650,000 acres of land adjacent to the downstream end of the Hells Canyon reservoir and dam. The HCNRA includes the free-flowing portion of the Snake River corridor from the downstream end of the Hells Canyon Project downstream approximately 71 miles. The HCNRA includes portions of the Nez Perce, Payette, and Wallowa-Whitman National Forests with the Wallowa-Whitman National Forest managing recreational use of the HCNRA, including boating in the HCNRA portion of the Snake River (Sorensen, 2003).

Recreational opportunities at the HCNRA are extensive and diverse, but the primary attractions are whitewater boating and associated fishing and camping on the free-flowing portion of the Snake River downstream of Hells Canyon dam (Brown, 2003c). Whitewater boating opportunities range from riffles and Class I rapids at the downstream end of the HCNRA to technical Class III and IV rapids in the upper reaches of the canyon. The unique whitewater opportunities located in an isolated canyon attract private and commercial kayakers, rafters, and power boaters. Rafters and kayakers typically launch at the Hells Canyon Visitors Center, approximately 1 mile downstream of the Hells Canyon dam, and take out at Pittsburg Landing (33 miles downstream) or Lewiston (114 miles downstream). Private and commercial powerboat trips are typically staged from Lewiston or Pittsburg Landing, running up the river a few miles or all the way to Hells Canyon dam and returning to the launch area.

The Snake River through Hells Canyon (downstream of the project) has a long navigational history, with attempts to run the rapids as early as the 1890s and commercial outfitting beginning in the 1950s. Regular operation of commercial boating trips through all rapids in the canyon is a relatively recent event, associated with the development of powerful jet boats capable of climbing rapids at low to moderate flows and navigating technical downstream routes through the rapids. Idaho Power estimates between 40,000 and 50,000 boaters used the river annually in the HCNRA in the 1990s, with seasonal and annual variation linked to flow (Brown, 2003c). Commercial power boaters were the majority of HCNRA boaters in the years included in the survey (table 76).

Table 76. Number of registered boaters entering the HCNRA through Hells Canyon Creek, Pittsburg Landing, Dug Bar, and Cache Creek portals combined, by year. (Source: Brown, 2003c, as modified by staff)

Type of Boater	1992	1993	1994	1995	1996	1997	1998	1999
Commercial Power	27,169	30,275	28,831	30,443	29,000	29,275	29,405	31,113

Type of Boater	1992	1993	1994	1995	1996	1997	1998	1999
Private Power	11,820	11,490	12,941	12,268	11,056	10,068	10,647	10,509
Private Float	3,798	3,241	4,727	3,321	2,857	2,133	2,754	2,448
Commercial Float	2,058	4,783	4,592	5,618	5,696	1,885	3,930	2,216
Total	44,845	49,789	51,091	51,650	48,609	43,361	46,736	46,286

In addition to providing boating opportunities, the HCNRA has about 925 miles of trails that provide outstanding opportunities for hunting, fishing, backpacking, horseback riding, mountain biking, photography, and many other recreational pursuits. Two important hiking and horse pack trails parallel the Snake River through Hells Canyon downstream of the project: on the Idaho side, the Snake River National Recreation Trail runs approximately 30 miles from Pittsburg Landing to Butler Bar, and on the Oregon side, the Snake River Trail parallels the river for about 45 miles from Dug Bar to Battle Creek. Both trails allow visitors to explore several side-trail loops from the river up the canyon to higher elevation bench and summit trails.

3.10.1.2 Recreational Facilities within the Project Boundary

Numerous recreational facilities are located within the project boundary, including 24 formal or semi-formal public-access sites that have some level of recreational infrastructure ranging from minor to substantial;[98] 4 private marinas and camping areas; and at least 123 undeveloped, dispersed, or informal sites (figure 115). These sites within the project boundary are owned and managed by a variety of entities, including Idaho Power; state, federal, or county government agencies; and private companies.

The formal public recreational sites provide a wide range of opportunities and public access to the project. As shown in table 77, 8 of the 24 sites are fully developed, with management presence during the peak-use season of May 1 through September 31. These sites also have received substantial capital investment in site-specific infrastructure that supports a wide range of recreational uses. All of these parks provide some level of barrier-free access and include boat launch and dock facilities, permanent toilets, potable water, and picnic areas. Some include fish cleaning facilities, tent and RV camping pads, rental cabins, dump stations, electricity hook-ups, and/or showers, among other things. Camping fees at these 8 sites range from $5 to $35 per night.

The other 16 formal public recreational sites have minimal improvements, with a lower level of development that supports lower intensity recreational use. These sites typically have gravel rather than paved boat ramps, simple vault or portable toilets, no potable water, and limited signage and management presence. Within this group, sites that allow camping do not necessarily have designated camping areas or fire rings, electricity or other infrastructure; instead, campers typically disperse into user-defined areas.

Idaho Power owns and manages nine formal recreational areas within the project boundary and manages two additional sites located on BLM lands within the boundary (Hall and Bird, 2003). At these sites, Idaho Power provides management staff; posts park rules and regulations; provides public telephones; and develops and installs informational, historical, and interpretive signs. Most of the public parks in the project are open from March 1 through September 31, but Idaho Power keeps its parks open year-round, with limited amenities and reduced rates available during the off-season.

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[98] Idaho Power (2003a) included the 11 public access sites in its inventory of dispersed sites. Because these sites have some level of infrastructure and management presence, we categorize these sites as formal recreational areas.

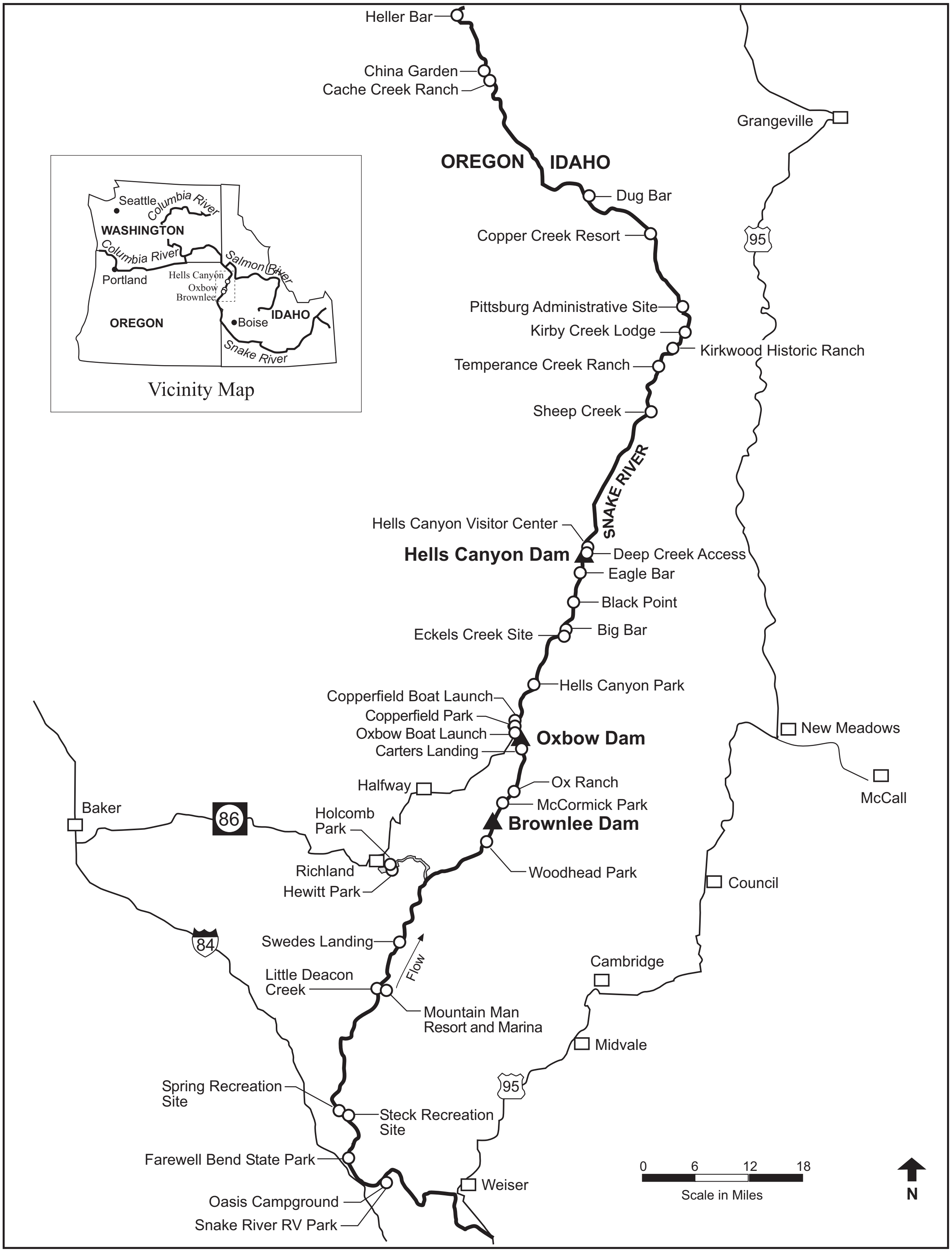

Figure 115. Hells Canyon Project recreational sites. (Source: Idaho Power Company, 2003a, as modified by staff)

Table 77. Formal and semi-formal public recreational facilities within the Hells Canyon Project boundary. (Source: Idaho Power, 2003a; Moore and Brown, 2003, as summarized by staff)

Park	Ownership	Reservoir	State	Camping	Picnic Area	Potable Water	Toilets	Showers	Electricity	Dump Stations	Boat Ramp	Location (RM)
Eagle Bar	Forest Service	Hells Canyon	ID	Yes (informal)	No	No	No	No	No	No	Yes (unimproved)	249.5
Black Point overlook	Forest Service	Hells Canyon	ID	No	No	No	No	No	No	No	No	252.7
Big Bar	Forest Service	Hells Canyon	ID	Yes (informal)	No	No	Yes	No	No	No	Yes (unimproved)	256.2
Eckels Creek	Forest Service	Hells Canyon	ID	Yes (informal)	No	No	No	No	No	No	No	256.8
Copper Creek (Hells Canyon Trailhead)	BLM	Hells Canyon	OR	Yes (informal)	No	No	Yes	No	No	No	No	260.3
Hells Canyon Park[a]	Idaho Power	Hells Canyon	ID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	264
Bob Creek	BLM	Hells Canyon	OR	Yes (informal)	No	No	Yes	No	No	No	Yes (unimproved)	265.9
Airstrip A	Owned and managed by BLM	Hells Canyon	OR	Yes (informal)	Yes	No	Yes	No	No	No	Yes (unimproved)	
Airstrip B	Idaho Power	Hells Canyon	OR	Yes (informal)	Yes	No	Yes	No	No	No	Yes (unimproved)	265.9
Westfall	BLM	Hells Canyon	OR	Yes (informal)	Yes	No	Yes	No	No	No	Yes (unimproved)	267.3
Copperfield boat launch	Idaho Power	Hells Canyon	OR	No	No	No	Yes	No	No	No	Yes	269
Copperfield Park[a]	Idaho Power	Hells Canyon	OR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	270
Oxbow boat launch	BLM (managed by Idaho Power)	Oxbow	OR	No	No	No	Yes	No	No	No	Yes	276

Park	Ownership	Reservoir	State	Camping	Picnic Area	Potable Water	Toilets	Showers	Electricity	Dump Stations	Boat Ramp	Location (RM)
Carters Landing	BLM (managed by Idaho Power)	Oxbow	OR	Yes	Yes	Yes	Yes	No	No	No	Yes (unimproved)	281
Old Carters Landing	Idaho Power	Oxbow	OR	Yes (informal)	Yes	No	Yes	No	No	No	Yes (unimproved)	281,4
McCormick Park[a]	Idaho Power	Oxbow	ID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	284
McCormick Overflow	Idaho Power	Oxbow	ID	Yes	No	No	Yes	No	No	No	Yes	284
Woodhead Park[a]	Idaho Power	Brownlee	ID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	288
Hewitt and Holcomb Parks[1]	Baker County	Brownlee (Power River)	OR	Yes	Yes	Yes	Yes	No	Yes	No	Yes	7.5
Swedes Landing	BLM	Brownlee	OR	Yes (informal)	No	No	Yes	No	No	No	Yes (unimproved)	304
Hibbards Landing	Idaho Power	Brownlee	OR	Yes (informal)	No	No	Yes	No	No	No	Yes (unimproved)	318
Spring recreation site[a]	BLM	Brownlee	OR	Yes	Yes	Yes	Yes	No	No	No	Yes	327
Steck recreation site[a]	BLM	Brownlee	ID	Yes	Yes	Yes	Yes	No	No	Yes	Yes	327
Farewell Bend State Park[a]	State of Oregon	Brownlee	ID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	334
Oasis	BLM	Brownlee		Yes (informal)	No	No	Yes	No	No	No	Yes	340

[a] Fully developed public recreational site, with numerous permanent facilities, daily management presence during primary recreational season, and user fees.

Undeveloped, dispersed, and informal recreational sites have no facilities but, nonetheless, show a clear indication of recreational use (Hall and Bird, 2003). Of the 123 such sites within the project boundary, 62 are at Brownlee reservoir, 29 are at Oxbow reservoir, and 41 are at Hells Canyon reservoir. In addition, Idaho Power identified 7 dispersed sites in the Hells Canyon dam tailwater area that are within the project boundary.

In general, undeveloped, dispersed, and informal recreational sites are user-created recreational areas, typically including access trails, boat-in and drive-in camping areas, and campfire rings. The average density of recreational areas across all three reservoirs is approximate 1 per 0.58 river mile, with a higher concentration of dispersed sites associated with roads and relatively level land, and a lower concentration of dispersed sites in large roadless areas. Although generally minor, most of the dispersed sites show some deterioration or resource damage associated with recreational use (e.g., damage to trees, presence of waste or litter, evidence of campfires, erosion, and damage to shoreline vegetation cover [table 78]).

Table 78. Descriptive statistics of dispersed, undeveloped, and informal recreational sites within the project boundary. (Source: Hall and Bird, 2003, as modified by staff)

Description	**Statistic**
Total number of sites	139[a]
Total number of used areas	341
Total number of usable areas	470
Average number of used areas per site	2-3
Percent of usable areas touching shoreline	43
Percent of sites with boat access	94
Average density of sites	1 site per 0.58 RM
Percent of sites with observable human waste	58
Percent of sites with observable livestock waste	54
Percent of sites with observable litter	99.9
Percent of sites with fire rings	73

[a] Idaho Power included all recreational sites except the eight fully developed sites within its inventory of dispersed sites. We consider 16 of the dispersed sites with some level of development and management (such as Eagle Bar and Big Bar) as semi-formal sites and include them in table 77. As such, we estimate that there are 123 dispersed sites within the project boundary.

3.10.1.3 Recreational Use within the Project Boundary

Recreational use in the project varies by year and season. During Idaho Power's pre-filing study period (1994–1998 and May 1 through October 31, 2000), Idaho Power found a declining use trend in total annual recreation days (table 79). Total annual recreation days dropped from a high of 484,612 recreation days in 1994 to 204,526 in 1997, a decline of 58 percent. From 1997 to 2000, warm-season recreational use increased slightly from 167,478 to 173,008 recreation days. We discuss the possible reasons for this decline in use, including low water levels and changes in the crappie population, below under *Recreational Trends.*

Table 79. Total annual recreation days by development and season. (Source: Idaho Power, 2003a, as modified by staff)

Reservoir	Season	1994	1995	1996	1997	1998	2000
Brownlee	Warm-season	223,139	162,356	137,397	106,643	93,733	102,665
	Winter	86,440	29,874	12,419	26,095	--	--
Oxbow	Warm-season	22,755	18,362	25,417	18,620	16,160	20,385
	Winter	8,734	4,382	5,171	3,015	--	--
Hells Canyon	Warm-season	118,250	94,525	60,500	42,215	38,605	49,958
	Winter	25,294	17,551	8,545	7,938	--	--
Total		484,612	327,050	249,449	204,526	148,498	173,008

Note: -- – not reported by Idaho Power

Approximately 60 percent of total use within the project boundary occurs during warm-season months (May through September) at Brownlee reservoir, a percentage that has remained relatively constant over Idaho Power's study period, despite a significant decrease in total recreational use. During the study period, there appears to have been a relative increase in use at Oxbow reservoir and commensurate decrease in use at Hells Canyon reservoir (table 80).

Table 80. Percent of warm-season recreation days by development. (Source: Idaho Power, 2003a, as modified by staff)

	1994 (%)	1995 (%)	1996 (%)	1997 (%)	1998 (%)	2000 (%)
Brownlee	61.3	59.0	61.5	63.7	63.1	59.3
Oxbow	6.2	6.7	11.4	11.1	10.9	11.8
Hells Canyon	32.4	34.3	27.1	25.2	26.0	28.9

Idaho Power also reported recreational use data for the project in hours of use by zone,[99] a metric that is more sensitive to identifying recreational use patterns than the common metric of recreation days (Idaho Power, 2003a, section E5.2.1.2). The decline in recreational use was primarily associated with Zone 2, which includes most of the developed recreational sites at Brownlee, Oxbow, and Hells Canyon reservoirs, and Zone 4, which includes the recreational sites on the Powder River (figure 116). Recreational use of Zone 2 declined from a high of more than 703,000 hours in 1994 to a low of 115,000 hours in 1996 and rebounded to about 594,000 in 2000. In contrast, recreational use of the Powder River

[99] Because of the size of the project and the variation in topography, access, type of use, and ownership of adjacent lands within the Hells Canyon Project, Idaho Power divided the complex into six management zones as follows: Zone1 from Hells Canyon Visitors Center (RM 247) to Copper Creek (RM 260); Zone 2 from the upstream end of Zone 1 to the south side of the mouth of Brownlee Creek on Brownlee reservoir (RM 288.4); Zone 3 from the upstream end of Zone 2 to Swedes Landing (RM 303.7); Zone 4 is the Powder River arm from the Snake River (RM 0) upstream to the upper end of the reservoir pool (RM 9); Zone 5 from the upstream end of Zone 3 (RM 303.7) to the Burnt River (RM 328); and Zone 6 from the upstream end of Zone5 upstream to the transmission line crossing of Brownlee reservoir just upstream of Porter Island (RM 343). Zone 2 includes both the largest area and the primary recreational sites on Brownlee, Oxbow, and Hells Canyon reservoirs.

arm declined from a high of 413,000 hours in 1994 to less than 100,000 hours by 2000. Recreational use in the other zones remained fairly constant throughout this period.

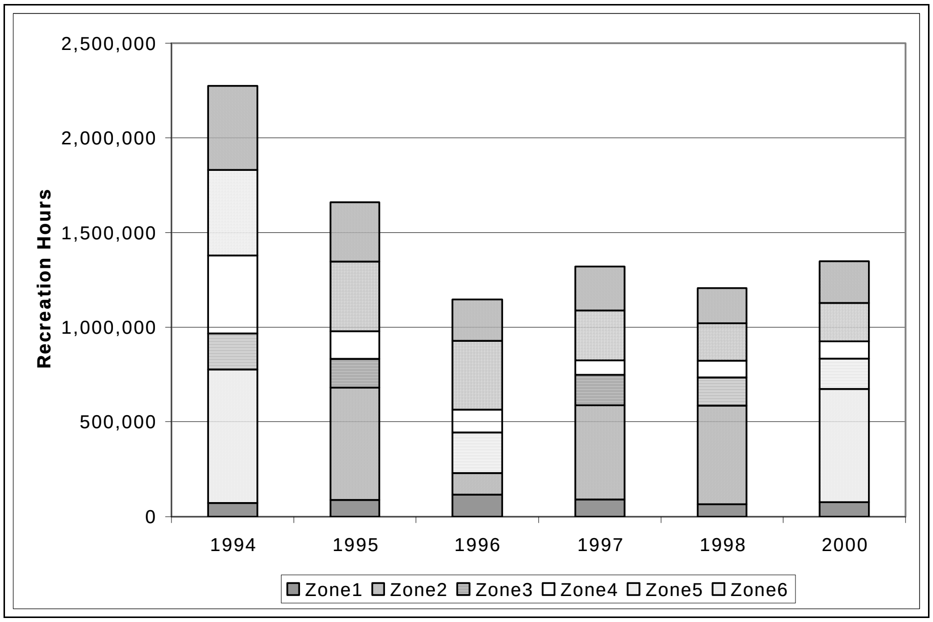

Figure 116. Hours of recreational use by year and zone. (Source: Idaho Power, 2003a, as modified by staff).

Idaho Power found that recreational use decreased over the study period at all developed sites on Brownlee reservoir except at Woodhead Park (Idaho Power, 2003a, section E.5.2.2.2). Woodhead has a number of attributes that may explain this trend: (1) it is one of the largest parks in the project and provides a wide variety of recreational opportunities, (2) it is near all three project reservoirs, providing a convenient location from which to base daytrips to different areas within the project; and (3) it is one of a few sites on Brownlee reservoir with boat ramps of sufficient length to access the water during deep drawdown of the reservoir.

Idaho Power found that more than 75 percent of visitors to the project stay overnight at the developed parks (Idaho Power, 2003a, section E.5.2.2.2). Although the majority of visitors to the Hells Canyon tailrace are reported as day users, Idaho Power indicates that these users could be boaters entering the HCNRA or project visitors staying in other parts of the project.

Despite the recent decline in recreational use of the project area, Idaho Power anticipates substantial future growth in recreational use. Although not quantified, Idaho Power bases its assumption of increased use on anticipated population growth of neighboring and regional counties; nation-wide changes in preference for certain types of recreational use, with anticipated growth in camping, hiking, and water-related activities; and proposed improvements to the project recreational facilities. In addition, Idaho Power points out that if the crappie population rebounds as a result of low water years, it is likely that the project would experience another recreational use bubble related to angling success (see section 3.10.2.1 for more information about the relationship between the crappie fishery and recreational use trends).

Site Capacity

Idaho Power studied the ability of the public recreational sites to meet demand by estimating capacity and use for tent and RV services at the eight formal sites. During the May through September warm season, the average use at all sites is well below the total capacity (table 81). For the most part, site

Table 81. Physical capacity of project sites developed for RVs and tents. (Source: Moore and Brown, 2003, as summarized by staff)

			RV (weekday/weekend)			Tent (weekday/weekend)		
Park	**Ownership**	**Reservoir**	**Capacity**	**Mean Use**	**Max. Use**	**Capacity**	**Mean Use**	**Max. Use**
Hells Canyon Park	Idaho Power	Hells Canyon	24	8.3/10	24/40	15	5.1/8.4	55/60
Copperfield Park	Idaho Power	Hells Canyon	62	24.2/25.3	60/50	10	6.3/9.2	24/39
McCormick Park	Idaho Power	Oxbow	34	6.7/7.9	39/26	8	3.4/4.8	19/26
Woodhead Park	Idaho Power	Brownlee	124	19.2/32.5	94/91	15	5.18/12.3	40/64
Hewitt and Holcomb Parks	Baker County	Brownlee (Powder River)	35	5.2/4.7	21/27	15	1.3/1.8	20/16
Spring recreation site	BLM	Brownlee	34	3.6/4.7	14/19	10	0.8/1.5	5/12
Steck recreation site	BLM	Brownlee	45	3.2/6.4	19/36	5	1.6/4.7	11/23
Farewell Bend State Park	State of Oregon	Brownlee	138	20.9/29.6	71/93	4	5.7/14.1	33/83
Idaho Power developments	Idaho Power	HCC	244	58.4/75.7	155/147	48	19.3/34.7	80/159
Non-Idaho Power developments	Other	HCC	252	24.5/36.2	156/42	34	5.3/14.3	42/112

Notes: BLM – Bureau of Land Management
HCC – Hells Canyon Complex

capacity for RVs is rarely met, even during peak-use periods, and average weekend demand is generally well within site capacity. In contrast, demand for tenting facilities during peak-use days exceeds capacity at all of the eight developed sites, with use often exceeding capacity by several hundred percent. Average use of tenting facilities on weekends is generally near capacity at most sites.

Nonetheless, despite the appearance that some of the developed recreational sites may reach capacity during peak-use periods, survey results suggest that capacity concerns are not displacing visitors to the informal sites (Whittaker and Shelby, 2003a). Results from Idaho Power's year 2000 mail survey indicate that less than 0.05 percent of all respondents reported being displaced to other sites as a result of full parks.

3.10.1.4 Recreational Activities

The project provides a wide variety of recreational opportunities. However, as observed by Idaho Power, most visitors come to the project for angling and other water-based activities (figure 117). Together, lounging (primarily associated with relaxing along the project shoreline), boat angling, and bank angling make up approximately 80 percent of warm-season recreational use. Although cold-season recreational use represents only about 30 percent of total recreational use, these same three activities account for nearly 80 percent of cold-season use. Other important warm-season recreational activities include hiking, power boating, picnicking, and water skiing,

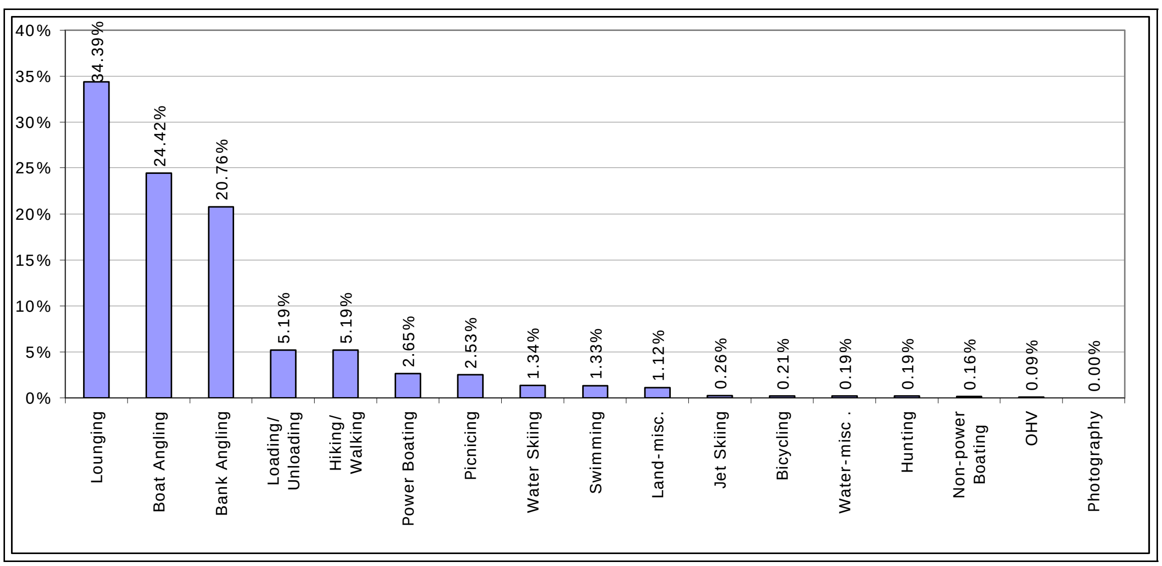

Figure 117. Average percentage of total warm-season hours of recreational use by activity. (Source: Idaho Power, 2003a, as modified by staff)

The decline in recreational use described in the previous section can be seen in the hours of use by activity data. The three primary recreational activities within the project boundary decreased by about 38 percent from 1994 through 2000, with the majority of the decrease associated with boat and bank angling; lounging declined slightly over the same period (figure 118).

In interviews, visitors listed angling as the primary activity and reason for their visit to the project, with approximately three-quarters of all visitors listing fishing among their primary activities, and about 70 percent of visitors listing fishing as their main focus (Whittaker and Shelby, 2003b). Results from the year 2000 mail survey indicate that while most visitors focus on fishing, many visitors do more than just fish; they camp, sightsee, view wildlife, and swim.

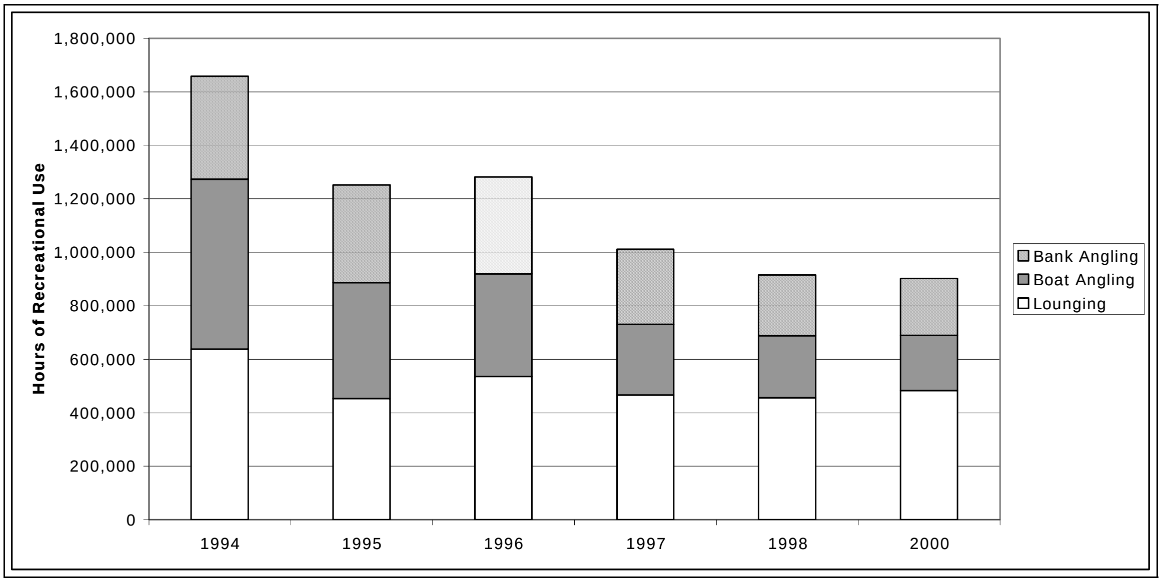

Figure 118. Total hours of warm-season recreational use by primary activity. (Source: Idaho Power, 2003a, as modified by staff)

Recreational activities differ slightly between the reservoirs. Hells Canyon reservoir users were less likely to report fishing as a primary activity than were users at the other reservoirs and a higher percentage of Oxbow reservoir visitors reported fishing as one of their three primary activities.

3.10.1.5 Recreational Visitor Concerns

As part of the onsite interviews and year 2000 mail survey, Idaho Power collected more than 23,000 comments from visitors about their recreational experiences. The questions in the survey were open-ended and the results do not provide a statistically meaningful representation all visitors' attitudes toward project-related issues. In addition, visitor concerns or criticisms of project-related recreational characteristics represent less than 10 percent of all comments received. Nonetheless, the results provide some insight into visitor perceptions of recreational needs at the project. Overall, the majority of all specific comments focused on the level of facility development (28 percent), water levels (14 percent), facility and site maintenance (10 percent), angling (7 percent), and access (6 percent) (table 82).

Table 82. Percentage of comments by major category and reservoir. (Source: Idaho Power, 2003a)

Category	Hells Canyon Tailwater (%)	Hells Canyon Reservoir (%)	Oxbow Tailwater (%)	Oxbow Reservoir (%)	Brownlee Reservoir (%)	All Areas (%)
General Positive	34	28	33	23	19	23
General Negative	4	3	1	2	2	3
Facility Development (Positive)	20	16	14	16	14	15
Facility Development (Negative)	9	17	16	17	10	13
Maintenance (Positive)	10	10	4	7	6	7
Maintenance (Negative)	1	4	1	3	3	3

Category	Hells Canyon Tailwater (%)	Hells Canyon Reservoir (%)	Oxbow Tailwater (%)	Oxbow Reservoir (%)	Brownlee Reservoir (%)	All Areas (%)
Angling (Positive)	1	1	2	2	2	2
Angling (Negative)	2	3	6	4	7	5
Water Levels (Positive)	<1	<1	1	<1	1	1
Water Levels (Negative)	7	4	7	7	20	13
Access (Positive)	1	1	0	0	1	1
Access (Negative)	3	4	4	4	6	5
Visitor Impacts (Litter/Interaction)	3	3	5	3	3	3
Fees	<1	3	<1	5	2	3
Angling Regulations	<1	1	1	2	1	1
Enforcement/regulations	1	2	2	1	1	<1
Commercial Services	1	<1	<1	1	1	1
Hunting	0	<1	0	<1	<1	<1
Agency Evaluations	2	1	0	1	1	1
Total	100	100	100	100	100	100

The majority of comments related to facility development were positive, and negative comments were generally site-specific. The most common facility complaints were associated with a shortage of restrooms (9 percent), shortage of facilities in general (8 percent), and interest in electric or water hookups (4 percent). Findings suggest that there are, or have been, toilet facility problems at Oxbow dam tailrace area and along Hells Canyon reservoir and that many Brownlee reservoir users are interested in more shade.

Reservoir fluctuations appear to be an area of concern for recreational visitors to the project. Approximately 13 percent of all visitors complained about reservoir levels, with the majority of concern expressed about Brownlee reservoir elevations (approximately 20 percent of all comments at Brownlee concerned reservoir fluctuations). At Brownlee reservoir, the most common subcategories of reservoir elevations were "stop fluctuations," specific criticism of low levels, biological issues, and general criticism of levels. Because Brownlee reservoir does not fluctuate significantly each day, Idaho Power indicates that the "stop fluctuation" comments might refer to criticisms of seasonal changes. Less often mentioned comments for Brownlee reservoir were water quality criticisms, the need for more information about levels, and the need to "remove the dams." Specific reservoir level comments at Brownlee reservoir focus on a wide variety of issues, including effects on fishing, use of boat ramps, access to parts of the reservoirs, and the aesthetics of a reservoir drawdown.

The most often mentioned subcategories for reservoir fluctuations at Hells Canyon and Oxbow reservoirs were "stop fluctuations," biological issues, and specific criticisms of low levels. Most of the biological issues focused on effects on fish and fishing. The less often mentioned comments for Hells Canyon and Oxbow reservoirs were the need for more information about levels, general criticisms, water quality criticisms, and the need to "remove the dams." Idaho Power points out that blue-green algae blooms are a common occurrence on project reservoirs in some summers and states that the blooms could be responsible for many of the water quality comments.

3.10.1.6 Boating Use Downstream of the Project

Boaters typically access the HCNRA and register for use of the Snake River downstream of the project at four entry portals, including Cash Creek Ranch, Dug Bar, Pittsburg Landing, and Hells Canyon Creek (Brown, 2003c). Recreational use of the HCNRA typically does not start or finish within the project; however, both private and commercial boaters that use the Hells Canyon Creek portal must pass through the project on project roads along Hells Canyon reservoir, cross Hells Canyon dam, and launch at the Forest Service-managed Visitors Center approximately 1 mile north of the Hells Canyon dam and just outside of the project boundary.

Of the four portals, Cache Creek Ranch consistently registered the most boaters during the study period, varying from a low of 27,842 in 1996 to a high of 30,205 in 1999. The Hells Canyon Creek portal was the second most heavily used access point. During the study period, Idaho Power found that access through the site varied considerably, from a low of 10,714 in 1997 (the highest flow year on record) to a high of 20,369 in 1995 (figure 119). Although boater counts at Pittsburg Landing remained relatively consistent (from a low of 2,234 in 1996 to a high of 2,844 in 1994), they were much lower than those at Cache Creek and Hells Canyon Creek. Dug Bar portal had very few boaters registering each year, varying from 4 in 1996 to a high of 74 in 1999.

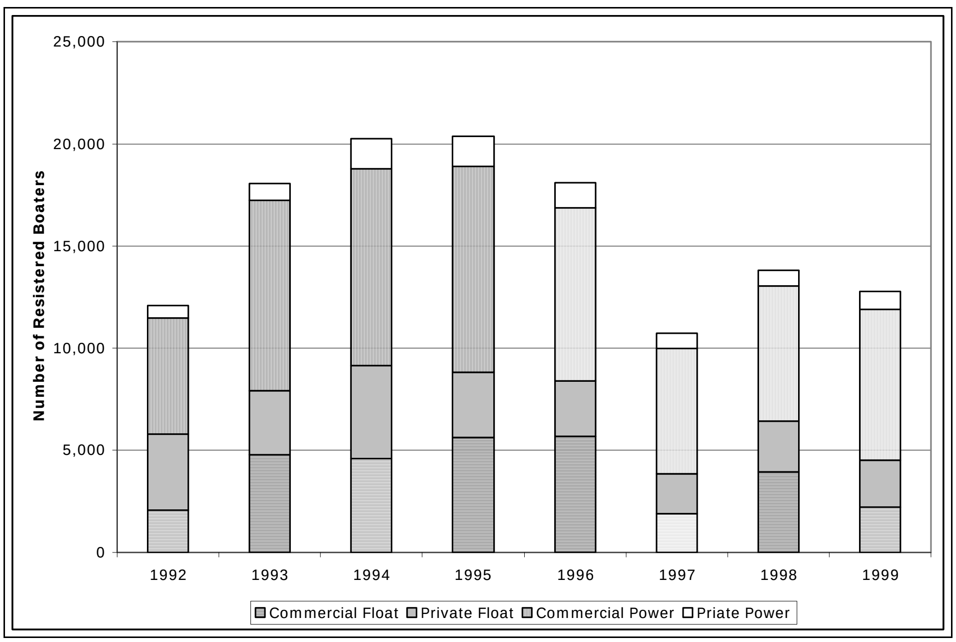

Figure 119. Annual number of boaters by status (commercial or private) and type (float or power) registered as entering the HCNRA through Hells Canyon Creek portal (from Forest Service boater registration database). (Source: Brown, 2003d)

Idaho Power found that most commercial power boaters visit the HCNRA as part of sightseeing tours in boats with capacities of up to 40 people (Brown, 2003d). In comments on the draft EIS, NPPVA states that the larger commercial power vessels are certified to carry 50 to 60 passengers (letter from Alan Odergaard, President, Northwest Professional Power Vessel Association, to the Commission, filed October 31, 2006). Sightseeing tours are typically day trips that stop at historic and cultural sites along the river. A smaller percentage of this group uses commercial outfitters to stage angling or hunting trips. An even smaller number of commercial powerboat customers “drop camp,” using the outfitter to transport the group and equipment to campsites in the HCNRA.

Private power boaters consist of both day and overnight users. Private power boaters have the flexibility to travel throughout the HCNRA. Depending on boat size and operator expertise, three large rapids in the upper canyon (Wild Sheep, Granite, and Rush Creek) limit many private power boaters to areas either above or below this stretch. These users participate in a broad range of outdoor activities in the HCNRA, including angling, hunting, camping, hiking, sightseeing, and pleasure boating.

A large majority of commercial float boaters access the river through Hells Canyon Creek portal and stay overnight while floating the river. Some outfitters offer day trips where customers float downstream for all or a portion of a day and are transported back upstream by powerboat. Many commercial float boaters also participate in angling, hiking, swimming, picnicking, and sightseeing while on these trips.

Private float boaters typically access the river through Hells Canyon Creek portal and more than 90 percent of these visitors stay overnight. Generally, private float boaters participate in activities similar to those of commercial float boaters.

Flows

Idaho Power found that releases from the project into the Snake River downstream and outside of the project boundary affect recreational use in the HCNRA in two primary ways (Shelby et. al., 2002). First, different flow levels support specific types of recreational activities and influence the amount, type, and location of recreation use. Second, daily fluctuations can interfere with certain activities and affect the quality of recreational experiences that occur in the HCNRA.

Flow Levels

Idaho Power found that different types of boating opportunities are provided in different parts of the hydrograph (Brown, 2003d). Flows over 30,000 cfs provide challenging trips, of interest primarily to a small number of highly skilled float boaters. Flows between 10,000 and 30,000 cfs provide less challenging trips that are used by both private and commercial power and float boaters. Within that range, float boaters prefer slightly higher flows than those preferred by power boaters. Below about 10,000 cfs, boating trips tend to be more technical for both types of craft.

Overall navigability through the HCNRA tends to be limited by low flows through Granite Creek and Wild Sheep rapids in the upper canyon, particularly for larger powerboats. While the overall whitewater challenge drops at low flows for float boaters, these rapids are still navigable at 5,000 cfs, the lowest flow under current project operations. Experienced powerboat operators are known to take boats about 24 feet long through these rapids at flows as low as 5,500 cfs, and boats up to 40 feet long[100] at flows as low as 6,500 cfs. However, interviews with commercial powerboat operators suggest that the larger boats require flows higher than 7,500 cfs for upstream navigation when fully loaded, and flows between 8,000 or 9,000 cfs for safe downstream navigation when fully loaded. Idaho Power concluded that, depending on the type and size of craft, the minimum navigable flows are between 5,000 and 9,000 cfs and maximum navigable flows range from 30,000 cfs for power boaters to 50,000 cfs for float boaters.

Flow Fluctuations

Idaho Power found that visitor concerns about daily fluctuation of flows appear to be more important than flow changes throughout the year or absolute flow levels for the different types of recreational use in the HCNRA (Shelby et al., 2002). Under current project operations, daily fluctuations can exceed 9,000 cfs in late June, July, August, and the first half of September. In an average water year, the largest daily fluctuations (between about 5,000 to 10,000 cfs) occur during two distinct periods:

[100] The Forest Service permits powerboats up to 40 feet long in the HCNRA.

(1) winter months before spring runoff, typically December through February, and (2) the midsummer months, after runoff but before stable salmon spawning flows occur in early October. During high runoff periods, typically March through June, fluctuations are smaller because generators are often near capacity and dams are passing spill flows. During periods of low reservoir inflows in late summer, higher fluctuations are also rare because they would compromise the provision of average minimum navigation flows of about 7,000 to 7,500 cfs.

A majority of experienced boaters report that these daily flow fluctuations adversely affect trips in a number of ways, including access to camping areas, beaches, and fishing areas; the use of sites and facilities; trip schedules; and the quality of fishing (table 83). Idaho Power found few substantial differences in fluctuation-related problems encountered between float boaters and power boaters, although slightly more float boaters report access problems (particularly access to camping sites and beaches), as well as problems with the use of sites (particularly the ease of walking along the bank), than power boaters. In contrast, more power boaters reported having to wake up at night to move boats as the water level rises or drops or stay with boats during day stops to avoid having boats stranded during a rapid drop in the water level.

Table 83. Snake River fluctuation-related problems experienced by boaters. (Source: Shelby et. al., 2002).

Float Boaters			**Power Boaters**		
Comment	**Reported Problems (%)**	**Major Problems (%)**	**Comment**	**Reported Problems (%)**	**Major Problems (%)**
The way they have to tie up boats	97	68	Having to wake up at night to move/check boats	100	70
Where they set up camps	98	53	Effects on steelhead fishing	93	73
Access to camps	94	54	The way they have to tie up boats	93	61
Access to beaches	93	51	Where they set up camps	86	40
Overall fishing quality	89	45	Effects on overall fishing quality	92	55
Having to abandon camps	81	46	Having to stay with boats at stops	81	43

Flow Information

Numerous sources provide Snake River flow information (table 84). Most of these sources include historical and near real-time flow information for gages within the HCNRA. Although real-time and historical information is useful and readily available, Idaho Power found a strong interest by experienced boaters in obtaining daily flow forecasts for the upcoming day or week in order to assist boaters in planning trips (Shelby et. al., 2002).

Table 84. Typical source of flow information for boaters who checked flows before their trip (% using various sources). (Source: Shelby et. al., 2002)

Source of Flow Information	**Private Float Boaters**	**Commercial Float Passengers**	**Private Power Boaters**	**Commercial Powerboat Passengers**
Idaho Power Phone Line	14	1	16	5

Source of Flow Information	Private Float Boaters	Commercial Float Passengers	Private Power Boaters	Commercial Powerboat Passengers
Idaho Power Internet Site	17	2	7	1
USGS Internet Site	21	3	8	2
Forest Service Phone Line	13	3	4	1
Idaho Water Resources phone line	7	1	3	0.5
Idaho Water Resources Internet Site	14	1	6	0.5
Other (guides, newspaper, Idaho Power staff, other Internet sites, friends, previous experience)	17	18	11	6

3.10.2 Environmental Effects

3.10.2.1 Effects of Project Operations on Recreation Resources

We describe Idaho Power's Proposed Operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on reservoir levels and project outflows in section 3.3.2, *Effects of Project Operations on Water Quantity*. In section 3.3.2.2, we identify operation-related recommendations filed by agencies, tribes, and other parties (table 9), and we describe three alternative operational scenarios that we use to assess the effects of the various operation-related recommendations. At our request (AIR OP-1), Idaho Power simulated project operations for these representative scenarios under various hydrologic conditions. Refer to section 3.3.2.2 for additional discussion of the scenarios and the modeling process used for the simulations. We use the results of these simulations to assess the effects of the operation-related recommendations.

In the following sections, we evaluate the effects of Idaho Power's Proposed Operations and of operation-related recommendations received from agencies, tribes and other parties on the following resources: (1) flat-water boating and reservoir access; (2) recreational trends; (3) navigation downstream of Hells Canyon dam; and (4) boating and access downstream of Hells Canyon dam.

Flat-water Boating and Reservoir Access

Flat-water boating use of Brownlee reservoir is affected by seasonal drawdown of the reservoir. As the reservoir drops, the navigable surface area is reduced and some boating ramps become dewatered. Also, when the reservoir is low, the upstream end of the reservoir becomes very shallow, with channels cut by inflow through silt deposits in the lakebed, which can affect navigability.

Our Analysis

Existing conditions and Proposed Operations entail substantial spring and early summer drawdown of Brownlee reservoir to meet flood control requirements and substantial late summer and fall drawdown to meet minimum flow requirements for the Fall Chinook Salmon Recovery Plan downstream of Hells Canyon dam (see section 2.1.2, *Current Project Operations*). Years with high inflow amplify both the timing and magnitude of the drawdown, with full pool elevation reached for a short period during the primary recreational season and deeper drawdown to meet winter storage requirements.

As Brownlee reservoir drops from full pool (2,077-foot contour), recreational opportunities, including navigable surface area, and public access are reduced starting in the upstream end of the reservoir and the Powder River arm. When the reservoir is drawn down about 15 feet below full pool (2,062-foot contour), Cobb Rapids can be exposed, creating a wide cobble riffle that is difficult to navigate in powerboats. Starting just north of Spring recreation site, about 10 miles of substantial sediment deposits are normally under water. When the reservoir level drops to about 40 or 50 feet below full pool (2,037-foot contour), sediment deposits in the upper 10 miles of the reservoir are exposed and currents begin to cut channels through them. At levels 60 to 70 feet below full pool (2,017-foot contour), these channels present steep-sided walls that rise well above the water surface, limiting public access to the shoreline. At its lowest drawdown of 101 feet[101] (1,076-foot contour), the surface area of the reservoir is about half of the full pool area.

Under existing conditions and Proposed Operations, drawdown of Brownlee reservoir dewaters many of the primary public access boat ramps (table 85). Idaho Power found that from 1994 through September 2001, reservoir levels were within 30 feet of full pool about 74 percent of the days and within 40 feet of full pool about 86 percent of the days. However, the timing of lower reservoir levels exacerbates the problem of public access to the reservoir. In general, flood control and minimum fish flows considerations require that Brownlee be drawn down in April and May and again in mid-July through October. These are prime parts of the reservoir recreation season and Idaho Power found that the lower reservoir levels displace users from some ramps (Idaho, Power, 2003a, section E.5.2.2.2).

Table 85. Elevation of the toe of boat ramps at Brownlee reservoir parks compared to full pool elevation. (Source: Whittaker et. al., 2002).

Park	Elevation of Ramp's Toe	Feet Below Full Pool
Farewell Bend State Park	2,051	−26
Steck Park Ramp	2,062	−15
Steck Park North Ramp	2,040	−37
Spring Recreation Park	2,045	−32
Hewitt Park	2,041	−36
Woodhead Park	2,025	−52
Woodhead Park (gravel launch)	1,976	−101

Compared to existing operations and Proposed Operations, any operations scenario would adversely affect boating access and navigability on Brownlee reservoir if it increased the magnitude of the drawdown, increased the duration of the drawdown, and/or increased the amount of time the reservoir is below full pool during peak use summer months.

Scenario 1 (Reregulating) would not generate any noticeable changes in Brownlee reservoir management compared to existing conditions and Proposed Operations, and there would be no change in flat-water boating at Brownlee reservoir.

Scenario 2 (Flow Augmentation) would have the most substantial adverse effects on flat-water boating opportunities. In all hydrologic year types, the Flow Augmentation Scenario would result in an earlier and more rapid drafting of Brownlee reservoir and in some water years, full pool would not be reached at all during summer months.

Under Scenario 3 (Navigation), flat-water boating opportunities would generally be consistent with existing operations and Proposed Operations, except during low and extremely low water conditions. When inflow is low, Brownlee would be drafted relatively early during spring months to meet navigational flow requirements downstream of Hells Canyon dam, and there would be insufficient inflow

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[101] The largest drawdown of Brownlee reservoir since 1994 was 101 feet and is the maximum permissible drawdown under the current license.

to raise Brownlee reservoir back up to full pool. Under this scenario, the navigable surface area of the reservoir would be reduced during most of the primary recreational season.

Recreational Trends Based on Crappie Population Changes

In the early 1990s, the project experienced a significant rise and subsequent decline in recreational use that, by all accounts, appears to stem from a commensurate rise and decline in the crappie population in Brownlee reservoir. During visitor surveys conducted by Idaho Power, some anglers associated the decline in the crappie population with project operations, specifically the mid- to late-summer drawdown of Brownlee reservoir to meet minimum flows for the fall anadromous fish runs.

Our Analysis

Idaho Power reports that creel studies and anecdotal information show that a substantial increase and subsequent decline of the crappie population in Brownlee reservoir began in the late 1980s and extended through 1994 (Brown, 2003a). IDFG and ODFW conducted a creel study at Brownlee reservoir in 1989 and estimated crappie populations at a much higher level than Idaho Power found during its resident fish study (Brown, 2003a). Idaho Power states that the relative boom of the crappie population could have been the result of a series of drought years that allowed juvenile crappie to accumulate rather than be flushed through the project by high flows.

Peak recreational use in the early 1990s at Brownlee reservoir appears to be associated with the beginning of the decline in the crappie population. During the 1994 field season, Idaho Power observed recreational visitors with large crappie catches, some with thousands of crappie fillets packed into freezers retrofitted into motor homes for the primary purpose of handling the catch. By 1995, the crappie fishery was in decline and recreational demand at the project facilities was starting to drop.

Under Proposed Operations, the crappie population would be expected to follow similar patterns of population growth and decline associated with the water year. During extended periods of drought, when Brownlee is held at near full pool through spring and summer months and there is little inflow, it is likely that spawning nests would be preserved because more stable reservoir levels and lower inflow would wash fewer juvenile crappie through the reservoir. As shown in the early 1990s, there is significant recreational demand for crappie angling; a spike in recreational use would likely follow any spike in the crappie population.

Scenario 1 (Reregulating) would not generate any noticeable changes in Brownlee reservoir management compared to existing conditions and Proposed Operations and would not change the crappie population and recreational use trends at Brownlee reservoir.

Scenario 2 (Flow Augmentation) would have the most substantial adverse effects on crappie fishing opportunities. In all hydrologic year types, the Flow Augmentation Scenario would result in an earlier and more rapid drafting of Brownlee reservoir, which would result in difficult spawning conditions and a relatively narrow channel with relatively rapid currents that would be more likely to flush juvenile fish through the project than under existing conditions and Proposed Operations.

Under Scenario 3 (Navigation), crappie fishing opportunities would generally be consistent with existing operations and Proposed Operations except during low and extremely low water conditions. When inflow is low, Brownlee would be drafted relatively early in the spring to meet navigational flow requirements, and there would be insufficient inflow to raise Brownlee reservoir back up to full pool. Currently and under Proposed Operations, when inflow is low or drought conditions exist, Brownlee is held near full pool and the crappie population is likely to increase. However, under similar low inflow conditions, the Navigation Scenario would result in a lower pool elevation in Brownlee reservoir, which would reduce spawning opportunities and increase relative currents through the reservoir with a commensurate reduction in the crappie population.

Navigation Downstream of Hells Canyon Dam

Safe navigation of the Snake River downstream of Hells Canyon dam requires minimum flows sufficient to effectively cover rocks and create navigable channels through important rapids. Historically the Corps has supported 6,500 cfs as the minimum navigable flow for the river. As part of this relicensing, however, and based on an assessment of boating accidents in the canyon at flows below 8,500 cfs, the Corps now recommends that minimum navigable flows are 8,500 cfs downstream of Hells Canyon dam and 11,500 cfs downstream of the mouth of the Salmon River. In their comments on the draft EIS, many parties, including the Corps, the Forest Service, NPPVA, local Chambers of Commerce, and others, indicated their concern for safety and their support for an 8,500-cfs minimum navigation flow.

Our Analysis

Operational scenarios that maintain the Corps-recommended minimum flows for the longest duration would benefit navigation. Flows under Proposed Operations would routinely fall below the 8,500-cfs navigation target at the Hells Canyon dam gage in most water years and would routinely fall below 11,000 cfs downstream of the Salmon River confluence in low water years.

The Navigation Scenario was derived primarily from the Corps recommendation (see measure Corps-3 on Table 9). The Corps has responsibility for protecting navigable waters and expertise in determining safe navigation requirements. The Commission gives serious consideration to the Corps' input in determining appropriate license conditions. Compared to Proposed Operations, the Navigation Scenario would provide substantial benefits for boating, particularly for the larger powerboats, by keeping flows at or above 8,500 cfs more of the time. During low water years, both the total number of days and the magnitude of flows below the minimum recommended flows would be substantially less than under Proposed Operations. In addition, this scenario would also provide boaters with the ability to predict flows when they drop below minimum levels, as outflow from Hells Canyon dam would equal Brownlee reservoir inflows based on the previous 3-day moving average. Providing a systematic approach to minimum flows would improve navigability downstream of Hells Canyon dam by giving predictability to low flows. Boaters could decide whether their specific boat would be capable of running the most difficult rapids in the HCNRA at the predicted flows and could schedule and plan their trips accordingly. Some of the predictability regarding low flows could also be obtained through better communication (see section 3.10.2.8 for our discussion of flow information and coordination.

The Corps compiled incident and accident data showing that flows of 8,500 cfs downstream of Hells Canyon dam and flows of 11,500 cfs below the Salmon River confluence significantly reduce accidents in the river (Corps, 2006). The Corps study indicates that historically, boating accidents are correlated with releases of 7,500 cfs or less, with accidents causing boat sinking as well as lacerations and broken bones. As further evidence of its assessment, the Corps indicates that there were no reported accidents resulting from low flows in 2004 and 2005 when Idaho Power implemented an 8,500-cfs minimum flow.

As discussed in section 3.10.1.6, *Boating Use Downstream of the Project*, float boaters can navigate key rapids at flows as low as 5,000 cfs, while larger (40-foot) power boats, when fully loaded, require flows in the 8,500-cfs range. To provide clearance over rocks for all vessels, and a margin of safety during passage through critical rapids, the Corps' recommended minimum flow of 8,500 cfs appears to enhance navigation and provide a greater margin of safety than Idaho Power's proposed minimum flow of 6,500 cfs, particularly for larger boats.

The Corps assessment focused on minimum flows, which are only one aspect of many that affect safe boating. Other factors include operator skill and experience, boat characteristics, navigational markings, and other environmental factors, none of which were controlled for in the Corps assessment of minimum flows. The data show that accidents occur for a wide variety of watercraft at various flows, although many of the powerboat accidents are associated with lower flows. Given the many factors that influence boat-related accidents, it may be possible to develop other programs, such as navigational markings, channel modification, and boater safety courses that would improve boater safety in the HCNRA.

In the draft EIS, we concluded that the Flow Augmentation Scenario would improve boating opportunities compared to Proposed Operations because flows would be greater during the month of July and minimum overnight flows would rise accordingly. While true of the 350-kaf flow augmentation scenario, this would be less true of the 237-kaf augmentation flow included in the Staff Alternative in the draft EIS. In comments on the draft EIS, Idaho Power provided the results of additional operational modeling for the 237-kaf flow augmentation regime. The incremental effect of adding the Corps' minimum flow recommendation to the 237-kaf flow augmentation regime would be to reduce the below-target days from 116 to 100 under extremely low water conditions, from 120 to 32 under medium-low water conditions, and from 40 to zero under medium water conditions. Thus, the Navigation Scenario would provide substantially more flows above 8,500 cfs than would be achieved with a 237-kaf flow augmentation regime, and would therefore provide a substantially better boating flow, especially for the larger boats.

As discussed in section 3.10.2.8, *Flow Information and Coordination Downstream of Hells Canyon Dam,* improved communication between Idaho Power and boaters in the HCNRA would help improve safety by providing boaters with sufficient information to allow them to more accurately assess their skills in the context of actual flows.

River Fluctuations and Campsite Access Downstream of Hells Canyon Dam

Daily river level fluctuations downstream of the project can affect access to camping sites. If river levels rise overnight, boats secured near the low water edge can float off moorings and be damaged by rubbing against rocks. Conversely, when flows drop overnight, large boats can get stranded above the waterline and boaters may have to wait for high water to launch boats.

Our Analysis

Experienced rafters and power boaters apply basic standard operating practices for extended boating trips on regulated rivers, such as the Snake River and the Colorado River. These practices include, among other things, protocols for anchoring boats overnight. Anchoring systems are typically designed to be flexible and easily adjusted to accommodate fluctuating river levels, including anchor and stay systems with ropes that can be extended or shortened as needed. Typically, at least one member of the party sleeps on each boat and wakes periodically overnight to adjust the rigging. Although good planning and camping protocols allow most groups to manage diurnal river stage changes, the quality of the river trip would generally improve, boaters' rigging systems could be less complex, and contingency planning for any stranding that may occur would be eased to the degree that river fluctuations are lessened. Under the Proposed Operation, there would be substantial flow fluctuations up to 10,000 cfs per day that would ebb and flood over shoreline areas. Boaters would have to follow standard protocol for safe and efficient camping along the river.

Similar to Proposed Operations, Scenario 3 (Navigation) would allow river flow fluctuations up to 10,000 cfs per day except when minimum navigation flows are reached. At these low flows, the Navigation Scenario would benefit the quality of the boating experience by reducing stage changes.

In contrast, Scenario 1 (Reregulating) and Scenario 2 (Flow Augmentation) would substantially reduce diurnal fluctuations. The stabilized flow regime under Scenario 1 would have the most benefits to boaters camping along the river by reducing the diurnal ebb and flood. The ramping rates would also minimize the hourly change in river levels, which would further improve public access to camping areas.

3.10.2.2 Recreation Plan

The Hells Canyon Project includes some of the most important recreational resources in the region, and acts as a gateway to the upstream end of the nationally significant Hells Canyon whitewater boating run. Public recreational facilities in the project are managed by a number of different organizations, including private companies, counties, and state and federal agencies. Early in the relicensing process, Idaho Power convened the Recreation and Aesthetics Resource Work Group (RARWG).[102] RARWG found that in general the quality of some existing recreational facilities associated with the project is good, with some sites showing deterioration as a result of insufficient capital investment, increased use, and deferred maintenance. RARWG also found that some new recreational facilities are needed to meet project-related demand (Whittaker and Shelby, 2003b). The primary recreational issues identified by RARWG include the need for expansion/revitalization of some existing park facilities, new recreational facilities in some areas, an improved information and education (I&E) program, an improved litter and sanitation program at dispersed sites, and measures to address unforeseen recreational needs over the term of any new license.

To address the recreational issues identified by the RARWG, Idaho Power proposes to implement a Recreation Plan for the project that includes the proposed recreational measures that we describe and analyze below in sections 3.10.2.3 through 3.10.2.10. In this section, we consider the merits of developing a Recreation Plan and the procedural framework necessary to support implementation of the proposed measures. In subsequent sections, we consider specific proposals and recommendations that would be included in the plan, as well as the proposed and recommended related plans (e.g., road management plan, visual resource plan, vegetation management plan).

Idaho Power's proposed Recreation Plan would be designed to achieve the following objectives: (1) promote public safety and increase public awareness of recreational opportunities by providing interpretive, informative, and educational panels and kiosks at developed recreational sites and by providing information through a web site and a toll-free telephone number; (2) promote reasonable health and safety standards through a Litter and Sanitation Plan (see section 3.10.2.4); (3) provide accurate and timely information about water flow and river fluctuations downstream of Hells Canyon dam via the web site, toll-free telephone number, and onsite flow monitors (see section 3.10.2.8); (4) provide accurate and timely information about water flow and reservoir fluctuations at Hells Canyon Project reservoirs via the web site and toll-free telephone number (see section 3.10.2.8); (5) provide safe and reasonable access to recreational areas (see section 3.10.2.3); (6) reduce congestion and conflict among visitors and resources related to recreational activities; (7) provide reasonable and amenable recreational facilities that provide for a range of recreational opportunities (see section 3.10.2.3); (7) reduce effects on cultural, terrestrial, and aquatic resources; (9) provide a forum for the coordination of resources between Idaho Power and law enforcement agencies (see section 3.10.2.9); and (10) provide opportunities to work cooperatively with agencies and other entities to provide adequate and reasonable recreational developments that incorporate desired future conditions (see section 3.10.2.9).

The Forest Service (FS-12) specifies that within 1 year of new license issuance, Idaho Power, in consultation with the Forest Service, would finalize the Hells Canyon Complex Comprehensive Recreation Management Plan (Recreation Plan) and file the plan with the Commission for approval. In addition to specific measures that we discuss below in sections 3.10.2.3 through 3.10.2.10, the recommended Recreation Plan would include an annual implementation schedule, consultation, and

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[102] RARWG consists of the Forest Service, BLM, National Park Service, Idaho Department of Parks and Recreation (IDRP), Idaho Department of Fish and Game, Oregon Department of Parks and Recreation, Oregon Department of Fish and Wildlife, Idaho Rivers United, Oregon State Marine Board, Baker and Wallowa counties (Oregon), and Washington and Adams counties (Idaho).

approval procedures. The Forest Service also specifies that the plan adequately address Forest Service resource concerns and standards of quality (e.g., Meaningful Measures) for the term of any new license.

Interior's modified condition no. 6 specifies that Idaho Power prepare a Comprehensive Recreation Management Plan (CRMP). Specific elements that are included in the CRMP that are not addressed elsewhere in this EIS include: (1) consulting with the recreation workgroup (RRWG); (2) using a decision making structure that involves the RRWG; (3) implementing provisions of the recreation mitigation package according to the Americans with Disabilities Act (ADA); and (4) establishing protocols for consultation with and approval by agencies. In its comments on the draft EIS, Interior indicates that the CRMP would identify, enhance, and sustain an appropriate range of recreation settings and experiences on lands for the public over the entire complex; identify recreation facility needs; and enable Idaho Power to identify and correct public health problems as they arise. The CRMP would also identify how to use visitor contact, resource patrols, public outreach, and interpretation and information efforts to improve voluntary compliance with rules and regulations. Interior also specifies that the CRMP define acceptable operational and maintenance standards for all recreational facilities and improvements, and define monitoring and data collection standards used to determine facility conditions, resource conflicts, public safety issues, levels of use, needs for new or expanded facilities, and levels of public satisfaction with recreation experiences. Interior justifies the scope of this recommendation by stating that future management of the project should be planned and managed as one unit, irrespective of ownership.

BPT-19 recommends that Idaho Power prepare an Integrated Comprehensive Recreational Plan, subject to approval by the federal agencies and the Burns Paiute Tribe. As recommended, the plan appears to be generally consistent with Idaho Power's proposal and would include measures to provide interpretive signage for education and information that would be developed in consultation and with approval of the tribes. BPT-19 also recommends that the Tribe have the authority to review and approve the selection of all contractor(s) and sub-contractor(s), and, whenever possible, that tribal preference would be exercised to develop and increase competencies and capacities of the tribe.

Our Analysis

Idaho Power currently manages recreational facilities through a Recreation Use Plan that was required by the Commission in Article 38 of the original license. During the past 20 years, Idaho Power has updated and revised the plan to accommodate improvements at the applicant-owned recreational sites. In addition to implementing measures in the Recreation Use Plan, Idaho Power has also worked closely with various resource agencies to assist in funding and implementing recreational site improvements throughout the project area, including major capital improvements at some sites, such as Holcomb and Hewitt parks.

The proposed Recreation Plan would replace the old plan and substantially increase and formalize Idaho Power's responsibilities to provide and maintain recreational resources throughout the project area, including those formal and dispersed recreational sites managed by others that provide public access to the project. The plan would provide a framework for Idaho Power to implement the recreational site improvements (discussed in section 3.10.2.3, *Recreational Site Improvements*) and coordinate management of recreational resources with the many land managers that have jurisdiction over project lands, and monitor recreational use and needs over the term of any new license. These measures would provide substantial improvements to management and delivery of recreational resources and would substantially expand recreational opportunities within the project.

The proposed plan reflects the unique character and management responsibilities of public recreational sites around the project. The plan would recognize that, while Idaho Power has no legal authority to redevelop public access sites owned or managed by others, it does have some responsibility to ensure reasonable public access to project lands and waters for that portion of the site that is within the project boundary. The assistance and funding included in the plan would improve delivery of recreational services by streamlining implementation of the improvement measures, minimizing jurisdictional conflicts between the Commission and the various land management agencies, and providing a mechanism for earmarking Idaho Power funds to specific project-related improvements.

Although the Forest Service recommends many additions to specific components of Idaho Power's proposal, the Forest Service recommendation for the administrative components of the Recreation Plan is generally consistent with Idaho Power's proposal. Including a discussion of how Idaho Power would meet Meaningful Measures in any license issued would help ensure that the proposed Recreation Plan addresses Forest Service standards for any improvements constructed on Forest Service-managed lands. This part of the plan would help balance Forest Service conditions against recreational needs in other parts of the project.

The CRMP that Interior (Interior-6) and the Burns Paiute Tribe recommend is also similar to Idaho Power's proposed Recreation Plan. Some of Interior's specifications for standards and procedures that would be outlined in the Recreation Plan would benefit recreational opportunities by establishing procedures for communication and consultation with other land managers. Interior's specification to establish a RRWG would help ensure that appropriate consultation occurs as the plan is being developed and implemented without including too many stakeholders in a manner that slows planning and delivery of the plan. Similarly, Interior's specification to establish protocols for consultation with agencies would ensure that Interior and other agencies have reasonable opportunities to provide input into the finalization and implementation of the plan. Interior's specification to include a discussion of ADA in the proposed Recreation Plan would help ensure that an appropriate level of barrier-free access is achieved and maintained for the term of any new license.

There is no indication that recreational resources would benefit from Interior's specification that the plan include a decision-making structure that involves all stakeholders and the Burns Paiute Tribe's recommendation that the tribe have review and approval authority over the selection of all contractor(s). Idaho Power's proposed plan would include consultation with agencies and stakeholders prior to implementing the measure, which would be the appropriate time for Interior and/or the Burns Paiute Tribe to comment on the plan. Additionally, we note that as the licensee, it is Idaho Power, and not any other party, that the Commission holds responsible for implementing the terms of any new license

In conclusion, a number of the recommended measures would improve planning and delivery of the proposed Recreation Plan. Idaho Power provides little detail about how the plan would be prepared, how consultation with agencies and stakeholders would be handled, what standards for construction and O&M would be met for different properties, and how Idaho Power would implement measures across the many jurisdictional boundaries within the project area. In addition to those measures discussed in the application, it would improve recreational resource management if the Recreation Plan included standards for construction that meet the disparate agency requirements; measures to comply with ADA standards; a description of how Idaho Power would plan, design, and construct new facilities (including a detailed description of each measure to the conceptual design level); and a description of how Idaho Power would comply with various federal and state standards for site development, help define appropriate procedures for implementing the plan, and help ensure that adequate standards are met for all recreational improvements over the term of any license issued. Also, finalizing the proposed plan in consultation with the primary land managers, including the Forest Service, BLM, IDPR, IDFG, ODFW, OPRD, and the Oregon and Idaho counties around the Hells Canyon Project, would help to ensure consistency between proposed and recommended measures.

3.10.2.3 Recreation Site Improvements

Recreational sites provide the primary public access to the Hells Canyon Project. Recreational use associated with the project increased and subsequently dropped in the early 1990s with slow but steady growth through 2002. Many new facilities were constructed in the early 1990s to meet visitor demand and Idaho Power's recreational use study shows that most of these developments have been underused at the current level of use (table 81). However, even with existing rates of growth in recreational use, project-related recreational facilities may reach capacity and displace recreational visitors over the term of any new license. As visitor demographics and use patterns change over the term of any new license, recreational amenities at these sites may no longer serve the type of recreational uses that visitors expect.

As part of the proposed Recreation Plan (section 3.10.2.2), Idaho Power proposes to improve many recreational sites and upgrade some informal recreational facilities to provide an improved level of service. These proposed measures are summarized in table 86. It is our understanding, from comparing the proposed project boundary in exhibit G of the license application with the description of the proposed improvements, that all of the proposed improvements summarized in table 86 would be within the project boundary.

Idaho Power developed the proposal over many years in consultation with the RARWG. All of the public comment concerning recreational facilities was from RARWG members and the majority of comments recommend implementing Idaho Power's proposed site improvements. Agency comments and recommendations regarding Idaho Power's proposal are listed in table 86, as well as additional recommended measures. Each agency recommendation that differs from Idaho Power's proposal is discussed in subsections below.

Our Analysis

Existing recreational facilities within the project include 24 formal or semi-formal public-access sites that have some level of recreational infrastructure ranging from minor to substantial; 4 private marinas and camping areas; and at least 123 undeveloped, dispersed, or informal sites (figure 115). These facilities provide the primary public access to project lands and waters. The infrastructure at many of the existing recreational facilities is degraded from deferred maintenance, and some of the facilities are not able to support the desired level or type of recreational use during peak-use periods. Although most recreational visitors interviewed expressed a high level of satisfaction with the condition of the sites, they also noted their desire for improvements, such as improved public access when the reservoirs are low, additional facilities along the Oregon shoreline of Brownlee reservoir and at Hells Canyon reservoir, and site improvements throughout the project (Whittaker and Shelby, 2003b).

Idaho Power's proposal to enhance, expand and formalize the sites listed in table 86 would substantially improve public access in the project area. Idaho Power's proposed improvements to recreational facilities within the project boundary would be site-specific, derived from a recreational needs assessment, prepared in consultation with stakeholders, and targeted at either improvements to existing facilities or development of informal facilities. In addition, the proposal considers recreational needs from a geographical perspective and recommends site improvement measures based on the overall need in a given project reach. This approach would help to ensure that certain areas of the project or certain facilities are not over-capitalized and that other areas receive appropriate improvements to meet existing and projected needs.

The proposed improvements and expansions to the semi-formal sites would include expanding camping facilities and formalizing uses at Swedes Landing, Carters Landing, Westfall, Bob Creek, Airstrip A&B, Copper Creek, Eckels Creek, Big Bar and Eagle Bar. Historically, these sites have received substantial overnight and day use by campers and boaters visiting the project. The recreational studies indicate that some basic infrastructure is needed to support recreational activities, such as improved toilet facilities; defined camping, driving and parking areas; designated day-use facilities; and improved maintenance (Whittaker and Shelby, 2003b). Idaho Power's proposal would address these needs by expanding and formalizing recreational opportunities at these semi-formal sites and would help

Table 86. Proposed and recommended recreational facility improvement measures. (Source: Idaho Power, 2003a, as modified by staff)

Site	Idaho Power Proposal	Agency Conditions and Recommendations
Oasis		Interior-16: Within 2 years of new license issuance, develop an enhancement plan for the Oasis site that would include provisions that would, among others, address the need for and feasibility of enhanced restrooms, parking, vehicle control, day use activities, foot trail, and signage. Interior states that recreational use of the site is primarily project-related.
Steck recreation site		Interior-12: Develop an enhancement plan for the Steck recreation site within 1 year of new license issuance. The plan would include provisions that would, among others, address the need for and feasibility of adding communication capabilities for emergency and other necessary purposes to meet the needs based on site requirements; separate day-use facilities with shade structures, tables, cement pads, and grills; and an additional public information kiosk.
Weiser Dunes		Interior 27: Idaho Power, in coordination with BLM, would conduct a recreation user study at Weiser Sand Dunes to determine levels and types of recreation use and the relationship between use at the project and Weiser Dunes. Idaho Power would then cooperate with BLM to develop a Recreation Plan for the site. Idaho Power's level of participation in designing and implementing the plan would be proportional to the amount of recreation assigned to the project. Assessments of additional site needs, including facilities, O&M, enhancements and mitigations would be conducted through the Adaptive Management Plan.
Farewell Bend State Park		OPRD-3 and -4: Develop and implement a maintenance plan that would address and remove sediment buildup around docks and in-reservoir pumps. OPRD indicates that the sediment buildup results from project operations of Brownlee reservoir and that the buildup reduces lake access from the docks and adversely affects the performance of the park's irrigation pumps.
Jennifer's Alluvial Fan		Interior-13: Develop and implement an enhancement plan within 2 years of new license issuance that would include installing toilet facilities, limiting the further spread of vehicle damage and noxious weeds, repairing and preventing further erosion damage at the entry/exit point of the site, and providing an information kiosk and map.

Site	Idaho Power Proposal	Agency Conditions and Recommendations
Spring	Prepare a site plan for Spring recreational site to enhance existing recreational facilities and improve boat ramp access to Brownlee reservoir to be completed within year 4 of the new license.	Interior-11: Develop a site plan that would include: (1) redesigning vehicle circulation and relocate portions of the interior road; (2) increasing parking capacity for day use boat trailer parking; (3) defining camping sites and adding electric and water hookups where appropriate; (4) improving tent camping areas, including parking and ADA toilets; (5) surfacing new and existing roads and parking areas with asphalt; (6) developing overflow parking; (7) retrofit the existing boat launch and boat ramp to be ADA accessible; (8) designing access from boat ramps to boarding docks with accessible grade according to OSMB ADA design; (9) replacing boat dock system to minimize ongoing maintenance and to better accommodate reservoir drawdowns and refill; (10) improving fish cleaning station to minimize ongoing maintenance, reduce offensive odors, and meet DEQ septic requirements; (11) retrofitting the water system throughout site and developing an irrigation system for vegetation; (12) upgrading one RV space for a campground host, including shade and septic system; and (13) landscaping the site to maximize shade and reduce dust and installing shade structures where appropriate. Idaho Power would assume the responsibility associated with the O&M of existing and new facilities at this site for the life of the new license.
Swedes Landing	Prepare a site plan for Swedes Landing to be completed within year 4 of the new license.	Interior-10: If a new low-water boat ramp and associated campground are not developed at Private Dude's Cove within 2 years of license issuance, develop an enhancement plan for Swedes Landing site that would include enhanced campsites with kitchen areas, improved ADA accessibility, enhancement of riparian area and rehabilitation, replacement of existing toilets, replacement of jersey barriers with more aesthetic barrier, boating facilities, and shade shelters. If a new boat ramp and campground are developed within 2 years at Private Dude's Cove, prepare and implement a plan at Swede's Landing to address riparian habitat restoration, public safety and control, and site vegetation. ODFW-83: Develop a low-water boat launch on the Oregon side of Brownlee reservoir at or near Swedes Landing. OPRD-9: Increase and improve low water access to project reservoirs.
Low-Water Boat Launch	Develop and implement a site plan for a low-water boat launch at or near Swedes Landing to be completed within year 3 of the new license.	Interior-18. If, within 1 year of license issuance, Idaho Power has not constructed a Low-Water Boat at Private Dude's Cove and if Interior-10 has not been implemented, then within the second year after license issuance, Idaho Power would file a Low-Water Boat Launch Plan that would include provisions to find a suitable location at or near Swedes Landing, developing a site plan, and implementing the site plan for a low-water boat launch.

Site	Idaho Power Proposal	Agency Conditions and Recommendations
Hewitt and Holcomb parks	Develop and implement a site plan for Hewitt and Holcomb parks to improve site condition and provide cultural and natural resource protection. Start consultation with Baker County and begin implementation within year 1. Additional measures would be implemented as appropriate through the RAMP.	ODFW-79: Develop and implement a site plan for enhancement of Hewitt and Holcomb parks.
McCormick Park	Reconstruct McCormick Park to meet current standards of services, benefit recreation, improve public access, and protect cultural and natural resources to be completed within year 5 of the new license.	
Carters Landing and Oxbow boat launch	Implement a site plan for Carters Landing and Old Carters Landing recreational sites to be completed within year 3 of the new license. Implement a site plan for Oxbow boat launch to be completed within year 3 of the new license.	Interior-15: Develop and implement enhancement plans for Carter's Landing and Oxbow boat launch. The plan for Carter's Landing would include provisions to enhance campsites with kitchen areas, improve ADA accessibility, and add boat moorage and shade shelters. The plan for Oxbow boat launch would include an improved boat ramp, boarding floats, improved ADA accessibility, and enhanced parking.
Copperfield boat launch	Enhance Copperfield boat launch area to improve day-use site conditions. Start implementing improvements in year 3 of the new license.	
Westfall, Bob Creek and Airstrip A, B, and C	Develop and implement site plans for Westfall, Bob Creek sections A, B, and C, and Airstrip A&B dispersed recreational site to be completed within year 3 of the new license.	Interior-9: Develop an enhancement plan for Airstrip, Bob Creek Section C, and Westfall within 10 years of new license issuance. The plan would include, but not be limited to, improved ADA accessibility, boat moorage, and one camp host site for all 3 sites. The provision of potable water would be evaluated and implemented if feasible. ODFW-80: Develop site plans for Westfall dispersed recreation site, Bob Creek sections A, B and C dispersed recreation site and Development of Airstrip A and B dispersed recreation site.
Hells Canyon Park	Reconstruct Hells Canyon Park within year 5 of the new license.	ODFW-80: Consult with state and federal agencies regarding proposed changes to Hells Canyon Park.

Site	Idaho Power Proposal	Agency Conditions and Recommendations
Copper Creek	Develop and implement a site plan for the Copper Creek dispersed recreation site to benefit recreation and provide cultural and natural resource protection to be completed within year 3 of the new license.	Interior-17: Develop an enhancement plan for Copper Creek within 2 years of new license issuance. Development would be consistent with section 106 of NHPA and the requirements for NEPA. Depending on findings of these evaluations, the plan may include provisions for a road system serving designated campsites with picnic shelters and fire rings, trailhead parking, equestrian staging area, boat moorage, and mitigations for soil erosion around the point near the mouth of Copper Creek. Enhancement design would mitigate effects on terrestrial and aquatic resources, i.e., trampling and removal of vegetation, shoreline erosion, and soil compaction.
Eckels Creek	Develop site plan and enhance Eckels Creek dispersed recreation site to benefit recreation and provide cultural and natural resource protection to be completed within year 3 of the new license.	FS-15: Implement the site plan proposed in the draft Recreation Plan (Idaho Power, 2003a), for the Eckels Creek dispersed recreation site within 3 years of new license issuance.
Big Bar	Develop site plan for Big Bar recreation site in coordination with the Forest Service consistent with the Settlement Agreement. The plan would include specific facility enhancements at Section C, as well as possible future expansion on other sections of the Big Bar as part of the adaptive management measures in the RMP. Big Bar Section C campground would be developed to level "3", or moderate site modification with design of improvements generally based on use of native materials, with about 15 to 20 campsites and support facilities.	FS-13: The modified condition is based on the Settlement Agreement between Idaho Power and the Forest Service and is consistent with Idaho Power's proposal.
Eagle Bar	Enhance Eagle Bar dispersed recreation site and improve boat ramp access to Hells Canyon reservoir to be completed by end of year 3 of the new license.	FS-14: Within 3 years of new license issuance, Idaho Power would implement the site plan proposed in the draft Recreation Plan (Idaho Power, 2003a) for Eagle Bar.
Deep Creek Stairway	Complete a condition and safety inspection of Deep Creek Stairway/Trail #218 within 1 year of new license issuance consistent with the Settlement Agreement. Upon completion of the inspection, Idaho Power would coordinate with the Forest Service and IDFG to address any mutually agreed upon deficiencies found in the inspection. Idaho Power would also develop an O&M Plan and implementation schedule for the site.	FS-16: The modified condition is based on the Settlement Agreement between Idaho Power and the Forest Service and is consistent with Idaho Power's proposal.

Site	Idaho Power Proposal	Agency Conditions and Recommendations
Hells Canyon Road pull-outs	Idaho Power proposes to grade and conduct litter patrols at informal pull-outs and parking areas along Hells Canyon Road.	FS-17: Develop, improve, and maintain parking and signage at Allison Creek, Kinney Creek, Eckels Creek, and Deep Creek parking lots. The Forest Service states that all of these facilities are used to provide public access to project lands and waters and that the facilities require improvements to meet the existing demand for recreational activities at those sites.
Hells Canyon Creek launch		FS-21: Prepare a plan for the launch that would include (1) adding potable water and grey water disposal; (2) leading a cooperative effort to provide a sanitary cleaning systems; (3) addressing safety issues at the boat launch that may include modifying the existing ramp;(4) repairing the footing on the ramp at the launch site; (5)maintaining the existing level of Licensee staffing; and (6) conducting 100% of the O&M for the road, parking area, vault toilets, and ramps associated with the launch.
Heller Bar		Interior-28: Develop a Heller Bar plan and implement facility upgrades Heller Bar within 5 years of new license issuance. The plan would include: (1) a new two-lane concrete boat ramp with concrete aprons for gear preparation along each lane to accommodate motorized boaters, and (2) a separate take-out facility for non-motorized boating traffic just downstream of the confluence of the Grande Ronde River, including graded access for boat trailers, a ramp designed to accommodate two parties with loading and unloading areas, and designed to be useable during average low water levels.
Angler Access downstream of the project		IDFG-8: Develop improved public angler access near IDFG-managed fish hatcheries on the Little Salmon River and Salmon River downstream and outside of the project boundary. IDFG points out that prior to construction of the Hells Canyon Project, access to adult anadromous resources in the Snake River provided significant fishing opportunities. IDFG states that hatchery fish are the key mitigation factor for the loss of anadromous fish species relative to the project; therefore, it is reasonable for Idaho Power to help facilitate societal use and access to that resource.
Boat moorages	Idaho Power proposes to develop boat moorages as part of the proposed Recreation Plan on Oxbow and Brownlee reservoirs	Interior-8: Develop a Project Boat Moorage Plan that would include a minimum of one moorage at Westfall, Bob Creek Section C, airstrip, and Copper Creek on Hells Canyon reservoir and Oxbow boat launch and Carter's Landing on Oxbow reservoir. OPRD-10 and -11: Install moorages for recreational watercraft. Include moorages for shore access and composting toilets in site development.

Site	Idaho Power Proposal	Agency Conditions and Recommendations
Idaho Dispersed Sites		Interior-14: Develop and implement a plan for Site No. 2 Below Hells Canyon Bridge to include a 5-vehicle gravel parking lot, a barrier to limit vehicle damage to adjacent uplands, and a portable toilet. Develop and implement a Litter and Sanitation Plan for Site No. 2 Below Hells Canyon Bridge and other dispersed sites, including Williamson Creek and Boat-in Camping Area No. 2, consistent with Interior-7.

Notes: ADA – Americans with Disabilities Act
BLM – Bureau of Land Management
IDFG – Idaho Department of Fish and Game
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
ODFW – Oregon Department of Fish and Wildlife
O&M – operation and maintenance
OPRD – Oregon Parks and Recreation Department
RV – recreational vehicle

to delineate appropriate recreational uses for various activities. Also, a number of the formal recreational sites, including Hewitt, Holcomb, Woodhead, McCormick, and Hells Canyon parks, are at or near capacity during peak-use periods. Improving the semi-formal sites by installing basic infrastructure would provide other opportunities within the project area to accommodate visitors displaced from full campgrounds.

Project operations limit public access to Brownlee reservoir when the reservoir is low. Currently, only Woodhead Park has a boat ramp that can access water when the reservoir is drawn to 101 feet below full pool. Woodhead Park is difficult for many Oregon residents to reach, given the topography of the area. The proposal to develop low water launch sites, particularly at the site near Swedes Landing, would improve recreational opportunities for visitors arriving from the Oregon side of Brownlee reservoir by providing access when the reservoir is low.

When we compare Idaho Power's proposed site improvements with agency recommendations for those sites, we note minor differences, such as the location of potable water taps and the number of campsites. These differences could be resolved through the consultation process during both finalization of the proposed Recreation Plan and implementation of site improvement measures.

Overall, Idaho Power's proposed measures listed in table 86 above and as detailed in the license application (Idaho Power, 2003a) would increase recreational opportunities by providing new facilities and would enhance visitors' recreational experiences by improving existing conditions. These measures represent a substantial improvement over existing conditions and would provide additional capacity in an area where existing project recreational facilities would continue to receive heavy recreational use, particularly on some weekends and holidays.

Oasis

Recreational use of Oasis appears to be project related. The site is the most southern recreational site within the project boundary that provides access to project lands and waters. This area is within the backwater influence of Brownlee reservoir, which explains why it is within the project boundary. Unlike the more remote sites within the project, Oasis is near Interstate 84 and is easily accessible by road from Weiser and other nearby population centers. Oasis receives continuous but small amounts of recreational use throughout the year, with spikes during early summer months that appear to be associated with full pool in Brownlee reservoir (Idaho Power, 2003a; Brown, 2003a). Although we acknowledge that the type and character of recreational use at Oasis differs from other sites within the project, this seems logical given its location within the project at the upstream end of Brownlee reservoir and the more riverine setting.

The condition of Oasis is informal, with a restroom, parking area, and gravel boat ramp. Interior-16 calls for site improvements to meet existing and future needs. However, it is unclear from the recreational use data to what extent improvements are needed. Oregon manages Farewell Bend State Park, just downstream of Oasis, at a very high level of development, so developed site recreation experiences are available in the vicinity. Relatively informal recreational sites provide a unique experience, and improvements may conflict with visitors' expectations for the site. Nonetheless, developing a plan for an initial round of Oasis site improvements that would define and contain parking and formalize areas for other recreational uses, and, if needed, installing improved toilets, would improve the site condition without developing the site beyond what is needed to meet demand. Any future recreational needs could be addressed through the RAMP discussed in section 3.10.2.9.

Weiser Dunes

As summarized in table 86, Interior-27 calls for Idaho Power to develop a Recreation Plan for the Weiser Dunes. The sand dunes are approximately 100 acres on BLM land located across the Snake River from Farewell Bend State Park, approximately 15 miles from Weiser and 5 miles upstream from Steck Recreation Site (Duneguide, 2006). Interior states that recreational use of the dunes is

> . . . strongly influenced by the Project area surrounding the reservoir, and as a consequence it is receiving increased recreational use and demand from a regional population. BLM acknowledges that some level of OHV use at Weiser Dunes from nearby local communities would have inevitably occurred without the impoundment of Brownlee Reservoir. However the development of the reservoir appears to have created a regional attraction that draws substantial use from larger urban communities outside the local area and accounts for much of the current and anticipated growth in recreational OHV use at Weiser Dunes (letter from Interior to the Commission dated January 26, 2006, pg 100).

There is little recreational use information about the site on the record that shows any relationship to project uses. No jet-skis, boat trailers or other water-related equipment was observed on vehicles in the parking lot and no shoreline angling was observed at the site during Idaho Power's recreation study (Brown, 2003d).

The property is not within the project boundary, is not associated with project-related camping or boating facilities, and is separated from the project boundary by a railroad track. There is no reasonable way for OHV users to access the property from Brownlee reservoir. As suggested by Interior, some visitors to the dunes may camp at Steck Recreation Site; however, if this is the case, it would appear the project is absorbing some level of use induced by proximity to the dunes, not the other way round. It is also possible that visitors to Steck Recreation Site, in addition to bringing boats and other water-related recreational equipment may also bring OHV equipment and all of the necessary gear to support that activity as well. The degree to which this may occur is not known.

Steck Recreation Site

As summarized in table 86, Interior-12 specifies that Idaho Power develop an enhancement plan for the Steck recreation site within 1 year of new license issuance. As shown in table 81, however, recreational use of the site does not appear to meet the existing day-use or overnight capacity. Facilities at the site have substantial capacity to meet current use. Thus, Interior's specification to develop an enhancement plan for Steck recreation site in anticipation of future recreational use does not appear to be needed at this time. It is likely that growing future use would degrade the existing facilities and ultimately require expansion and upgrades. Idaho Power's proposal to include Steck recreation site in the RAMP (see section 3.10.2.9) would allow Idaho Power and BLM to address future recreational requirements, including expansion of the site if needed, over the term of any new license issued.

Interior's specification for a communication system at Steck Park would improve safety along Brownlee reservoir by allowing visitors to contact emergency services or police. The project area is remote and communication throughout the area is difficult. Cellular phone reception is intermittent to non-existent around much of Brownlee reservoir, and evacuations could take many hours to arrange. However, the specification does not take into account many other potential systems that could improve communication in a more holistic manner. For example, it may be more efficient and provide much greater coverage to install a repeater, a cellular tower, or a radio tower at a location that would maximize coverage in the project area. As part of the I&E portion of the Recreation Plan (see section 3.10.2.5), Idaho Power could also study and consider the need for maps that show communication coverage areas. Considering the need for improved communication systems in the proposed Recreation Plan would allow Idaho Power to study the need for and implement the most practical and cost-effective communication measures throughout the project area rather than at individual sites. This approach may be more effective at addressing communication needs within the project area than installing a single landline at Steck recreation site.

Farewell Bend State Park

As summarized in table 86, OPRD's recommendation that Idaho Power remove sediment buildup around docks and in-reservoir pumps recognizes that sediment buildup at Farewell Bend State Park is project related. During the spring freshet, deposition of sediments in the river generally occurs where inflow meets the backwater from Brownlee reservoir. Farewell Bend State Park is located near the upstream end of Brownlee reservoir; when the reservoir is full, backwater in front of the park is relatively wide, with slow moving currents. Depending on the elevation of the reservoir, deposition occurs throughout the entire upstream end of Brownlee reservoir, as evidenced by the many feet of sand and silt that can be seen during seasonal reservoir drawdown. When the reservoir is near full, deposition occurs in the vicinity of Farewell Bend State Park. Given the nexus between sediment buildup and project operations, developing a plan to remove the sediments in a systematic manner would improve public access to the reservoir, improve aesthetics of the docks, and address project-related effects on the park's irrigation pumps.

Project operations appear to be the primary contributor to shoreline erosion and slope undercutting at Farewell Bend State Park. OPRD conducted and filed with its comment letter an erosion study for the site that found seasonal fluctuations of Brownlee reservoir and boat wave action cause erosion along almost 80 percent of the park shoreline. The report also suggests that, without stabilization treatments, the shoreline would continue to erode until the toe of the slope is at or just above the high water mark. OPRD estimates that without protection measures, bank stabilization would be achieved at a point approximately 120 feet inland from the current bank with a loss of about 4 acres of the park. Including measures to harden and protect the shoreline as part of the final Recreation Plan would help reduce project-related losses of recreational land and infrastructure, help protect riparian habitats from further degradation, and improve aesthetic characteristics of the site.

Jennifer's Alluvial Fan

As summarized in table 86, Interior's specified enhancement plan for Jennifer's Alluvial Fan would improve recreational opportunities at the site. Currently, the informal site is about 6 acres with no facilities, and it is used for project-related camping and fishing activities. Interior indicates that recreational use of the area has created problems with litter, disposal of human waste, vehicle damage to shoreline areas, and erosion damage at the entry/exit point of the site. Developing and implementing a site plan that includes basic infrastructure, such as toilet facilities, vehicular barriers, signage and regular maintenance, would help improve the site condition and would help protect the surrounding area from prohibited recreational activities.

Hells Canyon Road Pull-outs and Parking Areas

As summarized in table 86, the Allison Creek, Kinney Creek, Eckels Creek, and Deep Creek parking lots, which the Forest Service specifies be developed and improved, are relatively informal pull-offs along the project road that parallels Hells Canyon reservoir within the project boundary. The pull-offs are located near the creeks and provide public access to the reservoir and creeks. Developing and improving these sites would enhance the quality of the sites and potentially allow them to accommodate additional use. However, simply maintaining these sites under the Recreation Plan as proposed by Idaho Power would ensure reasonable informal access. If any modifications are needed at Eckels Creek and Allison Creek parking areas, these pull-outs could be included in the proposed site plans for Eckels Creek and Big Bar, respectively. Ongoing O&M of the pull-out areas could also be addressed through the proposed Road Management Plan. These areas are known for their important riparian areas; including these pull-outs in the proposed I&E plan (section 3.10.2.5) would help ensure consistency of educational and interpretive materials throughout the project area and describe site-specific acceptable and prohibited uses.

Boat Ramps on Hells Canyon Reservoir

Idaho Power proposes to continue to operate the Hells Canyon reservoir within a 5-foot maximum daily drawdown. However, as proposed, Idaho Power would allow for an additional 5-foot drawdown under atypical conditions. Atypical conditions, as defined by Idaho Power, are conditions when Idaho Power determines that operation of the project (which operation may occur automatically or manually) is needed to: (1) protect the performance, integrity, reliability, or stability of Idaho Power's electrical system or any electrical system with which it is interconnected; (2) compensate for any unscheduled loss of generation; (3) provide generation during severe weather or extreme market conditions; (4) inspect, maintain, repair, replace, or improve Idaho Power's electrical systems or facilities related to the project; (5) prevent injury to people or damage to property; or (6) assist in search-and-rescue activities. This proposal could affect recreational access to the reservoir because most of the existing facilities have been developed to provide access at a maximum 5-foot drawdown.

Forest Service condition no. 19 calls for Idaho Power to manage reservoir levels to minimize impacts on recreation resources during the summer. Maximum drawdown during the recreation season is currently limited to 5 feet from full pool elevation. If, based on operational modifications ordered by the Commission or system emergencies, the reservoir is drawn down for protracted periods below 5 feet from full pool elevation, FS-19 specifies that Idaho Power reconstruct or modify boat launching facilities to provide access to the reservoir.

In its comments on the draft EIS, the Forest Service clarified the purpose and scope of the condition, indicating that the major premise behind FS-19 is to provide access to Hells Canyon reservoir when water conditions are low as a result of operational conditions ordered by the Commission, system emergencies, or other situations that could cause the reservoir to be drawn down for protracted periods below the current 5-feet drawdown limit. This condition would require Idaho Power to reconstruct or modify launching facilities to provide access to the Hells Canyon reservoir during these times to avoid stranding of boating recreationists. FS-19 would not require operational changes at either Brownlee or Hells Canyon reservoirs, instead it requires construction of additional access facilities at Hells Canyon reservoir to provide continued access to that reservoir when drawdown is greater than 5 feet.

Our Analysis

There is little information on the record describing the length of boat ramps at recreational sites along Hells Canyon reservoir. However, it is likely that most of the sites were developed consistent with current project operations, suggesting that some of the existing ramps would not allow access to the reservoir during atypical days under proposed operations. Idaho Power indicates that proposed operations would rarely extend below the normal drawdown of 5 feet. Nonetheless, there is nothing in Idaho Power's proposal that would ensure that drawdown does not adversely affect boating on the reservoir.

FS-19 would help ensure that reasonable public access to Hells Canyon reservoir continues from Big Bar and Eagle Bar. These are the only Forest Service-managed sites on Hells Canyon reservoir, but they are important public access sites to the reservoir. Proposed changes to these sites (see table 86) would further improve the quality of the sites and may increase recreational demand for access to the reservoir from these sites. FS-19 would ensure that boat ramps are extended to support public access if proposed project operations interfere with reasonable use. The condition does not define "prolonged" drawdown. Defining the conditions under which Idaho Power would extend boat ramps as part of the proposed Recreation Plan, which would be prepared in consultation with the Forest Service and other resource agencies, would clarify what would constitute an adverse level of impact on boat access from project operations.

Other boat ramps could also be affected by proposed operations. Assessing the need for extending public boat ramps at Hells Canyon reservoir as part of the proposed Recreation Plan would help ensure that atypical conditions do not adversely affect boating. A systematic evaluation of existing boat ramps, based on the elevation at the bottom of each primary boat ramp, the amount of time that boat access would be limited under atypical conditions, and whether extending the boat ramp is needed to support public access to the reservoir, would help ensure reasonable public boat access to the reservoir for the term of any new license.

Deep Creek Stairway

Recreational use of the Deep Creek Stairway appears to be project related. The stairway descends from the Hells Canyon dam parking area to the mouth of Deep Creek, dropping approximately 350 vertical feet on a combination of 250 steps and short stretches of trail. The stairway starts within the project boundary and exits the project at a point approximately half way down the stairway. Deep Creek is approximately 0.1 mile downstream of the dam and just outside of the project boundary. The Forest Service states that prior to the construction of the stairway, visitors (primarily fishermen) traversed a steep, narrow, and dangerous path along the canyon to access the fishing hole at the mouth of Deep Creek. The stairway and trail is currently operated and managed by the Forest Service with the intent to provide public recreational and, possibly, maintenance access to the base of the Hells Canyon dam on the Idaho side of the river. The trail provides the only public access to the Idaho side of the Hells Canyon dam tailrace area. Given the contemporary and historical demand for access to the Deep Creek confluence and tailrace area, and the project's role in providing public access from the Hells Canyon dam to the tailrace area, we find that recreational use of the stairway and trail from the dam to the Deep Creek confluence is project related.

Idaho Power's proposal and Forest Service modified condition no. 16 to complete a condition and safety inspection of Deep Creek Stairway and trail and correct any deficiencies found during the inspection would address recreational needs at the site. Given the trail's close connection to the project and angling access to the base of the Hells Canyon dam, operating and maintaining the facility as part of the project would ensure public access for the term of any new license issued. In addition, including the stairway and trail in the project boundary would ensure that reasonable public access to the tailrace and Deep Creek area would be maintained for the term of any new license.

Hells Canyon Creek Launch

Idaho Power states that most of the use at Hells Canyon Creek launch area is related to the HCNRA, which would attract substantial use even without the project. Although we acknowledge that most of the use of the launch area is associated with boating downstream of the project, we find that recreational use of the launch is associated with the project. The launch site is the only area for boaters, and the primary area for anglers, to access the Snake River immediately downstream of the project. The project represents a substantial barrier to accessing the Snake River; given the national significance of the boating run downstream of the project, the launch site represents minimal and reasonable access to the Snake River downstream of the project.

As described in table 86, the Forest Service (FS-21) specifies site enhancements at the launch area, as well as development of a potable water system in the launch vicinity. Given the remote location of the Hells Canyon Creek launch area, providing potable water at the site or nearby would improve the quality of the site and provide important infrastructure necessary to safely and efficiently stage trips into the HCNRA. The benefits of similar systems can be seen at other major river portals in the region, such as the Middle Fork and Main Salmon River launch areas.

The Forest Service (FS-21) also specifies improvement of the primary public access at the launch area, as well as sanitation, safety, and public outreach. Overall, the specified measures recognize the responsibility of the licensee to provide reasonable access to the project and the river downstream of the project.

Because of the importance of the launch area and its relationship to the project, including the Hells Canyon Creek Visitors Center and boat launch area in the proposed Recreation Plan would allow Idaho Power and the Forest Service to cooperatively plan and implement appropriate recreational improvements to the site. Also, including this area within the project boundary would ensure that the site continues to provide safe public access for boaters to the river downstream of the dam, as well as appropriate facilities to provide reasonable access for powerboats and float boats.

Dispersed Sites

Interior-14 specifying site improvement measures for Site No. 2 Below Hells Canyon Bridge and a litter and sanitation program for dispersed sites, including Site No. 2 Below Hells Canyon Bridge, Williamson Creek, and Boat-in Camping Area No. 2, would improve the conditions of these sites and would be consistent with Interior-7 and with Idaho Power's proposed RAMP (section 3.10.2.9) and its proposed Litter and Sanitation Plan (section 3.10.2.4).

Heller Bar

Heller Bar is one of a number of primary access sites to the HCNRA well downstream and outside of the project boundary (RM 168). Heller Bar is used as one of a number of downstream takeout areas. Although the recommended measures may improve site conditions at Heller Bar, there is no indication that recreational use of the site is project related or that project operations adversely affects the site.

Angler Access Downstream of the Project

IDFG's recommendations to improve public angler access near IDFG-managed fish hatcheries on the Little Salmon River and Salmon River do not appear to be project related. We find that IDFG's recommendation mixes the issues of hatchery mitigation for the loss of anadromous fish species and societal use and access to hatchery fish. Although the hatchery program addresses a project-related effect on aquatic resources (see section 3.6.2.12), the project provides substantial recreational opportunities within and adjacent to the project boundary. The effects of project development and operations on pre-project recreational opportunities have been addressed by the current license and Idaho Power's provision of reasonable public access to project lands and waters. These existing facilities and opportunities for flat-water recreation would not exist without the project and recreational use statistics indicate that there is substantial demand for these recreational resources. Idaho Power proposes additional recreational measures to be included in any new license that would improve project-related recreational opportunities. As recommended by IDFG, the angler access sites would be well downstream and outside of the project boundary with no clear nexus to the project's recreational resources. In addition, numerous opportunities are available to access the free-flowing portions of the Snake and Salmon rivers, and the project has no demonstrated adverse effects on these access sites.

3.10.2.4 Litter and Sanitation Plan

The project provides recreational opportunities for many thousands of visitors from the region. However, in part because of this intense use, Idaho Power and RRAWG identified litter and human waste problems along the project shorelines, which can create public health and safety impacts and aesthetic impacts, and can detract from recreational experiences (Whittaker and Shelby, 2003b).

Idaho Power proposes to continue the current litter and sanitation program at dispersed and impromptu sites within the project boundary. Currently, Idaho Power maintains some trash receptacles at dispersed sites and places portable toilets at some highly used dispersed sites at all three project reservoirs. Idaho Power proposes to continue to fund the existing Litter and Sanitation Plan. Idaho Power also proposes to enhance the existing Litter and Sanitation Plan for the project by providing additional portable and vault toilets at appropriate dispersed recreational sites and by implementing a biannual litter pickup program throughout the project area. Idaho Power would develop the plan in consultation with the appropriate agencies and entities and would implement the Litter and Sanitation Plan for the term of any new license.

Interior-7 specifies that Idaho Power develop and implement a Litter and Sanitation Plan for the project that would include supplying dumpsters with appropriate frequency in appropriate locations near lands administered by BLM along the Homestead, Oxbow, and Snake River roads; installation of permanent vault toilets at appropriate dispersed recreation sites; providing at least one floating restroom on Brownlee and Oxbow reservoirs; and implementing a routine litter pickup program that is adequate to mitigate the litter problem. Parameters to determine appropriate locations for dumpsters and vault toilets, as well as adequacy of the litter program, would be identified within the recommended plan. O&M for this plan would be the responsibility of Idaho Power (discussed further in section 3.10.2.7, *Operation and Maintenance of Forest Service and BLM Sites*). Interior also specifies that Idaho Power continue existing actions regarding litter and sanitation measures consistent with its proposal and implement the litter and sanitation provisions of the Baker County Settlement Agreement, dated October 3, 2003.

OSMB-5 calls for Idaho Power to develop waste disposal measures that would include human waste disposal in its Litter and Sanitation Planning. OSMB recommends installation of boat toilet dump stations in the project area based on the fact that many smaller boats now carry portable toilets that require dump stations to be serviced. OSMB also recommends installation and maintenance of one floating toilet on Brownlee reservoir between Morgan Creek and Hibbards Landing. OSMB encourages Idaho Power to work with the Marine Board to solicit federal Clean Vessel Act funds to assist with installation and purchase of floating toilets and waste disposal systems.

ODFW-77 suggests that Idaho Power continue and enhance its Litter and Sanitation Plan within 1 year of new license issuance, similar to Idaho Power's proposal. ODFW recommends that the plan be developed in consultation with appropriate state and federal agencies and entities and the recreation stakeholder group.[103] Under ODFW's recommendation, Idaho Power would fund, operate, and maintain the Litter and Sanitation Plan and its improvements with regular monitoring of the litter and sanitation situation for the term of a new license.

As part of FS-21, the Forest Service specifies that within 1 year of new license issuance, Idaho Power design, construct and maintain a gray water disposal system and a sanitary cleaning system, comparable in design to SCAT cleaning devices, capable of cleaning portable human waste carry out systems within the Hells Canyon reservoir area. The Forest Service indicates that recreational use associated with the Hells Canyon Creek area is project-related; therefore, it is Idaho Power's responsibility to construct and maintain such a system.

Our Analysis

Idaho Power's litter and sanitation proposal would substantially improve existing conditions throughout the project area. Idaho Power and stakeholders identified litter and sanitation as an important recreational issue that affects both the quality of the recreational experience and the environmental attributes of the dispersed sites. As proposed, Idaho Power would continue to operate and maintain trash receptacles at important sites and would expand the program to include installation and maintenance of toilets at some more important recreational sites, as well as implement a bi-annual litter pickup program throughout the project area. Including these proposed measures in any new license issued for the project would substantially improve the condition of the dispersed sites, improve health and sanitation for

[103] ODFW recommended formation of this group as part of the Recreation Adaptive Management Plan discussed in section 3.10.2.9.

visitors, and potentially reduce some of the impacts from visitors on sensitive environmental resources around these sites.

Idaho Power has not identified all of the sites where toilet facilities and trash receptacles would be installed. In response to agency comments on the license application, Idaho Power indicates that the plan would include biannual litter pickup at Kevin's Alluvial Fan and Weiser Sand Dunes, Jennifer's Alluvial Fan, Snake River boat launch, and Oasis. Idaho Power indicates that Jennifer's Alluvial Fan and Snake River boat launch may also be included in the sanitation part of this measure if they are selected through ongoing consultation for portable toilet locations. Although the full details of the proposal are unclear at this time, Idaho Power would prepare the details of the Litter and Sanitation Plan in consultation with RRWG, allowing agencies to recommend the appropriate location for these facilities.

Interior's specified Litter and Sanitation Plan (Interior-7) is similar to Idaho Power's proposal. Interior calls for the installation of vault toilets on the grounds that they are more aesthetically pleasing and cost less to operate. Interior also specifies the installation of dumpsters in areas along Brownlee and Oxbow reservoirs. Both of these specifications would achieve similar goals for improved sanitation. To the degree that these specifications may differ from Idaho Power's proposal, resolution about the type of sanitation and trash facilities and the location of these facilities could be appropriately addressed through the consultation process and filed for Commission approval as part of the plan.

Interior's specification for the construction and maintenance of floating restrooms on Brownlee and Oxbow reservoirs (Interior-7) and OSMB's recommendation for a similar facility on Brownlee reservoir may provide additional recreational benefits for some boaters at the project. In some areas of the project reservoirs, particularly the middle portion of Brownlee and the northern portion of Hells Canyon reservoirs, convenient boater access to restrooms does not exist, which may result in boaters using waters and/or shoreline areas for their restroom needs. However, there is little indication on the record that floating restrooms are needed. Currently, numerous developed recreational sites with boat ramps along all reservoirs provide sufficient shoreline restroom facilities. Idaho Power's proposal includes additional shoreline toilet facilities through the Litter and Sanitation Plan, which should improve public access to these facilities, especially in the more remote areas of the project reservoirs. Boaters could access the existing and proposed facilities with relatively short travel times.

Although it is not entirely clear from the record, we assume that these agency recommendations are associated with Idaho Power's proposal to install moorings for overnight camping. If the final locations of the mooring sites are associated with shoreline facilities, the recommended floating restrooms do not appear to be needed. If the location of the moorings is more than 1 mile from a developed public access site, then floating restrooms may provide an appropriate level of service. Developing these details in the proposed Litter and Sanitation Plan, in consultation with the RRWG, would help ensure that an appropriate level of service is provided to meet recreational needs without overdeveloping the resource.

There is no indication on the record that OSMB's recommendation to develop a dump station for boat holding tanks at the upstream end of the project is needed. Although developing a dump station in the project area may be convenient for some visitors, public access through primary roads varies significantly throughout the project area. For example, boaters accessing Brownlee may approach and leave the project from Oregon or Idaho on roads accessed from the north or south. There is no one obvious portal on which to locate a dump station that would be convenient for most visitors. Boaters and RV campers have options to pump holding tanks along major highways throughout the region, and there is no indication in the public record to suggest that these regional facilities are insufficient to meet project-related visitor demand for such services.

One exception to our analysis is noted above with respect to the Forest Service specification that Idaho Power design, construct and maintain a gray water and sanitary cleaning system capable of cleaning portable human waste carry out systems within the Hells Canyon reservoir area. Recreational use associated with the Hells Canyon Creek area is project-related because the property, which is just outside of the project boundary, is the only area for boaters and anglers to access the Snake River immediately downstream of the project. The area is very remote and is accessible only along one project road. The specified sanitation measures would provide infrastructure to support reasonable public access to trips into the HCNRA. Many float boaters return to the Hells Canyon launch area by powerboat so that they do not have to arrange a vehicle shuttle (Brown, 2003c). Consistent with HCNRA regulations, most rafters that float the river collect human waste in ammunition boxes or other containers that can be conveniently stowed in float boats. However, safely disposing of human waste and sanitizing these types of containers is difficult for private boaters. Given the remote location of the Hells Canyon Creek put-in/take-out, construction of the Forest Service-specified human waste disposal system would improve sanitation and disposal of human waste. The benefits of similar systems can be seen at other major rivers portals in the region, such as those on the Middle Fork and Main Salmon rivers.

3.10.2.5 Information and Education

Idaho Power proposes to develop an Information and Education Plan that includes: (1) review and selection of appropriate themes; (2) review and selection of appropriate interpretive media to be used; (3) development of a web site and toll-free phone number accessing pertinent recreation-related information; and (4) review and selection of prioritized sites where the interpretive media would be located. Through these efforts, Idaho Power would then implement the plan in consultation with the appropriate agencies and entities, and operate and maintain I&E facilities and amenities resulting from the plan.

Both Interior-24 and ODFW-78 call for Idaho Power to develop and implement an Information and Education Plan consistent with Idaho Power's proposal.

OSMB-6 calls for Idaho Power to provide education and outreach materials at all boating access points designed to prevent the introduction and/or spread of invasive species, including zebra mussels, hydrilla, mud snails, and other non-native, aquatic species that pose a serious threat to western waterways. Under this recommendation, Idaho Power would monitor for introduction of these species and participate in state and federal planning efforts to prevent introduction or respond if an introduction occurs.

NMFS-20 recommends that Idaho Power design and construct an anadromous fish interpretive display at a location near Brownlee dam. The purpose of the display would be to instruct the public with respect to: (1) the biology and geographical ranges of anadromous fish species that historically migrated past the project; (2) the importance of anadromous fish to Native American Indian Tribes; (3) the factors contributing to the loss of these species (with graphical and geographical depictions of these losses over time); and (4) measures that Idaho Power is taking to protect and restore anadromous fish resources or their habitat.

Our Analysis

The proposed Information and Education Plan would promote protection and preservation of cultural, natural, and historical resources by providing educational and interpretation materials at primary recreational sites. The plan would also provide consistency of information and education materials between recreational sites, which would help give recreational users the sense of coherent management throughout the project area. As described by Idaho Power, the plan does not specify the location or type of materials that would be developed. Including this information in the plan, as well as operational and maintenance activities and any scheduled updates to the information and education materials, would help ensure that the plan can be successfully managed over the term of any new license.

OSMB recommends including information on aquatic invasive species in the proposed Information and Education Plan. Invasive aquatic species can adversely affect recreational and commercial uses of waterways and damage aquatic ecosystems by overwhelming native plant and fish populations and altering species composition throughout a waterway. Introduction of invasive species to the Hells Canyon Project could also threaten downstream areas as well as fish and habitat restoration efforts throughout the basin. The project draws recreational boaters from throughout the region, which increases the risk of introducing aquatic invasive species. Including this recommended measure in the Information and Education Plan would help inform visitors about the incremental role individual boaters play in spreading non-native species. Information and education materials about invasive species would also help to provide basic information about the potential harm these plants and animals could cause to important aquatic resources within the project area.

As discussed in section 3.7.2.8, *Special Status Wildlife*, Interior identified concerns about protection of special status bats and reptiles. In our analysis, we found that recreational activity could cause disturbance to these species and their habitat, and that educating visitors by including information about them in the Information and Education Plan could reduce the potential for adverse effects.

Implementing the NMFS recommendation to develop anadromous fish information and education materials at Brownlee dam would provide important information about the effects that hydroelectricity development has on migratory fish runs. Idaho Power contributes substantial resources annually toward the improvement of anadromous fish runs, without which certain populations of salmon would be further stressed. Including in the Information and Education Plan information about the role hydroelectric projects, as well as other human activities, play in bringing about the loss of anadromous fish runs, and the efforts underway to improve and protect these runs within the context of modern energy demands, would help place this issue in a contemporary context.

3.10.2.6 Trails

Trails provide important recreational and hunting access to the federal lands adjacent to the project. Although many other types of recreational uses are declining on a national level, demand for trail-related activities, such as walking, hiking, and biking tends, to be increasing. Of the numerous recreational and hiking trails that provide access to public lands managed by federal agencies near the project, many begin along project roads or at project-related recreational sites.

Idaho Power does not propose any specific measures for trails outside the project boundary. However, as part of the Litter and Sanitation Plan (discussed in section 3.10.2.4, *Sanitation and Litter Management*), as well as proposed improvement measures at Eagle Bar and Copper Creek dispersed recreation sites, Idaho Power proposes measures to improve O&M at trailhead sparking areas along Hells Canyon reservoir. In Idaho Power (2003a), Idaho Power states that funding for trail improvements and maintenance should remain the responsibility of the Forest Service because use of the trails is not primarily project related.

The Forest Service (FS-20) specifies that, within 1 year of new license issuance, Idaho Power perform trail maintenance of Forest Service trails accessed from the Hells Canyon reservoir and Hells Canyon Creek launch site. In Oregon, these trails would include Hells Canyon Trail (#1890), Bench Trail (#1884), McGraw Trail (#1879), and Stud Creek Trail (#1781). In Idaho, these trails would include Eckels Creek Trail (#223), Allison Creek Trail (#514), Midslope Contour Trail (#222), Kinney Creek Trail (#221), and Deep Creek Trail (#219). The condition also specifies that within one year Idaho Power would develop a plan to address future management of the Hells Canyon Reservoir Trail and within 5 years would develop a plan to address future management of the McGraw Creek Trail (#1879A). The Forest Service states that the primary use of these trails is by Hells Canyon Project visitors, who come to the area for other recreational activities, but who frequently use Forest Service trails during their visit. The Forest Service states that these visitors are attracted to Forest Service-managed trails because of their proximity to the project, the lack of opportunities on Idaho Power's lands, and the general increasing population base that is projected to influence use of the project area in the future.

ODFW-84 recommends that Idaho Power improve access to the Stud Creek Trail.

Interior-3 specifies that, as part of an integrated travel and access management plan for BLM-administered lands affected by the project, Idaho Power develop and implement a plan for non-motorized use of trails connecting recreation sites along the Oregon side of Hells Canyon reservoir and conduct a feasibility study for developing a trail system along the Hells Canyon, Brownlee, and Oxbow reservoirs connecting Farewell Bend State Park to the HCNRA. Interior states that a well-maintained trail system would accommodate increased use as well as prevent unregulated use, and thus protect natural and cultural resources.

Our Analysis

Recreational use within the project boundary is primarily associated with the project reservoirs, including boating, fishing and camping. With the exception of a few specific trails within the project boundary, little evidence on the record suggests that use of hiking trails that originate at the project are project related. Further, Idaho Power indicates that the Forest Service overstates the proportion of project-induced users that hike and does not consider other information that suggests most reservoir users are not seeking longer trail hiking opportunities. In its February, 27, 2006 filing, Idaho Power states that its new analysis of trailhead surveys collected from 1998 through 2002 offers additional information about the proportion of trail users who probably should not be categorized as project-induced because their primary purpose was hiking upland trails that would have been available with or without the project.

Although Idaho Power's recreational study shows that walking and hiking are secondary uses in the project area, there is little indication of where this walking and hiking occurs. Idaho Power found that less than 2 percent of all visitors to the area use Forest Service trails as their primary destination (Whittaker and Shelby, 2003b). The Forest Service states that 22 percent of all visitors surveyed reported using these trails during their visit to the Hells Canyon Project, but we cannot confirm this number from materials on the record. Whittaker and Shelby (2003b) state:

> Over one-quarter of all visitors reported walking, while 7% reported hiking. This suggests that most reservoir users do not travel along the reservoirs by foot, but if they do so, it is to explore the immediate vicinity rather than travel long distances. Fewer than 1% reported traveling by horse. Hells Canyon reservoir users were more likely to walk and hike than other users. Taken together, these results suggest greater visitor interest in short trails than in longer ones (although the lack of longer trails may also offer a partial explanation for these results).

Although there is good indication that visitors walk and hike in the project area, it is likely that walking and hiking mean different things to different visitors. Some visitors may report hiking while exploring a reservoir shoreline, walking along project roads, or walking around some of the larger recreational sites.

Based on the data in the record and our visits to the project, we cannot assume that this use is on Forest Service-managed trails. Instead, we assume that some percentage of project visitors hike on Forest Service lands as secondary activities. Likewise, some percentage of visitors to the area are attracted principally by hiking, hunting, horseback riding, or boating opportunities on Forest Service lands and secondarily use project resources. As such, project and Forest Service recreational resources probably induce secondary use on other resource areas, similar to what happens in other complex recreational areas.

As part of its proposal and settlement with the Forest Service, Idaho Power would maintain and improve the principal pullouts and trailheads within the project boundary that provide hiking access. The trails covered by FS-20 begin at the project boundary in these areas, but extend well beyond the project. Idaho Power's commitment to improve and maintain these areas includes the project-related uses of these areas, such as sightseeing, resting, picnicking, swimming, and hiking. Some of these uses may include hiking or other activities on Forest Service lands. It appears that the proposed and specified measures would fulfill Idaho Power's responsibility to protect environmental resources associated with access points to Forest Service trails.

Based on the information on the record, we do not find a clear nexus between project operations and recreational use of Forest Service-managed trails, including Stud Creek Trail, outside of the project boundary. Idaho Power appears to address the primary project-related effects on trails originating within the Hells Canyon Project by proposing to maintain pull-out and parking areas along Hells Canyon Road and improving sanitation and increasing litter patrols throughout the project.

With respect to Interior's modified condition specifying development and implementation of a new trail system (Interior-3), Idaho Power found in its studies related to project relicensing (Johnson, 2003) that creating a trail system may negatively affect wildlife and other natural resources, and recommended against expansion of access for recreational use where possible. In addition, Idaho Power states that the RARWG in its pre-application meetings did not discuss the concept of creating a trail system, which Idaho Power suggests is an indication that the group did not believe that a new trail or trails were needed in this area. While a trail system could improve recreational opportunities along Brownlee and Oxbow reservoirs, based on the record, Interior has not established a clear need for the recommended trail system to provide reasonable public access to the project.

3.10.2.7 Operation and Maintenance at Forest Service and BLM Sites

Long-term O&M of project recreational facilities would ensure that the quality of the recreational sites is maintained for the term of any new license. Under the current license, Idaho Power has kept its recreational facilities in good operating condition and has amended the current Recreation Use Plan with new capital improvements at its recreational sites. Idaho Power has also assisted some of the other land managers with sites adjacent to the project by providing litter patrol and maintenance at some dispersed sites and contributing funds toward capital improvements. However, some formal sites and many of the informal sites have deferred maintenance needs or receive minimal ongoing services.

Idaho Power proposes to continue O&M of its parks and recreation facilities and to perform O&M at Idaho Power-enhanced BLM and Forest Service reservoir-related recreational sites. In addition, as part of its settlement with the Forest Service (October 26, 2006), Idaho Power proposes to perform O&M necessary to meet USDA Forest Service Standards, Meaningful Measures, as amended, over the term of any new license for Eagle Bar, Eckels Creek, Big Bar, parking areas along the Hells Canyon reservoir, Black Point Viewpoint, and dispersed areas on National Forest System lands within the project boundary pursuant to the Recreation Plan. This proposal is consistent with FS-18 that calls for O&M on Forest Service-managed lands.

The Forest Service (FS-21) specifies that, among other things, Idaho Power perform 100 percent of O&M necessary to maintain the Forest Service-specified improvements at the Hells Canyon launch, and 50 percent of the remaining O&M needs at the launch. Idaho Power's alternative to the Forest Service 4(e) condition regarding the Hells Canyon launch area would require Idaho Power to maintain much of the access road, parking areas, vault toilets, and ramps associated with the launch.

OPRD-8 recommends that Idaho Power fund the O&M and monitoring efforts found within the Recreation Plan and is generally consistent with Idaho Power's proposal.

Our Analysis

Idaho Power's proposal to fund O&M at its recreational sites and those BLM and Forest Service sites as part of the license would provide substantial benefits over existing conditions by formalizing O&M at most of the primary recreation sites within the project boundary. Although Idaho Power's recreation sites are generally maintained in very good condition, many of the other public facilities that provide access to the project, including some of those managed by federal agencies, have not received consistent O&M funding. As discussed in section 3.10.2.3, *Recreation Site Improvements*, Idaho Power proposes substantial recreational improvements to many federally managed recreational sites within the project boundary. A license requirement for Idaho Power to pay O&M costs for these facilities would ensure that the facilities are adequately maintained for the license term and would be consistent with the settlement between Idaho Power and the Forest Service on condition no. 18.

3.10.2.8 Flow Information and Coordination Downstream of Hells Canyon Dam

Boating in the HCNRA downstream of the Hells Canyon Project is a recreational resource of national significance. Flows downstream of the project are affected by project operations, and change in stage can affect the navigability of certain rapids. In order for private and commercial boaters to plan and run trips in the HCNRA, a reasonable level of historical, near real-time, and projected flow information is needed.

Idaho Power proposes to continue to operate and maintain monitors to provide flow information about river flows downstream of Hells Canyon dam. Idaho Power currently publishes outflows from Hells Canyon dam via satellite transfer. The data are displayed graphically on the Internet in daily outflows for the previous 7 days, hourly outflows for the previous 24 hours, and projected hourly outflows for the next 24 hours. Idaho Power's toll-free flow phone line provides projected flows for up to 4 days. The gages are located at Hells Canyon Creek recreation site, Oregon; Pittsburg Landing, Idaho; Cache Creek Administrative Site (Forest Service), Oregon; Hells Gate Marina, Lewiston, Idaho; Heller Bar, Washington; and the Forest Service Clarkston Office, Washington.

No agency or stakeholder has specified the need for different flow information. However, as part of its comments on the draft EIS, NPPVA states that a significant need exists for accurate, reliable, and timely flow information. As part of its filing, NPPVA highlighted numerous times when the current Internet site reported flows there were different from those that were experienced on the river.

Our Analysis

Boating opportunities exist under all water conditions downstream of the project and, to a large degree, the regulated outflow of the project stabilizes the hydrograph, creating generally predictable flows and boating opportunities. Idaho Power voluntarily provides historical, near real-time, and planned project flow information at numerous points over more than 100 miles of free-flowing river downstream of the project. Boaters have benefited from Idaho Power's publication of this information by having detailed information from which to plan and stage river trips.

Minimum flows are of primary concern to boaters. Certain rapids, including Granite Creek and Wild Sheep rapids in the upper canyon, are not navigable by some boats, particularly large powerboats, at low water. Unless unforeseen problems occur, Idaho Power's proposal with the proposed forecast would allow power boaters to plan trip details, such as when to launch, where to camp, and when to run certain rapids, up to 4 days in advance of entering the canyon.

Overall, Idaho Power's Internet site and flow phone provide substantial information at sufficient detail to safely plan and stage trips downstream of the project. However, as noted by NPPVA in its comments on the draft EIS, there are discrepancies between the actual flow and the flows posted on Idaho Power's Internet site. Idaho Power is not currently under any license obligation to maintain accuracy on the Internet site, as illustrated in NPPVA's letter. In a letter to the Corps dated June 26, 2007, and filed with the Commission on July 3, 2007, Idaho Power outlined a number of measures that it is currently pursuing with respect to improved flow information, including: (1) emphasizing the importance of the Hells Canyon discharge information that is posted at the six flow monitor sites; (2) ensuring the accuracy of information posted on Idaho Power's website and 1-800 phone number; (3) providing timely and accurate press releases; (4) providing a common data source for the flow monitors, web site, and 1-800 number to ensure that accurate and timely information is provided via all three media and that the information is consistent among the three media; (5) continuing to evaluate the feasibility of developing a text messaging system that would send the current Hells Canyon discharge each hour to a list of subscribers with satellite phones that could be reached on the river; and (6) evaluating the feasibility of installing additional stream flow gaging facilities on the river or important tributaries so that boaters would have access to additional real time information regarding measured flows, in addition to the information already provided on dam releases.

Developing a plan to ensure that boaters have the most relevant flow information for various sections of the river would contribute to improved safety, especially for large powerboats during periods of low flow. Any plan for distributing timely flow information would require close coordination and consultation with the Corps and NPPVA. Such a plan may include forecasts of flows at key locations, taking into account the lag-time associated with releases made at Hells Canyon dam. Although flows would drop under 8,500 cfs under any operating scenario that did not include the Corps' recommended 8,500-cfs minimum flow, boaters would have a better idea when such lower flows might occur and, in the context of their experience and skills, could plan for the best time and route through difficult sections of the river.

3.10.2.9 Adaptive Management

Idaho Power proposes to develop a RAMP within 3 years of new license issuance to ensure the adequacy of the proposed Recreation Plan (section 3.10.2.2), as well as to identify and address recreation management, measures, and facility needs for the project over the term of any new license. Idaho Power would use recreational monitoring as the basis for evaluating and recommending any changes to the Recreation Plan that may be needed. Proposed monitoring would include annual informal onsite observations and traffic counters, as well as a more detailed recreational survey of social indicators and general recreational use every 6 years. Idaho Power would prepare summary reports for stakeholders annually and a comprehensive report every 6 years in coordination with FERC Form 80 (Licensed Hydropower Development Recreation Report) filing. Idaho Power states that the plan would provide a way to ascertain the appropriate level of recreation development or management in relation to the use of recreation sites and other measures, while protecting other resource values. Consultation with agencies and entities would occur in coordination with FERC Form 80 filing.

The Forest Service (FS-12) specifies that Idaho Power develop a Recreation Management Plan (discussed in section 3.10.2.2, *Recreation Plan*) that would include adaptive management measures. The Forest Service specification would require Idaho Power to: (1) develop a comprehensive recreation monitoring plan that includes evaluation of recreation use, preferences and trends; (2) report recreational use information to the Forest Service and other interested entities as it becomes available, including annual reporting of use occurring at Idaho Power's fee parks; (3) coordinate with the Forest Service to establish trigger points that indicate a need for additional development or improvements at sites identified in the Recreation Plan; and (4) provide for appropriate expansion of existing recreational facilities or development of new project related recreation facilities and for other recreational opportunities on Forest Service lands commensurately with project related use pursuant to the Recreation Plan. The Forest Service also specifies that Idaho Power conduct visitor satisfaction surveys every 6 years to monitor crowding and changing reservoir setting conditions. Details of the survey content and implementation would be coordinated with the Forest Service and other applicable entities to ensure that the level of detail and applicability of information would be consistent with previous surveys and analysis. When practical, these surveys would duplicate the survey protocols developed by Whittaker and Shelby (2003b) and presented in Whittaker and Shelby (2003a).

OSMB-4 recommends that Idaho Power fund, develop and implement a RAMP in consultation with a recreation stakeholder group to establish the procedures to accommodate the recreational boating needs within the project. Specific items that would be addressed include: (1) increasing low water access to provide better seasonal access to project reservoirs, and (2) developing moorages of adequate size and design for recreational watercraft to facilitate full use of the project waters. Under this recommendation, Idaho Power would complete a boat moorage and access facility needs assessment that would provide Oregon boaters fair and equitable access and services compared to Idaho-based facilities. Moorages would include shore access whenever possible and if not available, composting toilets would be included in site development to address sanitation issues.

OPRD, as part of OPRD-4 through -7, recommends a number of measures to be included in the RAMP, including: (1) formation of a recreational stakeholder group within 4 months of new license issuance to assist with the development and implementation of the RAMP; (2) Idaho Power funding, development and implementation of a RAMP in consultation with the recreation stakeholder group to ensure adequacy of the Recreation Plan and to identify and address recreation measures for the project over the life of any new license; and (3) a method to share information between Idaho Power and the recreation stakeholder group about recreation decisions, adaptive management, protocols for annual meetings, trigger points, and comprehensive recreation monitoring. The only recommended measures that appear to differ from Idaho Power's proposal is the 4-month initiation of consultation and the recommendation to include trigger points in the plan.

ODFW-1 states that Idaho Power should develop and implement a RAMP in consultation with a recreation stakeholder group. ODFW recommends that Idaho Power form the stakeholder group within four months of new license issuance, implement the RAMP within 3 years of new license issuance, and maintain the plan through the life of the new license. Under this recommendation, Idaho Power would fund all agreed-upon construction, O&M, and monitoring efforts associated with this license condition.

Interior-31 calls for development of a Recreation/Aesthetics Resource Workgroup to facilitate communication and consultation between Idaho Power and BLM and to develop recommendations regarding recreation and aesthetic resource management goals and objectives. The workgroup would include representatives from the BLM; Forest Service; State Park agencies; County Park representatives; tribal governments; NGOs, who have an expressed interest in the RRWG; and Idaho Power. Among other issues, the workgroup would convene to address: (1) development of the Recreation Plan; (2) Idaho Power's implementation of recreation and aesthetic conditions; (3) planning according NEPA that is necessary to implement the recreation conditions on Federal administered lands; (4) scope, design, and conduct of studies and monitoring procedures required by the recreational conditions; (5) study and monitoring results pertinent to the implementation of the recreational conditions; (6) modifying the recreational conditions based on input from monitoring, (7) land acquisition and selection criteria, required by the recreational conditions, (8) funding; (9) issues identified during any monitoring; (10) updating programs or plans; and (11) annual reporting for the recreational conditions.

Interior-29 calls for Idaho Power to develop and implement a Recreation Land Acquisition and Management Program for acquisition, management, implementation, monitoring, and adaptation of acquired recreation lands as mitigation for recreation resources affected by the continuing operation of the project. The primary goal of the program would be to provide water-based recreational opportunities for the public. Priority areas to acquire lands would include low gradient lands contiguous to project reservoirs. Acquisition of recreation lands would occur within the second decade after license issuance and would include provision for acquiring 42 acres of land suited for public recreational purposes, specifically targeting land in the vicinity of Home, Hibbard, and KFAN (dispersed recreation sites). Within 2 years of acquisition, Idaho Power would plan and implement enhancements for recreational purposes.

Our Analysis

Idaho Power's proposed RAMP would provide a framework for studying, planning, and modifying the proposed Recreation Plan if or when recreational needs have been established through monitoring and consultation. The Hells Canyon Project is complex, includes large geographical areas, crosses numerous jurisdictional boundaries, and provides a wide variety of recreational opportunities. In this context, planning for change in regional growth and change in recreational use patterns for the full term of any license issued is especially difficult. As proposed, the RAMP would provide a flexible tool that could accommodate changing use over time.

Idaho Power's consultation list includes the primary recreational managers in the project area and would provide a substantial level of coordination without overwhelming or slowing down the consultation process. As proposed, the RRWG would meet every 6 years in advance of filing the FERC Form 80. This schedule would allow the RRWG to study the recreational monitoring results and evaluate any recommended recreational improvements in the context of actual recreational use patterns. Interior's consultation recommendation is generally consistent with Idaho Power's proposal.

The Forest Service specification that Idaho Power provide annual reports to RRWG of recreational use at Idaho Power's recreation sites as they become available does not appear to improve the consultation process or provide additional protection to recreational resources. No information on the record indicates that more frequent surveys or more frequent reporting are needed to meet recreational needs, and other measures included in the proposed RAMP would provide timely consultation over the term of any new license.

Although the Forest Service and OPRD recommend the establishment of trigger points in the RAMP, neither agency provides supporting evidence on how such triggers would improve or protect recreational resources or indicates what the triggers should be. As understood by staff, the recommendation would require Idaho Power to establish quantitative triggers for recreational use for each established and dispersed recreational site in order for triggers to be effective. Even if reasonable triggers could be established, triggers would become prescriptive rather than responsive to site-specific recreational needs over time. As proposed, Idaho Power's RAMP would collect appropriate recreational use data at a sufficient level of detail to consider new recreational needs that arise. The consultation component would allow the Forest Service, ODRP, and other agencies to make recommendations about both the scope of the recreational studies and the type of measures needed, if any, to address recreational concerns, improve recreational opportunities, and protect recreational experiences.

The Forest Service specification to conduct detailed recreational user surveys consistent with the protocol established by Whittaker and Shelby (2003b) for ongoing monitoring does not appear to be warranted. Although much of the recreational use data collected during the pre-licensing period were important for understanding recreational issues at the project, the Forest Service has not indicated why this level of effort would be needed every 6 years. Reservoir level studies, creel surveys, recreational site inventories, and mail surveys are not likely to change in any substantial way every 6 years. Nonetheless, establishing details about a minimum level of recreational use monitoring as part of the RAMP and providing opportunities to expand the monitoring if certain issues arise would help ensure that adequate information is collected that would provide a basis for proposing any new recreational measures.

In some cases, annual consultation, as recommended by OPRD and ODFW, may provide marginal improvements to Idaho Power's ability to implement the RAMP. This would become apparent if there is a sudden change that would demand a rapid response from management agencies within the project area. However, changes in recreational use patterns tend to develop over a number of years or decades rather than from year to year. In that light, the benefits of annual consultation may be outweighed by the inefficiency of a larger bureaucracy on top of monitoring and implementation measures. Nonetheless, including a contingency in the RAMP that would elicit consultation between the 6-year filing of FERC Form 80 would help protect and preserve recreational opportunities if a relatively rapid recreational pattern becomes apparent in the proposed annual monitoring data. Also, it would be beneficial to establish consultation procedures associated with developing use studies, as well as preparing and filing reports every 6 years, that would ensure that agencies have reasonable input into study protocols and have time to consider data and make recommendations based on the data.

OSMB's recommendation to address low-water access and develop additional moorages does not appear to be needed as a specific item in the RAMP. Idaho Power has proposed to develop a low-water put-in on the Oregon side of Brownlee reservoir, and it appears likely that this measure would be sufficient to satisfy identified low-water access needs. Idaho Power's proposed RAMP would require reports and recommendations that result from the ongoing monitoring prepared in consultation with agencies every 6 years. OSMB would have monitoring data from which to make reasonable recommendations at that time and, if needed, could raise the issue of additional put-ins and moorages.

Interior's recommendation to develop a plan for acquiring new recreational lands does would not provide substantial new recreational opportunities. Idaho Power owns important recreational and project-related lands within the project boundary that provide reasonable public access to project waters. In addition, public lands boarder all of the project reservoirs and provide many hundreds of acres of informal recreational access to project waters, as well as numerous formal recreational sites. These facilities appear to be sufficient to provide reasonable public access to the project for the term of any new license.

3.10.2.10 Hells Canyon Visitors Center Staffing

The Hells Canyon Visitors Center is a heavily used facility that provides interpretive and educational materials to both HCNRA and project visitors. As a project-related portal to the Snake River downstream of the project, it is important that staffing be maintained at an adequate level to meet visitor demand.

Idaho Power proposes to continue its Memorandum of Understanding (MOU) with the Forest Service regarding staffing the Hells Canyon Visitors Center. This measure would provide staffing resources to assist the Forest Service in operating the Hells Canyon Visitors Center.

As part of FS-21, the Forest Service specifies that Idaho Power maintain the existing level of Idaho Power staffing (as referenced in MOU No. 99-MU-11061600-556 with Modification No. 001) at the Hells Canyon Creek launch site and Visitors Center for the term of any new license. Idaho Power's alternative 4(e) measure is generally consistent with the Forest Service specification but clarifies consultation and the scope of the capital improvements.

Our Analysis

Idaho Power voluntarily entered the MOU with the Forest Service to help meet staffing needs at the Hells Canyon Visitors Center. The Visitors Center is an important public use site for distributing educational information about the HCNRA and regulatory information about the Hells Canyon Project, as well as information about natural resources, human history, boating etiquette, and recreational facilities and opportunities in the area. The proposed continuance of the MOU would help maintain an appropriate level of staffing to meet recreational needs at the Visitors Center and launch.

3.10.2.11 Warmwater Fisheries Management Plan

Idaho Power has an existing Warmwater Fisheries Management Plan. Interior-32 includes elements of Idaho Power's existing plan plus a strategy for managing reservoir elevations so as to protect and enhance recreational fisheries. Specific elements of the plan would include a description of timing and reservoir elevation requirements for spawning and maintenance of centrarchid fish species populations; a description of the relationship between the timing of reservoir level fluctuations and the ability to access and launch boats at existing Idaho Power boat ramps; an analysis of options for reservoir level management to minimize effects on the warmwater fisheries while meeting flow releases downstream that support the anadromous fish and lamprey populations; and an adaptive management component that would satisfy the reservoir elevation requirements in the Baker County Settlement Agreement as well as fulfill the needs of the warmwater fisheries.

Our Analysis

Interior's recommendation for a new Warmwater Fisheries Management Plan does not appear to offer any improvements for recreational resources. As part of the license application, and as we discuss in section 3.10.2.1, *Effects of Project Operations*, operation of the project is expected to continue to limit public boating access at Brownlee reservoir during some periods. However, Idaho Power's proposal to develop a second deepwater boat launch on the Oregon side of the reservoir would improve public access over existing conditions.

In the same section, we also note that the crappie fishery appears to be influenced by inflow and the water year rather than project operations. Idaho Power is required to meet flood storage requirements as well as stable flows during fall months to meet fall Chinook salmon spawning requirements. During high-inflow years, these operational constraints require deep fluctuations of Brownlee reservoir and relatively rapid flow through the reservoir, both of which may adversely affect the warmwater fishery by limiting spawning areas and flushing young-of-year through the reservoir. During low-inflow years, less water flows through the project, which allows Idaho Power to maintain Brownlee at a higher elevation, and may keep the year-class of fish from being flushed from the reservoir. Given the project's flood storage and the outflow requirements, it does not appear that the recommended fisheries plan would benefit recreational angling opportunities.

3.10.2.12 Effects of Other Measures on Recreation

Sediment Transport

Implementation of measures to restore 14 acres of sandbars through sand augmentation, as specified in Forest Service 4(e) condition no. 4, would help maintain some current beaches and would provide a buffer against continued beach erosion. Because beaches provide locations for boat landing, swimming, and camping, the sand augmentation measure would benefit recreational users. Although the barges needed to deliver the sediment could interfere with recreational boat traffic, we conclude that any such effect would be minimal.

Aquatic Resource Measures

Numerous proposed and recommended aquatic resource measures would work in combination to improve recreational resources by improving the quality of the flat-water and riverine recreational fishery. The proposed improvements to the Fish Hatchery Plan would likely improve the quantity of anadromous fish returning to the project, and the tributary habitat enhancement program should provide some improvements to the quality of the trout fisheries that exists in those streams.

As discussed in section 3.10.2.1, *Project Operations on Recreation Resources*, the recommended Flow Augmentation Scenario to improve aquatic resource downstream of the project would potentially keep Brownlee reservoir below full pool for longer periods than existing conditions. While Idaho Power's low-water boat launch proposal would allow recreational use of the reservoir and provide access when the reservoir is low, the flow augmentation program could reduce the total navigable surface area during some water years.

Terrestrial Resource Measures

The proposed and recommended terrestrial resource measures would improve recreational resources by increasing the abundance and diversity of wildlife in the project area. Viewing and hunting wildlife in the project area represents important recreational opportunities that visitors are interested in pursuing (Moore and Brown, 2003; Claycomb and Brown, 2003). Terrestrial resource measures, including the proposal to acquire thousands of acres of upland and riparian habitats, have the potential to introduce wildlife to parts of the project where habitats are currently degraded, improving opportunities for wildlife viewing and hunting.

A major component of the proposed and recommended noxious weed program is to remove these weeds from dispersed recreational areas. To the degree that these measures are effective, they would help improve the quality and comfort of many of the dispersed sites.

Cultural Resource Measures

The proposed and recommended cultural resource measures would improve recreational opportunities in the project by enhancing public access sites with Euro and Native American education and interpretation information. Providing cultural resource materials at recreational sites would provide visitors with a historical and cultural context for their experience.

Land Use and Aesthetic Resource Measures

The proposed and recommended land use and aesthetic measures would improve recreational resources by enhancing the aesthetic character of the area, reducing contrasts between project facilities and natural environments and streamlining implementation of environmental resource plans. The proposed and recommended HCRMP would also help define appropriate and prohibited uses on lands throughout the project area, which would help reduce conflicts between recreational activities and between recreation and other land uses.

3.10.3 Cumulative Effects

The proposed and recommended recreational measures would contribute to a beneficial effect on recreational opportunities at the project. A primary goal of the proposed and recommended measures is to improve the recreational experience and manage recreational resources in a manner that does not conflict with other land uses. The proposed and recommended improvements to facilities and the proposed management measures would achieve these goals by reducing user conflicts, distributing visitors more evenly throughout the recreational season and expanding recreational opportunities to meet recreational demand for the term of any new license issued.

The cumulative effect of increased recreational use associated with both growing recreational demand and new recreational opportunities would create new recreational opportunities for regional visitors. Given the extent of land within the project boundary and the number of high quality dispersed recreational sites, it is unlikely that increased recreational use would be exceed the capacity of the project and be displaced to surrounding areas beyond the project boundary. However, as recreational demand for boating and camping opportunities at the project increases over time, some visitors may be displaced to dispersed sites along project reservoirs. Although individually minor, the cumulative effect of increased used of the dispersed sites may adversely affect wildlife and recreational values of these sites. The proposed site stabilization measures, the biannual litter management program, and RAMP should help Idaho Power and stakeholders preserve the recreational and wildlife attributes of these sites as demand increases. Overall, we believe that the proposed site improvements and improved management strategies within and adjacent to the project would offset any cumulative adverse effects of increased dispersed recreational use.

3.10.4 Unavoidable Adverse Effects

None.

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3.11 AESTHETICS

3.11.1 Affected Environment

Project area vistas are dominated by the waters of the three reservoirs and the landscape of rolling hills and steep canyon walls that surround the project. The gorge cut by the Snake River to form Hells Canyon is the deepest river canyon in North America, and as such it provides spectacular visual effects (Sullivan et al., 2001).

As part of its relicensing process, Idaho Power conducted a study of the aesthetic environment within the study area (Sullivan et al., 2001). The study used protocols developed by BLM and the Forest Service to assess visual resources. Sullivan et al. (2001) used the BLM's Visual Resource Management System (VRM) to describe areas of predominantly BLM lands, which also included state, county, private and a small amount of Forest Service lands (VRM study area). They used the Forest Service Scenery Management System (SMS) on areas of predominantly Forest Service lands, which also included limited state and privately owned lands (SMS study area).

The VRM and SMS visual management systems establish visual quality objectives as metrics against which introduced elements such as project facilities and operations can be compared to determine whether they comply with the stated visual quality objective. The BLM's VRM system uses a Visual Contrast Rating to determine the visual condition of a landscape. The Forest Service SMS system relies on an assessment of landscape character and scenic integrity to determine the visual and aesthetic condition of a landscape (Sullivan et al., 2001). Both systems establish specific viewpoints from which the landscape is observed and evaluated. In its study, Idaho Power evaluated only sites from which project facilities, operations, or their effects were visible.

Using these systems, Idaho Power found that 24 of the 27 viewpoints with views of project facilities or operational effects within the VRM study area exceeded the acceptable level of contrast allowed to maintain the visual quality objective. Visual contrasts found in the VRM study area include the appearance of power-generation facilities and substations, reservoir drawdown, vegetation alteration, and hardscape elements at recreational facilities. The facilities that were visible from the viewpoints, including Brownlee and Oxbow dams, powerhouses, substations, access roads, and reservoirs, dominated views and created strong to moderate degrees of contrast in form, line, color, and/or texture.

Within the SMS study area, Idaho Power found that the recommended desired landscape character was not achieved at 30 of 33 viewpoints and the recommended desired scenic integrity was not achieved at 22 of the 33 viewpoints; these two indicators comprise the two parts of the SMS visual quality objective.[104] Visual contrasts found in the SMS study area were the same as those found in the VRM study area with the addition of transmission line 945, river water-level fluctuations, and the loss of sandy beaches. The same types of facilities as those identified in the VRM study area created strong to moderate deviations in form, line, color and texture from the landscape in the SMS study area.

Unless otherwise stated, we use information from the Idaho Power license application's *Report on Land Management and Aesthetics* to describe aesthetic conditions within and adjacent to the project (Idaho Power, 2003a, exhibit E.6).

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[104] Idaho Power study results found that 35 of 47 viewpoints in the VRM study area, 41 of 44 viewpoints for the recommended desired landscape character in the SMS study area, and 33 of 44 viewpoints for the recommended desired scenic integrity also in the SMS study area did not comply with visual quality objectives. Some of these viewpoints include in their view transmission lines that are no longer considered to be project facilities. Those viewpoints are not considered in this analysis unless other project features are visible from the viewpoint.

3.11.1.1 Brownlee Development

The visual character around Brownlee reservoir is characterized by rolling sage and grass covered hills that are steeper as the canyon narrows at the downstream end of the reservoir. The lower two-thirds of the reservoir where the terrain is steeper is mostly void of forest vegetation with the exception of small pockets of riparian vegetation on the shoreline. Pockets of taller cottonwoods are found along small creeks and tributaries. While little sign of human presence exists along this 14,000-acre, 58-mile-long reservoir, Brownlee reservoir is, nonetheless, the most developed of the three reservoirs. Residential developments and docks are found along flat areas of the shoreline, and lead to developed parks and a rural community near the Powder River Arm.

Brownlee reservoir elevations vary substantially from season to season. During periods of drawdown, a large, light-colored ring, called the “drawdown zone,” is visible around the reservoir margin. The drawdown zone normally ranges from 20 to 70 vertical feet in the spring and 10 to 70 feet in the fall, but can be as large as 101 feet. Compared to the surrounding countryside, the drawdown zone provides weak contrasts in form and line, strong contrast in color, and moderate contrast in texture (Sullivan et al., 2001).

Deviations from native vegetation, including weed species colonization caused by drawdowns and exotic plants incorporated into facilities and parks, create visual contrasts on Brownlee reservoir. While the contrasts created by weed species colonization are weak in form, line, color and texture, those caused by exotic plants (e.g., irrigated and mowed lawn) incorporated into Idaho Power facilities are strong to moderate in form and line, moderate in color, and weak in texture (Sullivan et al., 2001). Hardscape elements at recreational facilities, such as site furnishings, parking areas, boat ramps, roads, picnic shelters and toilet facilities, are most apparent at developed recreational sites and some dispersed recreational sites, especially at Woodhead and Hells Canyon Parks. These elements generally create strong contrasts in form, line and color, and moderate contrasts in texture (Sullivan et al., 2001). Idaho Power notes that maintaining the full-pool elevation in the reservoirs would eliminate both visual contrasts created by the drawdown effect and undesirable vegetation in the drawdown zone.

From certain viewpoints, project facilities including Brownlee dam, powerhouse, access roads and appurtenant facilities including substations, typically dominate views in localized areas. From the upstream side of the dam, either from the road or the reservoir, the view of the dam and other facilities is subordinate to the landscape and reservoir, since it is mostly hidden from view by the reservoir. Project facilities are much more visible from the downstream side of the dam, including Oxbow Bridge, where they create strong to moderate degrees of contrast in form, line, color and texture. The dam is silhouetted against the skyline, becoming a focal point. The Brownlee cage, a wire frame that passes over the road from the rock wall on one side of the road to a metal grated wall on the other side of the road, protects project facilities from falling rocks along the Brownlee-Oxbow Road. It is constructed of steel beams, wire mesh and support cables. Although the cage dominates the viewshed only for short periods when viewers pass under it in a car, it contributes to the strong contrast caused by project facilities. Non-project transmission structures and the Idaho 71 road cut similarly dominate the viewshed at some points (Sullivan et al., 2001).

3.11.1.2 Oxbow Development

The canyon walls of the 1,400-acre Oxbow reservoir are characterized by steep rock cliffs, basalt outcroppings and talus slopes. The shoreline is well vegetated with shrubs and trees. Human development is limited in this area by the steeper slopes, but signs of human use are visible where small pockets of level land occur. The landscape and reservoir dominate the view through most of the reservoir’s 12-mile length.

The narrow reservoir fluctuates less than 5 feet per day, so the drawdown zone is small and the visual effect is minimal. The drawdown effect typically results in weak contrast in form, line and texture, and moderate contrast in color. Most of the development along Oxbow reservoir, including Idaho Power facilities, occurs on the Oregon side of the reservoir. The Brownlee-Oxbow Road, owned and maintained by Idaho Power, runs the length of the reservoir on the Oregon side, creating a high contrast (Sullivan et al., 2001).

Power-generating facilities of the Oxbow development create strong to moderate degrees of contrast in form, line, color and texture; however, this development is difficult to see from public roads. Upstream views of the development are primarily dominated by the landscape and the reservoir, but the dam can be seen from the lower 1-mile of the road. The closer visitors get to the dam, the more it contrasts with the surrounding landscape and dominates the viewshed. From downstream, the dam structure is contained by rocky outcroppings at the apex of the oxbow bend in the river and does not dominate the landscape from primary viewpoints. The area immediately below the dam is mostly denuded of vegetation and is crossed by a gravel service road. The spillway, road and parking area create high contrast (Sullivan et al., 2001). The bypassed reach, which runs for approximately 2.5 miles, is shallow and has little current.

3.11.1.3 Hells Canyon Development

The Hells Canyon reservoir covers 2,300 acres in its 25 mile length. It is bordered by vertical cliffs of rock and talus slopes, forming a narrow canyon whose shoreline has the most shrub and tree coverage of the three reservoirs. Little development other than small residential communities and Hells Canyon Park exist along this reach. As with Oxbow reservoir, the drawdown effect at Hells Canyon reservoir is minimal since the reservoir normally fluctuates 2 to 3 vertical feet per day, with a maximum of 5 feet. However, the drawdown effect in Hells Canyon reservoir does create a white- to buff-colored band that causes weak contrasts in form, line and texture, and a moderate contrast in color (Sullivan et al., 2001).

Alterations to vegetation caused by project facilities and operations along the reservoir, including irrigated lawns and ornamental landscaping at areas such as Hells Canyon Park and Kirkwood Ranch, result in contrasts in color and form that deviate from the natural landscape (Sullivan et al., 2001). However, Idaho Power reports that many users of these areas find the shade trees and green lawns to be a favorable feature in the summer heat of Hells Canyon. Heavy recreational use of the HCNRA has caused trampling of vegetation at many sites (6 acres total). Hardscape elements often found at developed recreational sites such as Hells Canyon Park and Dug Bar Landing contrast from the scenic integrity and are not consistent with the historical context of the landscape. Docks, structures and buildings, for example, have reflective materials and contrast in color with the surrounding landscape. Other features located in the Hells Canyon reservoir and Snake River vicinity, including handrails, fencing, Jersey barriers, signs, and some parking areas, cause strong contrasts in form, line and color, and moderate contrasts in texture (Sullivan et al., 2001).

Applying the Forest Service SMS system to the Hells Canyon reservoir and Snake River reach, Idaho Power found that both project[105] and non-project transmission structures, power-generation facilities, reservoir drawdown effects, river water-level fluctuations, alterations to vegetation, hardscape elements and structures, and the loss of sandy beaches create contrasts that are similar to those defined using the BLM's VRM system at the Brownlee and Oxbow developments. Sullivan et al. (2001) found that transmission towers and lines dominated the views, especially the non-project transmission line 907 along Wallowa Mountain Loop Road, a designated Scenic Byway.

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[105] Transmission line 945, the only project-related transmission line, is found in two of the SMS viewpoints where it creates inconsistencies in form, line, color, and texture with the desired landscape.

Viewed from the upstream side, the Hells Canyon dam tends to blend with the surrounding landscape since the dam is mostly concealed by the reservoir; however, when the dam is approached from the north (downstream) side, the dam and facilities create strong to moderate contrasts in form, line, color and texture (Sullivan et al., 2001). From the downstream side, the facilities dominate the scene, and the smooth, massive, gray concrete dam structure is visually inconsistent with the jagged slopes that form the dam embankments. The approach to the dam is not aesthetically pleasing and does not give any indication that is serves as the entrance to the deepest gorge in North America and the HCNRA (Sullivan et al., 2001). The Hells Canyon Visitor Information Center, which is owned and managed by the Forest Service and is associated with the Hells Canyon Boat Launch, presents only small inconsistencies with the surrounding landscape. Kiosks and stairs blend in, and the view is focused on the landscape rather than the structures. Some inconsistencies occur, however, such as the dock and counter-weight structures, the poor condition of signs, and dominant weeds (Sullivan et al., 2001).

3.11.1.4 Snake River Downstream of Hells Canyon Dam

The Snake River downstream of Hells Canyon dam, which is outside of the project boundary but inside the study area defined by Idaho Power, continues as a narrow and vertical basalt canyon for 17 miles, at which point it broadens as the rock cliffs transition to steep, grass covered hills. The aesthetic character of the Snake River downstream of Hells Canyon dam remains largely uncompromised because the area is part of the HCNRA. The major cause of aesthetic inconsistencies with the landscape is visitor use and the associated trampled vegetation, denuded sites, compacted soils, and erosion. However, the scenery remains the focal point for viewers.

River level fluctuations along this reach can result in a prominent white- to buff-colored band varying in width from inches to several feet along the river's edge. The absence of sandy beaches is also notable (Sullivan et al., 2001).

3.11.2 Environmental Effects

3.11.2.1 Effects of Project Operations on Aesthetics

We describe Idaho Power's proposed operations in section 2.2.2, *Proposed Project Operations*, and we assess the effects of the proposed operation on reservoir levels and project outflows in section 3.3.2, *Effects of Proposed Operations on Water Quantity*. In section 3.3.2.2, we identify operation-related recommendations filed by agencies, tribes and other parties (table 9), and we describe three alternative operational scenarios that we use to assess the effects of the various operation-related recommendations. At our request (AIR OP-1), Idaho Power simulated project operations for these representative scenarios under various hydrologic conditions. Refer to section 3.3.2.2 for additional discussion of the scenarios and the modeling process used for the simulations. We use the results of these simulations to assess the effects of the operation-related recommendations.

In the following sections, we evaluate the effects of Idaho Power's proposed operations and of operation-related recommendations received from agencies, tribes, and other parties on aesthetic resources as they relate to reservoir drawdown and riverbanks downstream of Hells Canyon dam.

Reservoir Drawdown

Reservoir drawdown can create a distinct white- to buff-colored band along the perimeter of the reservoirs. This band of bare sediment can contrast in form, line, color and texture with the surrounding landscape and can affect riparian vegetation and noxious weed establishment and growth, which also affects the appearance of the drawdown zone. In this section, we evaluate the effects that proposed and alternative operations would have on the scenic integrity of the project area based on differences in the timing and amount of bare sediment that would be exposed. The extent to which riparian habitat and the presence of noxious weeds would be affected is discussed in section 3.7.2.

Our Analysis

Under Proposed Operations, water levels in Oxbow and Hells Canyon reservoirs typically fluctuate by no more than 5 feet, although fluctuations of up to 10 feet can occur (see section 3.4.2.1, *Effects of Project Operations*). Although these reservoir fluctuations are minimal compared to those of Brownlee reservoir, the visual contrast of the bare shoreline is still present. Any time the reservoir levels are below full capacity, the drawdown effect is visible. Compared to proposed operations, neither Oxbow nor Hells Canyon reservoirs would be affected by the alternative operational scenarios.

At Brownlee reservoir under Proposed Operations, the drawdown effect would be most pronounced by the end of April (a drawdown of 44 feet, 77 feet, and 97 feet for medium, medium-high and extremely high water years, respectively) and least pronounced by the end of June when the reservoir would be full. The drawdown effect would be apparent again starting in early July and would gradually increase through mid-October when the reservoir refilled again. With a lower reservoir level, the drawdown effect is greater, and the impact on visual resource is greater. Under extremely low or medium-low water years, when there is no need to draw down the reservoir for flood control, there would be very little springtime drawdown and thus very little effect on visual quality.

Water level fluctuations in Brownlee reservoir and the resulting visual contrasts that would result from Scenario 1 (Reregulating) would be similar to those associated with Proposed Operations for all water conditions.

Reservoir elevations under Scenario 2 (Flow Augmentation) would be the same as under Proposed Operations for the first half of the year. Starting in late June, operations under this scenario would lead to an earlier and more rapid drafting of Brownlee reservoir in the summer under all water conditions. In the medium water year, for example, the 2,050-foot-msl reservoir elevation would be reached by the end of July (exposing a band of bare sediment around the reservoir equaling as much as 27 vertical feet), in contrast to reaching the same point in mid-October under Proposed Operations (table 87; also see figure 15). Compared to existing conditions and Proposed Operations, this earlier drawdown would adversely affect the aesthetic appearance of Brownlee reservoir by allowing for a larger band of bare shoreline to be visible for a longer period. This would occur during the summer months, which is the peak of visitor use (see section 3.10, *Recreational Resources*).

Table 87. Range of drawdown zone (feet) for Brownlee reservoir under Proposed Operations and the Flow Augmentation Scenario during July to October representing the following water conditions: extremely low flow (1992), medium flow (1995) and extremely high flow (1997). (Source: Brink and Chandler, 2005)

Water Conditions	July	Aug	Sept	Oct
Proposed Operations				
Extremely Low Flow	2	3–5	5–10	10–11
Medium Flow	1–4	4–8	8–19	19–26
Extremely High Flow	0–8	9–18	18–39	41–42
Scenario 2 (Flow Augmentation)				
Extremely Low Flow	7–28	28	25–28	17–25
Medium Flow	3–27	28	28–29	26–29
Extremely High Flow	0–27	28	28–44	43–45

Scenario 3 (Navigation) would differ from the Proposed Operation only under extremely low water conditions and only during June through July. Under this scenario, little reservoir refill would occur as inflow spikes would be passed through the project during these months Water level fluctuations resulting from this scenario would detract from the visual integrity of the reservoir by maintaining a band of bare shoreline into the summer months compared to existing conditions. This negative effect would result in only minor adverse changes from Proposed Operations and would occur only during low water years.

For all scenarios as well as Proposed Operations, the greatest aesthetic effect of Brownlee reservoir drawdown would occur from January through April and again around mid-October, with deep drawdowns of more than 40 feet. These deep drawdowns would occur when relatively few visitors are present. During the summer months, the visual effect would be most pronounced under Scenario 3 (Flow Augmentation), resulting in a drawdown zone of more than 25 feet that would last through the summer. Maintaining existing conditions or adopting Scenario 1 would result in the smallest drawdowns and would thus have the least adverse effects on aesthetics.

It appears that the presence of noxious weeds and riparian vegetation would not change substantially from existing conditions with any of the scenarios or Proposed Operations (see *Noxious Weeds and Invasive Exotic Plants* and *Riparian Habitat and Associated Wildlife* in section 3.7.2.1). Thus neither Proposed Operations nor any of the scenarios would substantially affect the visual quality relating to vegetation in areas surrounding the reservoirs.

Idaho Power's proposal to implement informational and educational measures interpreting the reservoir drawdown zone would help educate the public about the color contrast caused by the drawdown effect and how reservoir drawdown may be important to other resources.

Riverbanks Downstream of Hells Canyon Dam

River stage changes downstream of Hells Canyon dam can cause a prominent white-to-buff band along the edge of the river, which can contrast in form and color with the surrounding landscape. Also, stage changes in the river as a result of project operations can affect the establishment of sandy beaches and alter their composition downstream of the project, which can affect the visual diversity that arises from the presence of beaches and sandbars in the river environment. The extent to which riparian habitat would be affected is discussed in *Riparian Habitat and Associated Wildlife* in section 3.7.2.1.

Our Analysis

In its comment on the draft EIS, Idaho Power indicates that the white band downstream of the Hells Canyon dam is visible in pre-project photographs from the 1940s. No study has been done to determine what portion, if any, of the white band results from project operations.

Details of how Proposed Operations and each of the operational scenarios would affect river water-level fluctuation in terms of the maximum percentage of the streambed that is subject to dewatering is found in *Primary Production and Aquatic Macroinvertebrates* in section 3.6.2.1 and in table 40. The higher the percentage of streambed that would be dewatered, the greater the effect on visual resources since more of the shoreline would be exposed. Proposed Operations, Scenario 2 (Flow Augmentation), and Scenario 3 (Navigation) are similar to each other in having the highest percentages of river water fluctuations and thus the greatest effect on visual quality under all flow conditions, with one exception: during high water years, Scenarios 2 and 3 would both dewater only a small percentage of the streambed below the Salmon River compared to Proposed Operations. The percentage of the streambed that is subject to dewatering would be the lowest under Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate) followed by Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate). These scenarios would leave the smallest amount of the stream bank exposed and thus have the least effect on aesthetics.

As described in *Beach and Terrace Erosion* in section 3.4.2.1, Parkinson et al. (2003a) report that three of four monitored sandbars experienced both erosion and aggradation (buildup through sediment deposition) during a 1997 to 2000 monitoring study, while the fourth sandbar experienced only erosion. The report concludes that slope failure at Fish Trap Bar due to load-following operations is *not* expected and notes that the substrate along the two unstable transects is not sand and would thus have a higher strength (due to interlocking) than the rest of the transects.

Although project effects on undercutting and slope slumping are minor, the visual diversity of the river is decreased to the degree that an operational scenario increases the undercutting and mobilization of sandbars and thus the loss of beaches and sandbars. In general, the area of sand mobilization would decline under the alternative operational scenarios compared to Proposed Operations. The area of sand mobilization would be the smallest under Scenario 1 (Stabilized Hells Canyon Release) and Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate), thus these scenarios would tend to preserve more beach and sandbar area and thereby maintain the visual quality.

Proposed Operations and all of the modeled flow scenarios would reduce the irrigation effect on riverbanks and thus plant assemblages within the area influenced by project operations would transition to drier cover types (see *Riparian Habitat and Associated Wildlife* in section 3.7.2.1). The loss of riparian habitat (table 68) would detract from the visual quality of riverbanks downstream of Hells Canyon dam and would occur under Proposed Operations and all operational scenarios but would be the least under Scenario 2 (Flow Augmentation).

3.11.2.2 Aesthetic Improvements and Resource Management

Project facilities and operations can directly affect the aesthetic character of the project area along the three reservoirs (Sullivan et al., 2001). Hardscape elements of recreational facilities and project developments often create contrasts with the natural landscape, as can transmission structures that are in the vicinity of travel corridors or silhouetted against the horizon. Power-generating and substation facilities often dominate views in localized areas, creating contrasts with the natural landscape. Deviations from native vegetation can also create visual contrasts.

As part of its settlement with the Forest Service and consistent with modified condition FS-22, Idaho Power proposes to develop an aesthetic improvement plan for the Hells Canyon Dam Site and Recreational Portal. The proposal and FS-22 call for Idaho Power to enhance the upper deck and the entrance and egress areas of Hells Canyon dam that would be incorporated into the Scenery Management Plan and to file the aesthetic improvement plan with the Commission for approval. FS-22 specifies that alterations may include changes in fencing material, color of materials, screening of stop blocks, parking, signage, pedestrian walkways, interpretation, viewing areas and landscaping provided that such alterations are consistent with the FERC approved security plan for the dam. A schedule for implementation, to be prepared by Idaho Power, would be included in the aesthetic improvement plan.

Idaho Power originally proposed to implement aesthetic measures as part of the HCRMP (see section 3.12.2.1, *Land Use Management Plan*), in which goals and objectives as well as policies and guidelines for aesthetic standards are discussed. Now, as part of its settlement with the Forest Service and consistent with modified condition FS-24, Idaho Power proposes to prepare a Scenery Management Plan for project facilities and operations on Forest Service lands within the project boundary and adjacent to the project boundary within 1 year of license issuance. This plan would include: existing transmission lines and associated service roads, design standards and guidelines for physical structures and landscaping, general aesthetic clean-up and implementation, replacement of guardrails and jersey barriers, mitigation of contrast from project facilities, and enhancement of other facilities.

Interior-25 recommends that Idaho Power develop a visual resource management plan (VRMP) for project facilities to address the design, maintenance, and construction of project facilities (both existing and future facilities) to preserve or enhance visual resource values in the project area. Interior recommends that within 10 years of license issuance, this plan incorporate a landscape development plan that includes standards and guides. Interior also makes recommendations within this plan regarding improvements to transmission lines and rights-of-way (discussed below). The purpose of this recommendation is meant to ensure that physical structures are compatible and complimentary to the landscape character as they are related to architectural consistency and appropriateness. Interior includes specific measures to improve color and form contrasts as well as enhance facilities using paint color or color additives to concrete, vegetative or other screening and landscaping, and planting native vegetation, and states that the VRMP should apply to the following facilities: (1) dams, bypass canals, spillways (concrete structures); (2) switch yards, power houses, buildings, penstocks, power lines (metal structures); (3) project recreation facilities including campgrounds and day-use sites; and (4) power line access corridors and cutbanks. Interior recommends the improvements noted above should occur at both existing and newly constructed sites, but that replacing conductors with non-reflective materials could occur at a time when reflectors would otherwise be replaced.

Our Analysis

Idaho Power's proposed and the Forest Service-specified scenery management plan (FS-24), including the aesthetic improvement measures (FS-22), would serve as a framework to develop and implement aesthetic improvement measures for the project. The plan would reduce the visual contrast of project facilities with their environment to improve aesthetics and enhance the recreational experience near those facilities. Developing the scenery management plan for the entire project area would help ensure that enhancements to project facilities and the landscape surrounding the entire project maintains its scenic integrity.

The Hells Canyon dam detracts from the scenic integrity of the surrounding landscape and the design of the entry sequence does not reflect the importance of the HCNRA (Sullivan et al., 2001). Idaho Power's proposed and the Forest Service-specified aesthetic improvements to Hells Canyon dam would decrease the facility's contrast with the surrounding landscape.

Interior recommends developing a VRMP with standards and guidelines for landscaping and development that would include concrete and metal structures, recreational facilities and power line access corridors as facilities to adhere to Idaho Power's proposed standards and guidelines. Including this recommendation in the HCRMP would help ensure that all facilities within the project area are improved to a consistent aesthetic standard and would help reduce existing contrasts in color and form created by the project.

Transmission Structures

The linear form and other attributes of transmission line corridors and tower access roads can contrast with natural features and detract from the visual quality of the environment. Regional transmission lines and towers are common detractors from valued landscapes, contrasting in form, line, color and texture in the SMS study area and dominating the foreground and middle ground views in several places. Transmission lines can also be highly reflective in sunny conditions and are visible on overcast days. Vegetation maintenance on transmission line rights-of-way creates gaps in native vegetation and produces a pronounced edge effect.

Idaho Power proposes to incorporate aesthetic concerns when upgrading or repairing the existing transmission line 945. The Aesthetic Subgroup developed several measures to address the visual effects of transmission line 945 and included the following standards: (1) when conductors are replaced or upgraded, non-specular conductors should be used; and (2) if a structure or series of structures needs to be replaced during a planned rebuild, structure type and in-line location should be reviewed with the BLM and/or Forest Service to incorporate aesthetic concerns, when compatible with engineering needs and designs.

As part of its recommended visual resource management plan (see above), Interior recommends that Idaho Power provide guidelines that address any new design, maintenance, or modification of transmission lines or associated rights-of-way to retain or enhance the visual resources of the area. Interior recommends that the plan explain how existing facilities would visually harmonize with the natural environment, for example, by replacing conductors with non-reflective material or replacing spectral wire with non-spectral wire during wire replacement during normal maintenance operations. In addition, Interior recommends that vegetation be managed in rights-of-way corridors to reduce visual contrasts created by the maintenance corridors according to VRM Class objectives.

Our Analysis

Transmission line 945 is the only project transmission line and is visible from only two of the SMS viewpoints. Idaho Power's proposal for improvements to transmission line 945 would help reduce the visual contrasts associated with these structures. The proposal is consistent with Interior's recommendation for improving the visual quality of transmission lines and their rights-of-way. However, Idaho Power's proposal does not include measures to enhance rights-of-way.

Creating a Transmission Line Aesthetics Plan within any overall aesthetics plan within the HCRMP would help improve the aesthetic environment by providing consistent guidelines for aesthetic changes. A plan that includes improvements to transmission structures as outlined in Idaho Power's proposal and Interior's recommendation, as well as right-of-way enhancements recommended by Interior, would help ensure that the negative aesthetic effects of transmission line 945 are ameliorated. Portions of Idaho Power's proposed design standards and guidelines for landscaping would be appropriate for enhancing deviations from native vegetation present in transmission line rights-of-way and could help diminish edge effects present in these areas. This is consistent with Interior's recommendation. However, because project transmission lines do not exist in the VRM study area, applying the standard VRM Class objectives may not be appropriate. In addition, because transmission line 945 is the only project line, the portion of Interior's recommended VRMP that includes modifications to transmission lines and rights-of-way would apply only to that line.

Idaho Power has proposed to develop standards and guidelines for new and existing physical structures; however, these standards and guidelines do not list transmission lines as one of the types of facilities to which these standards and guidelines would be applied. One of the long-term management strategies recommended in Sullivan et al. (2001) is a Transmission Line Aesthetics Plan. This report also lists several ways to reduce the contrast of transmission lines, including replacing conductors with non-specular materials to reduce reflectivity, painting towers to match the color of the landscape, and modifying vegetation management in transmission line rights-of-way to screen the lines and soften the edge effect. Creating specific standards and guidelines for transmission lines may not be necessary because transmission line 945 is visible only from two of the viewpoints established in Sullivan et al. (2001). However adapting the suggested enhancement measures for these viewpoints would bring these areas up to visual standards. These measures would include screening views of the transmission line, replacing lines with non-specular wire during normal maintenance cycles, and painting or dulling tower structures to minimize visual contrasts. In the event that new transmission lines are proposed, developing standards and guidelines for these facilities as well as using the suggested Transmission Line Aesthetics Plan found in the technical report on aesthetics as a guide would help reduce the aesthetic contrast of any new facilities.

3.11.2.3 Effects of Other Measures on Aesthetics

Sediment Transport

Implementation of measures to restore 14 acres of sandbars through sand augmentation, as specified in Forest Service 4(e) condition no. 4, would help maintain some current beaches and would provide a buffer against continued beach erosion. Because beaches add to the aesthetic value of the river and provide attractive locations for recreational use, the sand augmentation measure would improve the aesthetic appeal of the river canyon.

Water Quality Measures

Idaho Power proposes to develop a reservoir aeration system to supplement DO into Brownlee reservoir (see section 3.5.2.2, *Dissolved*). The reservoir aeration system would comprise an onshore oxygen supply facility, including various pipes, hose lines, storage tanks and truck access. Depending on how and where the facility is constructed, it could detract from the visual quality of the landscape. Adhering to proposed and recommended aesthetic guidelines and standards for physical structures (see section 3.11.2.2, *Aesthetic Improvements and Resource Management*) and using landscaping and other screening measures would help the facility blend in with the natural surroundings.

Aquatic Resource Measures

Idaho Power's proposal to implement a native salmonid plan, as discussed in section 3.6.2.8, *Resident Salmonid Passage*, includes the construction of facilities and has the potential to affect the aesthetic character of the project. However, incorporating landscaping and other screening measures as well as the standards and guidelines for design and landscaping found within the HCRMP would lessen any visual contrasts that might occur.

Terrestrial Resource Measures

Idaho Power's proposal to eradicate, contain, and control non-native invasive plants and noxious weeds along the Snake River corridor from Weiser to the Salmon River confluence (see section 3.7.2.3, *Noxious Weed and Exotic Invasive Plant Management*) would improve the aesthetic character of the project by decreasing the visual contrasts created by non-native vegetation.

Cultural Resource Measures

Idaho Power proposes to stabilize archeological sites and recover archeological data to prevent possible damage by project operations (see section 3.9, *Cultural Resources*). These measures would help preserve historical sites in their existing condition. Applying the HCRMP's standards and guidelines for design and landscaping to construction of any new structure necessary for stabilization would decrease deviations from the native landscape such structures might create.

Recreation Measures

Idaho Power proposes several recreation measures that include developing and enhancing both dispersed and developed recreation sites and boat launches. These measures are intended to improve access, benefit recreation and improve facilities (see sections 3.10.2.2, *Recreation Plan,* and 3.10.2.3, *Recreation Site Improvements*). Any new construction could detract from the aesthetic character of the project. However, adhering to the proposed design standards and guideline for physical structures and landscaping outlined in the HCRMP would decrease the visual contrasts created by any new construction. Applying these standards and guidelines to recreation sites where no new construction is proposed could improve their visual quality by helping them blend in with the surrounding landscape. The proposed Litter and Sanitation Plan would also enhance the visual quality of the project.

3.11.3 Unavoidable Adverse Effects

None.

3.12 LAND MANAGEMENT AND USE

3.12.1 Affected Environment

The project is located in a rural part of western Idaho and northeastern Oregon within four counties: Washington and Adams counties in Idaho, and Wallowa and Baker counties in Oregon. Land use in the region includes agricultural and ranch lands, with some timber and resource extraction on mountainous Forest Service-managed lands. Most of the lands in the region and surrounding the project are under federal ownership, with a broad range of land-use designations. Unless otherwise stated, information in the following section is from the Idaho Power license application's *Report on Land Management and Aesthetics* (Idaho Power, 2003a, exhibit E.6).

3.12.1.1 Project Boundary

When the project was established, two methods were used to define the boundary. On private lands, the boundary was established at a reservoir elevation (contour line) and on federal lands, the project boundary followed surveyed section lines or sectional subdivision lines per the United Sates Public Land Survey. The existing project boundary on federal lands thus includes about 3,800 acres above the contour line.

The proposed project boundary, which would be the same as the existing boundary except that it would eliminate the 3,800 acres above the contour line, includes the reservoirs, the riverine reaches between the reservoirs, project facilities, appurtenant structures, and one transmission line. It extends for 95 miles on the Snake River from RM 343 near Weiser, Idaho, downstream to Hells Canyon dam at RM 247.6 and includes about 16,460 acres. Thirty-eight percent (6,340 acres) of this is above the normal high-water mark and thus remains unflooded.

3.12.1.2 Land Ownership and Management Jurisdictions

Land ownership in and immediately adjacent to the project follows a gradient of private ownership intermingled with BLM lands along the upstream portion of the project, including the Weiser Reach and Brownlee reservoir, to predominantly Forest Service-managed lands along the downstream Hells Canyon reservoir portion of the project area.

Regional Land Ownership

Lands adjacent to the project along the most upstream Weiser Reach are predominantly in private ownership. The BLM manages lands along the steeper canyon walls of Brownlee reservoir, as well as on the Powder River Arm where federal and private lands intermingle. Private ownership increases toward the end of the Powder River Arm to Richland, Oregon. The state-owned Cecil D. Andrus Wildlife Management Area lies just upstream of Brownlee reservoir on the Idaho side.

A similar pattern of federal lands interspersed with private lands occurs around Oxbow reservoir. BLM is the primary federal land manager in this area.

Most of the land surrounding Hells Canyon reservoir is under federal management. The Payette National Forest begins just downstream of Oxbow Village and continues north to the Hells Canyon dam on the Idaho side of the Snake River. Land ownership on the Oregon side of Hells Canyon reservoir is predominantly private interspersed with a few BLM-managed tracts from Oxbow Village downstream to the 652,488-acre HCNRA. The HCNRA, established in 1975 under Forest Service jurisdiction (Wallowa-Whitman National Forest), extends north from Hells Canyon dam on the Idaho side and from Copper Creek on the Oregon side to a point just south of the border between Washington and Oregon. Portions of the HCNRA overlap with Hells Canyon Wilderness, which extends north along both sides of the river from Hells Canyon dam.

Land Ownership within the Project Boundary

Idaho Power owns the majority (54 percent) of the unflooded land within the proposed project boundary[106] (table 88). Twenty-nine percent of the land within this project boundary is under federal ownership, and 13 percent is owned by private entities other than Idaho Power. Idaho Power owns or controls 3,450 unflooded acres within the project boundary and 1,850 unflooded acres outside of, but immediately adjacent to the project boundary. Most of the non-Idaho Power privately-owned land and BLM land, along with the small amount of state land, is located toward the upstream end of the project on Brownlee reservoir. Toward the downstream end of Brownlee reservoir, private lands within the project boundary all but disappear and land ownership is mixed between Idaho Power and BLM. Similarly, BLM and Idaho Power share land ownership along Oxbow reservoir. The Forest Service is the primary manager of lands within the project boundary along Hells Canyon reservoir; however, land on the upstream end of the reservoir is mixed between the BLM, Idaho Power, and private ownership (Johnson and Holmstead, 2003). No part of the project is located on tribal land.

Table 88. Land ownership and management by development within the Hells Canyon Project proposed project boundary, in acres. (Source: Idaho Power, 2003a, exhibit E.6)

Land Ownership	Hells Canyon	Oxbow	Brownlee	Total	Percent of Total Non-flooded Lands
U.S. Forest Service	330	0	0	330	5.2
Bureau of Land Management	30	270	1,210	1,510	23.8
State of Idaho and State of Oregon	0	10	200	210	3.3
Private (excluding Idaho Power)	160	60	620	840	13.3
Idaho Power Company[a]	270	980	2,200	3,450	54.4
Total Non-flooded Lands[b]	790	1,320	4,230	6,340	100
Total Flooded Lands	1,280	460	8,380	10,120	
Total Flooded and Non-flooded Lands	2,070	1,780	12,610	16,460	

[a] When buying land for the project, Idaho Power allowed the former owners to maintain certain use rights on the land; thus, there are limits on Idaho Power's control over some of their project lands.

[b] Non-flooded lands, which comprise 38.5 percent of the project area.

Land Management Plans

Major landowners within the project vicinity have created plans to guide their land management. These plans are discussed below.

Until recently, Idaho Power did not have a management plan for its lands within the project boundary. As part of the relicensing process, however, Idaho Power developed a HCRMP. We discuss the plan in section 3.12.2, *Environmental Effects*.

The Wallowa-Whitman National Forest is in the process of creating a new Forest Plan. However, the goals of the current plan adapted in 1990, as amended, include: protecting and preserving cultural resources; maintaining and enhancing air quality, soil productivity, water quality, and water quantity; maintaining native and desirable introduced or historical plant and animal species and communities as

[106] All mention in this section of the project area or project boundary refers to Idaho Power's proposed project boundary, which is described in section 3.12.1.1, *Project Boundary*.

well as ecosystem function; maintaining or enhancing riparian areas; protecting and managing habitat for the perpetuation and recovery of threatened, endangered, or sensitive species; providing for big-game winter ranges and selected summer ranges; protecting and enhancing anadromous fish habitat; providing a wide variety of recreational opportunities to all segments of society; providing for well-planned adjustments to landownership that are responsive to National Forest land management objectives; preserving the natural conditions and outstanding opportunities for solitude represented in the four wildernesses on the Wallowa-Whitman National Forest; providing for exploration, development, and production of energy and mineral resources on the National Forest in coordination with other resource values and environmental considerations; providing a safe and economical transportation system; controlling forest pests and noxious weeds; and managing range vegetation and related resources for wildlife and livestock grazing (Forest Service, 1990).

The 1988 Payette National Forest Land and Resource Management Plan, as amended, has goals that include identifying and managing cultural resources and areas of Native American religious importance; providing habitat diversity to support all native vertebrate species and rare plant species; managing drainages containing habitat for anadromous fish and maintaining habitat for resident trout; managing soil and water resources; protecting air quality; managing and protecting riparian resources; managing existing and proposed Research Natural Areas; maintaining water quality, developing and managing wastewater collection systems, and preventing future pollution of surface or groundwaters; providing public access in appropriate and safe areas; and responding to notices of FERC Exemption, License, and Preliminary Permit Application for hydroelectric proposals.

The BLM's Baker Resource Management Plan Record of Decision (1989) contains management objectives for the following areas that fall within the Hells Canyon Project and adjoining areas: Lookout Mountain, Homestead, Oregon Trail, Sheep Mountain, and Baker County Miscellaneous. The management objectives include maintaining or improving the following: riparian habitat, habitat quality for featured wildlife species, bald eagle habitat, big game forage, suitable habitat for reintroduction of native wild species including bighorn sheep, and scenic quality. In addition, the plan includes enhancing recreational opportunities, protecting cultural resources, maintaining the Oregon Trail, providing historical interpretation, and maintaining the wilderness values of wilderness study areas. The plan's goals also include consolidating ownership patterns to improve resource management of private and public lands, maintaining availability of public lands for utility and transportation corridors, and maintaining lands for mineral extraction and exploration.

Federal lands within the Hells Canyon Project vicinity have a variety of land management designations. At the upstream end of the project, federal agencies have few restrictions on use and manage the lands to support public access, ranching, and recreational use. The BLM-managed Sheep Mountain Area of Critical Environmental Concern (ACEC) and Wilderness Study Area (WSA), located along much of the Oregon side of Oxbow reservoir and the upstream portion of Hells Canyon reservoir, is managed to "protect outstanding scenic qualities, and maintain or improve wildlife and crucial bald eagle winter habitat" (Johnson, 2003). Two other BLM-managed ACECs are located along Hells Canyon reservoir downstream of Oxbow dam: the Homestead ACEC is managed to "protect outstanding scenic qualities, and wildlife, bald eagle and sensitive plant habitat", and the McGraw Creek ACEC is managed through an agreement with the Wallowa-Whitman National Forest (Johnson, 2003). The Snake River through the entire HCNRA is designated as either wild or scenic under the Wild and Scenic Rivers Act. In addition, the Forest Service-managed Seven Devils Scenic Area is located along both sides of Hells Canyon reservoir and overlaps part of the HCNRA.

The following gives a brief description of land designations that occur in the project vicinity:

- **ACECs**—ACECs are BLM lands where special management is required to protect and prevent irreparable damage to important historical, cultural, or visual values, fish or wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards (Johnson, 2003).

- **HCNRA**—The purpose of the HCNRA is "to assure that the natural beauty, and historical and archaeological values of the Hells Canyon area and the 71-mile-long segment of the Snake River between Hells Canyon dam and the Oregon-Washington border, together with portions of certain tributaries and adjacent lands, are preserved for this and future generations, and that the recreational and ecologic values and public enjoyment of the area are thereby enhanced" (Forest Service, 2005).
- **Wild and Scenic Rivers**—The Wild and Scenic Rivers Act states that "certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations" (Public Law 90-542, as amended; 16 U.S.C. 1,271–1,287).
- **Wilderness Areas**—Wilderness Areas are federally designated lands, created under the Wilderness Act of 1964, that: are protected and managed to allow natural ecological processes to operate freely; possess outstanding opportunities for solitude or a primitive and unconfined type of recreation; provide areas where natural processes can operate free of human influence and man is a "visitor who does not remain"; and contain ecological, geological, or other features of scientific, educational, scenic, or historical value (Forest Service, 1990)

3.12.1.3 Land and Water Uses

Idaho Power studied land uses in an 848,000-acre study area that includes the project and surrounding areas (Johnson, 2003).[107] Major land uses in the study area include cultivated agriculture, livestock grazing, hydroelectric power generation, recreation, wildlife habitat, and residential and rural residential use. Idaho Power found that approximately 76 percent of the study area (646,000 acres) is included in grazing allotments and approximately 65 percent is federally owned. Idaho Power reports that any mining that occurs in the area is likely recreational, and timber harvests have not occurred recently. Some commercial use exists on I-84, located on the upper end of the project area on the Oregon side. At the upstream end of the study area, near the Weiser reach, the rolling hills and level topography allow for agricultural and rural development, recreation areas, and other human uses. Intense agriculture and grazing occur on the Powder River arm. Only pockets of development occur downstream where the canyon walls are steeper.

Four types of uses occur on Idaho Power-owned land within the project boundary (Johnson and Holmstead, 2003). The first type, project-related use, includes O&M of the hydroelectric plant, transmission lines, Idaho Power residential areas, and parks developed by Idaho Power. The second type of use, secondary residential use, is use by residents of Hells Canyon, which includes the approximately 120 residents associated with Idaho Power (employees and their families), camp hosts, consultants, and county sheriffs' deputies. Livestock grazing is reported as the primary non-residential use by these

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[107] Idaho Power's approximately 848,000-acre study area for land use and aesthetics extends beyond the project boundary and includes 170 miles of river: upstream from the project boundary to the bridge near Weiser (RM 351.2; the Weiser reach), downstream of Hells Canyon dam to the northern boundary of the HCNRA (RM 176.1). The study area includes two mountain ranges: the Seven Devils Mountains in Idaho to the east and the Blue Mountains in Oregon to the west, forming the nearly 10,000-foot-deep Hells Canyon.

residents, whose recreational use is considered part of the third type of land use (see below). The third type of use is recreation by the general public, which is dominated by fishing, boating, lounging, sightseeing, and hiking. The fourth type of use is that authorized by specific leases and permits. Activities licensed under these permits and leases include livestock grazing and agriculture, parks owned by local and federal governments, recreational concessions, and private recreational structures, all of which must comply with the FERC project license. In addition to the above uses, unauthorized use, particularly unauthorized cattle grazing, also occurs on Idaho Power lands (Johnson and Holmstead, 2003).

Various public recreation parks are operated by Idaho Power, BLM, Forest Service, State of Oregon and Baker County, Oregon (see section 3.10, *Recreation*). The small residential communities scattered through the project area, which tend to be clustered together, are located on the Oregon side of the upper Brownlee reservoir, around Richland on the Powder River arm, at Idaho Power's Brownlee and Oxbow villages on the Oregon side, and at Homestead near Hells Canyon reservoir. The year round population of the study area is about 200 people (Johnson, 2003). Other human uses include recreation areas and sanitary facilities, Idaho Power's hydroelectric facilities, old mines, and a few scattered residences. Water uses within Hells Canyon Project include irrigation; water supply for livestock, agriculture, and industry; wildlife; hunting and angling; boating; aesthetics; commercial navigation and transportation; and hydropower.

In describing study area land uses, Idaho Power defined land uses by reach, including the Weiser reach upstream of the project area, Brownlee reservoir with four subreaches (upstream, central, Powder River arm, and downstream), Oxbow reservoir, Hells Canyon reservoir with two subreaches (upper and lower), and the river reach just downstream of the project area. A description of land uses along these reaches within and adjacent to the project boundary follows.

The Weiser Reach (bridge near Weiser to Cobb Rapids) is dominated by cultivated agriculture and rural development. The town of Weiser (2000 population of 5,343) is connected by a substantial road network to several major highways.

The Brownlee reservoir reach is dominated by livestock grazing and recreation. Camping that occurs along this reach is located on federal, private, and Idaho Power owned lands. Much of this reach is also used by wildlife and serves as critical winter habitat for elk and mule deer. For study purposes, Idaho Power divided this reach into four subreaches:

- **Upstream Subreach (Cobb Rapids to Burnt River/Spring Recreation Site)—**The rolling topography of this reach, dominated by cultivated agriculture, is where I-84 passes through the region on the Oregon side. Because of the proximity of the highway, the area includes several RV parks, the BLM-managed Oasis dispersed recreation site and Spring recreation site, Farewell Bend State Park, and commercial businesses. Steck Park, jointly operated by the BLM and IDFG, and BLM-managed Weiser Dunes area for ATV use are located on the Idaho side. Secondary roads, public access, campsites and other uses also occur within this reach.
- **Central Subreach (Burnt River/Spring Recreation Site to Swedes Landing)**—The Oregon side of this reach includes a private recreational residential community comprising residences that are used seasonally or occasionally in association with recreation. Easy road access for approximately 1 mile of this subreach makes it a popular destination for dispersed recreation, including fishing and camping. Wildlife habitat and grazing dominate the remainder of the Oregon side and the virtually roadless Idaho side. A former commercial recreation site, the Mountain Man Lodge, was in operation on the Idaho side until 1997.
- **Powder River Arm Subreach—**The downstream end of this side channel is virtually roadless and is used primarily for livestock grazing as well as wildlife habitat. The area

upstream from the small oxbow is generally developed. County-operated Hewitt and Holcomb parks and scattered residences lead to Richland, Oregon and Oregon Highway 86.

- **Downstream Subreach (Swedes Landing to Brownlee Dam)**—This virtually roadless subreach is dominated by livestock grazing and wildlife habitat. Idaho 71 drops toward the reservoir for a short distance, providing access to Idaho Power-operated Woodhead Park and the Brownlee dam. Dispersed recreation occurs in this area.

The Oxbow reservoir reach starts just below Brownlee dam and runs the length of the Oxbow reservoir. Dispersed recreation, along with the Idaho Power-owned Brownlee Village and Oxbow Yard, occur along Idaho 71. The Idaho Power-operated McCormick Park is located near the Idaho 71 bridge on the Idaho side.

The Hells Canyon reservoir reach starts downstream of Oxbow dam and runs the length of the reservoir to the Hells Canyon Visitors Center, downstream of Hells Canyon dam. Hells Canyon Road runs the length of the reservoir on the Idaho side, with limited reservoir access points. The unpaved Homestead Road runs 9 miles downstream, starting from Oxbow Village on the Oregon side. Along the upper reservoir, land uses include private residences, dispersed and residential recreation, and an airstrip. The BLM-managed Copper Creek dispersed recreation site is located at the end of Homestead Road. Due to the steepness of the Idaho side of this reach, this area is primarily limited to wildlife habitat and livestock grazing, with the exception of Idaho Power-owned Hells Canyon Park. Along the lower reservoir, land is managed by Forest Service for wildlife habitat and dispersed recreation, including the Forest Service-managed Hells Canyon Creek recreation site and Hells Canyon Visitors Center. The HCNRA comprises most of the Oregon side of this reach, which includes dispersed recreation and livestock grazing.

The River Reach, downstream and outside of the project boundary, comprises the HCNRA and the Hells Canyon Wilderness. The river is designated as either wild or scenic under the National Wild and Scenic Rivers System through the length of the HCNRA. Recreational uses include jet boating, power boating, float boating, fishing, hiking, hunting, and camping. A few cabins, ranches, and commercial lodges are permitted by the Forest Service, and Forest Service administrative sites also occur along this reach.

3.12.1.4 Road Management

The major roads accessing the project area on the Oregon side are Interstate Highway 84 near Farewell Bend State Park on Brownlee reservoir and Oregon Highway 86 at Oxbow dam. Baker County, Oregon owns and maintains a 40-mile gravel-surfaced road that parallels the west side of Brownlee reservoir between Huntington and Richland (Idaho Power, 2003a, exhibit E-1). County-owned and maintained roads run along the shorelines of much of Brownlee reservoir on both the Oregon and Idaho sides. The middle part of the Idaho side of Brownlee reservoir is virtually roadless. Idaho 71 provides access to Brownlee reservoir from Woodhead Park to Brownlee dam on the Idaho side. It crosses Oxbow reservoir just below Brownlee dam and becomes Idaho Power's Oxbow-Brownlee Road. This road ends at Oxbow dam where it intersects with Oregon Route 86.

Idaho Power owns and maintains two roads that provide primary access for both the public and Idaho Power to the portions of the project area where these roads are located: (1) the 12-mile paved Oxbow-Brownlee Road that parallels the Oregon side of Oxbow reservoir, and (2) the 23-mile paved Hells Canyon Road that runs the length of Hells Canyon reservoir along the Idaho side and just beyond Hells Canyon dam on the Oregon side and provides the only land access to the HCNRA and the Forest Service Hells Canyon Visitors Center. Although county owned, the unpaved Homestead Road, which runs 9 miles downstream from Oxbow Village to near Copper Creek, is maintained by Idaho Power from Oxbow Village to near Ballard Creek.

3.12.2 Environmental Effects

3.12.2.1 Land Use Management

Project facilities and operations can be incompatible with other land and water uses within the project boundary, such as when development of a recreation facility leads to shoreline erosion or adverse effects on wildlife habitat or cultural resources. Land management issues also include the adequacy of buffers that separate incompatible uses, and the adequacy of management measures designed to protect natural and cultural resources.

Idaho Power proposes to implement the HCRMP to guide land management decisions within the project boundary. The plan has already been developed and includes defining buffers between incompatible uses and establishing and maintaining compatibility between and among the various land and water uses in the project. Idaho Power defines a buffer as "an area or structure that lessens, absorbs, or protects against an impact from an adjoining land use or activity" (Johnson, 2003). In addition, the plan includes Common Policies that would provide for the management, protection, and/or conservation of natural and cultural resources. The management directive of this plan is to provide for continual human use and opportunities while protecting natural and cultural resources.

Various policies within the plan require the development of implementation tools and programs as well as management plans specific to a resource or issue, including but not limited to, the following:

1. Information and Education Program—including an interpretive plan to explain the significance of a place or thing to the viewer; an education plan to inform people about resources and to protect natural and cultural resources by making people aware of the consequences that their actions can have on these resources; and a sign plan to provide visitors with information;
2. Evaluation of Dispersed Recreation Sites—to evaluate resource conditions at existing dispersed recreation sites within certain land/water designations to determine actions that may be needed to protect natural and cultural resources from human disturbance;
3. Evaluation of Recreation/Riparian Interfaces—to determine over time whether recreational activities adversely affect the vegetation cover and to take actions to protect the vegetation where vegetation cover is adversely affected;
4. O&M Standard Practices—to establish standard practices for O&M activities to reduce conflicts with natural and cultural resources and recreation;
5. GIS Atlas—to document critical and sensitive resources, track and reference critical and sensitive resources when significant human actions are proposed, and implement a monitoring program for the HCRMP as well as for specific policies and management plans found within the HCRMP;
6. Land and Water Use Classifications—to designate land and water use classifications, including maps that show the geographic distribution of these classifications, and define policies for these land uses that are intended to balance the various uses. Details about how Idaho Power proposes to separate various land uses are found in Johnson (2003);
7. Idaho Power Interdisciplinary Team—to use an internal team composed of members with expertise from all resources to make decisions and provide input on all land/water use and management determinations related to this plan;
8. Administration—including a use authorization/consultation system, action by the interdisciplinary team, and annual report and review of work plans;

9. Forums for Other Coordination—including communication with stakeholders, identification of communication needs, and assembly of parties to discuss issues, their causes and possible resolutions;
10. Evaluation of Existing Agreements—bring existing agreements up to standards based on a new license;
11. Agreements with Agencies—to pursue development of memoranda of agreement with local, state, and federal agencies to establish regular procedures for consultation and permitting processes;
12. Agency Actions—to coordinate with agencies on enhancement actions that must be led by agencies;
13. Partnerships—to provide a forum for organizing cooperative management efforts; and
14. Best Management Practices—to formulate BMPs based on those of ODEQ and IDEQ and others to minimize environmental impacts of future development and significant human actions.

The Burns Paiute Tribe recommends that Idaho Power establish and fund a resource coordinating committee comprising involved stakeholders to review and maintain oversight over the implementation of project activities, including the implementation of mitigation, adaptive management, and license implementation decision-making.

AR/IRU recommend that the final license include an adaptive management approach and that a Technical Advisory Committee be convened to oversee adaptive management in the license. The Technical Advisory Committee, which would include the various stakeholders, would oversee study design and implementation, develop mitigation measures based on those studies, and oversee implementation and monitoring of the measures.

Our Analysis

Implementation of the HCRMP would help define policies that would minimize the potential for human interference with the goal of protecting natural and cultural resources. As proposed by Idaho Power, the HCRMP includes 99 common policies and 55 policies that would be specific to certain land use classifications or resource management classifications. Adopting the proposed HCRMP and its common policies and including the proposed implementation tools in consultation with stakeholders would help ensure that compatibility among land uses is achieved and maintained by determining appropriate land and water uses and applying standard approaches to managing human use and resource protection.

The plan also contains goals and objectives, land- and water-use designations and environmental resource management policies that would help maintain compatibility between and among the various land and water uses. Idaho Power has mapped the land- and water-use designations at a small scale to serve as a guide. Designating land use classifications for lands within the project and displaying them on a map would help project area users understand what uses would be permitted in various areas and help establish appropriate buffers between uses.

While Idaho Power proposes to implement the plan on the project lands owned or controlled by Idaho Power (5,300 acres), Idaho Power developed the plan in consultation with stakeholders and it is intended to be applicable to an 850,000 acre area surrounding the project, on lands owned by stakeholder parties and others. Idaho Power encourages other parties to implement key elements of the plan on their own lands. Consistent land use management policies within the surrounding area would help ensure that appropriate land uses are designated to protect environmental resources while allowing for human use in the broad area. However, we note that the Commission does not have the authority to require application of the plan beyond the project boundary. Idaho Power may elect to apply the plan to its own lands beyond the project boundary, and other parties may similarly elect to apply the plan to their own lands.

The HCRMP includes development of several programs to minimize conflicts among various land uses, including the I&E program, dispersed site evaluation, evaluation of recreation/riparian interfaces, development of a GIS atlas, and monitoring environmental resources. Development of these programs would allow project users to participate in protecting important resources by informing them of land use designations and sensitive areas, help determine actions necessary to improve conditions that have been negatively affected by human use, help protect riparian vegetation where it is adversely affected by human use, help ensure that Idaho Power operations do not adversely affect important resources, and provide a mechanism for determining the effectiveness of such policies and allow for modifications as needed.

In addition, the HCRMP calls for development of several programs to facilitate coordination and consultation between local, state and federal agencies as well as other stakeholders. These programs, including the interdisciplinary team, administration, forums for other coordination, evaluation of existing agreements, agreements with agencies, agency actions, partnerships, and BMPs would include oversight of license implementation that would provide a forum for addressing the interests of all stakeholders and would help ensure a balanced approach to protecting important resources while allowing for human use and project operations. Formation of an oversight committee, as recommended by the Burns Paiute Tribe, could provide a standing forum for meeting the same goals outlined in Idaho Power's proposed plan. Similarly, formation of the Technical Advisory Committee recommended by AR/IRU would provide a standing forum for consultation over various adaptive management proposals. Because of the resource-specific nature of the adaptive management proposals, we discuss their merits and modes of consultation in the appropriate resource sections of this EIS, including sections 3.5.2.2, *Dissolved Oxygen*; 3.5.2.3, *Total Dissolved Gas*; 3.5.2.4, *Water Temperature*; and 3.6.2.3, *Anadromous Fish Rearing.* Formation of an oversight committee comprising representatives of the relevant agencies, tribes, and NGOs, with individual technical advisory subcommittees to address specific adaptive management measures and plan implementations, would provide an efficient forum for any consultations required by the terms of a new license.

As submitted with Idaho Power's license application, the proposed HCRMP includes only a few details about how the plan would be implemented. Idaho Power proposes that specific management plans be developed for resources or locations as part of the HCRMP, including: (1) from Exhibit E, E.3.1.3.2.1, the Native Salmonid Management Plan; (2) from E.3.2.3.2.1.1 and E.3.2.3 2.1.4, the general wildlife management plan developed as part of the Integrated Wildlife Habitat Program; (3) from E.3.2.3.2.2.1, the Transmission Line Operations and Maintenance Plan; (4) from E.3.3.3.2.1.2, the Cooperative Integrated Weed Management Plan; (5) from E.4.2.5, the Historic Properties Management Plan; and (6) from E.5.4.4, the Comprehensive Recreation Management Plan; and from the HCRMP, (7) from section 6.3.4.5, grazing/agriculture management plans; (8) from section 6.3.4.1.3, weed control; (9) from section 6.3.5.4, fencing to control open grazing; (10) from section 6.3.7.7, road maintenance; (11) from section 6.3.8.7, interpretive, information, and educational signage; and (12) from section 6.4.2.1.2, *Special Management Acres* (letter from C. Jones, Project Manager, Idaho Power, Boise, ID to the Commission, dated November 3, 2006). These plans would provide substantial opportunities for Idaho Power and stakeholders to cooperate in resource protection while allowing continued public use of the project.

3.12.2.2 Coordination with State and Federal Land Management Agencies

The Forest Service and BLM indicate that project-related activities that occur on or affect agency-administered lands within the project boundary may not be compatible with Forest Service or BLM management designations or may affect important resources on those lands.

The Forest Service (FS-1) specifies that Idaho Power obtain approval for site-specific project designs prior to any habitat or ground-disturbing activities on Forest Service lands and that if any Forest Service lands are added to the project boundary that Idaho Power obtain special-use authorization for occupancy and use of these lands. The Forest Service also specifies that Idaho Power obtain written approval prior to making changes in the location of any constructed project features or facilities, or in the uses of project land and waters on National Forest System lands.

The Forest Service (FS-2) specifies that Idaho Power prepare a resource coordination plan to establish a process for information exchange and to coordinate efforts for implementing license conditions, such as any required management plans, and ongoing project O&M activities potentially affecting Forest Service lands. This plan would include annual Forest Service consultation requirements; documentation of efforts to monitor project effects on other resources and effectiveness of required enhancement measures; means for revising or improving implementation strategies as needed; and standard operating procedures for activities on Forest Service lands.

Interior-1 specifies that Idaho Power consult and cooperate with the BLM prior to initiating activities on BLM-administered lands within the project boundary. Interior's condition would require Idaho Power to prepare site-specific plans for approval by the BLM, including a safety-during-construction plan and a spoils disposal plan prior to any ground disturbing activities on BLM-administered lands. It also recommends that Idaho Power prepare a hazardous substances plan prior to planning, construction, or maintenance that may affect BLM-administered lands. In addition, Interior calls for Idaho Power to restore BLM-administered lands to a condition satisfactory to BLM prior to any surrender of the project license or abandonment of project facilities.

Interior-2 specifies that Idaho Power prepare and provide a written report in consultation with the BLM documenting and/or evaluating measures necessary for the continued protection and utilization of BLM-administered lands and resources within the project boundary. Interior also recommends that BLM has the right to require changes to project operations through revision of 4(e) conditions.

The Oregon Department of State Lands (ODSL) recommends that Idaho Power obtain a lease from ODSL to occupy the state-owned submerged and submersible land underlying the three project dams as well as authorization from ODSL for project facilities or structures located on state of Oregon lands. ODSL indicates that the state owns the bed and banks of that portion of the Snake River within the boundary of the State of Oregon.

Our Analysis

The Forest Service's specification to obtain approval prior to initiating ground-disturbing activities that occur on Forest Service-administered lands would help ensure that resources located on these lands receive appropriate protection. The Forest Service specification to create a resource coordination plan to coordinate license implementation on Forest Service lands would allow the Forest Service and Idaho Power to collaborate in protecting Forest Service resources. However, rather than create a separate plan that would address consultation with the Forest Service, including details on consultation, coordination and reporting in the proposed HCRMP (see section 3.12.2.1) would provide an efficient means to implement consultation with the agency. The scope of activities would be limited to Forest Service lands within the project boundary.

Similarly, coordinating with and obtaining approval from the BLM for project related activities on BLM-administered lands would help protect natural resources on those lands. Developing Interior's recommended construction safety and waste disposal plans would help ensure that Idaho Power follows prudent construction practices. These policies and procedures would be appropriately established in the HCRMP (see section 3.12.2.1). Restoring BLM lands prior to any license surrender could be a reasonable measure, although Idaho Power's alternative approach offers a more flexible process because it would allow for a plan to be developed specific to restoration needs if and when the license is surrendered.

Interior's recommendation that Idaho Power prepare a report documenting protection of BLM-administered lands within the project boundary is consistent with policies outlined in the proposed HCRMP. Incorporating details specific to BLM-administered lands into the HCRMP would help ensure that BLM concerns are considered. We note, however, that once a new license is issued to Idaho Power by the Commission, only the Commission has authority to require changes in project operations. BLM may file requests for changes to project operations over the term of any new license if unanticipated project effects on BLM-administered lands within the project boundary are identified

With respect to ODSL's recommendation that Idaho Power obtain a lease from ODSL or an OSDL authorization for facilities, it is unclear from ODSL's statement whether the agency is suggesting that the project has been operated to date without such authorization. Under the conditions of the existing license and any new license, Idaho Power is required to obtain all necessary permits to operate the project.

3.12.2.3 Law Enforcement

Disturbances requiring law enforcement at the project occur throughout the year and peak during the summer recreational season. Issues include conflicts between users and the timeliness of response to safety-related incidents in remote areas such as the HCNRA. Various stakeholders have commented that the level of resources for and support of emergency services provided by Idaho Power is not sufficient to provide for visitor safety.

Idaho Power proposes to continue to support local law enforcement, indicating that such support improves public safety in the project area by decreasing emergency response times and increasing law enforcement presence. This measure would continue Idaho Power's memorandum of understanding with Adams County, through which Idaho Power funds an Adams County deputy, vehicle mileage reimbursement, and living quarters in project housing. To supplement this measure, Idaho Power proposes to develop a law enforcement program in which it would regularly coordinate and sponsor a forum and provide funds for prioritizing the resources used among applicable law enforcement agencies. Idaho Power proposes to sponsor biannual meetings regarding law enforcement issues, resources, and responsibilities; provide access to its property and facilities; and contribute to the O&M costs associated with this measure.

Interior-4 specifies that Idaho Power develop and implement a law enforcement and emergency services plan that includes provisions for coordination and funding of law enforcement and emergency services personnel with jurisdiction within the project. This plan would address medical response measures, include provisions to coordinate with the BLM and local counties to assess law enforcement needs, provide funding for additional personnel in the event that additional law enforcement is found to be necessary on BLM-administered lands, and require Idaho Power to implement its proposals (outlined above) and to implement law enforcement provisions of the Baker County Settlement Agreement dated October 3, 2003.

ODFW-11 recommends that Idaho Power fund one additional land-based law enforcement officer and two additional part-time marine or law enforcement personnel and associated equipment for law enforcement on project lands and waterways. In addition, ODFW recommends that Idaho Power sponsor biannual law enforcement meetings and form a safety committee to address public safety issues and law enforcement efforts and to coordinate resource use among appropriate law enforcement agencies in the project area.

With regard to law enforcement, OSMB recommends that Idaho Power: (1) provide salaries and expenses for two full-time seasonal Baker County marine deputies annually for Brownlee reservoir,

(2) provide an effective marine enforcement and safety presence on the Snake River below Hells Canyon dam by providing for two marine officers who would spend an estimated 576 hours annually patrolling the area, and (3) facilitate biannual law enforcement proceedings.

Our Analysis

Idaho Power's proposed law enforcement program and continuation of assistance to local law enforcement is similar to Interior's recommendation and would help improve cooperation between law enforcement agencies and help clarify responsibilities for enforcing public use and safety measures. Idaho Power's proposed assistance to Adams County, Idaho and Baker County, Oregon demonstrate its commitment to contribute to law enforcement programs and cooperate with other entities to provide law enforcement services within the project boundary. In *Comprehensive Development* under *Law Enforcement and Fire Protection*, we discuss the issue of agency jurisdiction over law enforcement.

Because several state and federal agencies and counties have land management and law enforcement responsibilities within the project area, we see the merit of Idaho Power coordinating these efforts through biannual meetings, as recommended by Interior, OSMB and ODFW. Including such meetings in a law enforcement plan would assist in evaluating and coordinating law enforcement within the project area. While Idaho Power does not have the responsibility to manage and enforce boating regulations on project reservoirs, Idaho Power may be able to improve law enforcement by assisting in the coordination of the various law enforcement and emergency services agencies.

3.12.2.4 Fire Protection

The project includes a mix of private and public lands adjacent to large tracts of undeveloped lands. Fires started on Idaho Power-owned lands within the project could rapidly spread to adjacent properties or onto the large public tracts. Fire suppression is the responsibility of the counties and the federal land managers, but, given the rural character of the project, it is unclear whether this is sufficient to protect the health, safety and welfare of project visitors.

In its license application, Idaho Power mentions its "legal obligation to prevent and suppress fires on the lands that it controls" and of its contributions to "rural fire departments in communities near its projects" (Idaho Power, 2003a, p. H-52). As part of the HCRMP, Idaho Power proposes to continue to coordinate with public agencies regarding the occurrence of controlled and uncontrolled fires.

As part of their settlement, Idaho Power proposes and the Forest Service (FS-3) specifies that Idaho Power develop a fire prevention plan for National Forest System lands within the project boundary in which Idaho Power would: (1) analyze fire prevention needs to ensure that prevention equipment and personnel are available; (2) identify fire hazard reduction measures (e.g., eliminating ladder fuels, reducing fuel loading); and (3) provide the Forest Service with a list of the locations of available fire prevention equipment and the location and availability of fire prevention personnel.

Interior-4 specifies that Idaho Power evaluate the need for fire protection on BLM-administered lands in coordination with BLM and that Idaho Power provide for 100 percent of the costs if evaluations demonstrate the need for increased fire protection.

Our Analysis

Idaho Power's proposal to continue to suppress fires on its property and cooperate with agencies to manage visitor access during uncontrolled fires recognizes some portion of the licensee's responsibility for fire suppression in the project area. The proposal would help improve public safety in the project area. Incorporating policies as part of the HCRMP, such as how Idaho Power is to suppress fires on its lands, how it manages and communicates with project visitors during evacuations, and what type of support Idaho Power contributes to fire agencies, would help ensure that the proposal meets public safety goals.

Developing a fire prevention plan for lands within the project boundary as recommended by Interior and the Forest Service could help prevent potential fires from spreading beyond project lands and would aid county and agency personnel if a fire were to move beyond the project boundary. Because fires often cross property boundaries, having Idaho Power develop a fire prevention plan only for Forest Service-administered lands within the project boundary would be of limited value in protecting all project resources. Developing fire management measures as a component of the HCRMP for all lands within the project boundary would be more protective of project resources. Defining these measures within the HCRMP would help improve public safety by defining the roles of the various agency, county and Idaho Power personnel; identifying the location and availability of fire equipment; and determining fire management needs. Idaho Power would be the best entity to coordinate efforts and hold meetings, but Idaho Power would bear the responsibility for funding only efforts required within the project boundary.

3.12.2.5 Boundary Modifications

The FPA requires the project licensee to provide safe public access to project lands and waters and include those lands necessary for project operations in the project boundary. In accordance with this law, the Commission requires that the project boundary contain the primary recreational facilities used to access project waters, as well as the lands necessary to ensure access for the term of the license, and the lands necessary to ensure an appropriate buffer between the project and neighboring lands.

Idaho Power proposes to remove 3,800 acres of federal land from the existing boundary. The new boundary would follow the same contour line as that followed on private lands, rather than following the metes and bounds system that was used to determine the project boundary on federal lands.

As part of their settlement, Idaho Power proposes and the Forest Service (FS-26) specifies that within 1 year of new license issuance, Idaho Power would provide the Forest Service with a map and aerial photos depicting the approximate location of the project boundary together with geographic information system (GIS), compatible with Forest Service GIS, shapefiles with metadata for the project boundary on National Forest System lands. The project boundary GIS data would be positionally accurate to ±40 feet, in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. At locations on National Forest System lands where the project boundary has been surveyed and monuments placed on the ground, monuments would be logged using a global positioning system (GPS) with accuracies meeting National Standard for Spatial Data Accuracy (NSSDA) standards. These data would be used to geo-reference the project boundary within the GIS.

Interior-11 recommends that the modified project boundary include all of the land within the Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites.

Our Analysis

In its license application, Idaho Power filed maps showing the proposed project boundary generally following contour lines around project reservoirs, with an expanded boundary where needed to encompass project facilities, recreation areas and parks. The proposed boundary would retain all project facilities including the Oxbow-Hells Canyon Road and Brownlee-Oxbow Road, both of which are owned and maintained by Idaho Power. In the license application, Idaho Power states that the land it proposes to exclude from the boundary is not necessary for project purposes such as public recreation, shoreline control, or protection of environmental resources. In that case, standardizing the boundary at the same contour line on both private and federal lands appears to be a sound approach to setting the project boundary. However, in its response to AIR LU-1 Idaho Power states that the existing land use of the lands to be excluded, all of which are federally managed, is multiple use dominated by recreation. Idaho Power further states that people camp in dispersed recreation sites in some of these areas.

Using Idaho Power maps, the BLM identified at least 15 recreational use areas that are located within some of the lands proposed to be removed from the existing project boundary (letter from D. Henderson, Vale District Manager, Department of the Interior, Vale, OR, to G. Green and C. Jones, Idaho Power Company, Boise, ID, October 29, 2004). In its response to AIR LU-1, Idaho Power defines these recreation areas as dispersed recreation sites that contain no facilities, and states that there are no project facilities located in the area proposed for removal from the project boundary. As such, Idaho Power states that these lands are not needed for project purposes. Nonetheless, dispersed recreation sites are used primarily for recreation and some provide direct access to the reservoirs. As such, we find that these dispersed recreational sites do serve project purposes. Including all dispersed recreation sites within 200 yards of project waters in the proposed project boundary and defining them on a map that includes the project boundary would clarify which sites would be included within the project boundary and would help ensure that dispersed sites are maintained in place to provide project access.

The recreation sites that Interior recommends for inclusion in the project boundary—Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites—are currently at least partially located within the project boundary and provide access to the reservoirs. Including these recreation sites within the proposed project boundary would ensure that these sites continue to provide access to project reservoirs and recreational opportunities.

As part of any new license, Idaho Power would provide a revised Exhibit G (project boundary map) for the project that would include a detailed description and maps of the project boundary. This, in combination with Idaho Power's proposal, consistent with FS-26, that it provide aerial photos marked with the project boundary, would be a reasonable approach to defining the project boundary more clearly for the Forest Service on Forest Service-administered lands. Surveys may be necessary before any ground disturbing activities are undertaken to verify the boundary on the ground. This is true for all project lands, not just Forest Service lands. Such surveys would ensure that natural and cultural resources are not compromised and that ground disturbing activities occur only within the project boundary.

With respect to the Forest Service condition that it must give approval for any proposed boundary change, we note that the Commission would approve or disapprove of any proposed project boundary changes, taking into account the position of the land management agencies.

3.12.2.6 Road Management Plan

Idaho Power-owned or maintained roads within the project area provide both public access to project lands and waters and Idaho Power access to project developments. Project roads may have adverse effects on cultural and natural resources by allowing public access to areas where these resources occur. Appropriate project road management provides for safety and protection of environmental resources while continuing to provide reasonable public access to the project.

Idaho Power proposes to continue maintenance of roads that it owns and maintains: Oxbow–Hells Canyon Road, 22 miles; Homestead Road from Oxbow, Oregon, to Ballard Creek, 6 miles; and Brownlee–Oxbow Road, 12 miles. In addition, within the HCRMP, Idaho Power proposes to develop a Road Management Plan in consultation with county, state, and federal agencies. The plan would include three elements: (1) BMPs for roads within Idaho Power's jurisdiction to address maintenance concerns regarding cultural resources, noxious weeds, sensitive plants, threatened and endangered species, soil erosion, and aquatic resources; (2) a road atlas containing spatially based information regarding roads and sensitive resources to enable analyses of existing and proposed road maintenance activities in relation to at-risk resources; and (3) a public information program to reduce vehicle collisions with big game animals. Idaho Power proposes to enhance road management on its roads or on roads for which it has assumed maintenance responsibility. In addition to its road management plan, Idaho Power proposes to implement Common Policies in the HCRMP with respect to roads within and with access to the project area (Johnson, 2003). These policies include the following:

1. Idaho Power would allow public access on its roads except in cases where public safety and project security could be compromised.
2. Major road improvements intended to improve traffic flow, which can increase visitor use, should be minimized to protect wildlife, their habitat and cultural resources, especially in areas where these resources are sensitive.
3. Motor vehicle use should be limited to roads, access drives, and areas that are federally, state or locally designated for motorized vehicle use except when necessary for maintenance of lands and utilities.
4. Commercial use of Idaho Power roads is prohibited without written permission.
5. Vehicle use below the full pool elevation of the reservoirs, except for the launch and retrieval of watercraft, should be discouraged because it can damage soils, cultural resources and water quality.
6. Idaho Power would develop a Road Maintenance Plan to identify and describe maintenance activities.
7. Idaho Power's involvement in developing access drives for private or public use should be considered on a case-by-case basis.

The Forest Service (FS-12) specifies that Idaho Power implement the proposed Comprehensive Road Management Plan as it pertains to National Forest System lands to meet existing standards, designs, and O&M requirements. The plan would include maintenance of the Hells Canyon Dam Road for safe and reasonable use by the public, including access to the Hells Canyon Creek Visitor Center, parking lot, and boat launch, as well as dispersed parking areas between the dam and the visitor center.

ODFW-2 recommends that Idaho Power develop a Road Management Plan that is consistent with Idaho Power's proposal with the addition that road maintenance standards should not allow sidecasting.

Interior-3 specifies that Idaho Power develop an integrated travel and access management plan for BLM-administered lands affected by the project, to be incorporated into the Interior-recommended comprehensive recreation management plan and coordinated with the Interior-recommended IWHP and WMMP. Provisions within this preliminary condition include: (1) management goals and objectives consistent with BLM resource protection; (2) identifying Idaho Power's road management and maintenance responsibilities for roads for which it has assumed responsibility and for roads on BLM-administered lands affected by the project (including 101 miles of road on the Snake River, including Homestead, Oxbow, Hells Canyon, Brownlee, and Olds Ferry roads, many of which are outside the project boundary); (3) replacing culverts to provide aquatic connectivity and re-connect riparian function and structure on all class 1 and 2 streams where shotgun culverts are located along the Hells Canyon and Brownlee roads; (4) implementing a plan for non-motorized use of trails connecting recreation sites along the Oregon side of Hells Canyon reservoir and conducting a feasibility study for developing a trail system along the Hells Canyon, Brownlee, and Oxbow reservoirs connecting Farewell Bend State Park to the HCNRA; (5) implementing BMPs for road maintenance and improvements while considering traffic levels, the management of OHV use, and the protection of natural and cultural resources; and 6) developing a road atlas. BLM also specifies that access may need to be restricted during certain times of the year to protect natural resources and reduce collisions with wildlife.

Our Analysis

As proposed by Idaho Power and recommended by the Forest Service, ODFW and Interior, a Road Management Plan would improve access management throughout the project by considering appropriate traffic levels to protect natural and cultural resources while providing reasonable public access. Such a plan would increase public safety by providing for road maintenance and management consistent with recreational demand and the goals of the HCRMP.

Idaho Power proposes to maintain the roads it currently owns and maintains (Oxbow–Hells Canyon Road; Homestead Road from Oxbow, Oregon, to Ballard Creek; and Brownlee–Oxbow Road) and points out that Interior's 4(e) condition would require Idaho Power to maintain roads outside of the project boundary. Interior has not established in the record a clear nexus between project operations and the need for road maintenance on all of the county and state roads outside of the project boundary. As part of its justification for modified condition no. 3 (which is the same as the preliminary condition), Interior relies on its preparation of materials for the trial-type hearing. It is our understanding that this new information was never heard before a judge, so the merits of establishing project nexus were never concluded in court. Part of Interior's position that there is a nexus is derived from a 1996 MOU between BLM and Idaho Power regarding cooperative management of land uses at Brownlee, Oxbow, and Hells Canyon reservoirs. However, this MOU was developed outside of the FERC process and does not appear to directly relate to project environmental effects. Given the numerous roads that provide access to the project, Interior's position appears to overstate the licensee's responsibility to provide reasonable public access to the project. Further, it is the responsibility of state and county governments to maintain roads that are within their jurisdiction and that are used for non-project purposes. For example, Olds Ferry Road, which Interior specifies that Idaho Power should improve, appears to be a county owned and maintained road that accesses not only the project but also the BLM-managed Weiser Dunes, the BLM- and IDFG-operated Steck Park, and dispersed recreation and camp sites as well as private residences and lots. We also note that any roads for which Idaho Power takes maintenance responsibility would need to be included within the project boundary.

As proposed by Idaho Power, the road management plan, to be developed in consultation with stakeholders and incorporated into the HCRMP, would address road management and maintenance needs for project related roads. As part of the consultation process, differences could be resolved about which roads Idaho Power would assume responsibility for. This would help ensure that reasonable access is maintained for the term of any new license.

Idaho Power's proposed plan lacks details that would be necessary to ensure public access and protect project-related environmental resources. The plan as proposed and recommended by ODFW would serve as a good base to improve Idaho Power's proposal, and the plan elements outlined by Interior would provide further guidance for improving access management. The recommended improvements in public information to decrease wildlife collisions would improve pubic safety and benefit wildlife, and a road atlas would help protect natural and cultural resources prior to any road maintenance activities. Replacing culverts would help protect aquatic resources. Providing the public with information regarding the presence of natural and cultural resources surrounding access points would help visitors understand the potential effects of their use that could, in turn, help prevent conflicts between human use and important resources (for example wildlife-vehicle collisions).

3.12.2.7 Effects of Other Measures on Land Management

Water Quality Measures

Idaho Power proposes to develop a reservoir aeration system, which would include the construction of an on-shore oxygen supply facility, to supplement DO into Brownlee reservoir (see section 3.5.2.2, *Dissolved Oxygen*). Constructing the proposed reservoir aeration system would include substantial ground disturbing activity. Locating this facility in an area where there would be little conflict with natural and cultural resources or recreation would minimize the effects this facility could have on these resources.

Aquatic Resource Measures

Idaho Power proposes to upgrade and enhance anadromous fish hatchery facilities. This measure, as discussed in section 3.6.2.12, *Hatchery Production*, includes the construction of holding ponds and the expansion of hatchery facilities. Idaho Power also proposes to implement a native salmonid plan, as discussed in section 3.6.2.8, *Resident Salmonid Passage*. This measure also includes the construction of facilities. Locating any construction that might include ground disturbing events within the project boundary and away from important natural and cultural resources would help reduce the effects such activity could have on other resources. Adhering to the policies for new development within the project boundary, as outlined in the HCRMP, would help minimize any adverse effects on other land use caused by proposed facilities.

Terrestrial Resource Measures

Idaho Power's proposal to develop a transmission line O&M Plan to address the effects of right-of-way management on botanical and wildlife resources (see section 3.7.2.4, *Road, Transmission Line, and Right-of-Way Management*) would help to minimize conflicts between project operations and natural resources by managing noxious weeds, restoring disturbed sites and timing activities to occur outside of critical periods for plants and wildlife. In addition, Idaho Power proposes to acquire manage, and enhance wildlife habitat to protect and enhance wildlife habitat and botanical resources; reintroduce mountain quail; and implement a wildlife habitat program (see sections 3.7.2.5, *Upland and Riparian Habitat Acquisition,* and 3.7.2.6, *Cooperative Wildlife Management Projects*). Defining land use designations from the proposed HCRMP for these areas would help ensure that they are protected from other project uses such as project operations and recreation.

Cultural Resource Measures

Idaho Power proposes to stabilize archeological sites and recover archeological data to prevent possible damage by project operations (see section 3.9.2, *Cultural Resources*). These measures would be consistent with the proposed HCRMP and would help define appropriate use and protect significant cultural sites found within the project.

Recreation Measures

Idaho Power proposes several recreation measures that include developing and enhancing both dispersed and developed recreation sites and boat launches. These measures are intended to improve access, benefit recreation and improve facilities, and many include the intention to protect natural and cultural resources (see sections 3.10.2.2, *Recreation Plan,* and 3.10.2.3, *Recreation Site Improvements*). Adhering to the policies and implementation tools proposed in the HCRMP intended to establish and maintain compatibility between and among the various land and water uses in the project would help off-set any conflicts these proposed recreation measures might create with other project uses and resources.

3.12.3 Unavoidable Adverse Effects

None.

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3.13 SOCIOECONOMIC RESOURCES

In this section, we review market conditions in the counties where the project is located and profile market characteristics of Idaho Power's electricity generation and its primary consumers. We use this information to establish a baseline of existing conditions from which to consider the economic effects of changes in electricity rates and other socioeconomic effects associated with relicensing the project.

3.13.1 Affected Environment

The project is located in four rural counties in two states, including Adams and Washington counties, Idaho, and Baker and Wallowa counties, Oregon. The economic performance of these counties is generally below state averages (BEA, 2005). While manufacturing, services, and government jobs have grown over the past decade, annual average wages and per capita income in the counties are somewhat below state averages. Many county residents are retired and on fixed incomes, and unemployment and poverty levels are higher than the state averages.

3.13.1.1 Idaho Power Electricity Generation and Rates

Idaho Power owns and operates 17 hydroelectric projects, two natural gas-fired generating plants, and one diesel-fired generating plant and co-owns three coal-fired generating plants (refer to section 1.2, *Need for Power*). Hydroelectricity represents approximately 55 percent of Idaho Power's total installed capacity. The Hells Canyon Project is the largest generation asset in Idaho Power's portfolio, accounting for about 38 percent of installed hydroelectric capacity and about 21 percent of Idaho Power's total generation capacity. As part of Idaho Power's resource portfolio, the electricity generated at the Hells Canyon Project is mixed with electricity generated and purchased from other sources and then distributed to a variety of industrial, commercial, and residential customers.

The availability of hydroelectric energy can affect both the amount of electricity and the net cost of electricity to customers (IDACORP, 2004). The amount of electricity that Idaho Power generates from hydroelectric sources varies annually depending primarily on stream-flow conditions and storage in upstream reservoirs.

On average, hydroelectricity makes up approximately 55 percent of Idaho Power's generation and purchases. Based on the recent historical average, the Hells Canyon Project accounts for approximately 38 percent of Idaho Power's generation and purchases, similar to the project's percentage of installed capacity discussed above.

Idaho Power provides electricity to more than 430,000 customers in an area of about 24,000 square miles, including 24 Idaho counties and 3 Oregon counties. Idaho Power serves all of the Hells Canyon Project area in Adams and Washington counties, Idaho, and Baker County, Oregon, but does not serve Wallowa County, Oregon, with the small exception of the area around the Hells Canyon dam (IDACORP, 2004). Demand for new electric service has been steadily climbing in the counties and the region since 2000, with approximately 13,000 new Idaho Power customers added in 2004.

Idaho Power's electricity sales typically exceed 13 million MWh per year (table 89). Industrial customers are the largest purchasing sector, accounting for about 39 percent of total sales.

Table 89. Idaho Power's sales of electricity in 2004. (Source: EIA, 2004)

	Sales (MWh)			
	Residential	**Commercial**	**Industrial**	**Total**
Idaho	4,389,994	3,411,043	4,773,507	12,574,544
Oregon	190,343	149,868	324,834	665,045

	Sales (MWh)			
	Residential	Commercial	Industrial	Total
Total	4,580,337	3,560,911	5,098,341	13,239,589
Percent of Total	34.60	26.90	38.51	100.00

Idaho and Oregon Public Utilities Commissions set Idaho Power's rates. Base rates are established through the Public Utilities Commissions' conditional approval of rate case applications. Base rates are adjusted annually through a Power Cost Adjustment (PCA) mechanism that allows Idaho Power to recoup costs based on the actual cost of generation in a given year.

In general, hydroelectricity is the least cost electricity in Idaho Power's blended power pool and provides base load and some peaking energy for customers, so changes in annual hydroelectric generation can affect rates. For example, when inflows to the hydroelectric projects are above normal, the net cost of annual generation is reduced by offsetting the need to generate using fossil-fueled plants and power purchases. In this type of water-year, the incremental additional cost of the PCA would be less than a normal year and Idaho Power's blended rates for that year would be lower than Idaho Power's average electricity rates.

Idaho Power's electricity rates are among the lowest in the region for investor-owned utilities in all rate classifications (Idaho Power, 2005l). Idaho Power rates are below both Oregon and Idaho state averages, and well below the U.S. average (table 90).

Table 90. Idaho Power's average electricity rates compared to Idaho, Oregon, and U.S. averages in cents/kWh, 2004. (Source: EIA, 2005)

	Residential	Commercial	Industrial
Idaho Power, Idaho[a]	6.02	4.59	3.91
Idaho Power, Oregon[a]	5.19	4.93	3.40
Idaho State Average	6.24	5.56	4.16
Oregon State Average	7.06	6.38	4.63
U.S. Average	8.70	7.98	5.13

[a] Source: IDACORP (2004). We estimated average rates by dividing average revenue by average generation for each sector. Idaho Power's actual rates may vary by state and county.

3.13.1.2 Relationship of the Hells Canyon Project to Local Governments

Idaho Power's primary socioeconomic relationship with governments within the Hells Canyon Project area is through payment of property taxes. In both Idaho and Oregon, property taxes for public utilities are assessed by the state based on capital investments rather than land value (table 91). The states redistribute Idaho Power's payments to the counties for emergency services, road maintenance and other county functions. Portions of these taxes are used to fulfill the counties' law enforcement, emergency service, and road maintenance responsibilities within the Hells Canyon Project area.

Table 91. Annual property taxes paid by Idaho Power to counties bordering the Hells Canyon Project in 2000. (Source: Idaho Power, 2003a, page E.5-166)

County	State	Taxes Paid by Idaho Power	Total County Property Tax Revenue	Idaho Power as Percent of Total
Adams	Idaho	$353,201	$2,983,354	11.84
Washington	Idaho	$958,812	$6,266,991	15.30
Baker	Oregon	$630,868	$11,311,000	5.58
Wallowa	Oregon	$380,002	$5,319,000	7.14

In addition to paying property taxes, Idaho Power also donates funds to specific law enforcement and emergency service agencies within the counties to provide additional services at the project (table 92).

Table 92. Donations by Idaho Power to counties bordering the Hells Canyon Project for enhanced services in 2002 and 2003. (Source: Idaho Power, 2003a, page E.5-189)

County	Agency	City/Town	Amount
Adams County, Idaho	Adams County Sheriff Department	Council	$70,219
Adams County, Idaho	Council Medical Clinic	Council	$10,000
Adams County, Idaho	Indian Valley Fire District	Indian Valley	$1,000
Baker County, Oregon	Pine-Eagle Ambulance District	Halfway	$10,000
Baker County, Oregon	Pine-Eagle Medical Clinic	Halfway	$1,000
Washington County, Idaho	Washington County Sheriff	Weiser, ID	$26,000
Washington County, Idaho	Weiser Ambulance	Weiser, ID	$5,000
Washington County, Idaho	Weiser Hospital	Weiser, ID	$25,000
		Total	$148,219

3.13.1.3 Commercial Enterprises in the Project Area

In general, the counties bordering the project are rural, with slow population growth and economies dependent on small to medium-sized private businesses and government employment. Adams County, Idaho and Wallowa County, Oregon are among the most rural in their respective states, with small populations, relatively high unemployment, and relatively high levels of poverty (U.S. Census Bureau, 2005).

Washington County, Idaho, and Baker County, Oregon are along the Interstate 84 corridor and benefit from rail and road transportation infrastructure. In these counties, population and economic activity are concentrated along the highway, primarily in Weiser and Baker City, which, relative to the region, have a larger economic base in manufacturing and retail trade. Outlying towns in Washington and Baker counties are generally smaller and more rural, especially north of the Interstate 84 corridor. Government employment, primarily local and state employment, accounts for about 15 percent of total employment in all four counties.

Government activities generate the most economic activity for all industrial sectors in the four counties, ranging from 24 percent in Washington County, Idaho to 44 percent in Adams County, Idaho. After government services, manufacturing is the most important economic activity in the counties. While agricultural earnings appear to be declining in all of the counties, four sectors appear to be increasing in economic importance to the counties: retail trade, accommodations and food services, recreation, and real estate.

Five towns act as portals to the project, including Huntington, Richland and Halfway, Oregon, and Cambridge and Council, Idaho. The largest employers in these counties are a mix of government, construction, and retail trade. While these businesses are sensitive to changes in electricity rates, electricity is generally a relatively small portion (less than 1 percent) of their total operating costs (U.S. Census Bureau, 2000). Certain manufacturing industries are particularly sensitive to changes in electricity rates, where electricity can exceed 20 percent of operating expenses. These industries include certain chemical, gas, aluminum, and newsprint manufacturers, none of which exist in the four counties. Two small wood-processing manufacturing firms are located in Council, including Intermountain Woodworking, a cabinet and fine woodworking shop, and Western Timber Products, a wood re-manufacturing mill. For these industries, electricity represents approximately 0.93 and 1.57 percent of operating expenses respectively.

The Hells Canyon Project receives about 200,000 recreational visitor days per year, with the majority of visitors participating in fishing, boating, and camping within the project and the HCNRA (see section 3.10, *Recreational Resources*). A recent study suggests that recreational angling throughout Oregon and Idaho creates numerous jobs and contributes as much as $1.3 billion to the Oregon economy and $681 million to the Idaho economy (ASA, 2002). Another recent study of the economic benefits of Idaho's tourist economy indicates that tourism in the counties surrounding the project represents a substantial portion of retail and accommodation earnings (table 93). Direct and indirect expenditures on tourist and recreational services account for between two and three percent of total sales in the counties.

Table 93. Total visitor spending by county. (Source: Global Insight, 2005)

County	Transport	Food	Room	Entertainment	Shopping	Total	Percent of Total County Sales
Adams	$0	$1,110,000	$610,000	$350,000	$880,000	$2,940,000	2
Washington	$5,430,000	$5,340,000	$790,000	$1,600,000	$4,990,000	$18,150,000	3

3.13.1.4 Minority and Low-income Communities

The majority (83 to 96 percent) of residents in the project area counties are non-Hispanic white (table 94), with small populations of Native Americans (less than 2 percent). With the exception of Washington County, Idaho, where 13.8 percent of the population is of Hispanic or Latino origin, the counties surrounding the project have smaller populations of Hispanics or Latinos than their respective state averages.

Table 94. Total population and population percentage by race categories. (Source: U.S. Census Bureau, 2005)

	Oregon			Idaho		
	Baker County	Wallowa County	State	Adams County	Washington County	State
Population, 2004 estimate	16,470	6,976	3,594,586	3,451	10,059	1,393,262
White persons (%)	95.7	96.5	86.6	96.3	87.6	91.0
Black or African American persons (%)	0.2	[a]	1.6	0.1	0.1	0.4
American Indian and Alaska Native persons (%)	1.1	0.7	1.3	1.4	0.7	1.4
Asian persons (%)	0.4	0.2	3.0	0.1	1.0	0.9
Native Hawaiian and Other Pacific Islander (%)	[a]	[a]	0.2	[a]	0.1	0.1
Persons reporting some other race (%)	0.9	1.0	4.2	0.9	8.2	4.2
Persons reporting two or more races (%)	1.7	1.5	3.1	1.2	2.4	2.0
White persons, not of Hispanic/ Latino origin (%)	94.6	95.7	83.5	95.5	83.1	88.0
Persons of Hispanic or Latino origin (%)[b]	2.3	1.7	8.0	1.6	13.8	7.9

[a] Value greater than zero but less than half unit of measure shown.

[b] Hispanics may be of any race, so also are included in applicable race categories.

The U.S. Department of Health and Human Services defined the poverty level in 2005 for a family of three as income less than $1,340 per month (HHS, 2005). Between 13 percent and 15 percent of the counties' population has income below the poverty level, which is 3 to 4 percentage points higher than state averages (table 95).

Table 95. Poverty statistics and housing affordability statistics. (Source: U.S. Census Bureau, 2005)

	Oregon			Idaho		
	Baker County	Wallowa County	State	Adams County	Washington County	State
Median value of owner-occupied housing units, 2000	$84,700	$111,300	$152,100	$88,800	$90,200	$106,300
Median household income, 1999	$30,367	$32,129	$40,916	$28,423	$30,625	$37,572
Persons below poverty, 1999 (%)	14.7	14.0	11.6	15.1	13.3	11.8

Housing, however, generally remains affordable within the four counties surrounding the project. The U.S. Department of Housing and Urban Development's (HUD) generally accepted definition of affordability is for a household to pay no more than 30 percent of its annual income on housing (HUD, 2005). HUD considers families that pay more than 30 percent of their income for housing to be cost burdened and may have difficulty affording necessities such as food, clothing, transportation and medical care. In the counties around the project area, median income as a percent of median house price is 30 percent or more, indicating that the cost of housing does not appear to place additional burdens on low-income residents.

3.13.1.5 Native American Tribes

No Native American reservations are near or physically connected to the project and very few Native Americans live in the four counties adjacent to the project (see table 94). Nonetheless, the Snake and Columbia rivers are important historical fishing grounds for the tribes in the region, and the remaining runs of anadromous fish continue to provide important food for Native Americans (see section 3.9.1.6, *Traditional Cultural Properties, Sacred Sites, and Rock Art*). A recent study finds that, historically, salmon were the primary food source for the tribes listed in table 96 (Meyer Resources, 1999). The study makes a strong case that the decline in salmon returns to the upper Snake River blocked by dams within the basin adversely affected the socioeconomic conditions of the tribes. Specifically, the study links tribal culture and wealth to historical trade in salmon and indicates that the decline in salmon returns to the Snake River contributes materially to poverty and unemployment on the reservations.

The reservations in the region are among the poorest in the nation, with high levels of unemployment. Compared to the four counties surrounding the project, the tribes have lower household income, higher unemployment, and a much higher percentage of families in poverty (table 96). Meyer Resources (1999) found that "the tribes cope with overwhelming levels of poverty, unemployment that is between three and thirteen times higher than for the regions' non-Indians, and rates of death that are from twenty percent higher to more than twice the death rate for residents of Washington, Oregon and Idaho as a whole." The study goes on to link the current socioeconomic and demographic conditions to the loss of salmon as a food source and a trading currency, pointing out that the decline in salmon is felt most by the tribes at the upstream end of the Snake River. The study estimates that the tribes harvest less than one percent of the levels of salmon harvested prior to contact with non-native Americans.

Table 96. Descriptive statistics of reservations in the project vicinity. (Source: U.S. Census Bureau, 2007, 2005)

Reservation	Warm Springs	Burns Paiute	Shoshone-Paiute	Umatilla	Shoshone-Bannock	Nez Perce
Distance to project (miles)	200	80	110	100	200	160
Reservation population (no.)	3,190	145	2,037	1,608	4,922	2,998
Families below poverty (%)	27	44	31	40	28	18
Children under 18 below poverty (%)	30	60	35	20	37	22
Median household income ($)	28,203	28,750	22,604	38,125	27,145	27,696
Unemployment (%)	15	14	14	9	12	8
Tribal language speakers (%)	14	33	24	9	24	7

3.13.2 Effects of Project Operations on Socioeconomic Resources

This section of the EIS considers the extent to which proposed and recommended changes in Project Operations may affect socioeconomic systems. We consider the socioeconomic effects of Idaho Power's Proposal, the Staff Alternative, and a No-action Alternative.

3.13.2.1 Effects on Power Costs

Economists recognize the effects of energy prices on local and regional economic growth. Low electricity rates can attract private investment, leading to jobs, increased demand for goods and services, more disposable income, and eventually a growing local and regional economy. From an industrial and commercial perspective, low electricity rates facilitate growth and improve a firm's cost competitiveness. From a residential perspective, low rates allow households to spend more of their money in other ways, possibly contributing to economic growth. Idaho Power's rates are amongst the lowest in the U.S. and it follows that economic conditions in Idaho Power's service area have benefited from these low rates.

As described in section 4.0, *Developmental Analysis*, the proposed and recommended operational and environmental measures would reduce the net power benefits of the project. Ultimately, any increased cost to operate the project could lead to increased electricity rates across Idaho Power's broad service area. Idaho Power's proposal and the Staff Alternative would increase the cost of generating electricity at the project by about 0.19 cents per kilowatt hour and 0.39 cents per kilowatt hour, respectively (table 97)

Table 97. Cost and net annual generation of the proposed and Staff Alternative measures.

	Net Annual Cost of the Alternative (dollars)[a]	Adjusted Net Annual Generation (MWh)	Increased Cost for Project Power (cents/kWh)	Percent Increased Cost from No Action	Percent Cost Increase of All Idaho Power Generation
No Action	0	6,562,244	0.000	0.00	0.00
Idaho Power Proposal	12,529,900	6,562,244	0.191	4.05	1.54
Staff Alternative	25,703,600	6,549,344	0.392	8.30	3.15

[a] We define the net annual cost as the sum of the cost of new environmental measures plus the value of reduced power benefits.

Electricity generated at Hells Canyon Project is part of a mix of electricity generated and purchased by Idaho Power and sold to customers in Idaho and Oregon. The Hells Canyon Project is the largest generation asset in Idaho Power's portfolio, accounting for about 79 percent of installed hydroelectric capacity and about 38 percent of total generation capacity. In order to evaluate a rough estimate of potential changes in rates, we allocated 38 percent of the cost increase to the rate classes (table 98). Although it is unlikely that any rate increase would mirror the changes in table 98, the results imply the effects of implementing the environmental measures on rates would be relatively minor potential increases 1 to 3 percent over the No-action Alternative. The actual extent of any rate increase would be determined by the Idaho Public Utility Commission.

Table 98. Estimated change in Idaho Power rates by rate class for the proposed and Staff Alternative measures.

	No Action	Idaho Power Proposal		Staff Alternative	
	Rates (cents/kWh-2004)	Incremental Increase (cents/kWh)	Increased Rates from No Action	Incremental Increase (cents/kWh)	Increased Rates from No Action
Residential	5.99	0.92	6.08	0.189	6.18
Commercial	4.61	0.071	4.68	0.145	4.75
Industrial	3.35	0.051	3.40	0.106	3.46
Irrigation	4.86	0.075	4.93	0.153	5.01
Weighted Average	4.80	0.074	4.88	0.151	4.95

Any proposed or recommended measures that are implemented would also contribute to a range of benefits, including improved aquatic and terrestrial resources, expanded recreational opportunities, and increased expenditures within the communities that serve the project. Implementing the environmental measures would require expenditures from Idaho Power into the local and regional economies to oversee the measures, as well as to purchase goods and services needed to construct, monitor and maintain new environmental measures. The improved environmental and site conditions would benefit all project visitors, with larger benefits accruing to those people that live near the project and can more easily take advantage of the improvements, as well as to those communities through which visitors travel to reach the project and that would provide goods and services to Idaho Power for implementing the environmental measures. To this end, any increase in electricity rates needed to provide for the proposed and recommended environmental measures would constitute a transfer of benefits from Idaho Power's broad ratepayer base to the counties surrounding the project.

3.13.2.2 Net Cost to Local Government

The project would have little adverse socioeconomic effects on surrounding county governments. As shown in table 91, property taxes assessed to Idaho Power constitute significant portions of total taxes paid to the counties. These monies are used to fulfill the counties' law enforcement, emergency service, road maintenance, and other responsibilities. The project already attracts large numbers of visitors to rural areas around the project reservoirs and visitor use is likely to continue to grow over the term of any new license. Given the remote location and rural character of the project, the counties' costs for providing services to the project are likely higher than the cost of serving other, more centrally located businesses in the counties. The proposed and recommended measures recognize the additional costs to the counties for providing these services and include some funding in addition to taxes, improved law enforcement coordination, and improved communication systems. These measures would help offset the counties' direct and indirect costs of providing public services over the term of any new license.

3.13.2.3 Effects on Commercial Enterprises

Implementing each environmental measure that includes a cost would also have direct and indirect benefits on commercial enterprises in the project area. For example, funding construction of new project facilities, as well as the ongoing costs associated with maintaining and monitoring environmental plans, would create expenditures in the local and regional economy for equipment and services and would provide jobs associated with implementing the measures. While we do not quantify the economic benefits of these expenditures, they would accrue to many local and regional commercial enterprises.

Project–related recreational use contributes more measurable economic benefits to the portal towns and neighboring counties. While, for example, the act of angling at the project may appear to generate little economic activity, visitors purchase tackle, boat and vehicle gas, food, and lodging, and pay usage fees. These expenditures generate direct and indirect benefits to local and regional businesses and counties.

The U.S. Natural Resource Conservation Service (NRCS) collects information for contingent valuation of recreational activities for watershed planning and other economic purposes. NRCS recommends use of the travel cost method to calculate recreational benefits, where researchers estimate primary and secondary expenditures associated with various recreational activities. Idaho Power did not collect recreational expenditure information from visitors to the project, but NRCS maintains a database of recreational travel cost studies, most recently updated in October 2005, with values for recreational activities estimated in more than 1,200 studies (Loomis, 2005).

Loomis (2005) found that the median recreational expenditure in Oregon, Washington and Idaho was about $33 per person per day, which, when applied to the number of visitors to the project, results in an estimated $5.8 million addition to the local economy (table 99). When considered by activity, direct project-related expenditures for recreation may be as high as $15 million per year. In addition to the primary benefits of the recreational expenditures on local business, they have secondary benefits as the millions of dollars work through the economy, generate expanded business, new commercial purchases, new jobs, and potentially increased household spending.

Table 99. Contingent valuation study results for recreational expenditures in Oregon, Washington and Idaho (n = 143) and estimated project-related expenditures for recreational activities.

	Estimated Expenditure per Person per Day[a]	**Number of Project Visitors per Day by Activity in Year 2000**[b]	**Estimated Direct Expenditures**
Average	$41.89	173,008[c]	$7,247,221
Median	$33.70	173,008[c]	$5,830,611
Camping	$70.01	129,756[d]	$9,083,574
Picnicking	$34.74	5,784	$200,959
Swimming	$6.06	2,319	$14,049
Sightseeing	$33.06	57,427	$1,898,378
OHV	$40.37	189	$7,617
Motor boating	$12.48	15,600	$194,619
Float boating	$144.68	253	$36,589
Hiking	$23.98	10,023	$240,317
Mountain Biking	$49.68	339	$16,841
Hunting	$43.87	677	$29,681
Fishing	$40.63	80,394	$3,266,371
Wildlife Viewing	$41.34	4	$186
Total		302,764	$14,989,181

[a] Source: Loomis (2005)

[b] Source: Idaho Power (2003a)

[c] Idaho Power estimated annual recreation days of 173,008.

[d] Idaho Power estimated annual recreation days by activity. Study results did not include camping as a separate and specific activity, but Idaho Power estimates that 75 percent of visitors stay overnight. For the purpose of estimating project-related recreational expenditures for camping, we include 75 percent of 173,008 recreation days based on the assumption that visitors would participate in recreational activities during the day in addition to camping. This assumption may lead to an overestimate of actual annual expenditures for the project by both inflating the number of visitors and because the estimate of expenditure per person per day may include expenditures for other recreational activities.

The proposed and recommended environmental measures would expand existing recreational opportunities, improve the reservoir and river fishery, improve terrestrial wildlife habitats, and improve scenic quality of the project. As a result of these improvements, Idaho Power expects that recreational use would continue to grow over the term of the new license as visitors take advantage of new recreational, wildlife viewing, and hunting opportunities. Any growth in recreational use would increase the project-related benefits to local and regional businesses associated with recreational expenditures.

3.13.2.4 Effects on Minority and Low-income Communities

In areas of economic depression, with high poverty levels and many residents on fixed incomes, increased electricity prices can contribute to increased poverty from increased living expenses, reduced number of jobs, reduced discretionary spending, and inflation. The extent of these effects depends on the level of electricity rate increase and the underlying economic conditions. Based on our rough estimate of a 3.5 percent potential increase in residential electricity rates, it does not appear that electricity rate increases resulting from the proposed project would have substantial adverse affects on minority and low-income communities.

Neither Idaho Power's proposed measures nor any of the recommended measures would have any noticeable adverse effects on neighboring county residents. In general, the benefit transfer from ratepayers to environmental enhancements and expenditures in the local economy would generally accrue to county residents. In addition, the proposed and recommended environmental improvements could benefit hunting, fishing and gathering activities in the area, which may contribute subsistence resources for people of limited means.

The demographic profile in section 3.13.1.4 indicates that the counties have higher than average elderly (age 65+) and low-income (less than $16,200) populations on fixed or limited incomes. For these populations, increased household expenses typically require commensurate deceases in spending on other items. A 2001 study in Washington found that electricity and natural gas accounted for approximately 3.3 percent of total household expenditures in low-income households (U.S. Census Bureau, 2005). During the energy price escalation in 2001, the state predicted that increased rates would raise the average low income and elderly household expenditures on electricity and natural gas to 5.2 and 4.9 percent, respectively, of total household expenditures (U.S. Census Bureau, 2005).

3.13.2.5 Effects on Native Americans

The Corps (2002) found that tribes in the region consider their fishing rights to include: (1) reasonable harvest of salmon, pacific lamprey, and river mussel shell, in addition to other species; (2) access to traditional places where harvest and processing can occur; (3) distribution of resources over the aquatic landscape in proportions adequate to be available for all affected tribes; (4) availability of desired aquatic resources at culturally significant places (e.g., fishing stations and grounds); and (5) sustainable aquatic resources and habitats to support present and future generations' harvest needs.

Five Native American tribes filed comments or testified about the draft EIS, including the Shoshone-Bannock Tribes, Fort Hall, Idaho; the Nez Perce Tribe, Lapwai, Idaho; the Umatilla Tribes, Pendleton, Oregon; the Shoshone-Paiute Tribe of the Duck Valley Indian Reservation, Idaho; and the Burns Paiute Tribe, Burns, Oregon. Although not immediately adjacent to the project, or within the four surrounding counties, these five tribes indicated that relicensing the project affects the tribes because of the project's effect on anadromous fish passage and other resources.

It is clear from the record that salmon play an important role in modern Native American communities for commercial, ceremonial, and subsistence harvests. From a socioeconomic perspective, the tribes fishing practices, religious values, and community activities provide insight into the cultural significance of the project and the Snake River. Meyers Resources (1999) found that salmon remain connected to tribal material and spiritual life and that tribal peoples "look first to the salmon with hope for a better future." The Meyers Resource report (1999) makes a strong case that the declines in salmon returns associated with dams on the Snake and Columbia rivers constitute a transfer of wealth from the tribes to non-Indians. As declining salmon returns materially and culturally affected the tribes in the region, construction and operation of the dams created wealth for non-Indians by providing electricity generation for industry, flood control to protect downstream communities, and irrigation services for agriculture in the Snake and Columbia basins.

The proposed and recommended aquatic resource measures, taken together, would represent an improvement in aquatic resources over existing conditions, with the goal of improving salmonid returns to and above the Hells Canyon Project. These incremental improvements, although incremental, would help restore and maintain long-term ecosystem health and support the economic and social needs of Native Americans in the project region. In particular, providing assistance to the Shoshone-Bannock's streamside egg incubation project on the Yankee Fork would help support ceremonial and subsistence fisheries I the Snake River basin (see section 3.6.2.12, *Hatchery Production, Yankee Fork and Panther Creek*).

3.13.2.6 Effects of Other Measures on Socioeconomics

Aquatic Resource Measures

Idaho Power proposes and agencies, tribes, and NGOs recommend numerous environmental improvements that would improve the anadromous fish returns in the Snake River downstream of the project, including improvements to water quality, aquatic habitat, hatchery production and performance and fish passage. Cumulatively, these aquatic resource and water quality measures would reduce the projects net benefits, but would improve environmental conditions at and downstream of the project. Implementing these measures would have non-market social, cultural and environmental benefits, particularly in regard to improving anadromous fish runs. Implementing these measures would also create direct short-term investment into the local economy for any construction and rehabilitation measures that would be needed, as well as small ongoing expenditures toward monitoring and maintenance. Over the long term, and to the degree that aquatic resource improvements attract more visitors to the project for fishing and wildlife viewing, recreational expenditures in the local and regional economy would grow.

3.13.3 Unavoidable Adverse Effects

None.

3.14 EFFECTS OF NO-ACTION ALTERNATIVE

Under the No-action Alternative as defined by the staff, the project would continue to operate as it is currently. There would be no significant change to the existing environmental setting or project operation. No new environmental measures would be implemented. Most of the current project effects, both positive and negative, would continue at the same level. For example, power output would continue at the same level, recreational opportunities would be essentially the same, and the four fish hatcheries would continue their current programs.

Adverse water quality conditions would continue until such time as off-project water quality improvements began to manifest. Poor water quality conditions would continue to adversely affect aquatic resources due to: (1) low DO levels during the summer and fall in project reservoirs and within 7 to 10 miles downstream of Hells Canyon dam; (2) gas supersaturation within and downstream of the project when spills occur; and (3) high water temperatures in the fall months, adversely affecting fall Chinook spawning. Other adverse effects on aquatic resources that would continue include: (1) blocked access to anadromous fish and blocked migration of resident fish species; (2) continued mortality of federally-listed fall Chinook salmon from stranding and adverse effects on fish growth caused by fluctuations in outflows from the project; (3) an unknown level of stranding mortality of federally listed bull trout; (4) potential adverse effects on critical spawning habitat of fall Chinook salmon due to reduced gravel recruitment; and (5) continued lack of recruitment of white sturgeon in the three interdam reaches between Swan Falls and Hells Canyon dams.

Ongoing effects of project operation on riparian habitat and wetlands would continue as a result of: (1) seasonal drawdowns at Brownlee reservoir that would continue to prevent riparian habitat from establishing in the fluctuation zone and along the shoreline; (2) project impoundments that would continue to trap large volumes of sediment, which would continue to limit the establishment of willows in the reach downstream of Hells Canyon dam; (3) Brownlee reservoir's continuing to accumulate organochlorine compounds and mercury from non-project sources, which may pose a risk to fish-eating wildlife such as river otters, great blue herons, and bald eagles; and (4) the presence of the reservoirs continuing to preclude restoration of more than 10,000 acres of low-elevation big game winter range that was lost when the project was built.

Because project impoundments would continue to trap sediment, beaches and sandbars downstream of Hells Canyon dam would continue to degrade, to the detriment of recreational, aesthetic, cultural, and wild and scenic river values.

3.15 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Relicensing this existing project would not irreversibly or irretrievably commit any significant developmental or nondevelopmental resources in the basin. At any point in the future, project facilities could be modified or removed and any operational effects could be altered. There is no major new capacity or construction proposed or recommended that would commit lands or resources in an irreversible manner.

3.16 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The Applicant's Proposal for the project is expected to provide an average of 6,562,244 kWh of energy each year to the region. This long-term energy productivity would extend for at least as long as the duration of the new license. Our evaluations are designed to identify and then minimize or avoid long-term decreases in biological productivity of the system, as well as enhance aquatic habitat and local and regional recreational opportunities.

If the project were operated solely to maximize hydroelectric generation, there would be a loss of long-term productivity of the river fisheries due to decreases in water quality and fish habitat. Moreover, many efforts to enhance recreational opportunities at the project would be foregone.

With the proposed operating mode, as well as with proposed and recommended enhancement and protection measures, the project would continue to provide a low-cost, environmentally sound source of power. The project would further many of the goals and objectives identified by agencies, tribes, and other interested parties.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we analyze the project's use of the available water resources to generate hydropower, estimate the economic benefits of the project, estimate the cost of various environmental enhancement measures and operational changes, and assess the effects of these measures on project operations. Idaho Power does not propose any modifications to the project generation facilities, but it does propose numerous environmental measures that would affect project costs.

4.1 BASIS FOR POWER, COSTS AND ECONOMIC BENEFITS OF THE PROJECT

The main purpose of the Hells Canyon Project is to provide power for Idaho Power's customers. Idaho Power has studied the existing project facilities, operation, and utilization of flows and concludes that the project, as proposed, would be developed to its optimal capacity.

Under its approach to evaluating the economics of hydropower projects, as articulated in Mead Corporation, Publishing Paper Division (72 FERC ¶61,027, July 13, 1995), the Commission employs an analysis that uses current costs to compare the costs of the project and likely alternative power with no consideration for potential future inflation, escalation, or deflation beyond the license issuance date. The Commission's economic analysis provides a general estimate of the potential power benefits and costs of a project and reasonable alternatives to project-generated power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license.

To determine the value of project power benefits, we assumed the value of generation is similar to the cost of Mid-Columbia forward pricing values, which vary by month and time of day. We use a value of dependable capacity of $114,000 per MW per year (MW-yr). We use these values to provide: (1) a basis for measuring the economic benefits of continued project operation; and (2) a basis for estimating the cost of replacing power for any environmental enhancements that would reduce project generation.

The current-cost economic analysis is not entirely a first-year analysis in that certain costs, such as major capital investments, would not be expended in a single year. Also, some future expenses, such as taxes and depreciation, are known and measurable and are, therefore, incorporated in the cost analysis. Table 100 summarizes the values that we use for key parameters in our analysis; these values were either obtained from Idaho Power's final license application and AIR responses or developed by staff. Table 101 summarizes the annualized costs associated with the project under existing conditions (no-action), which total $41,966,200.

Table 100. Summary of key parameters for economic analysis of the Hells Canyon Hydroelectric Project. (Source: Idaho Power, 2004, as modified by staff)

Parameter	Value	Source
Period of analysis	30 years	Staff
Term of financing	20 years	Staff
Discount rate	7.13 percent	Idaho Power
Cost of money	8.48 percent	Idaho Power
General inflation and real growth rate	0 percent	Staff
Depreciation	MACRS	Staff
Taxes and Insurance (%)		
Federal income tax rate	39.1%	Idaho Power

Parameter	Value	Source
Property tax rate	0.5%	Idaho Power
Insurance	0.07%	Idaho Power[a]
Capacity Value ($/MW-year)	$114,000	Staff
Energy Value ($/MWh) ($2006) from Idaho Power	**Heavy Load Period ($)**	**Light Load Period ($)**
January	70.09	60.00
February	64.25	55.00
March	58.41	50.00
April	44.03	35.12
May	39.81	31.76
June	45.90	36.62
July	53.59	43.70
August	62.04	50.59
September	59.12	48.21
October	58.18	48.81
November	56.54	47.44
December	62.28	52.25

Note: MACRS = Modified Accelerated Cost Recovery System

[a] Computed from Idaho Power data.

Table 101. Costs associated with the No-action Alternative for the Hells Canyon Project.

	No Inflation		
	Capital Cost	Annual Expense	Total Annualized Cost
Total original net investment[a]	$162,722,900		$18,428,500
Committed construction cost[b]	$2,477,100		$270,600
Total relicensing cost[c]	$80,700,000		$8,354,300
Ongoing environmental measures[a]	$11,600,000		$1,267,000
Total net investment			$28,320,400
Plant O&M [d]		$5,480,000	$5,480,000
O&M for current environmental measures		$5,542,500	$5,542,500
KWh Tax[e]		$903,300	$903,300
FERC fees[f]		$1,720,000	$1,720,000
Subtotal annual expenses			$13,645,800
Total annualized cost			$41,966,200

[a] We include property tax and insurance considerations in our annualized capital costs, while Idaho Power accounts for these costs separately. We revised this figure and subsequent subtotals in the final EIS based on a September 25, 2006, communication between Idaho Power and FERC staff.

[b] We estimated the committed construction cost by applying the ratio of the cash flow for a known cost to Idaho Power's cost of capital in table 1 of Idaho Power's response to AIR DR-4.

[c] We do not include property tax and insurance in annualizing the relicensing costs.

[d] We computed the plant O&M cost by dividing the 30-year total cost of $164.4 million by 30, based on Idaho Power's response to AIR DR-4.

[e] Based on Idaho Power's response to AIR DR-4 and computed by dividing $27.1 million by 30 years.

[f] Based on Idaho Power's response to AIR DR-4 and computed by dividing $51.6 million by 30 years. A higher figure was published in exhibit D of the final license application (Idaho Power, 2003a).

4.2 COST OF ENVIRONMENTAL MEASURES

Certain measures proposed by Idaho Power, recommended by agencies and other parties and/or considered by staff for inclusion in a Staff Alternative could affect project economics through costs (capital, O&M, plan development, etc.) or effects on power generation. Since several hundred measures have been put forward in this proceeding, we have placed the cost information for the developmental analysis in a set of three cost appendices. Appendix H provides detailed costs for measures included in Idaho Power's Proposal, while appendix I addresses other measures included in the Staff Alternative. Appendix J addresses section 4(e) mandatory measures not included in the Staff Alternative.

4.2.1 Reduced Benefits Associated with Operational Changes

In this final EIS we evaluate alternative operations, which include changes to ramping rates, reregulation of the reservoirs for flow augmentation, and flow management changes to provide minimum navigational flows downstream of Hells Canyon dam. These operational changes, if implemented, would affect both energy generation and dependable capacity, as well as the ancillary benefits of the project. Additional effects could include a loss in generation flexibility and transmission system modifications. We base our estimates of energy impacts on data provided by Idaho Power's CHEOPS model, a hydropower operations computer optimization model.[108]

We determine dependable capacity impacts by estimating project capacity during a critical hydrologic period, which is defined by Idaho Power as July 1994 (a below-normal flow year). In the case of the seasonal 4-inch-per-hour ramping rate measure, capacity losses are associated with Idaho Power's estimated loss of 113 MW of peaking capacity from June 1 through June 15.[109] Table 102, which is based on Idaho Power's response to AIR OP-1(a) (Bowling and Whittaker, 2005) and subsequent Idaho Power comments on the draft EIS, summarizes the effects on power benefits of the environmental measures that would affect generation.

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[108] The CHEOPS model and input files are proprietary tools of Idaho Power. Staff reviewed the model during earlier project proceedings. In response to our AIR OP-1(a), Idaho Power made a number of model runs to simulate certain flow scenarios (see section 3.3.2). Some operational measures, submitted in response to the Commission's Notice of Ready for Environmental Analysis, have not been modeled.

[109] This measure would be effective from March 15 through June 15 each year; however, Idaho Power estimates that it would affect capacity only during June.

Table 102. Annualized lost benefits associated with supplemental operational measures included in the Staff Alternative or recommended by the Corps for navigation purposes.

Measure	Change in Heavy Load Period Energy Generation (MWh)	Change in Light Load Period Energy Generation (MWh)	Lost Energy Benefits	Reduction in Dependable Capacity (MW)	Lost Capacity Benefits	Lost Ancillary, Transmission and Flexibility Benefits	Annualized Reduction in Power Benefits
Staff Alternative Measures							
Implement a 4-inch-per-hour ramping rate measured at Johnson Bar from March 15 through June 15, to be adjusted if warranted based on monitoring studies	–10,019	11,034	$76,000	0.0	$1,261,000[a]	$494,000	$1,831,000
For flow augmentation, refill Brownlee reservoir to full pool by June 20, release 237 kaf of stored water from Brownlee reservoir between June 21 and July 31 (release at least 150 kaf of this water by July 15) and not refill until after August 31	–53,649	39,508	$2,411,000	18.1	$2,056,000[b]	$4,561,000	$9,033,000
Total[c]	–63,652	50,751	$2,459,000	18.1	$3,317,000	$4,702,000	$10,478,000
Corps-recommended Measure							
Operate the project in the interest of navigation to maintain a flow of 8,500 cfs above the mouth of the Salmon River[d]	–6,442	6,324	$179,800	100.3	$11,437,600[e]	$931,500	$12,548,900

[a] This represents replacement of lost spring capacity as estimated by Idaho Power on April 25, 2007.

[b] If Idaho Power were able to use simple cycle combustion turbines rather than combined cycle turbines to replace lost dependable capacity, the economic impact on dependable capacity would be $1,329,200, or $726,800 less than using combined cycle. The resulting total annualized reduction in power benefits for both staff measures would be $9,751,200 instead of $10,478,000.

[c] The entries in the rows above represent the cost of each measure on its own, not in combination with the other flow measures. The total equals the combined effect of all measures and does not necessarily equal the sum of rows 1 (ramping rate) and 2 (flow augmentation) because when measures are combined one measure may partially offset another.

[d] The incremental cost of the Corp's navigation measure would have minimal effect on dependable capacity in July when the measure is incorporated into an operational scenario that includes flow augmentation. Dependable capacity is estimated based on typical July flows during the second driest year type (1994). Under the flow augmentation scenario, simulated July 1994 releases from Hells Canyon dam never fall below the 8,500-cfs navigation target level because water is being released from storage during this month to augment downstream fish flows. However, there would still be significant effects on dependable capacity later in the summer once the augmentation flows end. Additionally, an instantaneous minimum of 11,500 cfs below the mouth of the Salmon River as measured at the Snake River below McDuff Rapids gaging station is required. The measure also requires that the instantaneous minimum release from Hells Canyon dam for the current day be equal to the previous 3-day moving average for Brownlee reservoir inflow when the three-day moving average for Brownlee reservoir inflow is less than 8,500 cfs.

[e] If Idaho Power were able to use simple cycle combustion turbines rather than combined cycle turbines to replace lost dependable capacity, the economic impact on dependable capacity would be $7,394,300, or $4,043,300 less than using combined cycle. The resulting annualized reduction in power benefits would be $8,505,600 instead of $12,548,900.

4.2.2 Cost of Environmental Measures under the Applicants' Proposal, Staff Alternative, and Staff Alternative with Mandatory Conditions

Idaho Power provided cash flows for capital and O&M costs associated with their environmental measures in their response to AIR DR-4 (Bowling and Whittaker, 2005) or in subsequent filings.[110] Based on our review, we largely adopted these costs and applied the parameters summarized in table 100 to compute annualized costs. The annualized cost of the new environmental measures included in Idaho Power's Proposal is $12,529,900. The distribution of these costs by resource area is summarized in table 103, including capital costs, annualized O&M costs, and total annualized costs.

We created the cash flows for capital and O&M costs for environmental measures that were recommended by agencies and other parties or that we developed. In some cases, we estimated costs by extrapolating costs provided by Idaho Power in its application or response to AIR DR-4. The total annualized cost of the new environmental measures included in the Staff Alternative is $15,225,600 (table 103). The total annualized cost of the new environmental measures included in the Staff Alternative with Mandatory Conditions is $15,255,800 (table 103).

4.3 COMPARISON OF ALTERNATIVES

Based on Idaho Power's computer model and hydrologic data for the project, the estimated average annual output of the project under the No-action Alternative (current conditions) is 6,562,244 MWh. This would provide annual power benefits of $351,546,600. Subtracting current costs of $41,966,200 (see table 101) yields an annual net benefit of $309,580,400. This serves as the basis for the analysis of project economic benefits under Idaho Power's Proposal and the Staff Alternative. The project's output is sold to Idaho Power's ratepayers or to other utilities in the northwest region. Idaho Power is an Idaho corporation and is a publicly regulated investor owned utility. Its rates and charges are set by the Idaho Public Utilities Commission in a manner to cover its operating expenses, debt service, and other costs and to provide appropriate operating, capital and other reserves, as well as a regulated return on investment to shareholders.

Table 104 compares the power value, annualized costs, and net benefits of the No-action Alternative, Idaho Power's Proposal, the Staff Alternative, and the Staff Alternative with Mandatory Conditions. In section 5.0, *Staff's Conclusions*, we discuss our reasons for developing the Staff Alternative and explain why we conclude the environmental benefits may be worth these cost increases and benefit reductions. Net benefits would decrease from 47.18 mills/kWh under the No-action Alternative to 45.27 mills/kWh under Idaho Power's Proposal, a drop of 4.05 percent. The decrease in net benefits from 47.18 mills/kWh under Idaho Power's Proposal to 43.34 mills/kWh under the Staff Alternative represents an additional drop of 4.43 percent. Compared to Idaho Power's Proposal, the Staff Alternative causes a greater reduction in net benefits because of measures that would reduce generation and annual power values as well as measures that would increase project costs. If other mandatory measures not included by staff were included in any final license, the results would be almost identical to the Staff Alternative (about $0.005 mills/kWh less net benefit).

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110 Idaho Power provided costs associated with certain water quality measures in its responses to AIRs for WQ-1 and WQ-2 (Idaho Power, 2005e,g,h).

Table 103. Summary by resource area of capital and one-time costs, annual operation and maintenance costs, and total annualized costs of additional environmental measures included in Idaho Power's Proposal, the Staff Alternative, and the Staff Alternative with Mandatory Conditions.

	IDAHO POWER'S PROPOSAL[A]			STAFF ALTERNATIVE[A,B]			STAFF ALTERNATIVE WITH ALL MANDATORY CONDITIONS[C]		
RESOURCE AREA	CAPITAL COST	ANNUALIZED O&M COST	TOTAL ANNUALIZED COST	CAPITAL COST	ANNUALIZED O&M COST	TOTAL ANNUALIZED COST	CAPITAL COST	ANNUALIZED O&M COST	TOTAL ANNUALIZED COST
SEDIMENT TRANSPORT	**$0**	**$814,100**	**$814,100**	**$720,400**	**$842,900**	**$921,600**	**$720,400**	**$842,900**	**$921,600**
WATER QUALITY	**$15,734,400**	**$623,100**	**$1,798,100**	**$15,824,400**	**$650,100**	**$1,835,000**	**$15,824,400**	**$650,100**	**$1,835,000**
AQUATIC RESOURCES	**$17,000,000**	**$954,900**	**$2,811,700**	**$34,328,000**	**$1,141,400**	**$3,921,900**	**$34,328,000**	**$1,141,400**	**$3,921,900**
HATCHERIES	**$17,006,000**	**$469,200**	**$2,326,700**	**$17,381,000**	**$697,000**	**$2,591,600**	**$17,381,000**	**$697,000**	**$2,591,600**
OPERATIONAL MEASURES	**$0**	**$0**	**$0**	**$1,600,000**	**$68,000**	**$242,800**	**$1,600,000**	**$68,000**	**$242,800**
TERRESTRIAL RESOURCES	**$16,953,900**	**$1,046,000**	**$2,896,400**	**$18,709,000**	**$1,403,700**	**$3,445,500**	**$18,709,000**	**$1,403,700**	**$3,445,500**
CULTURAL RESOURCES	**$77,000**	**$499,800**	**$508,200**	**$77,000**	**$527,500**	**$535,900**	**$77,000**	**$527,500**	**$535,900**
Recreation	$9,929,800	$358,900	$1,207,900	$10,899,800	$543,000	$1,486,900	$10,899,800	$553,000	$1,496,900
Land Use and Aesthetics	$840,000	$83,000	$166,800	$950,000	$149,000	$244,400	$1,050,000	$159,000	$264,600
Total	$77,541,100	$4,849,000	$12,529,900	$100,489,600	$6,022,600	$15,225,600	$100,589,600	$6,042,600	15,255,800

[a] Source: Idaho Power, response to AIR DR-4 and staff estimates.

[b] Sum of all measures included in the Staff Alternative, including those proposed by Idaho Power (see appendix H) and those recommended by agencies or developed by staff (see appendix I).

[c] Sum all measures included in the Staff Alternative plus mandatory measures specified by agencies but not included by staff (see appendix J).

Table 104. Summary of the annual cost, power benefits, and net benefits for the No-action Alternative, Idaho Power's Proposal, the Staff Alternative, and the Staff Alternative with Mandatory Conditions.[a]

Hells Canyon	No Action	Idaho Power's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Capacity				
Dependable capacity (MW)	1,277.8	1,277.8	1,259.7	1,259.7
Generation				
Effect on heavy load generation (MWh)			–63,652	–63,652
Effect on light load generation (MWh)			50,751	50,751
Total Generation (MWh)	6,562,244	6,562,244	6,549,344	6,549,344
Changes in Capacity and Power Values				
Dependable capacity effects[b]			–$2,056,000	–$2,056,000
Spring capacity effects			–$1,261,000	–$1,261,000
Generation effects			–$2,459,000	–$2,459,000
Ancillary benefits effects			–$474,000	–$474,000
Transmission effects			–$2,028,000	–$2,028,000
Flexibility effects			–$2,200,000	–$2,200,000
Total Costs and Benefits				
Annual power value	$351,546,600	$351,546,600	$341,068,600	$341,068,600
($/MWh and mills/kWh)	53.57	$53.57	$52.08	$52.08
Annual cost	$41,966,200	$54,496,100	$57,191,800	$57,222,000
($/MWh and mills/kWh)	$6.40	$8.30	$8.73	$8.74
Annual net benefit	$309,580,400	$297,050,500	$283,876,800	$283,846,600
($/MWh and mills/kWh)	$47.18	$45.27	$43.34	$43.34

[a] Small round-off differences of $100 to $200 may carry forward from earlier tables as values are recombined.

[b] If Idaho Power were able to replace lost dependable capacity with simple cycle turbines instead of combined cycle turbines, the dependable capacity effect would drop to $1,329,200. This would add 726,800, or about $0.11/MWh, to annual net benefits.

The measures that Idaho Power proposes, as summarized in table 104, would increase annualized costs from $41,966,200 to $54,496,100 relative to the No-action Alternative. Idaho Power does not propose any significant operational changes and annual generation would remain unchanged at 6,562,244 MWh. This would provide annual power benefits of $351,546,600 and an annual net benefit of $297,050,500. This equals an overall reduction in annual net benefits of $12,529,900 relative to the No-action Alternative.

The measures included in the Staff Alternative, as summarized in table 104, would increase annualized costs from $41,966,200 to $57,191,800 relative to the No-action Alternative. Operational changes would reduce annual generation, which would decrease by 12,900 MWh to 6,549,344 MWh. The Staff Alternative would provide annual power benefits of $341,068,600 and an annual net benefit of $283,876,800. This represents an overall reduction in annual net benefits of $25,703,600 relative to the No-action Alternative. If mandatory measures not included by staff were ultimately made a part of the license, the costs would increase by $30,200 and annual net benefits would decrease accordingly to $283,846,600.

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5.0 STAFF'S CONCLUSIONS

When the Commission considers license proposals, besides looking at power and other developmental purposes—irrigation, flood control, water supply—it must also give equal consideration to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. In this section, we examine the environmental effects and project costs and explain how we decided on the environmental measures we include in a Staff Alternative.

5.1 SUMMARY COMPARISON OF IDAHO POWER'S PROPOSAL AND STAFF ALTERNATIVE

In this section, we outline Idaho Power's Proposal, the Staff Alternative, and the Staff Alternative with Mandatory Conditions, and summarize the key differences of the potential effects among alternatives.

5.1.1 Description of Alternatives

5.1.1.1 Idaho Power's Proposal

Idaho Power's Proposal consists of a proposed operating regime and 94 environmental measures summarized previously in section 2.2, *Idaho Power's Proposal*.

5.1.1.2 Staff Alternative

After evaluating Idaho Power's Proposal and recommendations from resource agencies, tribes and other interested parties, we compiled a set of environmental measures that we consider appropriate for addressing the resource issues raised in this proceeding. We call this the "Staff Alternative." The Staff Alternative includes some measures included in Idaho Power's Proposal, as described below, Interior's modified section 18 prescription (see section 5.2.4.4), some section 4(e) and alternative section 4(e) conditions (see section 5.3.2), section 10(j) recommendations (see section 5.3.1), section 10(a) recommendations, and measures developed by the staff.

Project Operation

Under the Staff Alternative, the project would be operated as proposed by Idaho Power (see section 2.2.2, table 1), but with the following operational changes: (1) reservoir refill targets after the flood control season, (2) flow augmentation to enhance juvenile fall Chinook salmon migration conditions, (3) additional ramping restrictions during the fall Chinook salmon rearing period, (4) revised minimum flow during medium-high and extremely high flow years; and (5) warmwater fish spawning protection levels in Brownlee reservoir. The operational modifications included in the Staff Alternative are as follows:

1. Idaho Power would consult with the Corps to develop a flood control plan for operating Brownlee reservoir consistent with regional and local requirements. Consistent with the flood control plan, Idaho Power would refill Brownlee reservoir to a level between: (a) 1 foot below the April 15 and April 30 required flood control draft; and (b) the required flood control draft on those dates. After April 30, Idaho Power would coordinate the refill of Brownlee reservoir with the Corps, NMFS, ODFW, IDFG, and the interested tribes to ensure that the refill of Brownlee reservoir does not result in unnecessary reductions of spring flows as measured at Lower Granite dam. This measure would not in any way diminish the Corps' discretion over the project's flood control operation.

2. Consistent with flood control requirements, Idaho Power would refill Brownlee reservoir to full pool (elevation 2,077 feet msl) by June 20 of each year and, in order to enhance migration conditions for juvenile fall Chinook salmon, would release 237 thousand acre-feet of stored water from Brownlee reservoir (draft to elevation 2,059 feet msl) between June 21 and July 31, except as may be restricted by the Corps for system flood control between June 20 and July 1[111]. Idaho Power would release at least 150 kaf of this water (draft to elevation 2,066 feet msl) no later than July 15 of each year, but would maintain Brownlee elevations through the Fourth of July holiday to enhance recreational use of the reservoir. Idaho Power would not refill Brownlee reservoir at any time between June 21 and August 31

3. The maximum variation in river stage would not exceed 1 foot per hour as measured at the Snake River at Johnson Bar gaging station 13290460 (RM 230), except during the March 15 to June 15 fall Chinook rearing period when the maximum variation in river stage would not exceed 4 inches per hour.

4. From Memorial Day weekend to September 30 in medium-high and extremely high flow years, Idaho Power would provide an instantaneous minimum flow of 8,500 cfs upstream of the mouth of the Salmon River, as measured at the Hells Canyon dam gaging station.[112] If the 3-day moving average inflow to Brownlee reservoir is less than 8,500 cfs, the instantaneous minimum release required from Hells Canyon dam for the current day would be equal to the previous 3-day moving average.

5. Idaho Power would protect warmwater fish spawning locations in Brownlee reservoir from May 21 through July 4. For the initial 30-day period beginning May 21, Brownlee reservoir would not be drafted more than 1 foot from the highest elevation reached during the 30-day period. From the end of the 30-day period though July 4, the reservoir could be drafted more than 1 foot, but an elevation of at least 2,069 feet above mean sea level would be maintained.[113]

Measures Proposed by Idaho Power

In the Staff Alternative, we also include the following environmental measures proposed by Idaho Power, based on our analyses included in sections 3 and 4. In some cases (italicized), we have deleted, modified, or supplemented Idaho Power's proposed measures. As noted in section 2.2.3, *Proposed Environmental Measures*, measures numbered 1P through 81P reflect Idaho Power's original proposal; measures 101P through 113P reflect changes to Idaho Power's proposal filed between the draft EIS and the final EIS.

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[111] Staff measure 8S would require Idaho Power to prepare a report 6 years after license issuance that summarizes available information on the effectiveness of this measure for improving the migration survival of juvenile salmon and steelhead, and evaluating whether any changes in the timing or quantity of flow augmentation water released from Brownlee reservoir are warranted.

[112] Staff measure 4S would require Idaho Power to install a new flow compliance gage within 5 miles downstream of Hells Canyon dam. Once it is operational, compliance for the minimum navigation flow would be measured at the new gage.

[113] The requirement for warmwater fish spawning protection (item 4, above) would be secondary to any conflicting operational requirement.

Sediment Supply and Transport

101P. Develop and implement a program to monitor beach and terrace erosion, substrate, and gravel. *We modified Idaho Power's proposed measures to include development and implementation of a 5-year volumetric monitoring of sand and gravel.*

102P. Create a mitigation fund to be used by the Forest Service to restore and maintain 14 acres of sandbars on or adjacent to National Forest System lands between Hells Canyon dam and the confluence of the Snake and Salmon rivers.

Water Use and Quality

1P. Continue 100-cfs minimum flow in Oxbow bypass to help maintain water quality in the bypassed reach.

2P. Continue recreation waste disposal to prevent waste from contaminating the river.

3P. Continue preferential use of the upper spillgates at Brownlee dam during spill periods to minimize elevated total dissolved gas as an interim measure until spillway flow deflectors are installed at Brownlee dam.

4P. Implement one of two measures (in-reservoir aeration or upstream phosphorus trading) to fully meet the Snake River-Hells Canyon TMDL Brownlee reservoir dissolved oxygen allocation (an average of 1,125 tons of oxygen during the summer into the transition zone of Brownlee reservoir). *We modified Idaho Power's proposed measure to include development and implementation of a dissolved oxygen enhancement plan that documents consultation with IDEQ and ODEQ regarding the appropriate dissolved oxygen load allocation for the project, documents efforts to identify upstream phosphorus trading partner(s), evaluates whether reservoir dissolved oxygen supplementation or phosphorus trading is the preferred method for meeting Idaho Power's Brownlee reservoir TMDL dissolved oxygen allocation, evaluates the feasibility and effectiveness of turbine aeration measures at Hells Canyon and Brownlee dams, evaluates the potential for each measure to elevate total dissolved gas to greater than the applicable water quality criterion (i.e., 110 percent of saturation); (2) monitoring the effectiveness of implemented measures; (3) holding annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, NMFS, and interested tribes to evaluate whether measures need to be modified or additional measures implemented to meet the dissolved oxygen load allocation for the project; and (4) filing an annual monitoring and implementation report with the Commission that summarizes monitoring results and outlines any modifications or new measures that warrant consideration and/or are proposed for implementation*

103P. Aerate Hells Canyon outflows using a forced air (blower) system at Hells Canyon powerhouse that would add 1,500 tons of oxygen per year.

104P. Install and operate a destratification system in the Oxbow bypassed reach at the deep pool just upstream of the Indian Creek confluence to prevent anoxic conditions at this location.

5P. Install Hells Canyon dam spillway flow deflectors to reduce total dissolved gas levels in the tailrace of Hells Canyon dam and the Snake River downstream of the dam.

105P. Install Brownlee dam spillway flow deflectors to reduce total dissolved gas levels in Oxbow and Hells Canyon reservoirs and the Snake River downstream of Hells Canyon dam.

106P. Evaluate and implement measures on the Oxbow dam spillway or bypassed reach to reduce total dissolved gas levels as necessary to meet the Snake River-Hells Canyon TMDL load allocation.

107P. Adaptively manage total dissolved gas abatement measures to ensure that Idaho Power meets its total dissolved gas load allocation below each of the project dams. *We modified Idaho Power's proposed measure to include: (1) annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, NMFS, and interested tribes to evaluate whether measures need to be modified or additional measures implemented to meet TDG responsibility for the project; and (2) filing of an annual report with the Commission that summarizes monitoring results and any modifications or new measures that warrant consideration and/or are proposed for implementation.*

108P. Work with ODEQ and IDEQ to develop a total dissolved gas monitoring plan that would include monitoring during spill to determine compliance with the TMDL load allocation assigned to Idaho Power.

109P. Implement Idaho Power's Temperature Adaptive Management Plan, which would: (1) define the extent of appropriate project temperature responsibility; (2) include an evaluation of potential measures; and (3) identify an appropriate measure(s) for implementation. *We modified Idaho Power's proposed measure to include: (1) monitoring of the effectiveness of implemented measures; (2) annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, and NMFS to evaluate whether measures need to be modified or additional measures implemented to meet the project's temperature responsibility; and (3) filing of an annual report with the Commission that summarizes monitoring results and any modifications or new measures that warrant consideration and/or are proposed for implementation.*

Fish and Snails

6P. Continue the fall Chinook plan.

6Pa. Continue reservoir operations in the fall, winter, and early spring for protection of fall Chinook salmon spawning and salmon incubation. *We modified Idaho Power's proposed measure to indicate that the stable flows to be maintained below Hells Canyon dam during the fall Chinook spawning season must be between 8,500 and 13,500 cfs, at a level selected (based on runoff forecasts) to ensure that spawning fall Chinook salmon redds are created at elevations that are protected during the winter peak load period.*

6Pb. Measure 6b in the draft EIS (concerning fall Chinook salmon redd and temperature monitoring) has been replaced by measures 110P and 10S.

110P. Implement the Fall Chinook Salmon Spawning and Gravel Monitoring Plan described in appendix B of Idaho Power's comments on the draft EIS. *We supplemented this measure to include: (1) annual consultation with NMFS, Interior, IDFG, ODFW, and interested tribes to report on monitoring results to date and to guide monitoring efforts in the coming year; and (2) the development and implementation of a gravel augmentation program if monitoring results indicate that project-related effects on the quantity or quality of spawning habitat are adversely affecting the spawning or incubation success of fall Chinook salmon.*

7P. Implement the warmwater fish plan.

7Pa. Protect peak spawning periods for smallmouth bass and crappie by limiting Brownlee reservoir drafts to no more than 1 foot from the highest elevation reached during a 30-day period starting on May 21, and by maintaining an elevation of at least 2,069 feet msl from the end of the 30-day period through July 4.

7Pb. Continue warmwater fish population monitoring to detect long-term effects on fish populations. *We modified Idaho Power's proposed measure to include gill netting or other measures to monitor the abundance of channel catfish in project reservoirs; filing of an annual report on the results of warmwater fisheries monitoring including an assessment of any operational effects on warmwater fisheries; and consultation with ODFW, IDFG and BLM on any feasible means to minimize or avoid adverse effects on the warmwater fishery in Brownlee reservoir.*

8P. Implement the native salmonid plan.

8Pa. Conduct pathogen survey in the Pine-Indian-Wildhorse core area to support development of a pathogen risk assessment plan. *In the Staff Alternative, we incorporated this measure in the description of Idaho Power measure 8Pb.*

8Pb. Prepare and implement a plan to allow for the capture of resident salmonids and other species migrating upstream and for their transfer to areas upstream of Hells Canyon and Oxbow dams. The plan would include modification of the Hells Canyon fish trap to capture juvenile salmonids, construction of facilities for sorting and holding fish and for scanning PIT-tag returns, and potentially expansion to year-round operation. The plan also would include a provision to construct a fish trap at Oxbow dam a minimum of 5 years after the Hells Canyon trap has been modified. *We modified Idaho Power's proposed measure to incorporate the FWS modified fishway prescription, which prescribes that Idaho Power prepare a bull trout passage plan that would include: (1) final design plans for the Hells Canyon trap modifications; (2) final engineering design plans for the Pine Creek monitoring weir and trap fishway, and construction of the weir and trap fishway within 2 years of license issuance; (3) specific protocols for the period of operation,*[114] *location of release point, and handling of all life-stages of bull trout and other fish captured at these two facilities; (4) provisions for transport of bull trout between Pine Creek and Hells Canyon dam; (5) an assessment of monitoring necessary to evaluate the potential and risk of introducing deleterious pathogens; and (6) a post-construction monitoring plan.*[115] *Under this modified prescription, the plan would include a description of specific triggers related to the timeline of construction and implementation of the Oxbow upstream trap fishway, the Indian Creek permanent weir and trap fishway, and the Wildhorse River weir and trap fishway. The plan would also include the specific monitoring necessary to determine when established triggers have been satisfied.*

8Pc. Prepare and implement a tributary habitat enhancement plan within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the Hells Canyon

[114] The period of operation would be determined in consultation with the agencies and tribes, but may include year-round operation.

[115] The post-construction monitoring plan for the fish trap at Oxbow dam, if constructed, would include evaluation of flows needed to provide effective passage through the Oxbow bypassed reach.

Project reservoirs. *We modified Idaho Power's proposed measure to include enhancement measures to support redband and bull trout restoration in portions of the Powder and Burnt River basins where such measures would provide substantial benefits to native resident salmonids.*

8Pd. Supplement marine-derived nutrients to enhance the forage base within bull trout rearing areas (Pine, Indian, and Wildhorse core area).

8Pe. Conduct Eagle Creek presence/absence survey to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek Basin.

8Pf. Design, construct, and monitor a permanent monitoring weir at Pine Creek to establish a long-term monitoring program of fluvial fish migrating upstream and downstream in the Pine Creek System. *In the Staff Alternative, we incorporated this measure in the description of Idaho Power measure 8Pb.*

8Pg. Evaluate the feasibility of, and possibly implement, an experimental brook trout suppression program in Indian Creek. *We modified Idaho Power's proposed measure to include implementation of brook trout suppression in the Wildhorse River and possibly Pine Creek using techniques proven effective in Indian Creek.*

9P. Continue anadromous fish production at hatchery facilities. *This Idaho Power measure is modified to note that hatchery operations are to be in keeping with any hatchery and genetic management plans*[116] *that are developed for these hatcheries. We recommend that Idaho Power's obligation to fund the hatchery genetic management plans be based on continuation of current smolt production targets, but may include improvements that are needed to better attain goals for adult returns and societal use.*

9Pa. Continue to operate the Oxbow fish hatchery.

9Pb. Continue to operate the Rapid River fish hatchery.

9Pc. Continue to operate the Niagara Springs fish hatchery.

9Pd. Continue to operate the Pahsimeroi fish hatchery.

10P. Upgrade and enhance anadromous mitigation hatchery facilities.

10Pa. Make improvements to the Pahsimeroi fish hatchery to control pathogens, develop a locally adapted steelhead broodstock, and monitor and evaluate hatchery performance.

10Pb. Make improvements to the Oxbow fish hatchery by constructing adult holding pond and spawning facilities, expanding the fall Chinook rearing program, distributing carcasses, generally upgrading the hatchery facilities, and monitoring and evaluating hatchery performance.

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[116] Because the hatcheries are operated by IDFG, hatchery and genetic management plans would be developed by IDFG in consultation with NMFS.

10Pc. Make improvements to the Niagara Springs fish hatchery by expanding the hatchery building, acquiring an additional smolt tanker, acquiring a fish marking unit, upgrading employee housing, and monitoring and evaluating hatchery performance.

10Pd. Make improvements to the Rapid River fish hatchery by constructing an adult holding pond and spawning facilities, distributing carcasses, upgrading employee housing, generally upgrading the hatchery facilities, constructing an offsite smolt acclimation/adult collection facility, and monitoring and evaluating hatchery performance.

11P. Implement Snake River White Sturgeon Conservation Plan.

11Pa. Assess water quality-related effects on early life stages of white sturgeon in the Swan Falls-Brownlee reach.

11Pb. Translocate reproductive-sized white sturgeon into the Swan Falls-Brownlee reach to increase spawner abundance and population productivity, if water quality is found to be adequate. *We modified Idaho Power's proposed measure to be dependent upon the findings of an evaluation of alternative approaches for rebuilding white sturgeon populations in affected reaches (part of modified Idaho Power measure 11Pc).*

11Pc. Develop an experimental conservation aquaculture plan to maintain adequate population size and genetic variability of white sturgeon in the Swan Falls-Brownlee reach, if approved by IDFG and ODFW. *We modified Idaho Power's proposed measure to include a feasibility assessment of alternative approaches for rebuilding sturgeon populations in reaches of the Snake River between Swan Falls and Hells Canyon dams, to include comparison of the risks and benefits of hatchery supplementation with the translocation of juvenile or adult sturgeon.*

11Pd. Make periodic population assessments to monitor white sturgeon populations in the Swan Falls-Brownlee, Brownlee-Hells Canyon, and Hells Canyon-Lower Granite reaches of the Snake River.

11Pe. Monitor genotypic frequencies of white sturgeon between Shoshone Falls and Lower Granite dams. *We modified Idaho Power's proposed measure to exclude genetics monitoring upstream of Swan Falls dam, which is addressed in the licenses for the mid-Snake and C.J. Strike projects.*

Wildlife

12P. Acquire, enhance, and manage approximately 22,761 acres of upland and 821 acres of riparian habitat in the vicinity of the Hells Canyon Project reservoirs to mitigate for the estimated effects of project operations on wildlife.

13P. In cooperation with ODFW and IDFG, enhance habitat on four Snake River islands (Gold, Hoffman, Patch, and Porter) for waterfowl and for threatened, endangered, candidate, and special status species. *We modified Idaho Power's proposed measure to include support for capital improvements needed to implement enhancement projects, as recommended by ODFW and IDFG.*

14P. Cooperate with state and federal wildlife management agencies to enhance low-elevation riparian habitat and reintroduce mountain quail in areas adjacent to the project reservoirs. *We modified Idaho Power's proposed measure to include consultation with state and* *federal wildlife management agencies to develop and implement habitat improvements or relocation projects.*

15P. Through an interdisciplinary team, develop and implement an Integrated Wildlife Habitat Program and a Wildlife Mitigation and Management Plan to manage wildlife resources on Idaho Power-owned lands associated with the project to ameliorate identified impacts and provide general land stewardship. *This measure is clarified to indicate that Idaho Power would establish a terrestrial resource work group to provide consultation in finalizing and implementing the management plan and implementing other measures to prevent wildlife disturbance.*

16P. Develop and implement an operation and maintenance plan for the Pine Creek-Hells Canyon transmission line to minimize effects on wildlife, protect wildlife resources, and enhance habitat conditions. *In the Staff Alternative, we combined this measure with Idaho Power measure 20P and included it in staff measure 13S, below.*

Botanical Resources

17P. Acquire, enhance, and manage upland and riparian habitat to mitigate for the estimated effects of project operations on botanical resources.

18P. Formalize cooperative relationships to accomplish noxious weed control and non-native invasive weed management, site monitoring, and re-seeding along the Snake River corridor from Weiser downstream to the confluence of the Salmon River. *In the Staff Alternative, we supplemented this Idaho Power measure to include agency consultation in the development and implementation of a project-wide integrated weed management plan to cover National Forest System and BLM-administered lands within the project boundary and lands affected by the project, as well as Idaho Power's ownership, and establishment of a Cooperative Weed Management Area as specified by the Forest Service. The plan would cover pesticide reporting to BLM.*

19P. Formalize cooperative relationships, including establishment of a rare plant advisory board, to protect and monitor sensitive plant sites along the Snake River corridor from the headwaters of Brownlee reservoir downstream to the confluence of the Salmon River. *In the Staff Alternative, we supplemented this Idaho Power measure to include agency consultation in the development and implementation of a project-wide threatened, endangered, and sensitive species management plan for plants and animals to cover National Forest System and BLM-administered lands within the project boundary and lands affected by the project, as well as Idaho Power's lands, as described in staff measure 12S, below.*

20P. Develop and implement an operation and maintenance plan for the Pine Creek-Hells Canyon transmission line and service road and adaptively manage operation and maintenance activities to minimize adverse effects on botanical resources and to manage noxious weeds. In the Staff Alternative, we c*ombined this measure with Idaho Power measure 16P and included it in staff measure 13S, below.*

21P. Implement cooperative projects recommended by agencies and included in the Transmission Line Operation and Management Plan. *In the Staff Alternative, we clarified this measure to indicate that it includes agency consultation in the development of the operation and maintenance plan.*

Historical and Archaeological Resources

22P. Monitor sites along transmission line 945 that are eligible for inclusion on the National Register.

23P. Monitor the known burial site on Oxbow reservoir.

24P. Monitor known eligible sites on Oxbow and Hells Canyon reservoirs. *In the Staff Alternative, we expanded this measure to include all known eligible resources in the areas of potential effect of these reservoirs.*

25P. Monitor known eligible sites on Brownlee reservoir. *In the Staff Alternative, we expanded this measure to include all known eligible resources within the area of potential effect of the reservoir.*

26P. Monitor known eligible sites downstream of Hells Canyon dam. We *expanded this measure to include all known eligible resources in the area of potential effect.*

27P. Stabilize approximately 20 archaeological sites below Hells Canyon dam after identifying sites requiring stabilization.

28P. Stabilize seven archaeological sites on Brownlee reservoir.

29P. Recover archaeological data at four archaeological sites on Brownlee reservoir to prevent possible damage by reservoir operations.

30P. Establish Native American interpretive sites on Brownlee reservoir to enhance visitors' awareness of Native American presence and land use in the project area.

31P. Establish Native American interpretive sites on Oxbow and Hells Canyon reservoirs to enhance visitors' awareness of Native American presence and land use in the project area.

32P. Establish European-American interpretive sites on Brownlee, Oxbow, and Hells Canyon reservoirs to enhance visitors' awareness of European-American presence and land use in the project area.

33P. Establish Asian-American interpretive sites on Brownlee, Oxbow, and/or Hells Canyon reservoirs to enhance visitors' awareness of Asian-American presence and land use in the project area.

34P. Support European-American and Asian-American interpretive projects by assisting local community museums with collections acquisition, display, and curation related to Hells Canyon area trappers, miners, homesteaders, ranchers, and river runners of European and Asian descent.

35P-40P. Provide support for Native American programs of the Burns Paiute Tribe, Confederated Tribes of the Warm Springs Indian Reservation, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Shoshone-Paiute Tribes, and Shoshone-Bannock Tribes in its efforts to obtain funding for participating in and/or administering cultural resources environmental measures, educating their youth by providing scholarship/training funds, and providing funds to facilitate several cultural enhancement programs. *We modified Idaho Power's proposed measure to delete the funding of scholarships and clarify that support for tribal programs is intended to support the tribes' participation in natural and cultural resource management.*

41P. Fund additional section 106 projects to protect sites and mitigate for any unforeseen adverse effects attributed to Hells Canyon Project operations.

Recreational Resources

42P. Continue to operate and maintain monitors to provide flow information about river flows downstream of Hells Canyon dam.

43P. Continue the Memorandum of Understanding between the Forest Service and Idaho Power with regard to staffing the Hells Canyon Visitor Center.

44P. Continue existing general measures for all zones.

44Pa. Continue litter and sanitation program.

44Pb. Continue public safety programs.

44Pc. Continue aid to local law enforcement in Adams County.

44Pd. Continue road maintenance.

44Pe. Continue operation and maintenance of Idaho Power-managed parks and recreation facilities.

45P. Provide additional boat moorage on Hells Canyon Project reservoirs to improve angling access. *We modified Idaho Power's proposed measure to include details of the boat moorage plan as part of the final Recreation Plan.*

46P. Enhance the existing Litter and Sanitation Plan to improve litter cleanup and access to portable and vault toilets at dispersed recreational sites. *We modified Idaho Power's proposed measure to address the need for, location of, and maintenance standards for floating restrooms; to develop maintenance and service standards for trash receptacles; and to design, install, and maintain a graywater carryout system in the vicinity of the Hells Canyon Creek put-in/take-out area.*

47P. Develop and implement an integrated Information and Education Plan to promote protection and preservation of cultural, natural, and historical resources through education. *We modified Idaho Power's proposed measure to have the I&E Plan indicate the location and type of information materials to be provided and include information about anadromous fish, invasive species, and sensitive wildlife.*

48P. Coordinate the prioritization of law enforcement resource use among appropriate law enforcement agencies to address public safety issues. *We modified Idaho Power's proposed measure to have Idaho Power provide coordination by planning and hosting biannual meetings of the parties responsible for law enforcement in the project, but not funding law enforcement by third parties. In the Staff Alternative, we re-designate this as a "Land Management" measure.*

49P. Develop and implement a Recreation Adaptive Management Plan to identify and address the adequacy of Idaho Power's Recreation Plan over the life of a new license. *In the Staff Alternative, we supplemented this measure to indicate that the recreation adaptive management plan should address dispersed site management and procedures for recreational use monitoring and reporting and should be part of the overall Recreation Plan.*

50P. Enhance road maintenance to improve public safety and further protect at-risk cultural and natural resources. *In the Staff Alternative, we re-designate this as a "Land Management" measure.*

51P. Perform operation and maintenance at Idaho Power-enhanced BLM sites and all Forest Service reservoir-related recreation sites consistent with the settlement (FS modified 4(e) condition no. 18) to benefit recreation, provide public access, enhance visitor services and user satisfaction, and reduce the responsibilities of federal agencies to provide operations and maintenance services. This measure includes a safety review and improvements of the Deep Creek Trail (FS modified 4(e) condition no. 16), and brings the Deep Creek Trail into the project boundary. *We modified Idaho Power's proposed measure to bring into the project boundary dispersed recreation sites that are within 200 yards of project waters as well as Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites and the trail to Deep Creek (see staff measure 23S below).*

52P. Enhance Eagle Bar dispersed recreation site and improve boat ramp access to Hells Canyon reservoir.

53P. Develop site plan for Big Bar recreation site consistent with the settlement (FS modified 4(e) condition no. 13).

54P. Measure 54 in the draft EIS (boat ramp and associated facilities at Big Bar section D) has been incorporated into Idaho Power measure 52P.

55P. Develop site plan and enhance Eckels Creek dispersed recreation site to benefit recreation and provide cultural and natural resource protection.

56P. Supplement the existing O&M budget to accommodate enhancements at Idaho Power-managed parks and recreational facilities.

57P. Develop and implement a site plan for the Copper Creek dispersed recreation site to benefit recreation and provide cultural and natural resource protection.

58P. Reconstruct Hells Canyon Park to benefit recreation, improve public access, and protect cultural and natural resources.

59P. Develop Airstrip A&B dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

60P. Develop and implement a site plan for Bob Creek Section A dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

61P. Develop and implement a site plan for Bob Creek Section B dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

62P. Develop and implement a site plan for Bob Creek Section C dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources

63P. Develop and implement a site plan for Westfall dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources.

64P. Enhance Copperfield boat launch area to benefit day-use activities.

65P. Implement a site plan for Oxbow boat launch to benefit recreation, improve public access, and protect cultural and natural resources.

66P. Implement a site plan for Carters Landing and Old Carters Landing recreational sites to benefit recreation, improve public access, and protect cultural and natural resources.

67P. Reconstruct McCormick Park to meet current standards of services, benefit recreation, improve public access, and protect cultural and natural resources.

68P. Develop and implement a site plan for Hewitt and Holcomb Parks to accommodate recreational use and provide cultural and natural resource protection.

69P. Develop and implement a site plan for a low-water boat launch at or near Swedes Landing to improve boat access to Brownlee reservoir during seasonal reservoir drawdowns and periods of low reservoir levels.

70P. Develop and implement a site plan for Swedes Landing to benefit recreation, improve public access, and protect cultural and natural resources.

71P. Develop and implement a site plan for Spring recreational site to enhance recreational facilities and improve boat ramp access to Brownlee reservoir.

Land Management and Aesthetics

72P. Implement the Hells Canyon Resource Management Plan, creating virtual buffer zones between some otherwise incompatible uses, to establish or maintain compatibility between and among the various land and water uses in the vicinity of the Hells Canyon Project. *In the Staff Alternative, we supplemented this measure to include clarifications regarding consultation, coordination, and reporting and to include resource maps, maps depicting road maintenance responsibilities, and maps for public use as part of the proposed GIS atlas of critical and sensitive resources.*

73P. Incorporate aesthetic concerns when upgrading or repairing the existing transmission line 945. *In the Staff Alternative, we supplemented this measure to include a monitoring strategy to analyze future modifications to the line, incorporating all viewpoints identified in the Technical Report on Aesthetics from which the line is visible, and a schedule for implementing aesthetic improvements on the line.*

111P. Implement the aesthetic improvements to the Hells Canyon dam site and recreational portal, consistent with the settlement (FS modified 4(e) condition no. 22).

112P. Implement the Scenery Management Plan, consistent with the settlement (FS modified 4(e) condition no. 24).

74P. Measure 74 in the draft EIS (standards and guidelines for physical structures) is incorporated in measure 112P.

75P. Measure 75 in the draft EIS (transmission line aesthetics) is incorporated in measure 112P.

76P. Measure 76 in the draft EIS (general aesthetic clean-up plan) is incorporated in measure 112P.

77P. Measure 77 in the draft EIS (guard rails and Jersey barriers) is incorporated in measure 112P.

78P. Measure 78 in the draft EIS (visual contrast) is incorporated in measure 112P.

79P. Cooperate with BLM and the Forest Service to develop and assist them with implementing proposed design standards and guidelines at specific BLM and Forest Service facilities, including the Spring recreational site on Brownlee reservoir (BLM), Copper Creek trailhead on Hells Canyon reservoir (BLM), and Big Bar and Eagle Bar on Hells Canyon reservoir (Forest Service).

80P. Provide signs and/or facilities that interpret some elements of the Hells Canyon Project that cannot be effectively modified to reduce their visual contrast.

81P. Implement the common policies of the Hells Canyon Resource Management Plan to provide for the management, protection, and/or conservation of natural and cultural resources. In the Staff Alternative, we *supplemented this measure to address law enforcement, fire prevention, and road management in the Common Policies.*

113P. Provide the Forest Service with a map and aerial photos depicting the approximate location of the project boundary, together with GIS shapefiles with Metadata for the project boundary on National Forest System lands. The project boundary GIS data would be compatible with Forest Service GIS and would be positionally accurate to ±40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. This measure is consistent with the settlement (FS modified 4(e) condition no. 26).

Additional Measures Proposed by Staff

Finally, the Staff Alternative also includes the following additional measures identified by staff based on agency, tribal, and NGO recommendations and our analysis. Measures numbered 2S through 27S reflect original staff measures presented in the draft EIS; measures 101S through 108S reflect staff measures added between the draft EIS and final EIS.

Sediment Supply and Transport

1S. Staff measure 1 in the draft EIS (beach and terrace erosion, substrate, and gravel monitoring) has been incorporated into Idaho Power's proposal (measure 101P).

Water Use and Quality

2S. Staff measure 2 in the draft EIS (develop and implement a temperature management plan) has been incorporated in Idaho Power's proposal (measure 109P).

3S. Staff measure 3 in the draft EIS (develop and implement a total dissolved gas abatement plan) has been incorporated into Idaho Power's proposal (measure 107P).

4S. Develop and implement an operational compliance and water quality monitoring plan to monitor compliance with minimum flows, reservoir levels, and ramping rates specified in the license, and to monitor water quality downstream of Hells Canyon dams. Develop the plan in consultation with IDEQ, ODEQ, IDFG, ODFW, NMFS, FWS, USGS, and interested tribes. The plan should, at a minimum, include:

- Identification of an appropriate location for continuous monitoring of river flow, stage, water temperature, dissolved oxygen, and total dissolved gas within 5 miles downstream of Hells Canyon dam, preferably within 3 miles of the dam;
- A schedule for the construction of a flow measurement gage at the selected site, and for the installation of water quality monitoring equipment;
- A description of procedures that would be followed to determine a ramping rate at the new gage site that is equivalent to any ramping rate specified for other locations in the new license;
- A description of the method that would be used to measure water surface elevations at Brownlee, Oxbow and Hells Canyon reservoirs, as well as flow rates in the Oxbow bypassed reach; and
- The time steps for which real-time and historical flow, water surface elevation and water quality information from each location would be posted on the Internet and annually reported to the Commission.

5S. If requested by IDEQ or ODEQ, make available tissue samples from white sturgeon within and downstream of the project area and from Brownlee reservoir fish for the purpose of monitoring toxic bioaccumulants. These samples would be collected during the routine population monitoring efforts proposed by Idaho Power (Idaho Power measures 7Pb and 11Pd).

Aquatic Resources

6S. Every 5 years, file a report that summarizes water quality changes in response to TMDL implementation upstream of Brownlee dam to determine when habitat becomes suitable to support any future reintroduction efforts.

7S. Staff measure 7 in the draft EIS (gravel augmentation pilot program) has been deleted.

8S. Six years after license issuance, prepare a flow augmentation evaluation report that evaluates the efficacy of flow augmentation water provided from Brownlee reservoir for aiding the downstream migration of juvenile salmon and steelhead; to include consideration of how these releases are coordinated with flow augmentation water contributed from the Snake River basin upstream from Brownlee dam and from Dworshak reservoir; and to include any recommendations, for Commission approval, for modifying flow augmentation releases from Brownlee reservoir.

9S. Develop and implement a stranding and entrapment monitoring plan to evaluate, and if needed develop and implement approaches to protect and enhance rearing juvenile fall Chinook salmon and bull trout downstream of Hells Canyon dam.

101S. Develop and implement an invertebrate monitoring plan to evaluate trends in the abundance and distribution of rare and sensitive species of mollusks, as well as to evaluate the effects of load following operations on rare and sensitive mollusks and the food supply available to fall Chinook salmon and to bull trout. As part of the plan, prepare annual monitoring reports and provide for updates to the monitoring plan every 5 years, addressing the need to alter project operations or implement other measures to address project effects based on monitoring results.

10S. Develop and implement a fall Chinook spawning and incubation flow management plan to determine appropriate monitoring methods to assist with determining flow levels to be maintained downstream of Hells Canyon dam during the fall Chinook salmon spawning and incubation season. The plan would be developed in consultation with NMFS, FWS, IDFG, ODFW, and the interested tribes.

102S. Fund the development and implementation of a hatchery and genetics management plan for each mitigation hatchery, including establishment of mitigation goals, but retaining current smolt production targets. As part of the plan, prepare annual reports on the hatchery program, including data on adult returns, to ensure the goals and objectives of the plan are being met.

103S. Develop a plan, in consultation with the Shoshone-Bannock Tribes, IDFG, NMFS, and FWS, to design, construct, and operate facilities on the Yankee Fork to collect, spawn and incubate 1,000,000 steelhead or Chinook salmon eggs to support the Shoshone-Bannock Tribe's existing streamside incubator program. The facilities would need to be operated in compliance with a Hatchery and Genetic Management Plan[117] approved by NMFS.

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[117] Because the facilities would be operated by the Shoshone-Bannock Tribes, the HGMP would be developed by the tribes in consultation with NMFS.

Production numbers from the Yankee Fork hatchery should be included in the annual reports on the hatchery program prepared by Idaho Power (102S).

104S. In consultation with ODFW, IDFG, FWS, NMFS, and interested tribes, develop and implement a plan to use surplus adult hatchery spring Chinook salmon and steelhead to: (1) provide marine nutrients and improve forage for bull trout in tributaries within the project area; (2) facilitate the evaluation of spawning success, egg viability and survival, and smolt outmigration and survival in Pine Creek; and (3) support ceremonial, subsistence, and recreational fisheries in select tributaries to the Snake River, including the Salmon River basin where appropriate.

105S. Participate in regional forums on lamprey restoration in the Snake River basin, file a summary of the activities with the Commission every 3 years, and identify and implement any feasible measures to address project effects on Pacific lamprey.

106S. Hold annual meetings of the White Sturgeon Technical Advisory Committee to review the results of past monitoring and enhancement efforts, and to guide such efforts in the upcoming year, and file with the Commission an annual report on the results from the previous year of monitoring and enhancement efforts, and any recommendations for revising the monitoring or enhancement measures.

Wildlife and Botanical Resources

11S. Develop and implement a plan to assess the feasibility of stabilizing/revegetating erosion sites around project reservoirs and along the river downstream of Hells Canyon dam; implement a pilot project and monitor results to determine the feasibility of implementing a long-term stabilization/revegetation program; and, if erosion predicted to occur during the new license period cannot be stabilized, acquire up to 70 acres of riparian habitat in coordination with Idaho Power measure 12P.

12S. Develop and implement a project-wide Threatened, Endangered, and Sensitive Species Management Plan to address plants (in coordination with Idaho Power measure 19P, above) and animals, including bald eagles, southern Idaho ground squirrel, bats, amphibians, and reptiles.

13S. Develop and implement a Transmission Line Operation and Maintenance Plan for transmission line 945 to address protection and enhancement of wildlife and botanical resources, including monitoring electrocution and collision mortality and scheduling operation and maintenance to minimize disturbance to wintering mule deer.

14S. In coordination with Idaho Power measure 12P, above, acquire 13.2 acres of riparian habitat to mitigate for the loss of riparian habitat predicted to occur as the result of implementing the staff's alternative flow measures; and 49 acres of riparian habitat to address the loss of suitable substrate for native willows along the Snake River downstream of Hells Canyon dam.

15S. Extend the Wildlife Mitigation and Management Plan to apply to all lands within the project boundary, including National Forest System and BLM-administered lands, as well as Idaho Power lands. As part of the Wildlife Mitigation and Management Plan, develop and implement an I&E program to minimize risk of wildlife disturbance. As part of the plan, schedule operation and maintenance to minimize disturbance on deer winter range.

Historical and Archaeological Resources

16S. Renew the licensee's offer to arrange for oral histories for the Shoshone-Bannock and Shoshone-Paiute Tribes.

17S. Develop and implement a monitoring plan for archaeological sites, rock art, and traditional cultural properties.

18S. Develop a plan to implement Idaho Power's deferred monitoring program concerning effects of reservoir water level fluctuations on cultural resources.

19S. Staff measure 19 in the draft EIS (file the final Historic Properties Management Plan within 1 year of license issuance) has been dropped because the Commission has ordered the plan filed by August 3, 2008.

20. Develop and implement a program to re-evaluate buildings and structures within the project boundary as they reach 50 years old.

Recreational Resources

21S. Finalize the proposed Recreation Plan to add specificity to implementation standards and expand the scope of the plan to address the following additional elements:

21Sa. Oasis recreation site improvements;

21Sb. Improved Brownlee reservoir communication system and, if recreational use demonstrates the need, expand Steck Park;

21Sc. Control and removal of sediment accumulation at Farewell Bend State Park;

21Sd. Improvements at Jennifer's Alluvial Fan, including toilet facilities, vehicular barriers, signage, and regular maintenance;

21Se. Staff measure 21e in the draft EIS (Deep Creek Trail improvements and incorporation in the project boundary) has been included in Idaho Power's proposal (measure 51P);

21Sf. Improvements at Hells Canyon launch to enhance access and safety, provide potable water, and provide a portable human waste disposal system; and

21Sg. O&M at primary recreational sites within the project boundary and clarification of O&M standards and responsibilities.

107S. Consult with ODFW to coordinate and provide form 80 recreational use data on recreational fishing effort in the project vicinity.

108S. As part of the Recreation Plan, consult with the Corps, NPPVA, the Forest Service, and other interested parties to prepare a navigation plan that addresses non-flow measures that could be implemented to improve boating safety downstream of Hells Canyon dam, including the installation of additional stream gages.

Land Management and Aesthetics

22S. Develop an Aesthetics Management Plan as part of the Hells Canyon Resource Management Plan to be applied to all lands within the project boundary, including transmission line 945 and the right-of-way, and to include Idaho Power's proposed aesthetic measures (see Idaho Power's proposed aesthetic measures, items 73 through 80 above), a monitoring strategy for all viewpoints established in the Technical Report on Aesthetics, and an estimated maintenance schedule and schedule for implementing aesthetic improvements.

23S. Include within Idaho Power's proposed boundary modification to include dispersed recreation sites that are within 200 yards of project waters; Airstrip, Steck Park, Swedes Landing, and Westfall recreational sites; Hells Canyon Creek launch area; Deep Creek trail; and all lands acquired for wildlife mitigation.

24S. Provide the Forest Service with aerial photographs at a scale acceptable to the Forest Service showing the approximate location of the project boundary throughout Forest Service-managed lands.

25S. Coordinate with BLM and the Forest Service concerning activities on lands managed by those agencies.

26S. Staff measure 26 in the draft EIS (aesthetics improvement plan for the upper deck, entrance, and egress of Hells Canyon dam) has been included in measure 111P, above.

Oversight and Adaptive Management

27S. Establish technical advisory subcommittees to facilitate consultation on the development and implementation of plans required by the new license and to provide consultation on the ongoing implementation of license requirements using adaptive management principles.

5.1.1.3 Staff Alternative with Mandatory Conditions

The Department of Commerce (for NMFS) has filed preliminary fishway prescriptions for the project and Interior (for FWS) has filed preliminary and modified fishway prescriptions (see section 2.3.1.2, *Section 18 Fishway Prescriptions*) which, when finalized, the Commission may need to include in a new license for this project. Similarly, Interior (for BLM) and the Forest Service have specified preliminary and modified 4(e) conditions (see section 2.3.1.3, *Section 4(e) Federal Land Management Conditions*) which, when finalized, the Commission may also need to include in a new license for this project. Incorporation of these mandatory conditions into a new license would add three measures that are not included in the Staff Alternative, as follows (see section 2.3.1.3 for the numerical designation of these measures):

- Interior-3—Development and implementation of a Travel and Access Management Plan;
- Interior 4—Development and implementation of a Law Enforcement and Emergency Services Plan; and
- FS-20—Trail maintenance on nine specified trails.

Except for these three measures, all of the mandatory conditions are included in the Staff Alternative.

5.1.2 Summary of Effects

We summarize distinguishable differences between Idaho Power's Proposal and the Staff Alternative in table 105, and briefly note the differences associated with the Staff Alternative with Mandatory Conditions. Idaho Power's proposed operation is similar to current operations. Therefore, unless otherwise noted, the ongoing effects of project operation under Idaho Power's Proposal are similar to current conditions.

Table 105. Summary of effects of Idaho Power's Proposal and Staff Alternative. (Source: Staff)

Resource	Idaho Power's Proposal	Staff Alternative[a]
Power Benefits		
Annual generation (MWh)	6,562,244	6,549,344
Net annual benefits	$297,050,500	$283,876,800
Sediment Supply and Transport		
Effects of Operations	• Beach and terrace erosion would continue downstream of Hells Canyon dam. • The quantity and quality of spawning gravels downstream of Hells Canyon dam would continue to be affected by project reservoirs trapping sand and gravel.	• Little or no change in beach and terrace erosion compared to Idaho Power's Proposal. • Little or no change in spawning gravel quantity or quality compared to Idaho Power's Proposal.
Effects of Environmental Measures	• The quantity, quality, and usage of spawning gravels downstream of Hells Canyon dam would be monitored. • Restoration of 14 acres on sandbar downstream of Hells Canyon dam would help mitigate for reservoir trapping of sand and gravel.	• Monitoring beach and terrace erosion would provide information about the effectiveness of mitigation strategies and support development of possible additional measures. • Gravel augmentation program would be developed if a reduction in the quantity or quality of spawning gravel is shown to adversely affect production of fall Chinook salmon. • Restoration of 14 acres of sandbar would have the same beneficial effect as Idaho Power's proposal.
Water Quality		
Effects of Operations	Compared to without project conditions: • Water temperatures would continue to be cooler in spring and summer and warmer in the fall and winter potentially resulting in reduced viability of fall Chinook salmon eggs and reduced growth potential of fry. • The project would continue to lower dissolved oxygen concentrations in and downstream of Brownlee reservoir affecting habitat suitability for fish. • Total dissolved gas levels downstream of Brownlee dam would continue to exceed the 110-percent of saturation	Compared to Idaho Power's Proposal: • The temperature of water released from Hells Canyon dam during the flow augmentation period would be slightly increased in extreme low flow years, but reduced warming would occur as flow passes through the reach due to higher flow volumes. These temperature changes would result in negligible effects on Chinook salmon and other fish downstream of Hells Canyon dam. • Dissolved oxygen concentrations would be slightly improved downstream of Hells Canyon dam during the

Resource	Idaho Power's Proposal	Staff Alternative[a]
	criterion when spill exceeds 3,000 cfs. • Total dissolved gas levels downstream of Oxbow dam would continue to exceed the 110-percent of saturation criterion coinciding with most Brownlee spill events of more than 3,000 cfs and independent spills at Oxbow dam. • Total dissolved gas levels downstream of Hells Canyon dam would continue to exceed the 110-percent of saturation criterion during virtually all spill conditions increasing the likelihood of gas bubble trauma. • Project operation would continue to result in ammonia and trace metal concentration in the reservoirs and bioaccumulation in fish.	flow augmentation period in extremely low flow years. • Ammonia and trace metals would be flushed from reservoirs more frequently, but bioaccumulation in fish would remain about the same.
Effects of Environmental Measures	• Dissolved oxygen supplementation would improve dissolved oxygen levels in the immediate vicinity of the proposed oxygen diffuser system in Brownlee reservoir or upstream phosphorus trading would improve water quality in affected tributaries and downstream reaches. • Hells Canyon turbine aeration would increase summer/fall dissolved oxygen levels downstream of the dam and thereby improve conditions for fall Chinook salmon. • Destratification of the deep pool in the Oxbow bypassed reach would increase dissolved oxygen levels in this pool and thereby improve native resident salmonid habitat. • Installation of spillway flow deflectors at Brownlee and Hells Canyon dams combined with total dissolved gas abatement measures at Oxbow dam, and an adaptive total dissolved gas abatement program would reduce the frequency and magnitude of total dissolved gas levels exceeding the 110 percent of saturation criterion and thereby reduce the potential for gas bubble trauma in Oxbow and Hells Canyon reservoirs, Oxbow bypassed reach, Hells Canyon tailrace, and the Snake River	• Monitoring the effectiveness of measures implemented under the dissolved oxygen enhancement plan, annual meetings with agencies and interested tribes, and filing of monitoring and implementation reports should improve the decision-making process for addressing project effects on dissolved oxygen and expedite implementation of associated measures. • Establishing a flow and water quality monitoring site within 5 miles downstream of Hells Canyon dam would improve monitoring of project effects on water quality. • Collection of tissue samples from white sturgeon and other fish species in Brownlee reservoir for monitoring of bioaccumulation of contaminants could lead to improved protection of public health and protection of bald eagles. • Monitoring the effectiveness of measures implemented under the Temperature Adaptive Management Plan, annual meetings with agencies and interested tribes, and filing of monitoring and implementation reports should improve the decision-making process for addressing project effects on water temperature.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	downstream of Hells Canyon dam. • Implementation of a Brownlee bubble upwelling system or watershed measures as part of a Temperature Adaptive Management Plan would reduce water temperatures early in the fall Chinook salmon spawning period and improve production potential.	
Aquatic Resources		
Effects of Operations	• Daily flow fluctuations downstream of Hells Canyon dam would continue to reduce the abundance of aquatic invertebrates, the primary food base for fish, by about 10 percent. • The reduction in aquatic invertebrates would especially affect fall Chinook juveniles, which rear in shallow areas that are subject to frequent dewatering • Migration conditions for juvenile fall Chinook salmon would remain the same as years when flow augmentation water has not been provided from Brownlee reservoir, but would be less favorable than conditions in most of the past 14 years when flows were voluntarily augmented.	• More restrictive ramping rates during the rearing period, as well as provisions for monitoring and adaptive management based on monitoring results, could substantially reduce fall Chinook salmon mortalities due to stranding and entrapment and improve the food base during the fall Chinook rearing season. • Invertebrate monitoring would help determine the extent that peaking operations affect rare and sensitive species of mollusks and invertebrate production, and could assist in identifying operational modifications to reduce adverse effects through adaptive management. • Most available information supports a conclusion that flow augmentation should enhance migration conditions for juvenile fall Chinook salmon in the Snake and the lower Columbia rivers, likely increasing adult returns. Review of new information on the efficacy of flow augmentation 6 years after license issuance would allow the timing and quantity of water delivered from Brownlee reservoir to be adjusted, if warranted. • A fall Chinook spawning flow management plan, flow augmentation evaluation report, and monitoring of fall Chinook salmon entrapment and stranding should improve the flow management decision process and the overall survival of fall Chinook salmon in the Snake River downstream from Hells Canyon.
Effects of Hatchery Measures	• Improved hatchery facilities and a monitoring and evaluation program would maintain anadromous fish production at current levels.	• Consulting with the fisheries management agencies and interested tribes to define appropriate goals and objectives of its hatchery program would help ensure that

Resource	Idaho Power's Proposal	Staff Alternative[a]
		Hatchery and Genetic Management Plans are consistent with Idaho Power's responsibilities under the new license, as well as reflect the management goals of the agencies and tribes. • Constructing and operating facilities to spawn and incubate steelhead and Chinook salmon on the Yankee Fork would (1) help rebuild, and facilitate the delisting of, listed ESUs, and (2) support ceremonial, subsistence, and recreational fisheries in the project area and Snake River basin. • Developing and implementing a plan to transport and distribute surplus anadromous fish that return to Idaho Power's hatchery system or the Hells Canyon trap to project reservoirs and tributaries in the project area, as well as other select tributaries in the Snake River basin, would provide several resource benefits because distributing surplus fish would (1) provide a source of marine nutrients for the system; (2) improve forage for bull trout; (3) provide an opportunity to evaluate spawning success, egg viability and survival, as well as smolt outmigration and survival in Pine Creek; and (4) support ceremonial, subsistence, and recreational fisheries in the project area and Snake River basin.
Effects of Other Environmental Measures	• Dissolved oxygen supplementation would improve fish habitat in the vicinity of the oxygen diffuser system, if implemented, in the upper end of Brownlee reservoir. • Phosphorus trading and watershed measures, if implemented, would provide broad benefits to water quality and habitat conditions for resident fish species within and downstream of the project, and in the tributaries where measures are implemented. • Hells Canyon turbine aeration would increase summer/fall dissolved oxygen levels downstream of the dam, improving habitat conditions for aquatic resources, including fall Chinook salmon. • Reductions in total dissolved gas exceedances	• Potentially greater temperature and habitat benefits would be provided if additional watershed or phosphorus reduction measures are implemented based on monitoring results. • Annual meetings with agencies and interested tribes and filing of monitoring and implementation reports should expedite the implementation of additional measures to reduce gas supersaturation, if needed, and reduce the likelihood of gas bubble trauma within, and downstream from, the project. • Implementation of upstream and downstream passage for native resident salmonids would increase connectivity and gene flow among populations in Pine Creek, Indian

Resource	Idaho Power's Proposal	Staff Alternative[a]
	downstream of Brownlee, Oxbow, and Hells Canyon dams, at low and moderate spill rates, would benefit aquatic resources by reducing gas bubble trauma. • Improvement of Hells Canyon dam fish trap would reduce stress and injury to fish by allowing onsite sorting and allow fish tagging activities. • Implementation of upstream passage for native resident salmonids could improve gene flow to some populations, but downstream populations may be reduced due to upstream migration. • Construction of a monitoring weir on Pine Creek would allow further monitoring of bull trout migration and enable downstream transfer of outmigrants past Hells Canyon dam. • Pathogen risk assessment would help manage increased risk of pathogen transfer associated with the proposal. • Tributary enhancements and carcass outplants or other nutrient supplementation would benefit bull trout and redband trout within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the project. • Brook trout suppression efforts could reduce competition and hybridization with bull trout in Indian Creek. • Implementation of the proposed White Sturgeon Conservation Plan and related measures would help rebuild the white sturgeon population in the Swan Falls to Brownlee reach.	Creek, and the Wildhorse River. • Construction of weir and trap fishways on Pine Creek, Indian Creek and the Wildhorse River would allow tracking of bull trout population trends and effectiveness monitoring of brook trout control and tributary enhancement efforts. • Construction of the Pine Creek weir to operate year-round would improve monitoring of bull trout movements and would enable assessment of spawning success of surplus adult steelhead and spring Chinook salmon released into Hells Canyon reservoir. • Benefits of Hells Canyon trap modifications, pathogen risk assessment, and nutrient supplementation would be the same as Idaho Power's Proposal. • Additional tributary enhancement measures would benefit native resident salmonids in the Powder and Burnt River basins. • Brook trout suppression efforts, if successful, would be expanded to include the Wildhorse River and Pine Creek using methods proven to be successful in Indian Creek. • Sturgeon stocking, if determined to be feasible, could augment white sturgeon populations in all reaches between Swan Falls and Hells Canyon dams, benefiting tribal and recreational fisheries.
Terrestrial Resources		
Effects of Operations	• Slightly increased potential for negative effects on special status plants. • Slightly increased occurrence and expansion of puncture vine at Brownlee reservoir. • Daily flow fluctuations would reduce riparian habitat at	• Effects on special status plants essentially the same as Idaho Power's Proposal. • Effects on noxious weeds similar to Idaho Power's Proposal, but slightly more weed occurrence at Brownlee reservoir and slightly less occurrence downstream of

Resource	Idaho Power's Proposal	Staff Alternative[a]
	Hells Canyon and Oxbow reservoirs by <1 acre and by about 15 acres downstream of Hells Canyon dam. • Conditions would remain about the same for fish-eating wildlife such as river otters, black bears, and bald eagles. • Brownlee reservoir would continue to pose a small risk to mule deer trying to cross it. • Continued erosion would be likely to affect about 70 additional acres over the term of the license.	Hells Canyon dam. • Daily flow fluctuations would reduce riparian habitat by <1 acre at Hells Canyon reservoir, about 1.5 acres at Oxbow reservoir, and about 13 acres downstream of Hells Canyon dam. • More stable flows benefiting fish would improve conditions for fish-eating wildlife, such as river otters, black bears, and bald eagles. • Risks to mule deer crossing Brownlee reservoir would be the same as Idaho Power's Proposal. • Continued erosion would be similar to Idaho Power's Proposal.
Effects of Environmental Measures	• Coordination and planning would improve protection of rare plants and control of noxious weeds. • Transmission line operation and maintenance plans for wildlife and botanical resources would reduce potential adverse operation and maintenance effects on terrestrial resources. • Management of 20,592 acquired acres and 2,990 Idaho Power acres for wildlife habitat would benefit terrestrial resources affected by operation of the project based on a 1:1 replacement ratio. • Habitat enhancement at four Snake River islands would improve habitat for waterfowl, nesting waterbirds, raptors, neotropical migrant songbirds, and aquatic furbearers. • Coordination with agencies to enhance mountain quail habitat and/or participate in relocation projects would benefit mountain quail. • Implementation of the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan would improve coordination and management of wildlife habitat in Idaho Power's ownership. • Threatened, endangered, and sensitive species would	• Rare plant protection and noxious weed control would be essentially the same as Idaho Power's Proposal, with some additional measures to improve efficiency and coordination and increased emphasis on surveys prior to implementation of ground-disturbing activities. • Transmission Line Operation and Maintenance Plan for terrestrial resources would be essentially the same as Idaho Power's Proposal, with some improved efficiency and coordination and increased raptor protection. • Acquisition and management of wildlife habitat would have essentially the same effects as Idaho Power's Proposal, but would also include measures to address ongoing effects on sandbar willow establishment; erosion anticipated to occur during new license period; and the loss of riparian habitat resulting from implementation of staff flow alternative. • Provision of funding for capital improvements and implementation of habitat enhancements to four Snake River islands would yield greater habitat improvement than Idaho Power's Proposal. • Improvements to mountain quail habitat and/or participation in relocation projects would be about the

Resource	Idaho Power's Proposal	Staff Alternative[a]
	continue to be managed on a case-by-case basis.	same as Idaho Power's Proposal. • Application of project-wide wildlife habitat planning would improve coordination of habitat management for lands within the project boundary compared to Idaho Power's Proposal. • Development of project-wide Threatened, Endangered, and Sensitive Species Management Plan would improve efficiency and coordination of protective measures for those species covered by the plan, compared to Idaho Power's Proposal.
Cultural Resources		
Effects of Operations	• Restoration of 14 acres of sandbar downstream of Hells Canyon dam would help protect some cultural sites from erosion damage. • Beach and terrace erosion would continue to put some cultural sites at risk.	• Restoration of 14 acres of sandbar would have the same beneficial effect as Idaho Power's proposal. • More restrictive ramping rates during the spring would provide a minor increase in cultural resource protection compared to Idaho Power's Proposal.
Effects of Environmental Measures	• Site monitoring would improve protection of monitored sites. • Site stabilization would protect 7 sites on Brownlee reservoir and 20 sites downstream of Hells Canyon dam, and data recovery at 4 sites would prevent possible future damage. • Establishment of Native American, European-American, and Asian-American interpretive sites could contribute to resource protection through visitor education. • Support for local museums would enhance cultural resources protection and education in the local area. • Support for Native American programs would enhance the tribes' informed participation in the management and protection of project resources. • Measures to improve the condition of aquatic resources would benefit culturally important species, including	• Development of site monitoring plan would improve efficiency and consistency of monitoring efforts. • Site stabilization, data recovery, and establishment of interpretive sites would achieve the same benefits as Idaho Power's Proposal. • Support for Native American programs would provide fewer benefits than Idaho Power's Proposal because scholarships would not be provided. • Renewed offer to prepare oral histories for Shoshone-Bannock and Shoshone-Paiute Tribes would potentially enhance cultural understanding. • Development of a plan to implement the deferred study of reservoir water level fluctuation effects on cultural resources would enhance understanding of those effects and form the basis for further protective measures, if needed. • Continuation of flow augmentation, expansion of tributary habitat improvements to the Powder and Burnt

Resource	Idaho Power's Proposal	Staff Alternative[a]
	white sturgeon and native resident salmonids. • Development of a plan to implement the deferred study of reservoir water level fluctuation effects on cultural resources would enhance understanding of those effects and form the basis for further protective measures, if needed.	River basins, implementation of the FWS fishway prescription, consultation with agencies and tribes to determine the best use of surplus adult hatchery steelhead and spring Chinook salmon, and potential expansion of white sturgeon measures to include stocking in project reservoirs would provide additional benefits to tribal fisheries and to culturally important species. • Revision of the HPMP to meet Forest Service 4(e) condition no. 25 would improve the plan overall, including provision for an adaptive management strategy to accommodate unforeseen challenges and conditions, and also provisions for determining when and under what circumstances new survey, or resurvey of previously examined areas, may be required.
Recreation		
Effects of Operations	• Brownlee reservoir level would continue to support flat-water boating and crappie fishing in the late summer and early fall. • Similar to current conditions, flows downstream of Hells Canyon dam would routinely fall below the Corps' recommended 8,500-cfs safe navigation flow. • Flow fluctuations downstream of Hells Canyon dam would continue to adversely affect boaters and campers.	• Flow augmentation would adversely affect flat-water boating opportunities and crappie fishing compared to current conditions and Idaho Power's Proposal. • Implementing an 8,500-cfs minimum flow downstream from Hells Canyon dam in medium-high and extremely high flow years would increase boaters' certainty of having those flows available. • Flow augmentation would slightly improve early summer boating opportunities downstream of Hells Canyon dam. • More stabilized flows during the spring downstream of Hells Canyon dam would enhance the quality of the boating experience.
Effects of Environmental Measures	• Preparation and implementation of a Recreation Plan would benefit recreational visitors by providing improved management of recreational programs. • Numerous proposed improvements would benefit recreational visitors by improving boat moorage, road maintenance, developed and dispersed recreation sites, and boat access in low water years, and would benefit cultural and natural resources by providing additional	• Adding specificity to the implementation standards of the Recreation Plan would clarify plans and improve delivery of the intended benefits. • Expansion of Recreation Plan to include site improvements at Oasis, Steck recreation site, Farewell Bend State Park, Jennifer's Alluvial Fan, Deep Creek, and the Hells Canyon launch would provide additional recreation benefits compared to Idaho Power's Proposal.

Resource	Idaho Power's Proposal	Staff Alternative[a]
	protection near recreation uses. • Proposed changes in the litter and sanitation management program would substantially improve upon existing conditions. • The I&E Plan would promote protection and preservation of cultural, natural, and historic resources. • Funding O&M at its recreation sites and those of BLM and the Forest Service that Idaho Power upgrades would benefit recreational visitors and resource protection by improving maintenance and management at most of the primary recreation sites in the project boundary. • Continuing to provide flow information for flows downstream of Hells Canyon dam would continue to benefit recreational visitors by providing timely information to be used in trip planning. • Continuance of the Memorandum of Understanding for staffing the Hells Canyon Visitor Center would continue to benefit visitors at the center. • Preparation of a Recreation Adaptive Management Plan would provide a framework for responding to changes in recreational needs. • Implementation of the White Sturgeon Conservation Plan should lead to an improved sturgeon fishery in the Swan falls to Brownlee Reach. • Implementation of the native salmonid plan and tributary enhancements should improve redband trout fisheries in the Pine, Indian and Wildhorse basins.	• Expansion of the litter and sanitation management program to include a gray water and sanitary cleaning system at the Hells Canyon Creek put-in/take-out would improve the sanitation system and disposal of human waste for boaters. • Increasing the specificity of the I&E Plan and including information on aquatic invasive species and anadromous fish would promote additional understanding of and protection for project resources. • Clarifying O&M funding and responsibilities at Forest Service and BLM recreational sites at the project through consultation as part of the final Recreation Plan would improve delivery of the intended plan benefits. • Preparing and implementing the navigation plan would increase the benefits of the flow information system by increasing the amount and timeliness of flow information. • Hells Canyon Visitor Center staffing would be the same as under Idaho Power's Proposal. • Adding details to the Recreation Adaptive Management Plan concerning the minimum level of recreational use monitoring and consultation every 6 years related to Form 80 filing would improve the responsiveness of the Plan to changing recreational conditions. • Expanded tributary enhancement measures would benefit redband trout fisheries in the Powder and Burnt River basins. • Sturgeon stocking, if determined to be feasible, would improve the sturgeon fishery between Swan Falls and Hells Canyon dams more rapidly than under Idaho Power's proposal.
Land Management and Aesthetics		
Effects of Operations	• The adverse visual effects of Brownlee reservoir drawdown would continue to occur from about July	• Flow augmentation would lead to earlier and more rapid drafting of Brownlee reservoir starting in late June, exacerbating the negative visual effect of Brownlee

Resource	Idaho Power's Proposal	Staff Alternative[a]
	through October. • Visual effects on the shoreline downstream of Hells Canyon dam would continue due to periodic dewatering of the shoreline, beach and terrace erosion, and loss of riparian habitat.	reservoir drawdowns. • Negative visual effects downstream of Hells Canyon dam would be reduced somewhat compared to Idaho Power's Proposal due to more stable water levels during the spring.
Effects of Environmental Measures	• Implementation of the Hells Canyon Resource Management Plan on project lands would enhance the management, conservation, and protection of natural and cultural resources. • Continuation of the project's law enforcement and fire protection programs and sponsorship of biannual law enforcement coordination meetings would help maintain and improve public safety and resource protection at the project. • Proposed boundary modifications to exclude 3,800 acres of federal lands from the project boundary would exclude some lands used for project-related purposes. • Development of a road management plan, application of the Common Policies of the Hells Canyon Resource Management Plan, and continued maintenance of 40 miles of road would lead to improved access, public safety, and resource protection related to those roads • Application of the aesthetic resource elements of the Hells Canyon Resource Management Plan would improve the aesthetic appearance of the project. • Reducing the visual contrast of transmission line 945 would enhance the visual experience of visitors.	• Adding specific details to the Hells Canyon Resource Management Plan to identify which policies need specific management plans and implementation programs would improve delivery of the intended benefits of the plan. • Adding specific agency coordination measures to the Hells Canyon Resource Management Plan would improve protection of resources on BLM and Forest Service lands in the project boundary. • Adding specific components of the law enforcement and fire protection programs to the Hells Canyon Resource Management Plan would improve delivery of the intended benefits of those programs. • Amending the project boundary to include lands acquired for wildlife mitigation, dispersed recreation areas within 200 yards of the shoreline, and the Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites would improve resource protection at those sites; other federally managed lands could be removed from the boundary without adversely affecting resources on those lands. Providing the Forest Service with appropriately marked aerial photographs would enhance coordination of resource protection on Forest Service lands. • Including additional consultation in the road management planning process and integrating that process with the Hells Canyon Resource Management Plan would help ensure that all project-related roads are appropriately maintained. • Adding specificity to the aesthetic resources portion of the Hells Canyon Resource Management Plan, based on previously developed, project-wide standards and

Resource	Idaho Power's Proposal	Staff Alternative[a]
		guidelines, and formalizing it into an aesthetic improvement management plan would improve delivery of the intended benefits. • Adding aesthetic improvements to Hells Canyon dam would enhance the visual experience for visitors. • Including transmission line aesthetic improvements in the aesthetic elements of the Hells Canyon Resource Management Plan would help ensure consistency in the approach to visual resource management.
Socioeconomics		
Effects of Operations	• Potential increase in electricity rates to pay increased cost of producing project power.	• Potentially greater increase in electricity rates to pay increased cost of producing project power. • Flow augmentation could lead to a shift in recreational spending away from warmwater fishing at Brownlee reservoir, affecting related businesses accordingly.
Effects of Environmental Measures	• Spending on environmental measures and increased visitor use could increase local business income, but also increase cost to counties to provide services in the project area. • Wildlife habitat restoration and improved conditions for some aquatic resources would benefit tribal cultures compared to current conditions.	• Greater spending on environmental measures could lead to greater increase in local business income. • Additional measures to benefit downstream anadromous fish populations and resident fish populations within and upstream of the project could lead to greater benefits to tribal cultures compared to Idaho Power's Proposal. • Constructing and operating facilities to spawn and incubate steelhead and Chinook salmon on the Yankee Fork and implementing a plan to transport and distribute surplus anadromous fish would provide ceremonial and subsistence fisheries for the tribes.

[a] The Staff Alternative with Mandatory Conditions is not listed in this table, and differs from the Staff Alternative only by the inclusion of three measures related to trail development and maintenance, road maintenance, and law enforcement

Notes: BLM – U.S. Bureau of Land Management
DO – dissolved oxygen
Forest Service – U.S. Forest Service
GBT – gas bubble trauma
HCRMP – Hells Canyon Resource Management Plan
IWHP – integrated wildlife habitat program

MOU – memorandum of understanding
MWh – megawatt hours
O&M – operation and maintenance
TDG – total dissolved gas
TMDL – total maximum daily load
WMMP – Wildlife Mitigation and Management Plan

5.2 DISCUSSION OF KEY ISSUES

The measures proposed by Idaho Power and those included in the Staff Alternative would help protect and enhance water quality, fisheries, and terrestrial, recreational, aesthetic, and cultural resources in the project area, but would reduce the net power benefits of the project. In this section, we discuss our rational for including some measures in our Staff Alternative and not including others.

5.2.1 Sediment Augmentation and Monitoring

The supply and movement of sediment in the free-flowing section of the Snake River downstream of Hells Canyon dam provide habitat for aquatic life, support recreational activities, and maintain important cultural resources. Sediment trapping within the project's reservoirs and flow fluctuations caused by project operations may contribute to the erosion of sandbars, beaches, and terraces downstream of Hells Canyon dam. Beach erosion may adversely affect aquatic resources by reducing the availability of gently sloping shorelines favored by rearing juvenile fall Chinook salmon and reduce the extent of beaches available for recreation (beaches are used for boat landing, swimming, and camping). Beach and terrace erosion may also affect important archaeological sites.

In its license application, Idaho Power proposes to stabilize terraces containing culturally important sites but does not propose any measures to stabilize or restore sandbars. Forest Service condition FS-4 specifies that Idaho Power fund a sandbar maintenance and restoration program consisting of sand augmentation and monitoring. To fund the program, Idaho Power would establish and maintain an interest-bearing account, with the Forest Service as the beneficiary. Under this condition, the Forest Service would use the fund to restore 14 acres of sandbars on or adjacent to National Forest System lands, placing sand above the level of the average annual maximum flow at selected sites, but within the levels of flows with annual recurrence frequencies of approximately 2.3 to 30 years. Due to the remoteness of most sandbars, sand augmentation would most likely include stockpiling and loading sand to a river barge at the Pittsburg Landing and unloading and spreading sand using a small loader, which would be carried on the barge. Idaho Power has agreed to implement this measure a condition of the license.

In section 3.4.2.2, we conclude that sand augmentation to restore sandbars could slightly increase rearing habitat for juvenile fall Chinook salmon, maintain beaches used for recreation, improve the aesthetic appearance of the riverscape, and potentially reduce losses to archaeological resources from beach erosion. We also note that implementing the measure has some potential to disrupt eagle nesting activity and to interfere with or present a hazard to recreational boaters if sand placement occurs in an inappropriate season. The funding for condition FS-4 specified by the Forest Service, $937,000 per year for 10 years (equal to an annualized cost of $545,100 over 30 years), would provide 2,500 cubic yards of sand per year. In the draft EIS, we did not include this measure in the Staff Alternative because of these potential negative effects on boating and wildlife and because we estimated that the proposed 25,000 cubic yards of sand (2,500 cubic yards per year for 10 years) would replace less than 1 percent of the total volume of sand retained annually in the three project reservoirs.

However, comments on the draft EIS led us to conclude that 25,000 cubic yards of sand would actually represent approximately 7 to 24 percent of the average annual rate of sand loss that was estimated by Wilcock et al. (2002) for all sandbars below Hells Canyon dam between 1964 and 1990. We conclude that the benefits of the sand augmentation and beach restoration program would be worth the cost, and that risks associated with potential adverse effects could be satisfactorily addressed. For these reasons, we include the sand augmentation and beach restoration fund in the Staff Alternative.

The Forest Service (FS-31) also recommends that Idaho Power prepare a gravel monitoring plan. The plan would include: (1) weekly aerial redd surveys; (2) mapping of reach-scale spawning substrate; (3) identification of representative reaches for intensive annual substrate monitoring (riverbed elevations, bed scour and deposition, and bedload sampling); and (4) a requirement for Idaho Power to provide an annual report of results to the Forest Service.

Under Interior-68 and Interior-69, Interior recommends that Idaho Power monitor selected beaches and gravel bars to determine rates of sediment depletion on exposed and submerged sediment deposits and the quantity and quality of gravel material used by aquatic species in the Snake River downstream of Hells Canyon dam.

NMFS-6 recommends that Idaho Power, in cooperation with various resource agencies, design and carry out monitoring of fall Chinook salmon spawning gravel between Hells Canyon dam and its confluence with the Salmon River. The recommendation calls for the study to be repeated every 5 years and to employ high-resolution, multi-beam bathymetry, reach-scale substrate mapping using Idaho Power's GIS database, and substrate monitoring using scour chains or sliding bead monitors. NMFS-7 recommends that Idaho Power evaluate fall Chinook salmon egg-to-fry survival in at least two representative spawning areas downstream of Hells Canyon dam in 2015 and every 5 years thereafter.

The Nez Perce Tribe (NPT-20) recommends that Idaho Power be required to monitor the movement of sand, silt, and gravel to accurately quantify the composition and rate of movement of sediment. The tribe (NPT-21) also recommends that Idaho Power be required to restore sandbars to their pre-project number and size, through the use of sand augmentation practices developed in consultation with resource agencies, to protect tribal cultural sites at risk of degradation from the erosion of sand bars and terraces.

ODFW-53 recommends that Idaho Power implement a gravel monitoring program to assess spawning gravel for fall Chinook salmon downstream of Hells Canyon dam. ODFW also recommends that Idaho Power develop a bedload augmentation program if monitoring indicates project operations are adversely affecting the quantity and quality of spawning gravel.

Finally, AR/IRU (AR/IRU-21) recommend that Idaho Power develop a plan to replenish an appropriate portion of sand and gravel to the Snake River downstream of Hells Canyon dam that have been diminished due to project operations and base the quantity and composition of the sediment on specific habitat needs of anadromous and resident fish species and benthic organisms. Additionally, AR/IRU-21 would require Idaho Power to estimate sediment volumes and water energy available for sediment transport, address monitoring and reporting, and develop an adaptive management protocol for sediment augmentation.

Idaho Power filed a Fall Chinook Spawning and Gravel Monitoring Plan with its draft EIS comments, and during the 10(j) meeting, Idaho Power stated that the plan should be considered part of its relicensing proposal. The plan includes the following elements: (1) continuation of aerial redd surveys from Hells Canyon dam to Asotin, Washington (RM 145), and deep-water redd surveys at approximately 35 sites; (2) high resolution bathymetry monitoring to estimate bed scour or deposition at selected reaches every 3 to 5 years; (3) ground surveys to cover shallow areas at the selected sites that are not covered by bathymetry monitoring; (4) reach-scale mapping of spawning substrate in potential high-use spawning index sites upstream of the Salmon River every 5 years; (5) substrate classification by photography at approximately 650 locations between Hells Canyon dam and the Salmon River every 3 to 5 years and after high runoff events; (6) assessment of gravel quality by monitoring incubation and emergence at four sites between Hells Canyon dam and the Salmon River at 5-year intervals; and (7) the use of scour chains or sliding bead monitors to assess gravel movement or displacement at selected known and potential spawning areas.

In the draft EIS, we concluded that the number of fall Chinook salmon spawning in the Hells Canyon reach may be approaching the capacity of available spawning and rearing habitat, and we recommended that Idaho Power undertake a pilot study to assess the potential benefits of gravel augmentation. Comments received from the resource agencies questioned whether the volume of gravel that we recommended would provide a detectable increase in spawning habitat. Also, in its comments on the draft EIS, Idaho Power questioned the need for even a pilot scale gravel augmentation program. Idaho Power reported that in each year of spawning surveys, it finds new areas being used for spawning that were not used in previous years, and also some areas that were used heavily in previous years that are receiving little or no use. It also notes that neither Idaho Power nor FWS has observed significant redd superimposition during their weekly aerial and ground surveys of spawning sites.

Based on the Idaho Power and FWS observations from redd surveys, we conclude that it is unlikely that spawning habitat is currently limiting fall Chinook salmon production, and that implementing a gravel augmentation program at this time would be premature. However, given recent increases in the number of fall Chinook salmon spawning in the Hells Canyon reach, it is possible that the quantity of spawning habitat could constrain production in the near future if the increasing trend continues. Accordingly, we conclude that the benefits of the Fall Chinook Spawning and Gravel Monitoring Plan proposed by Idaho Power warrants the estimated annualized cost of $280,000. However, we recommend modifying Idaho Power's proposal to include annual consultation with NMFS, Interior, IDFG, ODFW, and the interested tribes to report on monitoring results to date, guide monitoring efforts in the coming year, and determine whether gravel augmentation is warranted.

5.2.2 Water Supply—Operational Measures

5.2.2.1 Flood Storage

From December 1 to June 30, the Corps directs flood control operations of Brownlee reservoir as part of system flood control operations for the Columbia River projects to contain winter, spring, and early summer flood waters from inundating the main downstream flood damage center located in the Portland-Vancouver metropolitan area. Under the current license, Brownlee reservoir may be drawn down to elevation 2,034 feet msl by February 28 to provide a maximum storage space of 500,000 acre-feet for system flood control. By April 30, Brownlee reservoir may be drawn down further to elevation 1,976 feet msl to provide an additional storage space of 480,000 acre-feet to contain flood waters. This maximum draft of 980,000 acre-feet of storage space pertains to the most severe combination of forecasted hydrologic conditions for the Columbia River at The Dalles and Snake River above Brownlee reservoir. Following a period of analysis and revision to flood control rule curves in the 1980s, the Corps implemented a modified rule curve procedure in 1998. Flood storage requirements for Brownlee reservoir can extend through June, and Idaho Power may have to spill at any or all three project developments to achieve flood control storage objectives.

The Corps recommends that Brownlee reservoir continue to be operated in accordance with the Corps' November 1998 Procedure for Determining Flood Control Draft at Brownlee reservoir, which requires a drawdown sufficient to provide up to 1 million acre-feet of flood storage. Because this recommendation is the same as current operation, there is no incremental cost associated with it. In addition, the Corps recommends handling winter flood control operations on a case-by-case basis, subject to certain specified maximum draft rates. As we point out in section 3.3.2.3, *Flood Storage*, the Corps' recommendation specifies that the request for winter flood storage would occur only during the months of December and January, and that Idaho Power would not be required to spill to meet the Corps request. Because of these limitations, and because any such request would occur only occasionally, the potential impact on power benefits would be inconsequential. Idaho Power's proposed operations incorporate these two recommendations from the Corps, and we have also included them in the Staff Alternative.

NMFS recommends that Idaho Power control the level of Brownlee reservoir so as to be within 1 foot of the Corps' April 15 and April 30 target flood control elevations and then, after April 30, coordinate the refill of Brownlee reservoir with NMFS to ensure that the refill does not result in any drastic reductions of spring flows as measured at Lower Granite dam. Similarly, the Umatilla Tribes and the Nez Perce Tribe recommend that Idaho Power maintain Brownlee reservoir at its upper flood control rule curve elevation from February 28 through April 15 each year so as to accrue additional storage to assist in meeting spring target flows for anadromous fish.

Recommendations pertaining to closely tracking the Corps flood control elevation targets and refilling Brownlee reservoir as early as possible are directed toward avoiding excessive reductions in outflows from the project during the spring migration season for yearling steelhead and Chinook salmon smolts. Preventing such flow reductions would help to maintain suitable migration flows for spring-migrating yearling Chinook salmon and steelhead produced in the Salmon River, other Snake River tributaries, and to a lesser extent, spring migrants passing through the lower Columbia River. These flows would also benefit yearling fall Chinook salmon that are produced in the Clearwater River and the portion of the fall Chinook migrants that overwinter in the Snake River before migrating as yearlings. While closely tracking, and not exceeding, the Corps' Brownlee reservoir drawdown requirement would be beneficial in support of outmigration, Idaho Power operators require a certain degree of operational flexibility to ensure that the Corps' target flood control elevations are met. Further, during medium to high flow years, Brownlee reservoir is typically filling after April 30, capturing inflows as part of the springtime flood control operation. Under these circumstances, the Corps directs the rate of Brownlee reservoir's refill. In the Staff Alternative, we include an operational scenario consistent with the NMFS and tribal recommendations but indicate that the Brownlee reservoir refill during the flood storage season would continue to be accomplished under the direction of the Corps to ensure that the flood control purpose is not compromised. We do not have an estimate of the cost of this measure but conclude that it is likely to be inconsequential.

The Umatilla Tribes and the Nez Perce Tribe also recommend that Idaho Power, in consultation with the Corps, interested tribes, and other appropriate agencies, revise flood control operations to shift a minimum of 110,000 acre-feet of flood storage space from Brownlee reservoir to Lake Roosevelt reservoir on the Columbia River in the March-through-May period during low to average flow. NMFS makes a similar recommendation but specifies that the Corps determine the timing and amount of the flood storage shift.

Any long-term modification of the project's flood control operation involving transfer of storage capacity from Brownlee reservoir to other storage reservoirs in the Columbia River basin would be under the purview of the Corps. The Corps has neither recommended any changes to flood control at the project nor undertaken any basin-wide review of its flood control rule curves. Such an effort would require a separate environmental evaluation conducted by the Corps. Accordingly, we do not include this measure in the Staff Alternative. However, the Corps regularly evaluates short-term opportunities to shift flood control from Brownlee reservoir, and nothing in the Staff Alternative would affect that activity.

5.2.2.2 Navigation Target Flow Levels

Safe navigation for all of the boats currently using the Snake River downstream of Hells Canyon dam requires minimum flows sufficient to effectively cover rocks and create navigable channels through important rapids. Of particular importance for navigation are flows measured at the Hells Canyon dam gage (0.6 mile downstream of the dam at RM 247) and China Gardens Rapids gage (also known as the Snake River below McDuff Rapids gage) at RM 175.5. The latter gage is downstream of the confluence of the Snake and Salmon rivers.

Under Proposed Operations, Idaho Power would continue to operate the project for navigation purposes by maintaining 13,000 cfs in the Snake River at Lime Point[118] (RM 172, 2.5 miles downstream of the China Gardens Rapids gage) at least 95 percent of the time. Flows of less than 13,000 cfs would occur during July, August, and September, and Idaho Power would not use reservoir storage to meet the 13,000-cfs requirement.

To meet safe navigational flow targets during the new license term, the Corps recommends that Idaho Power operate the project to maintain a year-round instantaneous minimum flow of 8,500 cfs as measured at the Hells Canyon dam gage and 11,500 cfs as measured at the Snake River below McDuff Rapids (China Gardens Rapids) gage. If daily inflows to Brownlee reservoir fell below 8,500 cfs; however, the Corps suggests that Idaho Power would not have to meet these minimum flows. Instead, the Corps recommends that Idaho Power be required to release from Hells Canyon dam a flow equal to the previous 3-day moving average Brownlee reservoir inflow. NPPVA, representing power vessel owners that provide recreational trips on the river, concurs with the Corps' recommendation. The Forest Service (FS-29) provides a similar recommendation for a year-round minimum flow downstream of Hells Canyon dam of 8,500 cfs or project inflow (whichever is less).

The Umatilla and Nez Perce Tribes recommend that Idaho Power maintain a minimum flow of 6,500 cfs immediately downstream of Hells Canyon dam and 13,000 cfs at Lime Point. These tribes state that higher minimum flows would use limited water resources and jeopardize fish flows during low water years. The tribes' recommended flow levels are consistent with the current, and Idaho Power's proposed, Hells Canyon dam release regime.

In section 3.10.1.6, *Boating Use Downstream of the Project*, we point out that minimum safe boating flows vary by type of boat. For float boaters, the key rapids (Granite Creek and Wild Sheep rapids) are navigable at 5,000 cfs. Experienced operators can take 24-foot power boats through these rapids at flows much lower than 8,500 cfs. It is the larger (40-foot) power boats, fully loaded, that require flows in the 8,500-cfs range. In its comments on the draft EIS, NPPVA makes this same point, stating that 7,500 cfs does not provide an adequate margin of safety for fully loaded larger boats, but that 8,500 cfs is adequate for all boating.

With Idaho Power's proposed operations, modeled flows downstream of Hells Canyon dam routinely fall below the 8,500-cfs boating target from early June through late September under extremely low and medium-low water conditions and from late July through early September under medium water conditions. Flows seldom or never fall below the 8,500-cfs target under medium-high or extremely high water conditions (section 3.3.2.7, *Downstream Flows Important to Navigation*).

With the Staff Alternative, which includes 237 kaf of flow augmentation for salmon, Brownlee reservoir storage water would be released downstream starting in mid-June. Supplemental CHEOPS model data filed by Idaho Power in its comments on the draft EIS indicate that flow augmentation at the 237-kaf level would have little effect on navigation flows. For the June 1 through September 30 122-day period, Idaho Power's model simulations show that, even with the 237-kaf flow augmentation, there would still be 40 days with flows below 8,500 cfs in medium water years, 120 days in medium-low water years, and 116 days in extremely low water years.

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[118] Idaho Power does not explicitly propose 13,000 cfs at Lime Point, but this value is consistent with the flow releases from Hells Canyon dam assumed by Idaho Power for modeling purposes. In the absence of an explicit alternative proposal, we consider it part of Idaho Power's proposed operation. Idaho Power proposes that any navigation flow requirement for the Snake River reach from the Salmon River confluence to Lewiston be measured at McDuff Rapids (RM 175.5), 4 miles upstream of Lime Point.

In contrast, adding the Corps' navigation minimum flow recommendation (described above) to the flow augmentation scenario included in the Staff Alternative would reduce the frequency of occurrences when flows downstream of Hells Canyon dam fall below the 8,500-cfs boating target, thereby increasing the margin of safety at critical rapids and providing increased predictability for boat operators. Based on Idaho Power data, the incremental effect of adding the Corps' minimum flow recommendation to the Staff Alternative would result in zero days below 8,500 cfs under medium water conditions, 32 days under medium-low water conditions, and 100 days under extremely low water conditions.

These improved frequencies of meeting desirable boating flow levels would come with substantial costs, however. We estimate the cost of adding the Corps' recommended minimum flow requirement to the Staff Alternative, in terms of foregone power benefits, at $12.5 million annually. Of this loss in power benefits, $11.4 million is accounted for by the reduction in peaking capacity and the need to replace it. Losing this peaking capability would likely result in Idaho Power's having to construct replacement capacity using either simple cycle or combined cycle combustion turbines.

Currently, by reducing releases overnight at the Hells Canyon development during non-peak periods, Idaho Power is able to increase releases, and hence generation, during critical daytime hours. Due to the travel time of the peaking releases, however, the higher flow periods do not coincide with boating needs at downstream locations. Higher minimum flows provided for boating would constrain the ability of the Hells Canyon development to peak in response to high summertime power demands. Augmenting flows by 2,000 cfs (that is, going from a 6,500-cfs minimum flow to 8,500 cfs) in a medium-low water year, for example, would limit peaking capability for most of the period from June through September. July is the critical period for dependable capacity in Idaho Power's system, although similar needs can also exist in August and September, and the medium-low water year is the type of year (70^{th} percentile water condition) used in Idaho Power's integrated resource planning to define dependable capacity requirements. Thus, application of Idaho Power's standard integrated resource planning strategy would require the replacement of any dependable capacity lost due to a higher minimum flow requirement.

During the past 20 years, project operations have included a minimum release (when inflows allowed) of 6,500 cfs, augmented in some years by a program of pulses, or timed releases, as described in section 3.3.1.3, *Navigation*. Over that time, boating accidents have occurred at multiple locations for many reasons, including low flows, high flows, operator inexperience, inappropriate watercraft size and weight for the flow levels, and, possibly, weather or other environmental conditions. Despite these potential risks, a very robust private and commercial outfitting industry has evolved, with advanced boat designs that allow for larger and heavier watercraft. We recognize that flow levels are just one aspect of overall boater safety, and acknowledge that without higher flows some boating companies may choose not to operate during low flows or may choose to adjust operations through use of smaller boats or reduced passenger loads. We conclude that improving boating conditions by imposing the Corps' minimum flow recommendation is not worth the substantial reduction in power benefits. Accordingly, we do not include the Corps' navigation flow recommendation in the Staff Alternative. However, to ensure that the Corps' recommended navigation flow is provided in a way that would not reduce the project's dependable capacity, we include in the Staff Alternative a recommendation that the minimum flow be set at 8,500 cfs from the start of Memorial Day weekend to September 30 in medium-high and extremely high water years. We also recommend that, if the 3-day moving average inflow to Brownlee reservoir is less than 8,500 cfs, the instantaneous minimum release required from Hells Canyon dam for the current day would be equal to the previous 3-day moving average.

Additionally, we recommend that Idaho Power consult with the Corps, NPPVA, the Forest Service, and other interested parties to prepare a navigation plan that addresses non-flow measures that could be implemented to improve boating safety downstream of Hells Canyon dam. This navigation plan would be a component of Idaho Power's proposed Recreation Plan. In a letter to the Corps dated June 26, 2007, and filed with the Commission on July 3, 2007, Idaho Power outlined a number of non-flow measures that it is currently investigating and that we recommend be included in the navigation plan. They include: (1) signage/navigation aids/channel markings to help boaters identify the best course through difficult stretches of the river; (2) training opportunities where boaters could learn the best route through specific river reaches; and (3) the potential for rock movement and other in-river channel modifications.

We also recommend that the plan include several measures that Idaho Power is pursuing with respect to improved flow information, including: (1) emphasizing the importance of the Hells Canyon discharge information that is posted on flow monitors located at 6 sites (Hells Gate Marina in Lewiston, Idaho; the Forest Service office in Clarkston, Washington; Heller Bar in Washington; the Cache Creek HCNRA portal in Oregon; Pittsburg Landing in Idaho; and the Hells Canyon Launch site in Oregon); (2) ensuring the accuracy of information posted on Idaho Power's web site and 1-800 phone number; (3) providing timely and accurate press releases; (4) providing a common data source for the flow monitors, website, and 1-800 number to ensure that accurate and timely information is provided via all three media and that the information is consistent among the three media; (5) continuing to evaluate the feasibility of developing a text messaging system that would send the current Hells Canyon discharge each hour to a list of subscribers with satellite phones that could be reached on the river; (6) evaluating the feasibility of installing additional stream flow gaging facilities on the river or important tributaries so that boaters would have access to additional real time information regarding measured flows, in addition to the information already provided on dam releases; and (7) developing a forecasting method for determining when monthly flow conditions in May, June, July, August, and September are likely to be in the medium-high range or greater.

We recommend that under the plan and in consultation with the other parties, Idaho Power evaluate the pulsing flow program that it has followed in the recent past. The program should have a sound basis in the underlying hydraulics/hydrology of the river with respect to the lag time between flow releases at Hells Canyon dam and flow response at key points along the river. Because Idaho Power has the necessary models and has done a significant amount of hydraulic modeling on the river already, primarily to address aquatic resource issues, it should be able to adapt the models to evaluate the attenuation effects of different navigation flow scenarios. Hydraulic or hydrologic factors to be considered in developing a flow regime and navigation flow plan should account for: (1) the travel time of flow from Hells Canyon dam to points downstream as far as just above the Salmon River confluence with the Snake River; (2) the attenuation effect on flow between Hells Canyon dam and points downstream as far as just above the Salmon River confluence with the Snake River; and (3) tributary inflow downstream of Hells Canyon dam; and (4) should include maintaining accurate stream gage rating curves of the relationship between flow and stage.

Because we conclude that development of a navigation plan that includes these elements is essential to providing a safe boating environment on the Snake River downstream of Hells Canyon dam, we consider the preparation and implementation of a navigation plan to be worth the estimated cost of $36,300, including the installation and maintenance of two additional stream gages.

5.2.2.3 Flow Augmentation for Anadromous Fish Juvenile Migration

Juvenile fall Chinook salmon historically migrated from the Snake River in May and June, but impoundment of the river and blocked access to historical habitats has led to delayed migration in late June, July, and early August. Current spawning locations are generally cooler compared to the historical production area because they are farther removed from the Thousand Springs reach near Upper Salmon Falls, where spring-inflows provided a warmer incubation and early rearing environment. Loss of access to these spring-influenced production areas resulted in reduced growth potential and delayed emigration of juvenile fall Chinook salmon; this is associated with reduced survival. These adverse effects have been compounded by the construction of additional dams on the lower Snake and Columbia rivers, which contributed to increased water temperatures, increased predation, and slower migration.

From 1989 to 2000, as part of a comprehensive Snake River flow augmentation effort, Idaho Power released an average of 224 kaf from Brownlee reservoir to enhance migration of juvenile fall Chinook salmon. Flows from 1996 through 2000 were made as part of an energy exchange agreement between Idaho Power and BPA. That agreement expired in April 2001 and was not renewed by BPA. For the period 2002 through 2004, at the request of the Idaho Governor, Idaho Power cooperated with a rental program initiated by BOR to assist BOR in meeting its commitment to provide 427 kaf of water for flow augmentation purposes. Idaho Power leased the natural flow water rights that were acquired by BOR from the state water bank for power purposes to ensure that BOR rentals complied with state law and passed that water through the project. BOR and BPA were responsible for these costs. Additional augmentation flows were resumed in 2005 as part of an interim agreement to protect federally listed fall Chinook salmon (see figure 70).

In its license application, Idaho Power does not propose any measures to enhance migration conditions for juvenile fall Chinook salmon, but several resource agencies, tribes, and other interested parties recommend flow augmentation, or flow shaping, as a method to enhance migration by increasing flow through the lower Snake and Columbia River projects (NMFS-8, 9, and 18; CTUIR-6, 7, 8, and 9; NPT-2, 5, 6, and 7; AR/IRU-22; ODFW-32; and Interior-22). Most notably, NMFS recommended release of 237 kaf of flow augmentation water from Brownlee reservoir during the summer subyearling fall Chinook outmigration season, and the Nez Perce Tribe recommends that Brownlee reservoir be managed to maximize flow augmentation during the spring and summer smolt migration seasons, including the use of real-time adjustments to account for changes in runoff forecasts.

Increasing flows during the fall Chinook subyearling smolt outmigration may increase migration speed and improve survival (refer to our analysis in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*). In section 3.6.2.1, we identified no fewer than four studies indicating that summer flow augmentation downstream of the project would benefit outmigrating fall Chinook salmon by increasing flow volume and reducing travel time. Further, a review of trends in adult fall Chinook returns indicates that there is a generally positive relationship between flow and survival for outmigrating fall Chinook salmon. Our analysis in section 3.6.2.1 indicates that there has been a substantial increase in adult fall Chinook returns past Lower Granite dam that tracks closely with both the total flow augmentation provided from the Snake River basin and the volume of flow augmentation provided from Brownlee reservoir during the year of outmigration (see figure 77). We note that many other factors influence the number of adult salmon that return to the Snake River, especially a substantial increase in the number of hatchery fall Chinook salmon that have been released from acclimation sites in the Salmon and Snake rivers upstream from Lower Granite dam.

In its April 11, 2006, reply comments on recommended terms and conditions, Idaho Power cites recent testimony from NMFS and other scientists indicating that there is considerable disagreement on the benefits of flow augmentation for Snake River fall Chinook salmon. Part of this uncertainty relates to a recent analysis of the scales taken from adult fall Chinook in 2004, which indicates that a small proportion of the fall Chinook juveniles that overwinter in the river/reservoir environment before completing their migration may contribute more than half of the adult returns. The effects of summer flow augmentation on this portion of the population are poorly understood because these yearling fish typically migrate in the following spring, before flow augmentation water is released from Brownlee reservoir.

In 2003, the Independent Scientific Advisory Board (ISAB) completed a review of flow augmentation at the request of the Northwest Power Planning Council. ISAB (2003) concluded "*that there is a range of flow over which survival of PIT-tagged smolts increase with increasing flow and a range of higher flows in which fish survival appears to be independent of incremental changes in flow*."

ISAB further concluded that several parameters that may affect survival are correlated with flow, and that deliberately designed experiments may be needed to determine the effects of these variables. Variables identified by the ISAB include water temperature, water clarity, fluctuations in dam discharges, gas supersaturation, the timing of entry to the estuary and the ocean, and ocean conditions. In section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, we discuss how the weak relationship between flow and survival at higher flows (for both the spring and summer smolt outmigrations) described by the ISAB suggests that increasing the amount of flow augmentation water released in moderate and high water years, as recommended under measures recommended by the Nez Perce Tribe (NPT-7), may provide little survival benefit. We note, however, that the recent advent of 24-hour summer spills at the downstream federal Columbia River mainstem and Lower Snake River projects may alter the flow/survival relationships at higher flows, and that this relationship may warrant re-evaluation of the benefits of increased augmentation in medium and high flow years.

Based on the available information in the record, we conclude that continuation of the Snake River flow augmentation from Brownlee reservoir would continue to enhance migration of juvenile fall Chinook. We acknowledge, however, that there remains much to learn about the effects of flow augmentation on juvenile fall Chinook salmon migration and that there are other factors that contribute to the observed increase in adult returns, including increased supplementation with hatchery fish, favorable flows provided by Idaho Power during the fall Chinook spawning and incubation season, and favorable ocean conditions. In the draft EIS, we concluded that the benefits of releasing water from Brownlee reservoir as part of the summer flow augmentation program should be re-evaluated in 2009, after data from adult returns through 2008 are available. Comments received on the draft EIS reflected a consensus that it is unlikely that there would be sufficient information to allow the benefits of flow augmentation to be reevaluated in 2009, and that the evaluation that we proposed would be impeded by the wide range of factors that can affect adult returns. In addition, NMFS expressed concern that the measure introduced uncertainty about whether the measure would be continued beyond 2008, which it indicated would impede consultation on effects to federally listed ESUs of salmon and steelhead.

Although we understand the concerns expressed in these comments, we also conclude that it is likely that additional information will become available over the next license term that will improve our understanding of the effects of flow augmentation, and of how water contributed from Brownlee reservoir can be managed to maximize benefits to outmigrating juvenile salmon and steelhead. Therefore, we include in the Staff Alternative a measure that would require Idaho Power to prepare a flow augmentation evaluation report 6 years after license issuance, in consultation with the fisheries management agencies and treaty tribes, that evaluates available information on the benefits of providing flow augmentation water from Brownlee reservoir and whether any changes in the timing or amount of water delivered from Brownlee reservoir is warranted. The report should also: (1) consider and evaluate the effects of flow augmentation water contributed from the Snake River basin upstream from Brownlee dam and from Dworshak reservoir; and (2) include any recommendations, for Commission approval, for continuing flow augmentation releases. We conclude that in the interim, Idaho Power should continue to release 237 kaf from Brownlee reservoir as it did voluntarily in 2005 and 2006. Continuation of this release would be consistent with the average volume that has been released from Brownlee reservoir between 1989 and 2000, during which time the number of adult fall Chinook returning past lower Granite dam substantially improved. We conclude that continuation of the 237-kaf flow augmentation release is warranted to avoid adverse effects on this federally listed ESU. To address the concern expressed by NMFS regarding introducing uncertainty into the section 7 consultation, prior to implementing any changes in Idaho Power's participation in the flow augmentation program, we would consult with NMFS regarding the need to re-initiate formal consultation on potential effects on listed ESUs of salmon and steelhead.

We estimate the annualized cost of the continued release of 237 kaf of flow augmentation water from Brownlee reservoir, in terms of foregone power benefits, would be about $9.0 million, and the annualized cost of preparing the flow augmentation evaluation report would be $1,800. We consider these to be incremental costs, not part of the economic baseline because Idaho Power was reimbursed by BPA for its participation in the program from 1995 through 2001, and its participation in 2005 and 2006 was voluntary. In addition to the developmental cost, flow augmentation would result in an earlier and more rapid drafting of Brownlee reservoir than under Idaho Power's proposed operation. In the medium water year, for example, the 2,050-foot-msl reservoir elevation (27 feet below full pool) would be reached by the end of July under flow augmentation, in contrast to reaching the same point in mid-October under Proposed Operations (section 3.3.2.4, *Brownlee Reservoir Levels*). This earlier drawdown would adversely affect the aesthetic appearance of Brownlee reservoir during peak-use summer months (section 3.11.2.1, *Effects of Project Operations on Aesthetic Resources*) and adversely affect flat-water boating, reservoir access, and crappie fishing opportunities (section 3.10.2.1, *Effects of Project Operations on Recreation Resources*). Despite the cost and these anticipated adverse effects, we include flow augmentation as an operational provision of the Staff Alternative. We do so because flow augmentation is an inextricable part, along with spawning/incubation flow management and supplementation, of an overall management program that has recently shown a substantial increase in adult returns of fall Chinook salmon, a federally listed threatened species (ESU).

Interior-26 recommends that Idaho Power maximize use of recreation access sites by holding Brownlee reservoir at or near full elevation through June 20. Interior also recommends that the flow augmentation draft from Brownlee stop during the Fourth of July holiday or begin after the holiday. Similarly, the Forest Service (FS-19) specifies that Idaho Power manage the Hells Canyon reservoir level to minimize impacts on recreation during the summer. The Staff Alternative flow augmentation measure accommodates both Interior recommendations. With regard to the Forest Service, we concluded in the draft EIS that establishing Brownlee summer reservoir levels to support levels in Hells Canyon reservoir on the basis of recreation potential alone would conflict with aquatic resource protection measures that we have included in the Staff Alternative. However, in its comments on the draft EIS, the Forest Service clarified that the primary purpose of measure FS-19 would be to extend boat ramps on Hells Canyon reservoir if proposed operations interfere with a reasonable level of boat access. We now agree with the Forest Service on the need for this measure, as clarified, and recommend it as part of the Staff Alternative.

Finally, as part of our analysis, we also assessed the effects of a 350 kaf flow augmentation release from Brownlee reservoir. This scenario is roughly equivalent to recommendations AR/IRU-22 and ODFW-32, which would require 100 kaf of flow shaping[119] in addition to 237 kaf of flow augmentation water to be released from Brownlee reservoir.

Modeling conducted by Idaho Power shows that 350 kaf of storage from Brownlee reservoir during the summer would increase water temperatures directly downstream of Hells Canyon dam, especially in low water years. This effect may be balanced by reduced warming as the larger flow volume moved downstream through the reach between Hells Canyon dam and lower Granite reservoir, and could be compensated for by the release of cool water from Dworshak dam. However, as we note in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, a recent study funded by BPA (Cook et al., 2006) indicates that releasing too large a volume of water from Brownlee reservoir may reduce stratification in Lower Granite reservoir, which would increase water temperatures in the hypolimnion and affect the temperature of outflows from Lower Granite reservoir. Because of this potential adverse effect on rearing and migration conditions within and downstream of Lower Granite reservoir, and its slightly higher annualized cost ($9.7 million for a 350-kaf release versus $9.0 million for the 237-kaf release), we do not include the 350-kaf release in the Staff Alternative. However, we note that our

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[119] Flow shaping involves the pre-release of BOR augmentation water that cannot be delivered to Brownlee reservoir and then refilling Brownlee Reservoir with an equivalent amount of BOR water when that water reaches Brownlee reservoir.

recommended flow augmentation evaluation report would allow the amount and timing of flow augmentation releases from Brownlee reservoir to be re-evaluated 6 years after license issuance.

5.2.2.4 Water Rights

Lower Valley Electric recommends that Idaho Power compensate the state of Wyoming and the Wyoming public in the upper Snake River watershed in Wyoming, as represented by Lower Valley Electric, for the use of Wyoming's unused allocation under the Snake River Compact. However, the Wyoming State Engineer's Office is responsible for administering water resources in the state of Wyoming and would normally be the party expected to deal with water right issues between Wyoming and neighboring states. This agency has not made any comments on water rights in this proceeding. We note that there is extensive water storage and diversion between the Wyoming state line and the Hells Canyon Project. The Snake River basin is substantially allocated; therefore, it seems unlikely that surplus water would be available as far downstream as the Hells Canyon Project. In any event, this issue is outside the scope of the Commission's jurisdiction, and the relicensing, and we do not address it further.

5.2.3 Water Quality

5.2.3.1 Dissolved Oxygen Measures

Currently, low dissolved oxygen levels regularly occur in the transition zone and much of the lacustrine zone of Brownlee reservoir during late spring and summer, and downstream of Hells Canyon dam in spring through fall. These dissolved oxygen conditions are primarily a result of the high nutrient (phosphorus) loads to the project and the reduction in assimilative capacity caused by converting the riverine system into a reservoir system.

Low dissolved oxygen levels greatly reduce habitat suitability for both cold and warmwater species in the project reservoirs during the summer months, and dissolved oxygen levels in the first 6 to 7 river miles downstream of Hells Canyon dam are below optimal during the first month of the fall Chinook spawning season. Increasing dissolved oxygen levels in project reservoirs and downstream of Hells Canyon dam could greatly increase the usable fish habitat in the project reservoirs, reduce the incidence of fish kills, and improve conditions for fall Chinook spawning downstream of Hells Canyon dam.

In its license application, Idaho Power proposed to install an oxygen diffuser system in the transition zone of Brownlee reservoir to meet its TMDL obligation for Brownlee reservoir, which was estimated at 1,450 tons per year at that time but was revised to 1,125 tons oxygen per year in the final TMDL. Because of the significant annual variability in Brownlee water quality conditions, Idaho Power proposed to maximize benefits of the aeration system by varying injection rates and periods depending on conditions. Idaho Power also proposed to install and operate turbine venting systems in Brownlee units 1 through 4 and to evaluate the feasibility of implementing turbine-venting technology at Brownlee unit 5, but later withdrew this proposal.

The agencies, tribes, and NGOs made numerous recommendations to increase dissolved oxygen levels in the project reservoirs and in the Snake River downstream of Hells Canyon dam. Interior-61 recommends that Idaho Power install and operate a turbine-venting system on Brownlee units 1 through 4, and potentially on Brownlee unit 5 and on the units at Hells Canyon dam. NMFS-12 recommends that Idaho Power evaluate and design the most effective means of increasing late summer and fall dissolved oxygen levels in outflows of the Hells Canyon Project to exceed 6 mg/L to the extent that current technologies allow. The Umatilla Tribes (CTUIR-21) and Nez Perce Tribe (NPT-16) recommend that Idaho Power construct structures on Hells Canyon dam to add dissolved oxygen to the Snake River downstream of the project, and inject oxygen in Brownlee reservoir to meet the 6.5-mg/L dissolved oxygen target designated in the Snake River-Hells Canyon TMDL. AR/IRU-17 recommend an adaptive management approach using real-time monitoring results to trigger aeration/oxygenation of reservoir outflows. ODFW-55 recommends that Idaho Power consult with ODEQ to develop and implement a plan to ensure that the project does not contribute to violation of Oregon's dissolved oxygen standard within or downstream of the project. In addition, ODFW-58 recommends that Idaho Power consult with ODEQ and ODFW to develop appropriate water quality monitoring, including dissolved oxygen, and that the monitoring measures be approved by ODEQ. Interior also recommends that Idaho Power be required to meet water quality standards in Oxbow and Hells Canyon reservoirs (Interior-42), and monitor water quality twice per month at six locations downstream of Hells Canyon dam (Interior-67). AR/IRU-16 recommend that the Commission require Idaho Power to locate, fund, construct, and oversee operations of projects to reduce nutrient and suspended particle delivery from on-land sources to the Snake River and its tributaries above and within the project, in lieu of Idaho Power's dissolved oxygen supplementation proposal for Brownlee reservoir.

In the draft EIS, we concluded that Idaho Power is responsible for addressing the project's contribution to degraded water quality, although there was considerable uncertainty about the cost effectiveness of both reservoir dissolved oxygen supplementation and potential turbine aeration measures. Therefore, we recommended that Idaho Power develop a dissolved oxygen supplementation plan in consultation with IDEQ, ODEQ, tribes, and federal and state agencies responsible for managing fish and wildlife to reduce the uncertainty associated with potential measures to increase dissolved oxygen levels prior to implementing any of them. Our concept was that during development of this plan, the project's dissolved oxygen load allocation beyond that set in the TMDL would be determined and practical measures for meeting all of the project's load allocations would be selected. These measures would be implemented following approval by the Commission and a monitoring program would be implemented to aid in selecting appropriate times for reservoir oxygen supplementation, if appropriate, and to document the effectiveness of measures aimed at improving dissolved oxygen in the lower river.

As part of the water quality certification process, Idaho Power focused considerable effort on reducing uncertainty associated with its proposed measures to address low dissolved oxygen levels and increasing the environmental benefits of meeting its TMDL dissolved oxygen allocation, as well as adding a measure to address low dissolved oxygen levels in the Oxbow bypassed reach. Based on the reduced uncertainty associated with the measures now being proposed by Idaho Power and the potential for greater environmental benefits, we have revised our draft EIS recommendation as described below.

In its April 26, 2007, filing with the Commission and its January 31, 2007, application for water quality certification (Idaho Power, 2007a), Idaho Power now proposes measures that supersede the measures proposed in the license application. This includes a proposal to meet its TMDL dissolved oxygen load allocation in Brownlee reservoir either by installing an oxygen diffuser system in Brownlee reservoir as it proposed in its license application, or through upstream phosphorus trading.[120] Because phosphorus trading offers the potential for enhanced resource benefits over an oxygen diffuser system, Idaho Power proposes to devote a limited period of time (i.e., up to 1 year after license issuance) to identifying appropriate trading partner(s) first and, if that fails, to proceed with design and installation of the reservoir diffuser system. In its application for water quality certification, Idaho Power also proposes to aerate Hells Canyon outflows using a forced air (blower) system at the Hells Canyon powerhouse to add 1,500 tons per year of dissolved oxygen downstream during summer and fall, or to install a similar

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[120] Phosphorus trading refers to Idaho Power developing/implementing a legal agreement in lieu of supplementing oxygen in Brownlee reservoir to meet its TMDL dissolved oxygen allocation. This agreement would be made with a party located upstream of Brownlee reservoir that has accumulated phosphorus credits by providing benefits beyond what is required under that party's phosphorus load allocation (refer to section 3.5.2.2, *Dissolved Oxygen, Upstream Watershed Phosphorus Trading,* for further details).

system or aerating runners at Brownlee dam if it can provide reasonable assurance that the dissolved oxygen targets downstream from Hells Canyon dam would be met. Idaho Power's preliminary evaluations indicate that measures at Brownlee dam may be feasible to meet the proposed 1,500 tons per year below Hells Canyon dam. In its application for water quality certification, Idaho Power also proposes to install and operate a destratification system in the Oxbow bypassed reach at the deep pool just upstream of the Indian Creek confluence to prevent anoxic conditions that were found to occur in the deeper portions of the pool.

Our analysis indicates that the approach proposed by Idaho Power in its January 31, 2007 application for water quality certification has the potential to provide substantive benefits to water quality conditions within and downstream of the project. Phosphorus inputs to Brownlee reservoir could be reduced by Idaho Power's implementation of phosphorus trading, if an appropriate trading partner can be found. To accomplish this, another party would need to reduce its point and/or nonpoint loadings beyond its allocated level so that it could accumulate pollutant trading credits, which it could "trade" with Idaho Power to meet the TMDL allocation set for Brownlee reservoir. This reduction in phosphorus loads could provide environmental benefits that extend to all three project reservoirs and to the Oxbow bypassed reach. Our analysis indicates that an oxygen diffuser system in Brownlee reservoir would provide only localized benefits. If aeration measures at Brownlee dam can meet Idaho Power's responsibility for improving dissolved oxygen levels downstream of Hells Canyon dam without violating the 110-percent of saturation total dissolved gas criterion, this approach would provide additional benefits in the Oxbow reservoir and bypassed reach, as well as in Hells Canyon reservoir. Implementation of phosphorus trading and aeration measures at Brownlee dam would also be consistent with recommendations by the agencies and tribes to improve water quality conditions both within and downstream of the project. Our analysis indicates that destratifying the deep pool in the Oxbow bypassed reach would reduce anoxic conditions that currently occur in the pool, and has the potential to benefit aquatic resources that use the bypassed reach, including bull trout and redband trout.

Although we recognize that a phosphorus trading arrangement would address project effects on nutrients and dissolved oxygen only indirectly, this measure has the potential to provide a greater overall benefit than the reservoir oxygen diffuser system proposed in the application. Therefore, we conclude that this approach warrants further evaluation before an approach for meeting TMDL targets and applicable dissolved oxygen standards within Brownlee reservoir and downstream of Hells Canyon dam is selected. Such an approach would be in keeping with the adaptive approach reflected in many of the agency and tribal recommendations. Accordingly, we recommend that Idaho Power develop a dissolved oxygen enhancement plan, including appropriate provisions for monitoring, in consultation with IDEQ, ODEQ, NMFS, Interior, IDFG, ODFW, and interested tribes. The plan should document the process of identifying appropriate upstream phosphorus trading partner(s), document whether reservoir supplementation is cost effective, and provide a mechanism to evaluate the effectiveness and feasibility of alternative or additional measures. Such alternative measures should, at a minimum, include reducing nutrient and organic matter loadings from tributaries, injecting atmospheric air or oxygen into forebay waters or turbines, and installing/using aerating runners to increase dissolved oxygen in Brownlee turbine flows. We recommend that the plan be filed for approval with the Commission within 1 year of license issuance.

During development of this dissolved oxygen enhancement plan, Idaho Power would consult with IDEQ and ODEQ on the estimate of project effects that contribute to low dissolved oxygen levels in the Snake River downstream of Hells Canyon dam. Once the appropriate dissolved oxygen load allocation for the project has been determined, Idaho Power would evaluate the feasibility of implementing its proposed turbine aeration measures and assess the potential for the measures to cause total dissolved gas to exceed the 110-percent of saturation criterion. This evaluation would be conducted for installing forced-air systems at Hells Canyon and Brownlee, aerating runners at Brownlee, and implementing other measures if necessary. The dissolved oxygen enhancement plan would include a monitoring provision to:

(1) evaluate the quality of inflows to the project; (2) confirm that Idaho Power is meeting its obligations for aeration and phosphorus trading if appropriate; (3) evaluate the effectiveness of the measures implemented; and (4) evaluate any adverse effects of the aeration on total dissolved gas downstream of Brownlee, Oxbow or Hells Canyon dams. As a provision of the dissolved oxygen enhancement plan, we recommend that Idaho Power annually develop and file a draft monitoring and implementation report, which would include monitoring results and describe actions taken in the past year along with actions proposed for the coming year. The report would also be provided to the agencies for comment.

We estimate the annualized cost of developing the dissolved oxygen enhancement plan through the evaluation phase at $2,200. Because of its potential substantive benefits to aquatic resources, we include it as part of the Staff Alternative. The cost of implementing the measures identified in the plan and approved by the Commission would be determined as part of the plan. We estimate that the annualized cost of potential mechanical measures to address the low dissolved oxygen levels in the three project reservoirs and the river downstream of Hells Canyon dam likely would total $648,500. This is based on our estimated annualized costs of $447,800 for a Brownlee reservoir oxygen diffuser system, $184,700 for a forced air system at the Hells Canyon powerhouse, and $16,000 for a destratification system at the deep pool just upstream of the Indian Creek confluence. Although we do not directly include in the Staff Alternative Interior-61, the recommendation that Idaho Power install and operate a turbine-venting system at Brownlee units 1, 2, 3, 4, and possibly Brownlee unit 5 and the three Hells Canyon units, our recommended dissolved oxygen enhancement plan may determine that all or part of this recommendation would provide a reasonable approach for Idaho Power to meet its obligation to improve water quality. Therefore, Interior-61, for which we estimate an annualized cost of $17,000, could eventually be implemented under the Staff Alternative.

We do not fully include in the Staff Alternative Interior-67, the recommendation that Idaho Power monitor water quality at six or more sites downstream of Hells Canyon dam twice per month, and more frequently during low dissolved oxygen periods and when dissolved oxygen enhancement is being done. In the draft EIS, we concluded that monitoring at the level of intensity recommended by Interior, at an estimated annualized cost of $200,000, would not be warranted because it would provide little additional information compared to routine monitoring at a single site downstream of Hells Canyon dam. During the 10(j) meeting, Interior indicated that its intent was to collect sufficient data to determine the downstream extent of water quality effects, but that the frequency, timing and location of measurement sites could be developed in consultation with Idaho Power. We recommend that these aspects of monitoring be developed during consultation on the dissolved oxygen enhancement plan.

We do not include in the Staff Alternative Interior-42, the recommendation that Idaho Power be required to satisfy existing water quality standards in Oxbow and Hells Canyon reservoirs. As discussed above, Idaho Power is not solely responsible for dissolved oxygen deficits that occur within and downstream of the project, so it is not appropriate to hold Idaho Power responsible for addressing impacts that are beyond its responsibility as determined through the TMDL process and in its water quality certificate. Idaho Power's plan to evaluate phosphorus trading, as described above, would be limited to addressing Idaho Power's nutrient responsibility under the TMDL.

We do not include in the Staff Alternative the Interior and the Forest Service recommendations (Interior-66 and FS-30) to study the effect of dissolved oxygen additions below Hells Canyon dam on bull trout, invertebrates, macrophytes, and algae. We conclude that Idaho Power has conducted sufficient studies to evaluate the benefits of increasing dissolved oxygen levels downstream of the project. We cannot estimate the full costs of Interior's recommended measures because Interior has not described the scope of the measures to increase dissolved oxygen levels.

5.2.3.2 Water Temperature Measures

Brownlee reservoir, which has an average hydraulic retention time of about one month, substantially alters Snake River temperatures. Storage of water in the reservoir and the depth of the powerhouse intake result in cooler downstream water temperatures in spring and summer and warmer temperatures in the fall than would be the case in the absence of the project. This seasonal shift in water temperature may adversely affect fall Chinook salmon by causing water temperatures to be above optimal while adults are holding prior to and during the spawning period, and by causing juvenile fish to emerge into a cooler environment with reduced growth potential (see section 3.6.2.4, *Water Temperature*). High water temperatures immediately before and during the spawning season are of particular concern because they may lead to higher levels of pre-spawning mortality and reduced egg viability. However, later in the spring and early summer, juvenile fall Chinook salmon and other aquatic resources actually may benefit from delayed warming, which delays the onset of stressfully high water temperatures.

Idaho Power's proposed operations would be the same as the current operations, resulting in thermal regimes similar to current regimes within and downstream of the project. In its license application, Idaho Power did not propose any measures to modify the existing temperature regime. However, in its April 26, 2007, filing with the Commission and its application for water quality certification (Idaho Power, 2007a), Idaho Power proposed to implement a Temperature Adaptive Management Plan (through the implementation of appropriate measures) to meet the project's temperature responsibility under the TMDL. Under this plan, Idaho Power would: (1) define the extent and nature of the project's temperature responsibility; (2) evaluate potential measures; and (3) identify any appropriate measure(s) for implementation. The potential measures identified by Idaho Power include a bubble upwelling system that would be designed to lift cool water from the depths of Brownlee reservoir to be entrained into the project intake and implementing watershed measures to reduce the temperature of inflows to the project (e.g., increasing stream shading, restoring channels, increasing streamflows or groundwater inflows, or reducing heat loads contributed from agricultural return flows and other point sources).

ODFW-56 recommends that Idaho Power consult with ODEQ to develop and implement a temperature management plan to be approved by ODEQ as part of its section 401 certification for the project. This plan would include implementing measures, a timeframe for implementing measures, and an effectiveness monitoring plan. The Nez Perce and Umatilla Tribes (NPT-13 and CTUIR-22) and AR/IRU-19 recommend that Idaho Power, in consultation with appropriate state and federal agencies and interested tribes, investigate the installation of a temperature control structure at Brownlee reservoir to meet Clean Water Act numeric and narrative criteria to support the beneficial use of fisheries. They also recommend that Idaho Power work with a Technical Advisory Committee to identify and implement other possible remedies for achieving temperature control of outflows at Brownlee, Oxbow, and Hells Canyon dams.

Based on our analysis in section 3.6.2.4, *Water Temperature*, we conclude that increased temperatures in the fall that are attributable to the project likely cause reduced survival of fall Chinook salmon eggs that are spawned in the early part of the spawning season. We further conclude that this effect could be reduced with the implementation of watershed measures (e.g., temperature trading), through the installation of a bubble upwelling system in Brownlee reservoir, or through the installation of a temperature control structure in Brownlee reservoir. Notwithstanding those results, we also conclude that the latter two approaches involve potential adverse effects from releasing hypolimnetic water that is low in dissolved oxygen and may have elevated concentrations of ammonia, mercury, and organochlorine compounds. Using a temperature control structure to reduce water temperatures in the fall could also cause adverse effects by warming water temperatures during the summer outmigration period. Storing cool water for release in the fall would require summer releases to be drawn from higher elevations in the reservoir, which would increase the temperature of outflows from the project during the summer months. Such an outcome may adversely affect migration survival through Lower Granite reservoir.

Our analysis in section 3.6.2.4, *Water Temperature*, shows that releasing warm water via a temperature control structure has the potential to benefit fall Chinook salmon by counteracting delayed warming caused by the project, thereby increasing growth rates in the spring. This outcome may improve outmigration survival by fostering early outmigration or attainment of a larger size prior to outmigration. However, the modeling conducted by Idaho Power indicates that the ability to increase temperatures in the spring is limited in average and high water years, and there would be little effect prior to mid-March in all water years. Our review of Idaho Power's modeling results indicates that this finding is due to the limited degree of stratification that occurs in Brownlee reservoir in the early spring in low flow years, and that stratification is delayed until the late spring in higher flow years. Furthermore, increasing water temperatures in the spring could reduce the migration survival of yearling spring Chinook salmon and steelhead emigrating from tributaries downstream of the project.

Our evaluation of the preliminary simulation results for the bubble upwelling system leads us to conclude that the upwelling system, by itself, may not be sufficient to meet the project's temperature load allocation. While implementing watershed measures, such as increasing stream shading, would address project effects on water temperature only indirectly, this approach has the potential to provide a greater overall benefit than a bubble upwelling system. Such benefits could include improving water quality conditions within, and downstream from, the tributary streams where the watershed measures are implemented. This would provide benefits to native resident salmonids, white sturgeon, and other aquatic species. Accordingly, we conclude that watershed measures show substantial promise as a highly beneficial means for addressing the project's temperature responsibility, either alone or in combination with a bubble upwelling system.

We estimate that the annualized cost of developing and implementing Idaho Power's proposed Temperature Adaptive Management Plan would be $452,000, based on the costs for a Brownlee bubble upwelling system. Because the watershed measures and a bubble upwelling system could provide substantial benefits to fall Chinook salmon and other aquatic resources, we conclude that Idaho Power's proposed Temperature Adaptive Management Plan is warranted and would be worth the cost. Therefore, we include it as part of the Staff Alternative.

With regard to the temperature control structure, we continue to conclude that installing such a structure is not warranted. We base our conclusion on the high cost of this measure,[121] as well as the potential adverse effects on (1) fall Chinook salmon from increased water temperatures downstream of the project during the summer outmigration season, and (2) other water quality parameters including reduced dissolved oxygen and increased concentrations of ammonia, mercury, and organochlorine compounds in waters downstream from Brownlee reservoir.

In addition to the Temperature Adaptive Management Program, we recommend that Idaho Power: (1) monitor the effectiveness of implemented measures; (2) hold annual meetings with ODEQ, IDEQ, ODFW, IDFG, FWS, NMFS, and interested tribes to evaluate whether measures need to be modified or additional measures implemented to meet the project's temperature responsibility, and (3) file an annual monitoring and implementation report with the Commission that summarizes monitoring results and outlines any modifications or new measures that warrant consideration and/or are proposed for implementation. These steps would provide better information on the effectiveness of implemented measures and provide a greater level of assurance that the implemented measures meet the project's temperature responsibility.

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[121] In its response to AIR WQ-2, Idaho Power (2005e) estimated that the annualized cost for the construction and operation of five alternative water temperature control structures at the Brownlee intake ranged from $3.7 million for an overflow stoplog weir in the existing intake channel to $40.6 million for a new 35,000 cfs capacity variable-height-gated intake tower.

5.2.3.3 Total Dissolved Gas Abatement

Water flowing through dam spillways and plunging to depth in pools below dams causes air to be driven into solution, resulting in supersaturation of gasses in the water. Total dissolved gas levels above 110 percent of saturation can be injurious to fish by causing gas bubble trauma. Sampling conducted by Idaho Power in the project reservoirs and in the Oxbow bypassed reach found evidence of gas bubble trauma in some fish when total dissolved gas levels exceeded 120 percent of saturation. In addition, a wide range of fish species showed evidence of gas bubble trauma when total dissolved gas levels exceeded 125 percent (see section 3.6.2.3, *Total Dissolved Gas*). Gas bubble trauma causes increased stress in fish and other aquatic organisms, and severe gas bubble trauma can cause substantial levels of mortality.

Spills greater than 3,000 cfs at Brownlee dam currently result in total dissolved gas levels that exceed the 110-percent of saturation criterion downstream of the Brownlee dam spillway, and have substantial effects on total dissolved gas levels in Oxbow and Hells Canyon reservoirs. Nearly all spills at Hells Canyon dam result in exceedance of the 110-percent criterion, and at spills of 19,000 cfs and greater, the entire Hells Canyon reach down to the Salmon River confluence exceeds this criterion. Limited sampling at Oxbow dam indicates that spills at this facility also cause total dissolved gas to exceed 110 percent of saturation, independent of spills at Brownlee dam. With continued project operation, spills that cause exceedance of the 110-percent criterion would occur for prolonged periods in medium high to extreme high flow years, less frequently in medium flow years, and seldom if ever in low flow years.

In its license application, Idaho Power proposed to continue preferential use of crest (upper spillway) gates for passing spills at Brownlee dam. It also proposed to install flow deflectors on the Hells Canyon dam spillway that would alter the flow characteristics from the spillway to reduce air entrainment deep in the tailrace during spill episodes of up to approximately 30,000 cfs. In addition, Idaho Power proposed to develop a schedule for constructing and installing flow deflectors and an effectiveness monitoring plan in consultation with ODEQ and IDEQ.

ODFW-54 recommends that Idaho Power develop and implement a plan, in consultation with and approved by ODEQ, to satisfy Idaho Power's total dissolved gas allocation of less than 110 percent of saturation at the edge of the aerated zone below each project dam for all flows not exceeding the 10-year, 7-day average flood flow. Under this plan, Idaho Power would develop and monitor measures to assure compliance with Oregon's total dissolved gas standard below all three dams as required by the TMDL, Oregon water quality standards, and the Clean Water Act.

NMFS (NMFS-10 and NMFS-11), Interior-62, the Umatilla Tribes (CTUIR-20), and the Nez Perce Tribe (NPT-15) recommend that Idaho Power design and install gas abatement structures at Hells Canyon and Brownlee dams. In the event that the resulting structures do not meet total dissolved gas standards, the Umatilla and Nez Perce Tribes recommend that Idaho Power re-consult with the agencies to develop and implement other structural approaches to meet water quality standards within 5 years of the issuance of a new license. Each of these measures would reduce total dissolved gas levels in Oxbow and Hells Canyon reservoirs and in the free-flowing Snake River downstream of Hells Canyon dam.

AR/IRU (AR/IRU-18) recommend that the Commission require Idaho Power to use a 6-step adaptive management approach to eliminate or minimize total dissolved gas levels in excess of 110 percent of saturation. Idaho Power would conduct real-time total dissolved gas monitoring, either during periods of high spill or consistent with Idaho Power's water quality certificate once it is issued to detect and quantify total dissolved gas violations below each of the project dams.

Comments on the draft EIS emphasized the adverse effects of total dissolved gas on aquatic resources (Interior, AR/IRU), and included recommendations for additional evaluation of the effects of

Oxbow dam spills on total dissolved gas (ODEQ), clarification of the staff-recommended total dissolved gas measures (Interior and AR/IRU), development of a monitoring plan (ODEQ), and refinement of an adaptive approach to manage total dissolved gas (ODEQ, Forest Service, Umatilla Tribes, and Nez Perce Tribe).

In its April 26, 2007, filing with the Commission and its January 31, 2007, application for water quality certification, Idaho Power (2007a) now proposes to: (1) continue preferential use of crest gates for passing spills at Brownlee dam as an interim measure until the Brownlee spillway deflectors are constructed; (2) install flow deflectors at both the Hells Canyon and Brownlee dam spillways; (3) evaluate total dissolved gas reduction structures for Oxbow dam and install the most effective, safe, and economically feasible measure designed to reduce total dissolved gas at the dam; (4) adaptively manage uncertainties associated with its proposed total dissolved gas-abatement measures to ensure that it satisfies is total dissolved gas load allocation; (5) work with ODEQ and IDEQ to develop a total dissolved gas monitoring plan that would include monitoring during spill to determine compliance with the TMDL load allocation assigned to Idaho Power; and (6) if monitoring indicates that the implemented measures fail to meet the TDG criterion or protect aquatic life, adaptively manage TDG in the project through evaluation and implementation of additional measures designed to further reduce TDG levels..

In section 3.5.2.3, *Total Dissolved Gas*, we conclude that Idaho Power's proposal to continue preferential use of the upper spillway gates at Brownlee dam, along with the proposed installation of deflectors at Hells Canyon and Brownlee dams, would reduce the frequency of spill events that exceed the total dissolved gas standard. The 110-percent of saturation criterion would be exceeded less frequently, and the magnitude of exceedances would be reduced at flows up to at least the 10-year, 7-day average flood flow at Brownlee and Hells Canyon dams. This would reduce the potential for fish and other aquatic organisms to be exposed to high total dissolved gas levels in Oxbow and Hells Canyon reservoirs, as well as downstream of Hells Canyon dam. We estimate the annualized cost of Idaho Power's proposed total dissolved gas abatement measures at Hells Canyon at $182,700 and the additional annualized cost of deflector installation at Brownlee at $197,500. We include these measures in the Staff Alternative because the reduced frequency of elevated total dissolved gas would reduce the risk of gas bubble trauma in fish, especially to federally listed fall Chinook salmon.[122]

Since issuance of the draft EIS, monitoring conducted by Idaho Power indicates that spills at Oxbow dam, which do not coincide with Brownlee dam spills, can elevate total dissolved gas above allowable limits. Monitoring conducted by Idaho Power also determined that gas bubble trauma occurs in fish collected below the Brownlee and Oxbow spillways when total dissolved gas levels exceed 120 percent, and severe gas bubble trauma was observed when total dissolved gas levels exceeded 125 percent of saturation. Idaho Power is currently evaluating total dissolved gas reduction structures for Oxbow dam, and proposes to install the most effective, safe, and economically feasible measure to reduce total dissolved gas at the dam. Based on these recent study results, we have amended the Staff Alternative to include Idaho Power's proposed evaluation of total dissolved gas abatement measures for Oxbow dam and implementation of the most effective, safe and economically feasible measure for reducing total dissolved gas below the dam. Assuming that spillway deflectors would be installed, we estimate that the annualized cost of Oxbow dam total dissolved gas abatement measures would be $278,200. Because this measure could substantially reduce adverse effects on aquatic resources downstream of Oxbow and Hells Canyon dams, we conclude that the cost is warranted and include this measure in the Staff Alternative.

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[122] In the draft EIS, we based our annualized cost estimates of $407,600 for Hells Canyon spillway deflectors and $354,700 for Brownlee spillway deflectors on the contracted cost for construction of spillway deflectors at Ice Harbor dam. In this final EIS, we revised these estimates based on site-specific information that Idaho Power filed with the Commission on April 26, 2007.

Because the effects of the deflectors cannot be accurately predicted, and the specific measure to be implemented at Oxbow dam has yet to be determined, it is not known to what extent the combination of Idaho Power's proposed operational changes and the installation of Brownlee and Hells Canyon spillway deflectors would satisfy the applicable total dissolved gas standards downstream of each of the project dams. Measures included in Idaho Power's application for water quality certification to monitor total dissolved gas levels and adaptively manage uncertainties associated with its proposed total dissolved gas-abatement measures would help ensure that it satisfies its total dissolved gas load allocation and minimizes adverse effects on aquatic resources. We estimate that the total dissolved gas monitoring effort proposed by Idaho Power would have an annualized cost of $37,200. The cost of adaptive management depends on whether additional measures are required, but we estimate that consultation with the agencies would have an annualized cost of $2,000. Because high total dissolved gas levels can cause substantial adverse effects on aquatic resources, monitoring and adaptive management would help ensure that adverse effects on aquatic resources are reduced. We further recommend that the monitoring effort include the development of an annual monitoring and implementation report, which would include monitoring results and describe actions taken in the past year along with actions proposed for the coming year. The report would be developed in consultation with IDEQ, ODEQ, NMFS, Interior, IDFG, ODFW, and interested tribes. Idaho Power would provide a draft of the report to the consulted parties for comment; and subsequently file the report with the Commission.

5.2.3.4 Water Quality Monitoring

Although several of Idaho Power's proposed water quality measures include monitoring components, Idaho Power does not propose to develop or maintain any permanent water quality monitoring stations.

NMFS (NMFS-14) recommends that Idaho Power fund and maintain six permanent water quality monitoring stations in the mainstem Snake River to document trends in water quality (temperatures, dissolved oxygen, total dissolved gas, and pH) and collect additional water quality samples twice each month to assess progress in reducing nutrient and fine sediment loads in the Snake River. Water quality monitoring stations would be located below Hells Canyon dam, below Brownlee dam, between Brownlee reservoir and the Weiser River confluence, below Swan Falls dam, below C.J. Strike dam, and below Bliss dam.

In the draft EIS, we did not adopt the NMFS recommendation to install monitoring stations upstream of the project because these gages would be located upstream of the influence of the project and would not provide data relevant to Idaho Power's management of the Hells Canyon Project. In its comments on the draft EIS, however, NMFS expressed interest in developing a permanent flow and water quality monitoring site downstream of Hells Canyon dam that would allow for a common monitoring platform by which to more realistically evaluate operations, flows, and their interactions with measures to improve important water quality parameters.

During the 10(j) meeting, Idaho Power indicated that the installation of spillway deflectors at Hells Canyon dam would direct more energy downstream during spill periods and would likely cause inaccurate flow and stage measurements at the former USGS gage site located 0.6 miles downstream of the dam. However, Idaho Power also indicated that it had identified several potentially feasible flow measurement sites located between 2.5 miles and 5 miles downstream of Hells Canyon dam. We conclude that establishing a new gage site closer to Hells Canyon dam would provide more useful data on water quality, as well as flow. We also conclude that measuring flow and water quality conditions at the same site would improve the evaluation of any relationship between flow and water quality parameters, which would be useful for evaluating and refining measures implemented to improve dissolved oxygen and to manage total dissolved gas levels. Therefore, we include within the Staff Alternative the development of an operational compliance and water quality monitoring plan, which would encompass the development of a new flow gaging and water quality monitoring site within 5 miles downstream of Hells Canyon dam.

Idaho Power should develop the plan in consultation with IDEQ, ODEQ, IDFG, ODFW, NMFS, FWS, USGS, and interested tribes. The plan should, at a minimum, include:

- Identification of an appropriate location for continuous monitoring of river flow, stage, water temperature, dissolved oxygen, and total dissolved gas downstream of Hells Canyon dam, preferably within 5 miles of the dam;
- A schedule for construction of a flow measurement gage at the selected site, and installation of water quality monitoring equipment;
- A description of the procedures that would be followed to determine a ramping rate at the new gage site that is equivalent to any ramping rate specified in the new license for other locations;
- A description of the method that would be used to measure water surface elevations at Brownlee, Oxbow and Hells Canyon reservoirs, as well as flow rates in the Oxbow bypassed reach; and
- The time steps for which real-time and historical flow, water surface elevation and water quality information from each location would be posted on the Internet and annually reported to the Commission.

We estimate that the annualized cost of developing and implementing the operational compliance and water quality monitoring plan, including establishing a new flow gaging site, would be $30,500. The plan would include provisions for making water quality, flow data, and reservoir levels available on the Internet to facilitate verification of compliance with operational conditions specified in the new license and to facilitate adaptive management.

5.2.4 Aquatic Resources

5.2.4.1 Fall Chinook Spawning and Incubation Flows

Flows released from Hells Canyon dam affect the quality and quantity of spawning habitat available to fall Chinook salmon in the Snake River between Hells Canyon dam and Lower Granite reservoir, a reach that contains most of the spawning habitat that is currently accessible to fall Chinook salmon in the Snake River System. The reach is not known to be a major spawning area for any other anadromous fish species.

Since 1991, Idaho Power has voluntarily implemented a flow program to enhance spawning and incubation conditions for fall Chinook salmon in the Hells Canyon reach. To prevent redds from becoming dewatered during the spawning season, Idaho Power maintains steady flow conditions from mid-October through early December to keep spawning activity below a water level that can be maintained throughout the incubation and fry emergence stages. The spawning flow, which has typically been between 9,000 and 13,000 cfs, is determined each year before spawning begins based on forecasted inflows to Brownlee reservoir, predicted hydrologic-year type (low, medium, or high), and availability of habitat. After spawning has ended, Idaho Power maintains a minimum flow that protects the shallowest redd from being dewatered until fry have emerged from the gravel. Idaho Power proposes to continue the fall Chinook spawning flow program, although with the suggestion that some degree of flow fluctuation be allowed during the spawning period without reducing the availability of spawning habitat or hindering spawning behavior.

NMFS, the Nez Perce Tribe, ODFW, IDFG, and the Umatilla Tribes provided recommendations relating to the fall Chinook spawning flow program. We summarize these in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*.

The spawning flow program benefits fall Chinook salmon by maintaining near-optimal flow levels during the spawning period and by preventing dewatering of redds during the incubation period. Since the flow program was first implemented in 1991, the number of adult fall Chinook salmon returning to the Snake River has increased substantially. While other factors such as hatchery supplementation, improved migration survival, and favorable ocean conditions have contributed to this trend, there is little doubt that protecting redds from dewatering has improved incubation survival. NMFS, ODFW, IDFG, the Nez Perce Tribe, and the Umatilla Tribes all recommend that the fall Chinook flow program be continued, and we include it as an operational provision in the Staff Alternative. Since the flow program is part of the current operation, we do not attribute any incremental cost to its continuation.

In its description of this proposed measure, Idaho Power states that modifications of the flow program are being evaluated and explored in cooperation with interested agencies, including discussion of the potential for allowing some flow variation during the spawning season. Any flow variation that occurs during the spawning period could result in redds being constructed at higher elevations, which would require higher flows to be maintained during the egg incubation season to avoid dewatering redds. Redds that are constructed at higher elevations would be more vulnerable to exposure (and exposure-related mortality of eggs and fry), especially when inflows to Brownlee reservoir are lower than was forecast at the start of the spawning season. We conclude in section 3.6.2.1 that maintaining a stable flow during the spawning season is more protective than a variable flow regime would be, and, in the Staff Alternative, we do not amend the current program to allow variation during the season.

The spawning flow that is selected each year affects the quantity of habitat that will have suitable depths and velocities for spawning. Idaho Power proposes that a spawning flow between 8,000 and 13,000 cfs be determined each year based on forecasted inflows to Brownlee reservoir, predicted hydrologic-year type (low, medium, or high), and availability of habitat. NMFS (NMFS-1) recommends that the stable spawning flow be between 8,500 and 13,500 cfs, the Nez Perce Tribe (NPT-14) recommends a flow between 8,500 and 13,000 cfs, ODFW (ODFW-34) recommends that the spawning flow be at least 8,000 cfs, and the Umatilla Tribes (CTUIR-9) recommend a spawning flow of at least 9,000 cfs.

Our analysis indicates that flows between 8,000 and 15,000 cfs should provide near-optimal conditions for spawning fall Chinook salmon, and providing stable flows anywhere in this range should minimize the potential for redd superimposition, especially in years when large numbers of fall Chinook spawn in the Hells Canyon reach. In the Staff Alternative, we include NMFS's recommended flow range of 8,500 to 13,500 cfs as the range from which to select spawning flows for any given year. However, there is not likely to be any difference in the cost or benefit from specifying an upper limit of 13,000 or 13,500 cfs, since Idaho Power would not be precluded from selecting a spawning flow less than 13,000 cfs in any given year and the amount of habitat that would be provided is essentially unchanged over this range of flows.

Other recommendations made by the agencies and tribes relate to consultation and monitoring requirements for establishing spawning flow levels, in-season consultation on adjustments to flow levels due to changes in flow forecasts, establishing the flow level that is required to protect redds until fry have emerged from the gravel, determining the number and location of temperature monitors that are needed to track water temperatures and estimate the timing of fry emergence, determining the frequency of both shallow and deep-water redd surveys, and reporting requirements. Consultation with the resource agencies and tribes to determine appropriate monitoring efforts and to improve the efficiency of the flow management decision process would help to maximize resource benefits and avoid imposing any unnecessary constraints on project operations. This consultation could be accomplished through the development of a fall Chinook spawning and incubation flow management plan. We estimate the annualized cost of developing and implementing a fall Chinook flow management plan at $2,700, and we include it in the Staff Alternative.

5.2.4.2 Flow Fluctuations Outside of the Fall Chinook Spawning and Incubation Period

Flow fluctuations and changes in the seasonal flow regime caused by project operations can affect the quality and quantity of rearing habitat and the food supply that is available to rearing juvenile fall Chinook salmon and has the potential to cause juvenile fall Chinook salmon to become stranded on bars or trapped in pools that become isolated from the stream channel. Losses of fry that are trapped in pools may occur due to high water temperatures, increased vulnerability to predation, or stranding if the pools drain before they are reconnected to the river. The Hells Canyon reach is not known to provide important rearing habitat for other anadromous species, but it is the most important production area in the Snake River basin that is still accessible to fall Chinook salmon. Flow fluctuations may also affect the available food supply and has the potential to cause mortality due to stranding and entrapment of other fish species, including bull trout and redband trout.

Although the fall Chinook flow program (which we discuss immediately above) provides stable flows during the fall Chinook spawning season and maintains flows sufficient to keep redds watered until emergence is complete, Idaho Power's proposed operations would allow substantial flow fluctuations to occur during the fall Chinook rearing period (approximately March 15 through June 15), and at other times of the year, when bull trout and redband trout may be present. Idaho Power proposes to continue its current maximum up- and down-ramping rate of 12 inches per hour as measured at Johnson Bar, 17.6 miles downstream of Hells Canyon dam. This ramping rate causes stage fluctuations of about 16 inches per hour below Hells Canyon dam. Under typical operating conditions, Idaho Power proposes to limit the maximum daily change in flow to 10,000 cfs, and to maintain a minimum flow of 6,500 cfs from June 1 through September 30, and to maintain a minimum flow of 5,000 cfs for the remainder of the year.

NMFS, Interior, the Forest Service, ODFW, IDFG, the Nez Perce Tribe, the Umatilla Tribes, and AR/IRU recommend measures related to ramping rates and minimum flows outside of the fall Chinook spawning period. We describe these recommendations in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*. These include a recommendation by NMFS (NMFS-4) that sufficient flow be released to ensure that the largest juvenile entrapment areas are reconnected to the Snake River for at least 2 hours on a daily basis; ODFW's recommendation (ODFW-33) that Idaho Power be required to meet a specified seasonal schedule of ramping rates, minimum flows, and maximum daily flow change restrictions; Interior's recommendation (Interior-54) that Idaho Power implement seasonal run-of-river operations downstream of Hells Canyon dam during the white sturgeon spawning, incubation, and early life history stages; and recommendations by ODFW (ODFW-33), Interior (Interior-65) and NMFS (NMFS-15) that river flow and ramping rates be monitored within 1 mile downstream of Hells Canyon dam.

Based on our analysis in section 3.6.2.1 of habitat area, food supply, and the potential for entrapment and stranding, we conclude that reducing ramping rates during the fall Chinook rearing season would provide several benefits to juvenile fall Chinook salmon. Based on our analysis of Idaho Power's habitat modeling studies, restricting ramping rates would increase habitat stability, which would reduce energy expenditures from fish having to repeatedly move to find optimal rearing habitats or reduce food intake from residing in sub-optimal habitat. From our analysis of effects on invertebrate production, we conclude that Idaho Power's proposed ramping rate could result in complete dewatering of favored rearing habitats (<1.5 meters deep), which would substantially reduce macroinvertebrate abundance and the food base that is available to fall Chinook salmon in their preferred rearing habitat.

From our analysis of Idaho Power's entrapment monitoring work, we conclude that implementing more restrictive ramping rates could substantially reduce the number of fish entrapped, and reduce mortalities due to stranding and from entrapment. Data from Idaho Power's 2005 entrapment surveys indicate that implementing a 6-, 4-, or 2-inch-per-hour ramping rate in 2005 would have reduced the estimated stranding mortality of 2,643 fall Chinook salmon juveniles by 8.9 percent, 92.9 percent, and 95.4 percent, respectively (see table 50). We conclude that both the 2- and 4-inch-per-hour ramping rates would provide a high level of protection, compared to less restrictive rates, in conjunction with annual monitoring to determine whether additional operational adjustments or fish salvage operations were warranted to account for differences in seasonal flows or in channel topography between years.

Idaho Power identifies the primary fall Chinook salmon rearing season to be from March 15 to June 15, although ramping rate restrictions recommended by other stakeholders to protect rearing fall Chinook salmon would apply from March 1 to May 31 (AR/IRU-23b), April and May (NPT-3), and March 21 to June 21 (ODFW-33). We conclude in section 3.6.2.1 that implementing restrictive ramping rates as early as March 15 would benefit rearing fall Chinook salmon by allowing macroinvertebrates time to start colonizing shoreline rearing habitats before fall Chinook fry emerge from the gravel and take up residence in these areas. We also conclude that maintaining a ramping rate restriction until June 15 would protect the great majority of fall Chinook salmon from the risk of entrapment and stranding losses associated with load following operations.

In its response to AIR OP-1, Idaho Power estimated the annualized cost of changing the ramping rate compliance point from Johnson Bar to Hells Canyon dam, as recommended by NMFS-15, in conjunction with a reduced ramping rate from March 15 to May 31, would range from $6.6 million for a seasonal 6-inches-per-hour limit to $6.9 million for a seasonal 2-inches-per-hour limit. In the draft EIS, we adopted a provision that the maximum variation in river stage, as measured at the Snake River at Johnson Bar gaging station, not exceed 4 inches per hour during the March 15 to June 15 fall Chinook salmon rearing period. This measure would have a much lower cost than the scenarios evaluated by Idaho Power and the measures recommended by the agencies because the existing ramping rate and compliance point would be maintained outside of the March 15 to June 15 period, and would not affect the generating capacity available during high demand periods of the year. In the draft EIS, we concluded that this seasonal ramping rate limitation, implemented in conjunction with monitoring to adaptively manage stranding and entrapment losses of fall Chinook salmon, would provide a substantial level of protection for this threatened species, and we include this measure in the Staff Alternative.

In its comments on the draft EIS, NMFS expressed concern that imposing a fixed ramping rate would not take into account prevailing flow levels in a given year, and as a result may not reconnect some pools where substantial levels of entrapment and mortality could occur. Interior also expressed concern over the lack of information and the potential for stranding impacts on bull trout, another federally listed threatened species. During the 10(j) meeting, Idaho Power indicated that it had developed a draft stranding and entrapment management plan to address stranding risks to fall Chinook salmon, and that it was in the process of developing a stranding and entrapment management plan to address effects on bull trout.

We continue to conclude that available information indicates that a seasonal 4-inch-per-hour ramp rate would provide substantial benefits to rearing fall Chinook salmon compared to current operations. At an annualized cost of $2.07 million, we conclude that these benefits would be worth the cost and retain this measure in the Staff Alternative. However, we recognize that the effectiveness of this seasonal ramp rate for preventing losses of juvenile fall Chinook salmon may vary between years, depending on differences in hydrologic and meteorological conditions, and that there is little information available on the potential for losses of bull trout from stranding and entrapment. Accordingly, we expand our recommended monitoring study to address potential effects on bull trout, which would require monitoring to be expanded to include the winter season when fluvial bull trout are present in the mainstem Snake River. We recommend that Idaho Power consult with NMFS, Interior, IDFG, ODFW, and the interested tribes to develop a stranding and entrapment management plan. The plan would include a detailed description of how entrapment and stranding of juvenile fall Chinook salmon and bull trout would be monitored, any studies that are needed to quantify mortality or assess sublethal adverse effects, and provisions for implementing salvage operations or modifying project operations as needed to minimize losses from stranding and entrapment. We estimate that the annualized cost of implementing the expanded stranding and entrapment management plan would be $107,000. We conclude that its potential to improve flow management to protect fall Chinook salmon and bull trout warrant the costs of developing and implementing the plan.

NMFS (NMFS-4) also recommends that minimum flows be increased to 11,500 cfs if water temperatures in entrapment pools exceed 16°C for more than 3 days or when peak water temperatures in any pool exceed 18°C for more than 4 hours. We see little benefit to this recommendation, since most of the 2005 mortalities occurred at the middle Pine Bar pools, which Brink (2006) reports were disconnected from the river at a flow of 15,735 cfs and below (table 47). This high a minimum flow would essentially preclude load following while it was in effect, and would likely have an annual cost in excess of $2 million in lost power benefits. We do not include NMFS's recommendation that sufficient flow be released to ensure that the largest juvenile entrapment areas are reconnected to the Snake River for at least 2 hours on a daily basis. While we cannot estimate a cost of this NMFS proposal, we conclude that ramping flows to reconnect entrapment areas could increase losses from stranding. We note that Idaho Power's studies focused on entrapment in pools, and did not address fish stranding in dewatered cobble bars, where it is difficult to detect small fish between or under cobbles. As a result, the mortality from stranding may be higher than it appears from the 2005 study results, and this risk could be increased by implementing the NMFS recommendation, which would cause more cobble bars to be dewatered on a daily basis. We conclude that the 4-inch-per-hour ramping rate that we include in the Staff Alternative, in conjunction with monitoring to determine whether additional measures are necessary, would be more effective in reducing potential losses from stranding and mortality. Additional measures could include implementing a higher minimum flow under certain conditions. However, we conclude that the available information is insufficient to support NMFS's proposed temperature-dependent minimum flow of 11,500 cfs.

We do not include in the Staff Alternative ODFW's recommendation (ODFW-33) that Idaho Power be required to meet a specified seasonal schedule of ramping rates, minimum flows, and maximum daily flow change restrictions. Based on our evaluation of the effects of project ramping on aquatic resources, we include Idaho Power's proposed operating restrictions during the fall Chinook spawning and incubation period, the additional ramp rate restriction of 4 inches per hour during the fall Chinook rearing period, and the stranding and entrapment plan in the Staff Alternative discussed above. However, we found no evidence to suggest that substantive adverse effects were being caused to aquatic resources by Idaho Power's current ramping rate outside of these time periods. We estimate that the annualized cost associated with ODFW's proposed measure would be about $17.6 million in lost power benefits.

We see little benefit to the multi-year ramping rate study recommended by Interior (Interior-44 and -66) and the Forest Service (FS-30). We conclude that there is already sufficient site-specific information to determine appropriate operational constraints to protect rearing fall Chinook juveniles in conjunction with appropriate monitoring and provisions for limited adaptive management. The lost power benefits from implementing run-of-river operation for an estimated 6-year test period would have an annualized cost exceeding $5 million. To facilitate adaptive management of flows, if needed to support the food supply available to juvenile fall Chinook salmon, we adopt an invertebrate monitoring plan in the Staff Alternative. We discuss this plan in section 5.2.4.11, *Invertebrate Monitoring*.

We also do not adopt Interior's recommendation (Interior-54) that Idaho Power implement seasonal run-of-river operations downstream of Hells Canyon dam during the white sturgeon spawning, incubation, and early life history stages. Idaho Power's studies demonstrate that the sturgeon population in this reach benefits from regular recruitment, so there is no indication that load following is causing any adverse effects to white sturgeon spawning and recruitment. We estimate that the annualized cost of Interior's recommendation would be on the order of $2 million in lost power benefits.

In the draft EIS, we did not adopt recommendations made by ODFW (ODFW-33), Interior (Interior-65) and NMFS (NMFS-15) that river flow and ramping rates be monitored within 1 mile downstream of Hells Canyon dam. We based this decision on the difficulty of monitoring compliance at that point due to a reactive relationship between stage and discharge near the dam, and the fact that the existing monitoring location at Johnson Bar was used as the reference point in Idaho Power's licensing studies, which form the basis for the ramping rate restriction that we have included in the Staff Alternative. During the 10(j) meeting, however, the agencies expressed interest in identifying a single site for collecting flow and water quality information closer to the dam, where the influence of the project on dissolved oxygen and total dissolved gas levels could be monitored more effectively. Idaho Power indicated that the installation of spillway deflectors at Hells Canyon dam would direct more energy downstream during spill periods and would likely cause inaccurate stage and flow measurements if the gage used to monitor compliance were located too close to the dam. Idaho Power also stated that it had identified several potentially feasible flow measurement sites located between 2.5 miles and 5 miles downstream of Hells Canyon dam.

We conclude that establishing a new monitoring site closer to the dam would provide more useful data on water quality and that measuring flow and water quality conditions at the same site would improve evaluation of the relationship between flow and water quality parameters. This information would be useful for evaluating and refining measures implemented to address the dissolved oxygen deficit that currently extends for several miles downstream of the dam during the summer. It would also be more useful for measuring and managing total dissolved gas levels, which are more likely to exceed state standards in areas that are closer to the dam. Therefore, as part of the Staff Alternative, we recommend that Idaho Power develop an operational compliance and water quality monitoring plan. The plan, which we describe further in section 5.2.3.4, *Water Quality Monitoring*, should include an evaluation and development of a new flow gaging and water quality monitoring site within 5 miles downstream of Hells Canyon dam. The plan should also include provisions for determining a ramping rate at the new gage site that is equivalent to any ramping rate specified in the new license that is based on measurements at the existing compliance point at Johnson Bar. We estimate that the annualized cost of developing and implementing the flow compliance and water quality monitoring plan, including establishing a new flow gaging site, would be $30,500. Also, the plan should include provisions for making water quality, flow data, and reservoir levels available on the Internet, as well as through other appropriate reporting mechanisms, to facilitate verification of compliance with operational conditions specified in the new license and to facilitate adaptive management.

5.2.4.3 Anadromous Fish Restoration

The Hells Canyon Project has blocked anadromous fish from accessing spawning and rearing habitats upstream of Hells Canyon dam since initial attempts to provide passage were discontinued several years after Brownlee dam was constructed. A successful anadromous fish restoration effort above Hells Canyon dam would restore self-supporting runs in historically available habitat and increase the size and maintain the genetic diversity of Snake River populations.

Idaho Power proposes measures that are targeted toward the restoration of passage and habitat for bull trout. However, Idaho Power does not propose to restore passage for anadromous fish to habitat within and upstream of the project at this time.

State and federal agencies, tribes, and NGOs propose a range of approaches for restoring anadromous fish to areas upstream of Hells Canyon dam. We summarize these specific recommendations[123] and related general recommendations directed at improving water quality and habitat conditions to support anadromous fish restoration in sections 3.6.2.6, *Anadromous Fish Restoration,* 2.6.2.7, *Fish Passage Facilities,* and 3.6.2.8, *Resident Salmonid Passage*. Among the recommendations are suggestions for habitat improvement and the restoration of anadromous fish to historical habitat filed by the Burns Paiute and Shoshone-Paiute tribes (BPT-7 and SPT-3). ODFW (ODFW-2) recommends that specific target sizes be established for anadromous fish runs to areas upstream of the project.

Idaho Power conducted extensive studies to evaluate the potential for anadromous fish restoration, and concluded that restoring self-supporting runs was possible only in certain tributaries and under the most optimistic assumptions. In most of the major tributaries upstream of the project, they report that habitat and water quality conditions have been degraded by land use practices and development of the basins to support irrigated agriculture, and to provide municipal water supply. Water quality in the mainstem of the Snake River upstream of the project is also severely degraded, and the existence of eight mainstem dams in the downstream migratory corridor cause mortality during the upstream and downstream migration of all anadromous species. NMFS chose not to issue a specific section 18 fishway prescription at this time, stating that poor water quality severely limits the potential for fall Chinook salmon to incubate through emergence, and the degraded habitat in most tributaries would similarly limit the possibilities for successful reintroduction of spring Chinook salmon and steelhead into most areas upstream of the project.

Notwithstanding the aforementioned habitat limitations, state and federal resource agencies, tribes, and NGOs recommend numerous measures for upstream and downstream passage, mainstem passage studies, and habitat and water quality improvements as part of an overall restoration effort. Accordingly, after assessing the various agency, tribe, and NGO recommendations, we present and evaluate in section 3.6.2.6 a phased restoration approach (see table 59) that incorporates many of the agency, tribe, and NGO recommendations. This program would focus on tributaries within the project area that currently support resident salmonids without requiring passage at any major dams or reservoirs within the tributary. Based on our review of Idaho Power's reintroduction studies, tributaries that meet these criteria include Pine Creek, Indian Creek, the Wildhorse River, and several tributaries to the Powder River, especially Eagle Creek. These tributaries were also identified by many of the stakeholders as being suitable targets for an anadromous fish restoration effort.

Regarding fall Chinook restoration, in section 3.6.2.6, *Anadromous Fish Restoration*, we conclude that water quality conditions in the historical fall Chinook production area between Swan Falls and Brownlee dams are not sufficient to support restoration at this time. Specifically, low dissolved oxygen levels and the presence of hydrogen sulfide in the incubation environment are not likely to allow a sufficient hatch rate to support a self-sustaining run of fall Chinook salmon. However, there is potential that conditions will gradually improve over the term of the next license through implementation of the Snake River-Hells Canyon TMDL.

AR/IRU (AR/IRU-8b), IDFG (IDFG-9), NMFS (NMFS-14), and the Nez Perce Tribe (NPT-8b) recommend that the condition of historical spawning habitat in the mainstem Snake River, upstream from Brownlee reservoir, be monitored by evaluating the hatch rate of fall Chinook eggs using artificial redds. We estimate that this monitoring effort would have an annualized cost of $20,000. In the draft EIS, we concluded that substantial water quality improvement would be required before reintroduction of fall Chinook salmon to the Swan Falls to Brownlee reach proceeds, and that existing water quality monitoring efforts underway in the basin should provide adequate information for determining when it would be appropriate to initiate reintroduction studies.

[123] A breakdown of anadromous fish restoration recommendations, including AR/IRU-1 through 7; CTUIR-11 and 12; IDFG-9; Interior-46, 47, 49, and 60; NMFS-14, 16 and 17; NPT-8; and ODFW-1 through 17, 22, 24 and 40, is provided in table 56 in section 3.6.2.6, *Anadromous Fish Restoration*.

Comments from agencies and tribes on the draft EIS outlined their view that conditions in the water column are a poor predictor of water quality conditions within the intragravel incubation environment, which is influenced by other factors such as the amount of fine sediment that is present in the substrate. Comments filed by the Shoshone-Bannock Tribes also pointed to a study (Keller-Bliesner Engineering, 2005) that indicates water quality conditions in the Snake River upstream of Brownlee reservoir have not deteriorated substantially since the 1960s when fall Chinook salmon were successfully spawning upstream of Brownlee reservoir. This study also suggests that water quality may already be improving in the reach between C.J. Strike and Swan Falls dams.

We agree that the amount of sediment in the substrate affects dissolved oxygen levels within the gravel by affecting the flow of water through the substrate and through biological oxygen demand from decomposing organic material. Also, we point out that a reduction in seasonal peak flows caused by water storage at upstream reservoirs operated by the Bureau of Reclamation has likely contributed to the build-up of fine sediment in the intragravel environment and the establishment of rooted aquatic vegetation. Because of these factors, we conclude that, in addition to a substantial improvement in overall water quality (i.e., reduced nutrient and silt loading), substantial improvements in the condition of the intragravel incubation environment in the upstream Swan Falls to Brownlee reach would require one or more substantial high flow events to dislodge rooted aquatic vegetation and cleanse fine sediments from potential spawning areas. This same conclusion applies to the reach between C.J. Strike and Swan Falls dam, although the Keller-Bliesner report cited above suggests that less time may be required to restore spawning habitat in this reach. It is important to understand that Idaho Power's upstream projects on the mid-Snake have little if any effect on the nutrient loading that occurs upstream of the project, and unlike the Bureau of Reclamation projects, they have almost no effect on the magnitude of spring flushing flows due to their limited storage. Based on the discussion above and our analysis of the issue, we maintain that the nexus to project effects for the artificial redd studies proposed by the agencies is not sufficient, and we do not adopt this measure in the Staff Alternative. Restoring fall Chinook salmon to areas upstream of Swan Falls or C.J. Strike dams would require that downstream passage be implemented at those dams. Accordingly, the potential for restoration of fall Chinook salmon to areas upstream of either dam would need to be addressed through the upcoming Swan Falls relicensing proceeding for the C.J. Strike reach or through re-opening the C.J. Strike license for the Bliss reach.

As a means to improve water quality in the Brownlee to Swan Falls reach and other mainstem reaches, NMFS (NMFS-14) and the Nez Perce Tribe (NPT-8a) recommend that Idaho Power provide funding to support TMDL implementation, as developed by ODEQ and IDEQ. Implementation of the phosphorus TMDL would reduce the high nutrient loads that currently result from anthropogenic factors, and thereby act to alleviate toxic hydrogen sulfide and low dissolved oxygen levels. Providing $5 million to $6 million annually to fund TMDL implementation as recommended by NMFS and the Nez Perce Tribe would likely expedite improvements in water quality. These improvements would help to create conditions in the historical fall Chinook spawning habitat upstream of the project that would be suitable for reintroduction, and would have ancillary benefits to other aquatic species including resident native salmonids and white sturgeon. However, nutrient loads delivered from sources upstream of the project are not related to the continuing operation of the Hells Canyon Project or to the operation of Idaho Power's upstream hydroelectric projects. In addition, the funding levels proposed by the agencies appear to go far beyond the amount that would be required to meet Idaho Power's nutrient responsibility under the TMDL. Because of this lack of nexus to project effects, we do not include Idaho Power funding of TMDL implementation in upstream reaches as part of the Staff Alternative. We note that Idaho Power has committed to the removal and disposal of aquatic vegetation that accumulates on the trashracks of its upstream Upper Salmon Falls, Lower Salmon Falls and Bliss projects,[124] which would help reduce

[124] Idaho Power's proposal to remove and dispose of aquatic vegetation that gathers at the project intake was incorporated into the licenses issued for these projects.

nutrient loads delivered to downstream areas. Additionally, we note that unlike the rather broad TMDL funding measure recommended by the agencies, the evaluation of phosphorus trading included in Idaho Power's application for water quality certification, which we adopt as part of the Staff Alternative, would be specifically designed to meet the project's nutrient responsibility determined under the TMDL.

Restoring fall Chinook salmon to areas upstream of Brownlee reservoir may be warranted under the appropriate circumstances. However, water quality and other habitat issues in the Snake River make such an effort premature at this time. Because restoring fall Chinook salmon to areas upstream of Brownlee depends on the future improvement in water quality, we must have a mechanism for monitoring those events, to determine when restoration activities for fall Chinook salmon should be initiated. Therefore, as part of the Staff Alternative, and in lieu of the NMFS and Nez Perce recommended funding, we include a fish habitat monitoring plan whereby Idaho Power would develop and file a report on TMDL efforts in the basin that includes: (1) a schedule and format for filing a status report with the Commission every 5 years, reporting on the water quality monitoring data collected in the basin (with an assessment of how the data relates to the condition of the fall Chinook incubation environment in historical production areas and whether conditions indicate that survival rates may be high enough to support reintroduction); and (2) a description of the specific criteria (e.g., dissolved oxygen levels, phosphorus levels, etc.) that would trigger restoration planning for fall Chinook salmon in the Snake River between Brownlee reservoir and Swan Falls. Idaho Power would consult with NMFS, IDFG, ODFW, ODEQ, IDEQ and the tribes to develop this plan. The Staff Alternative also includes a specific provision that would afford the Commission an opportunity to reconsider restoration of fall Chinook salmon to historical habitat above Brownlee in the future.

Regarding restoration of other anadromous species, habitat in many of the tributaries that steelhead and spring Chinook salmon would potentially be able to access has been degraded through various land and water use activities, particularly in basins above Brownlee dam in which irrigation is extensive (Chandler and Chapman, 2003a). We share NMFS's view that the degraded habitat in many tributaries would limit the potential for successful reintroduction of spring Chinook and steelhead above the project. Because degraded tributary habitat could limit the restoration of spring Chinook salmon and steelhead, state and federal agencies, tribes, and NGOs recommend a variety of tributary habitat enhancement measures. As part of a plan to benefit native resident salmonids, Idaho Power proposes many similar measures in Pine Creek, Indian Creek, the Wildhorse River, and other smaller tributaries to the project. In their draft EIS comments, ODFW, IDFG, and the Shoshone-Bannock Tribes filed information indicating that several other tributaries show potential for anadromous fish restoration or expansion of populations of native resident salmonids. Accordingly, we have expanded Idaho Power's proposed plan to include suitable tributaries in the Powder and Burnt River basins (see section 3.6.2.10, *Tributary Habitat Improvements*).

In the draft EIS, we expressed concern about the apparent lack of comprehensive planning that would be required to reintroduce anadromous fish into the upper Snake River basin. We noted that no resource agency had provided us with any comprehensive resource or recovery plan that clearly defined management goals and strategies, similar to the plan developed for reintroduction of Atlantic salmon into the rivers and streams of New England. We concluded that such a planning effort would be key to the success of a fish reintroduction program of this magnitude, and to fully weigh the costs and benefits of such an undertaking on all stakeholders, including the land owners and water users in the basin.

Numerous parties objected to this rationale for deferring the restoration of anadromous fish to areas upstream of the project. The Forest Service commented that in other proceedings, the utility involved has recognized the lack of passage as being a major project effect, and has worked with the other parties to develop a fish passage plan that is acceptable to all those involved. ODFW commented that the reintroduction of salmonids into Pine, Eagle, Goose, and Daly creeks is of a much smaller scale and scope than the restoration of Atlantic salmon in the northeast, and should not require an extensive, comprehensive reintroduction plan that has region-wide consensus. They further recommended that

Idaho Power be required to develop a fish reintroduction plan with clearly defined management goals and strategies as an article in the new license. NMFS stated that rather than developing a comprehensive reintroduction plan, NMFS did what it typically does in FERC relicensing proceedings by providing its resource management goals and objectives for this relicensing. These include the general goals of avoiding extinction and fostering the long term survival and recovery of Columbia River basin salmon and steelhead and other species, and conserving the ecosystems upon which salmon and steelhead depend, including watershed health. NMFS also offered its specific goals for this relicensing proceeding, including the goal to improve water quality to restore spawning and rearing habitat in historically accessible areas as a vital step toward successfully restoring salmon and steelhead to historically important spawning and rearing habitat upstream of the project.

We recognize that a comprehensive plan is not always needed before implementing measures to restore anadromous fish to areas upstream of a project, and that a proposal to restore passage to a small number of tributaries would not require regional consensus. We also recognize that applicants and stakeholders are often able to attain some degree of consensus and address restoration issues as part of the licensing process. However, we maintain that in this case, there is substantial uncertainty regarding the feasibility of restoring anadromous fish to areas upstream of the project, and that there are substantial stakeholder concerns that would need to be considered and addressed before even a limited reintroduction program could be undertaken. Accordingly, we maintain that until such a plan is developed, it would not be prudent to advocate for the reintroduction of steelhead, spring Chinook salmon, or fall Chinook salmon upstream of the Hells Canyon Project.

We note that many of the measures that we include as part of the Staff Alternative could help lay the groundwork for the eventual restoration of anadromous fish to areas upstream of the project by: (1) providing relevant information; (2) improving habitat conditions in potential restoration areas; (3) constructing facilities that could be used to pass anadromous fish; and (4) increasing the number of fish available for restoration efforts. Measures in the first category include establishing a water quality monitoring station at the head of Brownlee reservoir; compiling water quality data from upstream parts of the basin; monitoring tributary habitat enhancements in the Burnt, Powder, Wildhorse, Indian, and Pine basins; monitoring habitat use by surplus hatchery steelhead and spring Chinook salmon in Pine and Indian creeks; and observing behavior and habitat use, as well as reproductive success, of surplus adult salmon and steelhead released in tributaries to support tribal and recreational harvest fisheries. Measures in the second category include tributary enhancements in the five basins listed above and dissolved oxygen enhancement measures that are implemented upstream of Hells Canyon dam. Measures in the third category include improvement of the adult trapping facility at Hells Canyon dam; installation of a trap and weir (operable year-round) in Pine Creek; and eventual installation of additional passage facilities at Oxbow dam, Indian Creek, and the Wildhorse River. Measures in the fourth category include flow augmentation, continuation of the fall Chinook spawning and incubation flow program, measures to improve dissolved oxygen and total dissolved gas levels, implementation of seasonal ramp rate restrictions, and construction of a new spawning and incubation facility for steelhead and Chinook salmon on the Yankee Fork in the Salmon River basin.

In section 3.6.2.6, *Anadromous Fish Restoration*, we present a phased fish passage plan that would lead to the reintroduction of steelhead and spring Chinook into the tributaries of the project reservoirs. We estimate the annualized cost of developing and implementing this plan at $1.7 million, assuming that all phases are implemented in a sequential manner over a 32-year period.[125] We received

[125] Our cost estimate assumed that 5 years would elapse between the construction of each major upstream and downstream passage facility. Under this timeline, installation of the Powder River smolt trap would not occur within the next 30 years, so the cost of this facility is not included in our estimate.

few comments on the approach that we described. ODFW commented that the timeline for restoring anadromous fish to the Powder River tributaries was too long. ODFW and other parties also provided information indicating that habitat within some tributaries, especially in Pine Creek and some tributaries to the Powder River, currently support native resident salmonids and are currently suitable to support anadromous fish. However, given the potential effects of anadromous fish restoration on other water users in these tributaries, we maintain that the concerns of these stakeholders would need to be addressed before restoration of anadromous fish to project tributaries is undertaken. This effort would also need to include consideration of the number of adult salmon and steelhead that such an effort would be likely to produce, given current or future survival rates that can be expected to occur in the migratory corridor downstream of Hells Canyon dam. Although efforts to improve the downstream migration survival of anadromous salmonid smolts through the lower Snake and Columbia rivers are ongoing, mortality during migration would likely continue to affect the potential benefits of undertaking a restoration, even in streams where habitat is in relatively good condition. Accordingly, we do not include this phased fish passage plan in the Staff Alternative.

Many agencies, tribes, and NGOs also filed recommendations associated with reintroduction of anadromous fish above the project. These recommendations include specific monitoring and evaluation measures, evaluation of reservoir drawdowns for downstream passage (CTUIR-11a and 11c; AR/IRU-8e), developing alternative mitigation if reintroduction efforts fail (ODFW-20), a downstream passage and collection facility at Hells Canyon dam (ODFW-12), survival studies of downstream migrants (ODFW-14), and establishment of specific reintroduction targets (ODFW-2; BPT-7; SPT-3). For the reasons outlined above, we conclude that these recommended measures and their associated costs are premature and, accordingly, we do not include them in the Staff Alternative.

Finally, we do not include recommendations made by the agencies, tribes and NGOs that relate to Pacific lamprey passage or restoration (AR/IRU-13, CTUIR-17, 18 and 19, IDFG-10, Interior-56 and 57, NPT-19 and ODFW-17 and 49). Although we recognize that the counting stations at downstream fish ladders are not fully effective for monitoring lamprey abundance, it appears that very few Pacific lamprey succeed in migrating upstream past the Lower Columbia River and Lower Snake River dams to reach the project area. Accordingly, we do not consider restoration of this species to the project area to be feasible in the near future, and we also conclude that the scarcity of the species is not caused by the existence or operation of the project. Also, it appears that existing screening technology may not be effective for providing downstream passage for lampreys, and as a result we are not able to estimate the cost of providing effective downstream passage for this species.

We consider the effects of the Hells Canyon Project on the population size of Pacific lamprey to be limited. However, it is clear that the project blocks access to a substantial amount of habitat that was historically used by this species, and because larval lamprey burrow in fine sediment deposits, trapping of fine sediments in the project reservoir likely reduces the quantity and quality of rearing habitat downstream of the project. Accordingly, we consider it to be appropriate for Idaho Power to participate in regional forums on Pacific lamprey restoration to keep abreast of new information on the number of lamprey that are returning to use rearing habitat downstream of the project, and information on methods and approaches being developed to conserve and enhance this culturally and ecologically important species. In addition, we recommend that Idaho Power file a report with the Commission every 3 years summarizing the results of research activities that may affect the future potential for implementing measures to benefit Pacific lamprey in habitat that is blocked by the project or that is affected by its operation. The report should include information on the number of Pacific lampreys that have been collected in the Hells Canyon fish trap over the past 5 years and a description of any studies or measures to benefit Pacific lamprey that Idaho Power proposes to undertake in the next 5 years. We estimate the annualized cost of participation in regional forums and the recommended reporting effort to be $5,000, and recommend this measure in the Staff Alternative.

5.2.4.4 Resident Salmonid Passage

Construction of the Hells Canyon Project has blocked upstream passage and impeded downstream movement of native resident salmonids, thereby isolating local populations, inhibiting fluvial life histories, and reducing access to additional habitat and thermal refugia. The primary native resident salmonid species of concern are redband trout and the federally listed bull trout.

Idaho Power proposes a two-phased fish passage plan for transporting resident salmonids above Hells Canyon and Oxbow dams. The first phase would involve collecting bull trout, redband trout, and possibly other species in the Hells Canyon trap after it is modified (see section 3.6.2.7, *Fish Passage Facilities*) and transporting them to areas upstream of Hells Canyon dam. The second phase would involve the construction of a new trap, similar in operation and design to the Hells Canyon trap, at the base of the Oxbow dam to collect fish for transport upstream. However, because of uncertainty surrounding the intent of fish collected in the trap and the status of habitat in tributaries such as the Wildhorse River, Idaho Power proposes delaying construction of the Oxbow trap for a minimum of 5 years following completion of the Hells Canyon trap modifications. Idaho Power also proposes to design, construct, and operate a permanent weir in Pine Creek to monitor the fluvial component of resident salmonid populations.

Interior (Interior-45 and -59), the Forest Service (FS-32), IDFG (IDFG-11 and -13), and ODFW (ODFW-18 and -36a) make recommendations that are consistent with Idaho Power's proposal to develop and implement a passage plan that would use the modified Hells Canyon trap and a newly constructed Oxbow trap to provide upstream passage for resident salmonids. The agencies, tribes, and AR/IRU also recommend that Idaho Power design, construct, and operate tributary weirs additional to the proposed Pine Creek weir (see section 3.6.2.6, *Anadromous Fish Restoration*). Prospective weir sites include Indian Creek, the Wildhorse River, and Eagle Creek. While it is the intent of these agencies, tribes, and NGOs that these weirs would be used to collect juvenile anadromous salmonids, they would also collect migrating native resident salmonids for transport to appropriate locations, as determined in a resident salmonid plan developed in consultation with the agencies and other stakeholders. The agencies also stipulate that the implementation of various plan components should be contingent upon the feasibility of passage measures and the suitability of habitat to which fish would gain access, as determined in consultation with the agencies and other stakeholders. To improve tributary habitat such that the translocation of resident salmonids would be beneficial, Idaho Power proposes, and the agencies and AR/IRU recommend, specific tributary habitat enhancement measures, which we address in the following section and describe in detail in section 3.6.2.10, *Tributary Habitat Improvements*.

ODFW (ODFW-18) further recommends that Idaho Power conduct a population viability risk analysis of genetic and demographic costs incurred by donor and recipient bull trout populations. ODFW (ODFW-36b and 37) also recommends that Idaho Power investigate bull trout mortality associated with spill or turbine passage.

In its preliminary fishway prescription, Interior (Interior-87) prescribed that Idaho Power develop a passage plan within 6 months of the issuance of a new license that would provide for the modification of the Hells Canyon fish trap to allow the collection of bull trout and the construction and operation of a weir at the mouth of Pine Creek, and identify specific habitat conditions that would trigger implementation of passage-related actions in Indian Creek, the Wildhorse River, and the Oxbow bypassed reach. Interior prescribes that the plan: (1) include specifications for construction and operation of permanent weirs and trap-and-haul fishways on these tributaries; (2) establish suitable upstream and downstream release points for adult and juvenile fish; (3) describe the location, functional design, and operating characteristics of all upstream and downstream fishways; and (4) include schedules and milestones for their timely modification, operation, and evaluation. Interior also prescribes that, within 1 year of license issuance, Idaho Power develop a post-construction monitoring plan and implementation schedule to monitor fishway effectiveness.

In response, Idaho Power submitted an alternative section 18 prescription that, like Interior's prescription, would proceed with modifying the Hells Canyon fish trap and construction of the Pine Creek weir. For the Oxbow fish trap and the Indian Creek and Wildhorse River weir and trap fishways, however, Idaho Power specifically identified the types of triggers that would be included in its passage plan to control the timeline of construction. Under Idaho Power's alternative prescription, these triggers would be based on the status of bull trout within these tributaries in terms of their abundance, the potential for hybridization with non-native brook trout, the potential of the fishways to contribute toward recovery, and habitat conditions necessary to support bull trout. Idaho Power's alternative prescription also specifies that development of functional designs and monitoring plans would not be initiated until the trigger criteria for a facility have been met. The plan would also include: (1) final engineering design plans for modification of the Hells Canyon fish trap and the Pine Creek monitoring weir and trap, as well as operating protocols; (2) locations of release points and handling of all lifestages of bull trout and other fish collected at the two facilities; (3) provisions for bull trout transport between Pine Creek and Hells Canyon dam; (4) an assessment of monitoring needed to evaluate the risk of introducing deleterious pathogens; and (5) a post-construction monitoring plan.

Interior incorporated the trigger elements from Idaho Power's alternative section 18 prescription in its modified fishway prescription filed with the Commission on January 3, 2007. The three primary differences from Idaho Power's alternative and Interior's modified prescription that remain are: (1) Interior's modified prescription maintains language regarding the need for appropriate attraction flows in the Oxbow bypassed reach when the Oxbow dam fish passage facility is constructed; (2) the modified prescription specifies that the Pine Creek weir and fish trap would be constructed within 2 years of license issuance; and (3) Interior states that the period of operation for downstream passage facilities would be developed based on further monitoring efforts.

We agree with the approach identified by Idaho Power and included in Interior's modified prescription of establishing a more detailed set of triggers that must be met before the Oxbow fish trap and the Indian Creek and Wildhorse River weirs would be constructed. Inclusion of these more detailed trigger points would be more cost-effective and help ensure that the facilities would provide a biological benefit. In addition, developing functional designs and monitoring plans after trigger criteria for a facility have been met would allow experience and knowledge gained from early phases of the program to be applied to maximize the effectiveness of any facilities that would be constructed. In addition, we agree that there is a need to ensure that flows in the Oxbow bypassed reach are sufficient to allow upstream migrating bull trout to access the upstream passage facility at Oxbow dam after it has been constructed. We agree with Interior that there is no need to delay construction of the Pine Creek weir beyond 2 years after license issuance, and that information on the timing of bull trout movements gained from monitoring at the Pine Creek weir would help determine appropriate periods of operation for the facilities that would be constructed later based on the trigger criteria. Finally, we note that there is insufficient information at this time about the migration timing of bull trout to identify the period of operation prior to construction of the Pine Creek weir and trap fishway.

Interior's modified prescription includes a provision that the licensee employ all measures necessary and appropriate to facilitate effective upstream and downstream fish passage over the full range of river flows for which the project maintains operational control. However, it is unclear what flow range the weir and trap fishway on Pine Creek would be designed under, since Idaho Power does not have operational control over the flows in Pine Creek. Because there is limited information available on the timing of bull trout movements into and out of Pine Creek, we recommend that the Pine Creek weir and trap fishway be designed to provide effective downstream passage over a wide range of flows (encompassing the range of flows that occur at least ninety percent of the time in an average water year). This would also allow monitoring of the reproductive success of surplus hatchery steelhead and spring Chinook that enter Pine Creek, which would help to evaluate the efficacy of this measure for improving forage for bull trout.

As recommended by ODFW (ODFW-18), a risk analysis that considered the genetic and demographic effects of increased immigration and emigration would be useful in developing procedures for translocation within the fish passage plan. However, we conclude that the demographic and genetic benefits of transferring fish that are collected in adult traps or tributary weirs to upstream or downstream populations can be considered based on the population data collected by Idaho Power in its licensing studies, which includes information on the distribution and abundance of bull trout populations and the abundance of brook trout and brook trout hybrids. Furthermore, Idaho Power would collect additional information on population demographics through trigger-related monitoring efforts under Interior's modified fishway prescription, which we include in the Staff Alternative.

ODFW also recommends (ODFW-36b and 37) that Idaho Power evaluate mortality associated with spill and turbine passage. Depending on the release locations of bull trout collected in the dam traps or tributary weirs, evaluating turbine or spill mortality would help to quantify any losses associated with these passage routes. This information would be useful for guiding decisions on optimal release locations for fluvial fish that are collected as they emigrate from project tributaries. For example, radio telemetry studies conducted by Idaho Power found that dam passage was not observed for any of the six radio-tagged bull trout that were released into the project reservoirs, and all six of the redband trout that passed a project dam did so during periods when the project was spilling.[126] Nonetheless, we add the cost of additional radio telemetry studies as a component of the post-construction facility evaluations and trigger-related monitoring associated with Interior's modified fishway prescription, which we include in the Staff Alternative.

The provision of passage for native resident salmonids within the project would reestablish connectivity among currently isolated populations. Due to small population sizes and obstructed immigration and gene flow between populations, bull trout populations are particularly vulnerable to the effects of environmental variations such as low water years and hot meteorological conditions. Providing passage between isolated tributaries and the Snake River would enhance fluvial life histories. Likewise, providing passage would allow bull trout to access additional thermal refugia and forage, as well as spawning and rearing habitat. Collectively, these additional resources could result in increased growth, fecundity, and egg deposition and, consequently, abundance. Although redband trout populations are less sensitive to environmental variation, they would similarly benefit from increased connectivity.

We estimate the annualized cost of the FWS modified fishway prescription to be $1,974,300, and the cost of Idaho Power's alternative fishway prescription to be $1,464,900.[127] The cost of the FWS modified prescription is greater than Idaho Power's alternative because we have assumed that the Pine Creek weir and trap fishway would be designed to function over a wider range of flows than the weir that would be constructed under Idaho Power's alternative prescription. Constructing the Pine Creek weir and trap to function at a greater range of flows would enable monitoring of bull trout emigration to occur over most of the year, and would also enable the weir to be used to evaluate the reproductive success of any surplus hatchery steelhead and spring Chinook that enter Pine Creek to spawn. We conclude that these benefits would warrant the cost difference of $509,400 in annualized costs, so we include Interior's modified fishway prescription in the Staff Alternative.

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[126] In the final EIS, we expanded the text of section 3.6.1.4, *Native Resident Salmonids*, to include the results of this study.

[127] For Idaho Power's alternative condition and Interior's modified prescription, we assume that the Pine Creek weir and trap fishway would be constructed 2 years after license issuance, that the Indian Creek weir and trap fishway would be constructed 10 years after license issuance, and the Oxbow adult trap and the Wildhorse River weir and trap fishway would all be constructed 20 years after license issuance.

5.2.4.5 Tributary Habitat Improvements

As discussed in the preceding section, construction and operation of the Hells Canyon Project has adversely affected bull trout and redband trout populations in the project area, primarily through a loss of habitat connectivity. These species require access to high quality tributary habitat for every life stage and life history. Through a variety of causes, resident salmonid habitat in tributaries to the project has been degraded. The project has contributed to the degradation of habitat quality and ecological function by inundating low-gradient sections of the tributaries, precluding anadromous fish from contributing nutrients and forage important for supporting bull trout, and reducing connectivity among bull trout populations due to adverse water quality conditions in project reservoirs.

As part of its proposed native salmonid plan, Idaho Power proposes to prepare and implement a Tributary Enhancement Plan targeted to benefit bull trout within the project area (Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to project reservoirs). This plan would include a Technical Advisory Committee that would work with landowners adjacent to the tributaries to identify, prioritize, and recommend actions needed to improve bull trout habitat. Specific measures that would be considered in the plan include: (1) construction of irrigation diversion screens; (2) conservation easement agreements; (3) construction of riparian corridor fences (implementation of this measure would also depend on landowner maintenance agreements); (4) purchase or lease of water rights from willing sellers (these water rights would have to be those that can be demonstrated to provide improved instream flow in critical areas, especially those extending the coldwater refuge potential near the upper portions of streams that serve as spawning and rearing areas, and would apply only in Oregon tributaries); (5) land acquisition along key riparian corridors; and (6) instream habitat enhancement measures in critical spawning and rearing areas. The native salmonid plan would also include provisions for brook trout eradication in Indian Creek, a presence/absence survey in Eagle Creek (Powder River basin), and restoration of stream nutrients through distribution of salmon carcasses or alternative nutrient supplements within known rearing areas in the Pine-Indian-Wildhorse core area. We evaluate Idaho Power's proposed measures in more detail, along with related recommendations received from ODFW, IDFG, Interior, and AR/IRU, in section 3.6.2.10, *Tributary Habitat Improvements*, and in section 3.3.2.11, *Marine-Derived Nutrients*.

Bull trout are extremely sensitive to environmental change because of their specific habitat requirements. Water temperature, in particular, may be the most critical factor affecting the suitability of habitat for bull trout. The prospective habitat enhancement measures proposed by Idaho Power and recommended by the agencies would reduce the effects of water- and land-use practices that alter stream temperatures. Depending on the scope of the measures taken, curtailing certain land-use practices and increasing instream flow would also indirectly enhance physical instream habitat by increasing woody debris contribution and vegetative cover, reducing erosion and sedimentation, enhancing natural geomorphological processes, and increasing wetted area. Measures targeted directly at enhancing physical habitat have the potential to increase population abundance by increasing the amount of spawning, rearing, and adult habitat available to bull trout. Although redband trout have generally less-specific habitat requirements, the proposed and recommended physical habitat enhancement measures would similarly enhance habitat for this species as well. Reestablishing connectivity among tributary populations by eliminating barriers and reducing entrainment by screening irrigation diversions would improve the health of the fluvial component and increase the viability of resident bull trout subpopulations.

The bull trout populations that constitute the Hells Canyon Recovery Unit include the Pine-, Indian-, and Wildhorse core area and the Powder River core area. These core areas contain local populations, and are areas identified as containing potential spawning and rearing habitat. ODFW (ODFW-38) recommends that the habitat enhancement efforts include the Pine, Powder and Burnt river basins, and IDFG (IDFG-16) recommends that tributary habitat enhancement measures include the Weiser River. Idaho Power's Tributary Enhancement Plan would include improvements in the Pine

Creek, Indian Creek, and Wildhorse River basins, but would not include measures in the Burnt, Powder or Weiser river basins.

In the draft EIS, we adopted Idaho Power's proposed Tributary Enhancement Plan, on the basis that the three basins identified by Idaho Power have the greatest potential for restoring connectivity among bull trout populations among the basins that are directly affected by the project. We did not recommend that the measure extend into the Weiser, Powder, or Burnt River basins based on our understanding of a limited potential for restoring connectivity among bull trout populations and the more limited effect of the project on habitat in tributaries upstream of the project.

During the 10(j) meeting, ODFW expressed strong interest in the restoration of redband trout in the Burnt and Powder River basins, and stated that they anticipate bull trout would be found in Eagle Creek (a Powder River tributary) during Idaho Power's proposed presence/absence survey. Also, a tribal representative present at the meeting outlined the cultural importance of native resident salmonids, including redband trout, which were relied on by the tribes when anadromous fish were not available. Impacts of the project on redband trout in the Powder and Burnt rivers are similar to the impacts on bull trout in the Pine, Indian and Wildhorse basins, through inundation of part of each stream and reduced connectivity between populations due to poor water quality conditions in Brownlee reservoir. Based on these considerations, we revised the Staff Alternative to include enhancement efforts in portions of these river basins where there is strong potential for rebuilding populations of redband and/or bull trout. We recognize that streams upstream of Brownlee reservoir, including the Weiser River, have been affected by the loss of anadromous fish, but the physical habitat in these streams has not been directly affected by project construction. Consequently, we find that there is less justification to include the Weiser River in the program.

Idaho Power's proposed tributary enhancement program would have a total capital cost of $8.5 million. Although Idaho Power did not specify a time frame for implementation, its response to AIR DR-4 indicates that the funding would be allocated in year 1, which equates to an annualized cost of $928,400. ODFW recommends that Idaho Power contribute $750,000 annually over the term of the license. IDFG does not specify a recommended amount of funding. To estimate the cost of staff's recommendation, which would include enhancement efforts in the Pine, Indian, Wildhorse, Powder, and Burnt river basins, we used Idaho Power's proposed funding level to estimate an average cost per square mile of drainage area for the Pine, Indian and Wildhorse basins, and for the Powder River we applied that cost per square mile to the drainage area of key tributaries identified by the agencies for restoration efforts (Eagle, Goose and Daly Creeks). We assumed that enhancement efforts in the Burnt River basin would be focused in tributaries with a similar drainage area as the Powder River tributaries. For five basins we assumed that expenditures would be spread out over a 10 year period, resulting in a total annualized cost of $1,466, 700. We have also assumed that this funding level would encompass a level of monitoring appropriate for guiding future enhancement efforts.

Implementing staff's recommended tributary habitat enhancement program would help reestablish connectivity among redband and bull trout populations, increase available habitat and population sizes, and increase the viability of subpopulations of native resident salmonids within the Pine, Indian, Wildhorse, Powder and Burnt river basins. Because of the substantial benefits that would be provided to these valuable resources, we conclude that the benefits of implementing the staff-developed measure would justify its costs.

Idaho Power proposes to assemble an interagency and landowner team to help identify opportunities to enhance bull and redband trout populations within these basins, prioritize measures, develop an implementation plan, and monitor the effectiveness of implemented measures. The committee should include landowners and representatives from any state or federal agencies involved in the management of areas selected for enhancement, fisheries management agencies (ODFW, IDFG, FWS and NMFS), interested tribes, and a representative from the conservation groups.

Idaho Power's proposed bull trout presence/absence survey in Eagle Creek would have an annualized cost of $42,700. Such a measure would further bull trout conservation efforts by improving knowledge of the species distribution and assist with identifying appropriate enhancement measures that could be implemented through the Tributary Enhancement Plan. We conclude that the benefits of the survey would justify its cost.

AR/IRU (AR-IRU-11b) and Interior (Interior-41) recommend that anadromous fish be reintroduced upstream of Hells Canyon dam as a means to increase forage opportunities for bull trout. ODFW (ODFW-39) and IDFG (IDFG-17) recommend that nutrient supplementation be implemented in tributaries to improve forage opportunities for bull trout. As we discuss in section 5.2.4.3, *Anadromous Fish Restoration*, we conclude that until a comprehensive resource or recovery plan is put forward for restoring anadromous fish upstream of Hells Canyon dam, it would not be prudent to advocate for the restoration of steelhead, spring Chinook salmon, or fall Chinook salmon populations upstream of the Hells Canyon Project.

As discussed in section, 5.2.4.8, *Hatchery Production*, and section 5.2.4.3, *Anadromous Fish Restoration*, we recommend that Idaho Power consult with the agencies and tribes to determine how to make the best use of surplus hatchery steelhead and spring Chinook salmon, which may include transporting fish for release into the project reservoirs to improve forage opportunities for bull trout, to evaluate anadromous fish production potential in Pine Creek, and to support tribal and recreational harvest fisheries.

Idaho Power's proposal and the resource agency recommendations to supplement nutrients in tributaries using spawned salmon carcasses or nutrient analogs would serve to replace much needed nutrients lost from the system and would increase growth rates, and consequently fecundity, of bull trout and redband trout. Idaho Power's proposed plans for nutrient enhancement would have an annualized cost of $40,000. Because the measure would provide substantial benefits to bull trout at a reasonable cost, we include this measure in the Staff Alternative. Also, carcass plants could be included in the tributary enhancement program for Eagle Creek if bull trout are found there during the proposed presence/absence survey.

Hybridization and competition with nonnative brook trout poses a serious risk to overlapping bull trout populations. Hybridization reduces the fertility and survival of progeny, and brook trout may out-compete and displace bull trout when resources are limited. Any action that limits hybridization by eliminating or reducing brook trout numbers could reduce the risk of extirpation of bull trout populations. Idaho Power's proposed brook trout eradication effort could allow brook trout populations in Indian Creek to be brought under control before bull trout passage to this tributary is restored, which would substantially improve the benefits of providing passage. Idaho Power's proposed plans for brook trout eradication in Indian Creek would have an annualized cost of $51,700. Because of the benefits to be derived by the federally listed bull trout at a reasonable cost, we include Idaho Power's proposed brook trout suppression efforts in the Staff Alternative.

5.2.4.6 Fish Pathogen Assessment

Prospective measures to restore anadromous fish, improve connectivity among resident fish populations, and supplement marine-derived nutrients through carcass outplants have the potential to introduce fish pathogens to areas within and upstream of the project. These pathogens could adversely affect resident fish populations, including the federally listed bull trout.

Before implementing prospective passage measures, Idaho Power proposes to develop, fund, and implement a pathogen risk assessment plan for the Pine, Indian, and Wildhorse Core areas, after consultation with ODFW and IDFG fish pathologists. Following an initial assessment of pathogen risks, Idaho Power proposes follow-up surveys at 5-year intervals if the initial risks associated with upstream passage were deemed acceptable and passage was provided.

IDFG, AR/IRU, and the Shoshone-Bannock Tribes (IDFG-12 and AR/IRU-7d and 9c) support Idaho Power's proposal, but IDFG recommends that Idaho Power begin consultation with the IDFG Fish Health Laboratory prior to issuance of a new license to discuss potential pathogens, sampling protocols, and priority sampling locations. Although supporting the measures proposed by Idaho Power, ODFW (ODFW-21) recommends the expansion of pathogen surveying and monitoring to both native resident and anadromous populations above, within, and below the project. In addition, ODFW recommends that the development of a pathogen assessment plan take place in the first year, and initial assessment in the third year, following issuance of a new license. ODFW also recommends that Idaho Power provide funding for a fish health specialist, supplies, and services associated with production of hatchery fish and the fish passage program, as well as fish health examination and storage areas. In its April 10, 2006, submittal to the Commission, Idaho Power defines the scope of the proposed pathogen assessment as including the Snake River downstream of Hells Canyon dam (including the Imnaha River), Hells Canyon reservoir, and Oxbow reservoir during initial passage and restoration efforts.

By increasing the connectivity among currently isolated native resident salmonid populations, fish passage measures proposed by Idaho Power would increase the risk of pathogen transfer among these populations. As part of Interior's modified fishway prescription, which we include in the Staff Alternative, the bull trout passage plan would include an assessment of monitoring needed to evaluate the risk of introducing deleterious pathogens. We assume that the effort would include monitoring of pathogens among salmonid populations every 5 years, as proposed by Idaho Power. The annualized cost of this expanded measure is estimated at $107,100, $72,400 more than Idaho Power's proposed plan. We include this cost within our estimate of the cost of Interior's modified prescription, and we conclude that the increased cost is justified by the expected benefits.

5.2.4.7 Oxbow Bypassed Reach Flows

Diversion of flow through the Oxbow powerhouse reduces flow in the 2.5-mile-long bypassed reach immediately downstream of the dam, affecting the quantity and quality of habitat available to bull trout. Idaho Power currently releases a minimum flow of 100 cfs through the bypassed reach, and proposes to continue this release over the term of a new license.

Interior (Interior-43) recommends that, within 1 year of issuance of a new license, Idaho Power develop and implement a plan to provide sufficient flow in the Oxbow bypassed reach to meet water quality standards and life history requirements for bull trout. The plan would focus on the duration, timing, and quantity of flow necessary to provide for the movement, foraging, and rearing of adult and sub-adult bull trout in the Oxbow bypassed reach, including unrestricted access to Pine and Indian creeks. Interior (Interior-63) also recommends that Idaho Power provide adequate flows and oxygen supplementation to maintain water quality parameters in the Oxbow bypassed reach.

AR/IRU (AR/IRU-11c) recommend that Idaho Power provide sufficient flows in the Oxbow bypass to allow physical access to the proposed Oxbow fish trap, as well as to maintain adequate water quality for bull trout.

The Oxbow bypassed reach currently provides overwintering habitat for bull trout and redband trout. However, high temperatures and low dissolved oxygen concentrations render this area unsuitable for native resident salmonids during warmer months when they typically seek refuge in Pine and Indian creeks. In section 3.5.2.5, *Oxbow Bypassed Reach Flows*, we note that the poor water quality conditions in this reach are largely a result of the water released from Oxbow reservoir and, at higher reservoir elevations, inundation from the upper end of Hells Canyon reservoir. Study results indicate that increasing flow would provide little improvement in water quality conditions in the bypassed reach. Further, we conclude that increasing bypass flow would not substantially increase the amount of habitat suitable for native resident salmonids because, although increasing flow would increase the wetted width of the bypassed reach, study results indicate that corresponding increases in velocity reduced the suitability of available habitat. We estimate the effect of providing Interior's recommended bypass flows to include a reduction in power benefits of $1.6 million per year.[128] The annualized cost of providing oxygen supplementation, as recommended by Interior, would be $447,800. The overall net power benefit reduction would be $2.05 million. We do not include Interior's recommendation in the Staff Alternative because the limited benefits to native resident salmonids do not warrant the high cost of this measure.

We also conclude that increasing flows in the Oxbow bypassed reach would be unlikely to substantially improve water temperatures for native resident salmonids during the summer months. Also, based on the habitat modeling results from the instream flow study conducted by Idaho Power, we conclude that the proposed minimum flow release of 100 cfs maximizes the amount of overwintering habitat that is available for these species. Accordingly, we include Idaho Power's proposed 100-cfs Oxbow bypass flow in the Staff Alternative. There is no incremental cost of this measure because it is part of the current operation.

As we discuss in section 5.2.3.1, *Dissolved Oxygen Measures*, we adopt the installation and operation of a destratification system to reduce anoxic conditions that currently occur in a deep pool in the Oxbow bypassed reach. Although bull trout are unlikely to use the bypassed reach when temperatures become warm, it is possible that they could hold in deeper areas of the pool and be subjected to mortality when anoxic conditions occur. Destratifying the pool would reduce this potential source of mortality at a low annualized cost of $16,000. Accordingly, we adopt this measure in the Staff Alternative. As part of its modified section 18 fishway prescription, Interior (Interior-87) prescribed measures and operations necessary to provide adequate attraction flow to safely and rapidly attract bull trout into the Oxbow trap for collection and transport. We conclude that following construction of the Oxbow trap, radio-tracking studies would be necessary to demonstrate accessibility, and to ensure that a high percentage of fish are able to locate and enter the trap. We included costs for these types of post-construction facility evaluations along with monitoring related to triggers for their construction in Interior's modified prescription, which we include in the Staff Alternative. Interior also expressed concern regarding the accessibility of Pine and Indian creeks to bull trout seeking refuge from the bypassed reach. These types of passage obstructions would be evaluated and addressed as part of Idaho Power's proposed tributary habitat improvements, which we also include in the Staff Alternative.

5.2.4.8 Hatchery Production

Idaho Power's hatchery system has been in operation since initial attempts to provide passage were discontinued several years after Brownlee and Oxbow dams were constructed. The intent of the hatchery production was to mitigate for the loss of upstream production of salmon and steelhead and provide fish for harvest.

Idaho Power proposes to continue anadromous fish production at its hatchery facilities at the same levels specified in the 1980 Hells Canyon Settlement Agreement and the current license. This includes producing 3 million spring Chinook salmon smolts at the Rapid River Hatchery, 1 million summer Chinook salmon smolts at the Pahsimeroi Hatchery, 1 million fall Chinook smolts at the Oxbow hatchery, and 400,000 pounds of steelhead smolts. Idaho Power also proposes to make improvements to their hatchery facilities and to hire a full-time biologist to conduct monitoring and evaluation studies of their hatcheries' performance. We summarize the proposed improvements and agency recommendations pertinent to hatchery production and operations in section 3.6.2.12, *Hatchery Production*.

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[128] Our estimate is based on the following assumptions: (1) an additional 900 cfs would be required from May through October; (2) Idaho Power's power factor of 0.0072 MW/cfs (Bowling and Whittaker, 2005) would apply; and (3) the overall power value is $53 per MWh.

Idaho Power's proposals and agency and tribal recommendations to upgrade, modify, and in some cases expand, its hatchery facilities or operations would increase efficiencies, capacities, and staff safety to better meet current and future production goals, as well as monitoring and evaluation requirements. Updating facilities with more current technology could also decrease fish handling stress and mortality.

In the draft EIS, we recommended that Idaho Power develop a hatchery management plan. In final EIS section 3.6.2.12, *Hatchery Production*, we note that to conform with the requirements of the ESA, Idaho Power's hatcheries need to be operated in compliance with Hatchery and Genetic Management Plans that would be developed by IDFG and NMFS. Under NMFS's final 4(d) rule, the plans are required to include clearly stated goals, performance objectives, and performance indicators that define the purpose of the program, its intended results, and measurement of performance in achieving those results. Consultation among Idaho Power, the fisheries management agencies, and interested tribes to outline the goals and objectives for each hatchery would help ensure that such goals and objectives are accurately reflected in the Hatchery and Genetic Management Plans. This consultation also would help ensure that the Hatchery and Genetic Management Plans are consistent with Idaho Power's responsibilities under a new license, as well as reflect the management goals of the agencies and tribes. Accordingly, we recommend that Idaho Power consult with these parties to define the goals and performance objectives for the plans that would govern operation of Idaho Power's hatchery program. We also recommend that Idaho Power file the results of this consultation, annual reports on the hatchery program (including adult returns), as well as the draft and final Hatchery and Genetic Management Plans, with the Commission so that we can ensure that the plans and the overall hatchery program conform to license requirements. Because the 4(d) rule requires that hatcheries be operated in compliance with the plans approved by NMFS, we conclude that funding the implementation of measures included in the Hatchery and Genetic Management Plans is an appropriate component of Idaho Power's responsibility. We estimate the incremental annualized cost of funding the development and implementation of the four Hatchery and Genetic Management Plans at $66,700. This would be in addition to the estimated $2.33 million annual cost of Idaho Power's hatchery proposals. We include Idaho Power's hatchery proposals in the Staff Alternative, along with funding for the development and implementation of the Hatchery and Genetic Management Plans.

We do not include recommendations made by Interior (Interior-48), and ODFW (ODFW-26) that would require Idaho Power to replace hatchery production goals based on smolt production with goals based on adult escapement or returns to sport and commercial fisheries. Replacing hatchery production goals with escapement goals to the hatchery or to fisheries would be difficult, given the external management and environmental factors that affect escapement success in any given year. As a result, we are not able to estimate the cost of Interior or ODFW's recommended measures.

The Shoshone-Bannock Tribes (SBT-4) recommend that Idaho Power develop two hatcheries in Yankee Fork and Panther Creek for the purpose of recovering wild stocks of sockeye and Chinook salmon and steelhead. Although the cost of these facilities would depend upon their size and production capacity, we concluded in the draft EIS that the annualized costs would likely exceed $1 million even for modest-sized hatcheries. The Yankee Fork, a tributary to the Salmon River near Sunbeam, Idaho, historically supported populations of spring/summer Chinook salmon. Panther Creek flows into the Salmon River east of the confluence of the Middle Fork Salmon River. Runs of Chinook salmon and steelhead in Panther Creek were largely eliminated as a result of mining activities in the drainage beginning in the 1940s. The tribes report that restoration activities have resulted in near complete restoration of these tributaries, and that they could again support native fish populations. Although we concluded in the draft EIS that habitat in the Yankee Fork and Panther Creek has not been directly affected by construction or operation of the Hells Canyon Project, we did not consider the fact that the project affects river flows and water quality conditions in the migratory corridor of Yankee Fork and Panther Creek salmonids downstream of the confluence of the Salmon and Snake rivers. These effects include elevated total dissolved gas levels during high spill periods and reduced flows during the smolt outmigration period caused by flood control operations.

During tribal consultation meetings held in March 2007 with the Shoshone-Bannock Tribes, the tribes indicated that they have been involved in extensive habitat restoration work on the Yankee Fork, including some out-planting of steelhead and Chinook salmon using streamside incubation boxes. The tribes also indicated that the state and federal hatcheries frequently do not have eggs available to support these efforts. They stated that of the two streams, the Yankee Fork is the stream where enhancement efforts would be most important to them. They also clarified that the focus of their program is on rebuilding the ESU, using low-tech techniques such as stream-side egg incubators to rebuild the number of wild-reared fish that return to the stream. We estimate that constructing and operating the facilities needed to spawn and incubate 1,000,000 salmon and steelhead eggs per year on the Yankee Fork would have an annualized cost of approximately $89,600.[129] Based on survival rates estimated by Galindo and Rinehart (1998) for steelhead produced by the streamside incubator program, 1,000,000 eggs would result in the return of 2,060 adult salmon or steelhead to the Yankee Fork, contributing to rebuilding the ESU.

In section 3.6.2.12, *Hatchery Production*, we discuss some of the benefits of the tribes' streamside incubator program, which takes advantage of available instream habitat to cost-effectively rear smolts that are hardier and more fit to survive outmigration. Because of this improved migration survival and the relatively low cost of streamside incubators, the tribes' program is likely to produce adult returns more cost-effectively than a program that produces hatchery-reared smolts. The fish that are produced through the tribes' program are also more suitable for rebuilding the listed ESUs, and may contribute to their eventual delisting. Providing facilities for spawning and incubating eggs to the eyed stage would provide a more reliable source of eggs than existing sources, and thus improve the success of the tribes' existing streamside incubator program. Because of the project's effects on the migratory corridor, the cost-effectiveness of the measure, its potential for rebuilding the listed ESUs, and the cultural benefits to the Shoshone-Bannock Tribes, we conclude that construction and operation of low-tech spawning and incubation facilities on the Yankee Fork is warranted, and we include it in the Staff Alternative.[130] We also recommend that Idaho Power include Yankee Fork hatchery production numbers in the annual report on its hatchery program.

During tribal consultation meetings held on March 29 and March 30, 2007, the Burns Paiute and Shoshone-Paiute tribes expressed concern about the long-time line associated with restoration of anadromous fish to their ancestral fishing grounds upstream of the project. The Burns Paiute are particularly interested in anadromous fish restoration efforts on the Malheur River, and the Shoshone-Paiute are interested in restoration efforts in the Owyhee River to establish subsistence and ceremonial fisheries.

In the past, surplus adult spring Chinook salmon and steelhead returning to Idaho Power's hatchery system have been used to support tribal and recreational fisheries. Between 1985 and 1990, a total of 6,617 surplus adult spring Chinook salmon were released into tributaries in the Salmon River basin including the Yankee Fork, Panther Creek, and the Lemhi River (Abbott and Stute, 2003). Between 1966 and 2000, IDFG released a total of 45,588 surplus adult steelhead to support recreational fisheries in Hells Canyon reservoir and in the Boise and Payette rivers (Abbott and Stute, 2003). We have found no

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[129] The $1 million cost estimate that we provided in the draft EIS was an order-of-magnitude estimate for a traditional hatchery that includes facilities for adult collection and holding, incubation, and concrete raceways for rearing fish to smolt size. Our revised cost does not include the facilities or operational costs associated with rearing, which occurs in the stream environment in the tribe's streamside incubator program.

[130] We note that like Idaho Power's other mitigation hatcheries, the Yankee Fork facilities would need to be operated in compliance with a NMFS-approved HGMP.

information in the record that indicates whether these practices have continued since 2000, or whether Idaho Power has borne the cost of transporting and releasing surplus hatchery spring Chinook salmon and steelhead in the past. Using surplus hatchery fish to provide fisheries to the tribes that historically fished in areas upstream of Hells Canyon dam would allow the tribes to resume subsistence and ceremonial fisheries that are clearly of substantial cultural importance.[131] Idaho Power has indicated that it is prepared to make fish available, based on consensus reached among agencies and the tribes. We estimate that developing and implementing a plan to collect surplus anadromous fish that return to Idaho Power's hatchery system or the Hells Canyon trap and to transport and distribute them to select tributaries in the project area and Snake River basin would have an annualized cost of $80,900.[132]

Given the reasonable cost of the measure and the substantial benefits to be derived, we conclude that a plan to distribute surplus hatchery fish is warranted. Moreover, we realize there are many demands for these fish. In the draft EIS, we recommended that the hatchery management plans, as described above, address the distribution of surplus fish. We now recommend the development of a separate plan that addresses the use of surplus fish, and include the measure in the Staff Alternative. We recommend that the plan be developed in consultation with the Shoshone-Paiute, Burns Paiute, Shoshone-Bannock, and Nez Perce tribes. ODFW, IDFG, NMFS and Interior should also be consulted to ensure that actions implemented through the plan are consistent with fisheries management objectives, bull trout recovery, and other ongoing restoration efforts.

5.2.4.9 Warmwater Fisheries

Seasonal changes in water levels in Brownlee reservoir may affect the reproductive success of warmwater fish species including smallmouth bass, black crappie, white crappie, and channel catfish. These species support a substantial recreational fishery that is important to the economy of local communities.

To promote spawning success for warmwater fish species, Idaho Power proposes to limit the drawdown of Brownlee reservoir during the spawning period. Beginning on May 21, reservoir spawning habitat would be protected for a 30-day period, during which time the reservoir would not be drafted more than 1 foot from the highest elevation reached during the 30-day period, although exceptions would be allowed for system or economic emergencies. From the end of the 30-day period though July 4, the reservoir could be drafted more than 1 foot, but an elevation of at least 2,069 feet msl would be maintained through July 4. Idaho Power also proposes to continue warmwater fish population monitoring to detect long-term effects on fish populations, including annual electrofishing surveys in all three project reservoirs and surveys in the Swan Falls-to-Brownlee reach every fifth year.

ODFW (ODFW-51) and IDFG (IDFG-27) recommend the same operating constraints that Idaho Power proposes to protect warmwater fish spawning, although ODFW recommends that drawdown of Brownlee reservoir to levels below elevation 2,069 msl be allowed if flow augmentation (for salmon migration) occurs before July 4. ODFW also recommends that Idaho Power conduct annual creel surveys in all three project reservoirs (ODFW-50) and studies of the food habits of warmwater fish species, including the effects of reservoir operations on zooplankton production (ODFW-52).

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[131] As identified in section 3.6.2.12, *Hatchery Production*, there are likely to be other benefits to out-planting surplus hatchery fish, including those associated with (1) adding marine nutrients to the system; (2) improving foraging opportunities for bull trout; (3) evaluating spawning success, egg viability and survival, and smolt outmigration and survival in Pine Creek; and (4) supporting recreational fishing opportunities in the project area.

[132] This estimate was based on the delivery of up to 30 truck loads of 50 to 300 adult spring Chinook salmon or steelhead to select tributaries in the project area from the Hells Canyon dam fish trap or from other traps that are part of Idaho Power's hatchery system in the Salmon River basin.

In section 3.6.2.1, *Effects of Project Operation on Aquatic Resources*, we conclude that limiting reservoir fluctuation to a maximum of 1 foot from May 21 through June 20, as proposed by Idaho Power and recommended by ODFW and IDFG, would minimize adverse effects to smallmouth bass over their entire spawning season and limit adverse effects to crappie in the latter half of their spawning season. Limiting drawdown to elevation 2,069 (an 8-foot drawdown from full pool) through July 4 should protect early-spawning channel catfish but would afford little protection to later spawning fish, since their spawning period extends to the end of July and nests may remain active until mid-August. Our analysis of proposed and alternative operating scenarios, however, indicates that there is a relatively small potential for adversely affecting channel catfish, even with the drawdown associated with flow augmentation.

Because the proposed limitations are similar to current operations, any incremental cost of this restriction would be negligible. Therefore, we include this Brownlee reservoir warmwater fish spawning protection measure in the Staff Alternative.

To address the potential for conflict between this measure and other operating requirements in the Staff Alternative, and to address ODFW's (ODFW-51) concern that the limitation not restrict flow augmentation releases, we also indicate in the Staff Alternative that the requirement for warmwater fish spawning protection would be secondary to any conflicting operational requirements.

We do not include ODFW's recommendations (ODFW-50 and ODFW-52) to conduct annual creel surveys in all three project reservoirs and to conduct studies of the food habits of warmwater fish species, including the effects of reservoir operations on zooplankton production. We conclude that, due to the inherent variability in creel surveys, Idaho Power's proposed fish population monitoring effort using electrofishing techniques would provide more reliable information on the status of warmwater fisheries at a substantially lower cost. We also see no benefit to conducting a food habits study of warmwater fish species. Based on fish condition factors measured in Idaho Power's studies, it appears that warmwater fish populations are not limited by food supply. We do not see how either of these measures would provide any benefit to reservoir fisheries beyond the measures that are already proposed by Idaho Power. We estimate that ODFW's recommendations would have an annualized cost of $278,500.

In its comments on the draft EIS, ODFW expresses support for staff's recommendation for warmwater fish monitoring, as long as Idaho Power coordinates annually with ODFW and includes appropriate sampling techniques for monitoring the abundance of channel catfish, a species identified in Idaho Power's angler survey effort as important for anglers. During the 10(j) meeting, Idaho Power indicated that its sampling effort could be modified to include gill netting to sample catfish at minimal additional cost. This is a minor adjustment in staff's recommendation for warmwater fish monitoring that would yield valuable information on the project's fisheries. The measure could be implemented at little additional expense.

In its comments on the draft EIS, Interior reiterates its recommendation (which we discuss in section 3.10.2.11, *Warmwater Fisheries Management Plan*) that Idaho Power be required to: (1) implement an adaptive management program to identify impacts of project operations on the warmwater fishery; (2) develop a mitigation plan for any impacts as the result of project operations; and (3) consult with BLM to ensure that recreational fisheries are provided wherever possible. Based on our analysis in sections 3.6.2.1, *Effects of Project Operations on Aquatic Resources,* and 3.10.2.1, *Effects of Project Operations on Recreation Resources*, we conclude that the warmwater fishery (especially for crappie) is affected primarily by the type of water year due to flushing of fish from the reservoirs in high flow years. In addition, our analysis indicates that drawdowns for flow augmentation and power generation purposes have only a minor effect on the warmwater fishery. Moreover, our analysis shows that drawdowns for power generation purposes are relatively minor compared to those that occur for flood control, flow augmentation, or for the fall Chinook salmon spawning flow program. Drawdowns for each of these purposes are necessary to support important project functions, including the protection and enhancement of federally listed fall Chinook salmon downstream of Hells Canyon dam. As noted above, we adopt in the Staff Alternative Idaho Power's proposal to limit drawdowns during the crappie spawning period to avoid nest dewatering. We conclude that limiting drawdowns during the crappie spawning period appears to be the only feasible operational measure that could improve the warmwater fishery without adversely affecting other major project purposes. However, annual consultation with the agencies on the results of warmwater fisheries monitoring efforts would provide a forum for the effects of project operations on the warmwater fishery to be considered, and may identify opportunities for reservoir levels to be managed in ways that reduce adverse effects on the warmwater fishery.

5.2.4.10 Sturgeon Conservation Measures

Construction of the Hells Canyon Project, 10 other dams on the Snake River downstream from Shoshone Falls, and other mainstem dams on the Columbia River has eliminated upstream connectivity and gene flow among sturgeon populations over most of their historical range in the basin. Idaho Power's monitoring studies indicate that little or no recent recruitment has occurred in seven of the nine populations that are isolated by mainstem dams between Shoshone Falls and Lower Granite dam (refer to section 3.6.2.13, *Sturgeon Conservation Measures*).

Idaho Power established a technical committee to address sturgeon conservation issues associated with its mainstem hydroelectric projects within the historical range of the white sturgeon, which includes the Hells Canyon Project and five upstream developments (Upper Salmon Falls, Lower Salmon Falls, Bliss, C.J. Strike, and Swan Falls). In consultation with the technical committee, Idaho Power developed a conservation plan that identifies the following conservation measures, which are part of Idaho Power's proposal for the Hells Canyon Project: (1) assessment of water quality-related impacts on early life stages of white sturgeon in the Swan Falls to Brownlee reach; (2) translocation of reproductive-sized white sturgeon to the Swan Falls to Brownlee reach to increase spawner abundance and population productivity; (3) development of an experimental conservation aquaculture plan; (4) periodic population assessments; and (5) monitoring of genotypic frequencies.

Recommendations by agencies, tribes, and NGOs relating to sturgeon conservation are summarized in section 3.6.2.13, *Sturgeon Conservation Measures*. The recommendations address Idaho Power's proposed measures, but also identify several additional measures, including evaluating the need for passage or anti-entrainment measures, measures to improve water quality, monitoring of contaminant bioaccumulation, and changes in operations to improve reproduction at Idaho Power's upstream projects.

Regarding actions associated with the upstream Idaho Power projects, Article 407 of the licenses issued for the Upper Salmon Falls, Lower Salmon Falls and Bliss Projects and Article 408 of the license issued for the C.J. Strike Project require Idaho Power to develop a white sturgeon conservation plan to include appropriate measures for the protection and enhancement of white sturgeon in the Snake River. Idaho Power filed an updated version of the plan in compliance with these license articles in August 2005, which identified measures that would be implemented as part of Idaho Power's mid-Snake projects. The Commission accepted the plan on May 31, 2006, with the addition of a requirement for filing annual reports on activities undertaken in the previous year. Accordingly, we do not include any measures associated with the upstream projects in the Staff Alternative.

The results of Idaho Power's sampling program indicates that the sturgeon population is particularly depressed in the Swan Falls dam to Brownlee segment and in all three of the Hells Canyon Project reservoirs. The lack of recruitment in the Swan Falls reach despite the presence of adult sturgeon and appropriate spawning habitat suggests that water quality conditions may be affecting spawning success or the survival of early lifestages. Idaho Power proposes a phased approach to rebuilding the white sturgeon population in the Swan Falls to Brownlee reach, which would start with studies to evaluate the effects of water quality conditions on spawning success and survival of early life-stages. Based on the results of these studies, adult sturgeon would be translocated from a donor population, or, if current water quality conditions would not support natural reproduction, a conservation aquaculture program would be implemented to rebuild white sturgeon populations in the Swan Falls to Brownlee reach. Idaho Power does not propose any measures to rebuild sturgeon populations in the project reservoirs.

In section 3.6.2.13, *Sturgeon Conservation Measures*, we conclude that implementation of a conservation hatchery program has the potential to rebuild sturgeon populations in the reaches between Swan Falls and Hells Canyon dams more rapidly than the translocation program proposed by Idaho Power. In the draft EIS, we did not include Idaho Power's proposed translocation plan in the Staff Alternative. However, based on their comments on the draft EIS, we recognize that IDFG and ODFW have concerns about potential genetic implications of stocking hatchery fish. Thus, so that both approaches are fully considered, we include in the Staff Alternative a measure that would require Idaho Power to conduct a feasibility assessment to assess the risks and benefits of both the translocation and conservation aquaculture approaches, and to select the most appropriate approach for restoring white sturgeon populations in the reaches between Swan Falls and Hells Canyon dams. The feasibility assessment would be prepared in consultation with IDFG, ODFW, FWS and interested tribes, and would be filed with the Commission for approval. We estimate that the annualized cost of preparing the feasibility assessment would be $2,200. Because the aquaculture approach has the potential to provide greater benefits to tribal and recreational fisheries, we conclude that the cost of preparing the feasibility assessment is justified. If an aquaculture program appears feasible, Idaho Power would develop an aquaculture implementation plan that describes: (1) a schedule and an approach for broodstock collection; (2) rearing facilities and rearing methods; and (3) a release schedule. If the translocation approach appears to be more feasible, Idaho Power would develop a translocation implementation plan that describes the schedule and details of the program, including the number, size, and source of sturgeon to be translocated between reaches. In either case, the implementation plan would be developed in consultation with the fisheries management agencies and interested tribes, and would be filed with the Commission for approval.

We estimate the annualized costs of implementing a sturgeon aquaculture plan to be between $28,000 and $42,000, depending on whether stocking is focused on the Swan Falls to Brownlee reach, or whether stocking in Oxbow and Hells Canyon reservoirs is included. We estimate the annualized cost of implementing Idaho Power's proposed sturgeon translocation program to be $20,600. Implementing either approach would assist with rebuilding sturgeon populations in the reaches between Swan Falls and Hells Canyon dams, where populations are currently depressed. Because rebuilding sturgeon populations in these reaches would contribute to restoring valuable sturgeon fisheries, we conclude that implementing the approach that is selected based on a feasibility study is warranted. Therefore, we include such measures in the Staff Alternative. Idaho Power proposes to conduct population monitoring in each of the reaches between Swan Falls and Lower Granite dams at 10-year intervals. The population monitoring effort proposed by Idaho Power would help determine the effectiveness of implemented measures, as well as facilitate an assessment of whether any changes in approach are warranted for rebuilding populations of white sturgeon in reaches affected by the Hells Canyon Project. Accordingly, we conclude that the sturgeon population monitoring effort proposed by Idaho Power, which would have an estimated annualized cost of $95,900, is warranted, and we include it in the Staff Alternative.

Idaho Power also proposes to assess the effects of water quality conditions on the early lifestages of sturgeon and to monitor the genetic makeup of sturgeon sampled during population monitoring. In the draft EIS, we concluded that these measures would not be needed if Idaho Power were to proceed directly with an aquaculture program. However, these studies would help to determine the feasibility, and guide the implementation, of a translocation approach for rebuilding white sturgeon populations. The water quality study would help Idaho Power, the resource agencies, and tribes assess the potential for achieving successful reproduction in the Swan Falls to Brownlee reach. Genetic monitoring would aid in assessing any effects of translocation on the genetics of sturgeon populations in each reach, and guiding any adjustments that are needed. Although we typically view genetic studies to be a responsibility of the management agencies, in this case we recognize that genetic monitoring is an integral component of Idaho Power's proposal, and would help guide the implementation of measures to address project effects on white sturgeon. We estimate that the annualized cost of conducting the study of water quality effects on early lifestages of sturgeon would be $24,000. The annualized cost of genetic monitoring would add $2,300 to the cost of the proposed population monitoring effort. Because these measures would assist with implementing and guiding measures designed to rebuild sturgeon populations and their cost would be relatively minor, we conclude that these measures are warranted and include them in the Staff Alternative.

Several parties also recommended that the conservation plan be updated to include their recommendations (CTUIR-13, IDFG-24, Interior-51, NPT-18, ODFW-42), and Interior (Interior-52) recommended that Idaho Power develop an action plan to coordinate implementation. However, as discussed above, we recommend that Idaho Power prepare a feasibility assessment to assess the risks and benefits of translocation and conservation aquaculture approaches for restoring white sturgeon populations in the reaches between Swan Falls and Hells Canyon dams. We also recommend that as part of the sturgeon monitoring effort, Idaho Power hold annual meetings of the white sturgeon Technical Advisory Committee to review the results of monitoring and enhancement efforts, which we expect would guide future management efforts. Also, we recommend that Idaho Power file with the Commission an annual report on the approved monitoring and enhancement efforts, as well as any recommendations for revising the monitoring or enhancement measures, based on monitoring results. We conclude that these annual meeting and reporting efforts would be sufficient to guide and coordinate the implementation of appropriate sturgeon conservation measures at the Hells Canyon Project. Accordingly, we do not recommend that the white sturgeon conservation plan be updated or an action plan be developed at this time.

We do not include AR/IRU (AR/IRU-12e) and Interior's (Interior-50b) recommendations that Idaho Power evaluate the potential need for, and benefits of, implementing measures to protect sturgeon from entrainment and impingement. The potential for impinging juvenile sturgeon could increase substantially if trash rack spacing were reduced in an attempt to limit entrainment. Installing a fish screening system that provided sufficiently low velocities to limit the impingement of juvenile sturgeon would involve modifications with costs on the order of tens of millions of dollars for each development. We conclude that the conservation aquaculture program would provide a far more cost-effective means for rebuilding sturgeon populations to levels that would support viable recreational and tribal fisheries throughout the species' historical range in the Snake River.

We do not include AR/IRU or ODFW's (AR/IRU-12d and ODFW-19) recommendations to conduct a study to determine whether white sturgeon passage is feasible and desirable. We conclude in section 3.6.2.13 that, due to a lack of proven technology, the construction of upstream passage facilities is not currently a viable means of restoring Snake River sturgeon populations or for maintaining the genetic variability. Further, we conclude that providing sturgeon passage, even if it were to become technically feasible, would not be as effective as a conservation aquaculture program for rebuilding sturgeon populations.

In the draft EIS, we did not adopt ODFW's recommendation (ODFW-43) that Idaho Power evaluate bioaccumulation of contaminants in white sturgeon in Hells Canyon and Oxbow reservoirs and between Brownlee and Swan Falls dams. We concluded that determining whether bioaccumulants are likely to inhibit sturgeon reproduction was not needed if sturgeon populations were to be rebuilt by stocking. We also concluded that monitoring contaminants in shorter-lived species would provide a better means of monitoring contaminant levels in the environment and assessing risks to the angling public and fish-eating wildlife. During the 10(j) meeting, however, the agencies and tribes noted that contaminant levels in sturgeon are a concern because the Nez Perce Tribe has a consumptive fishery, and the potential effects on reproduction are important if a translocation approach for restoring sturgeon is considered.

Although we acknowledge the potential benefits of monitoring bioaccumulants in sturgeon and warmwater fish species in Brownlee reservoir, we note that Idaho Power should not bear the full cost of this monitoring effort because they are not responsible for the introduction of these contaminants into the environment. However, it would require minimal effort for Idaho Power to collect tissue samples for analysis during its proposed monitoring of white sturgeon populations and warmwater fish species in Brownlee reservoir. Accordingly, we recommend that Idaho Power, if requested by IDEQ or ODEQ, collect tissue samples during the proposed sturgeon population monitoring efforts and make the samples available to the state agencies for their use in analyzing contaminant bioaccumulation.

5.2.4.11 Invertebrate Monitoring

The invertebrate community downstream of Hells Canyon dam includes a number of special status mollusk species. The composition of the aquatic invertebrate, periphyton and macrophyte communities serve as an indicator of water quality conditions as well as a food resource that is available to native species of fish, including juvenile fall Chinook salmon, bull trout, redband trout, and white sturgeon. Long-term monitoring can be useful for tracking ecological responses to changes in basin conditions and project operations, and the implementation of aquatic resource enhancement measures. Idaho Power does not propose any such monitoring efforts.

AR/IRU (AR/IRU-14) recommend that an adaptive management approach be employed to assess and mitigate project effects to the benthic community in the Snake River within and downstream of the project. Interior (Interior-70, -71, -72 and -73) recommends several monitoring programs associated with a recommendation to evaluate a series of three operational modes. Interior also recommends establishment and monitoring of experimental populations of Hells Canyon rapids snail and short-faced limpet within 10 miles downstream of Hells Canyon dam (Interior-74), and of western ridged mussel in appropriate habitat (Interior-75). Monitoring of the experimental populations would be conducted during the three operational test periods and continued for the term of the license or as determined to be appropriate.

We find it difficult to assess the potential benefits of AR/IRU's recommendation without knowing what specific measures would be implemented. For this reason, we do not include this measure in the Staff Alternative.

In the draft EIS, we concluded that Idaho Power had provided sufficient information to allow us to assess the effects of load following and other operations on aquatic resources, so we did not include Interior's recommended multi-year study of operating modes in the Staff Alternative. However, comments received on the draft EIS include information suggesting the shallow water habitats that are most affected by load following operations may include areas that are especially important for some rare and sensitive species of mollusks and for invertebrate production. This information also suggests that dewatering of these areas may have a disproportionately large effect on the food supply that is available to fall Chinook salmon juveniles and bull trout.

Idaho Power's studies did not evaluate the effects of project operations on invertebrates in shallow areas along the Snake River downstream from Hells Canyon dam. If exposure of these shallow areas during load following operations adversely affects invertebrate production, as available literature suggests, this would affect the food supply for rearing fall Chinook salmon and other fish species including redband and bull trout. The reduction in growth rates of fall Chinook salmon observed in the Hells Canyon reach in recent years suggests that any reduction in the available food supply is likely to affect growth rates and survival of fall Chinook salmon. In addition, flow fluctuations could adversely affect habitat conditions for several sensitive species of mollusks. For these reasons, we recommend, as part of the Staff Alternative, that Idaho Power develop and implement an invertebrate monitoring plan.

The plan should be developed in consultation with state and federal fisheries agencies, and should include annual monitoring efforts in order to encompass a wide range of hydrologic and operating conditions. The plan should include annual reporting of the results of monitoring efforts, a description of any recommended adjustments to the monitoring effort, and a description of any measures that are identified by Idaho Power, the resource agencies, or tribes to address project effects on invertebrates, including sensitive mollusks. We estimate that the annualized cost of implementing the staff-recommended invertebrate monitoring plan would be $57,000. Because implementing the plan would improve our understanding of project effects and could lead to improved management of project operations in a way to benefit important natural resources, we conclude that the benefits of implementing the invertebrate monitoring plan warrants its cost.

We do not concur, however, with the Interior and the Forest Service recommendations (Interior-44 and -66 and FS-30) to establish specific study durations for baseline invertebrate sampling and for sampling with dissolved oxygen enhancement measures in place and with run-of-river operations. We conclude that a well-designed study program, with a year or more of baseline data, should be sufficient to document changes in the invertebrate community prior to dissolved oxygen implementation, and we expect that the schedule for implementing dissolved oxygen enhancement measures would be established in the 401 water quality certificate. We also conclude that a well-designed monitoring program could assess the effects of load following operations without imposing a multi-year test period of run-of-river operations. This can be accomplished by comparing and evaluating species composition and abundance in areas that have been dewatered at different frequencies over a range of hydrologic year-types, as part of the invertebrate monitoring plan included in the Staff Alternative.

We see little benefit in Interior's recommendation that Idaho Power establish experimental populations of Hells Canyon rapids snail, short-faced limpet, and western ridged mussel downstream of Hells Canyon dam. In section 3.6.2.15, *Benthic Community Monitoring*, we point out that a wide range of variables could affect the success or failure of an experimental population, and this approach is premature and would not be an effective or efficient way to monitor trends in habitat condition over time. However, staff's recommended invertebrate monitoring plan could include provisions for the reintroduction of rare and sensitive mollusks if the results of water quality monitoring indicate that habitat downstream of Hells Canyon dam has improved to a point where it is likely to support their reintroduction.

5.2.5 Terrestrial Resources

5.2.5.1 Special Status Plant and Wildlife Protection

Idaho Power has documented the presence of a number of special status plants and animals in the project area.[133] In section 3.7.2.2, *Special Status Plant Protection*, we conclude that project operations, project-related maintenance, management activities, and recreational activities have the potential to disturb rare plant populations or to disturb the habitat that supports them. Idaho Power proposes to establish a rare plant advisory board that would coordinate the efforts of resource management agencies, local landowners and land managers, and other interested individuals and organizations in protecting sensitive species within the river corridor between the headwaters of Brownlee reservoir and the Salmon River confluence.

Additionally, Idaho Power identified 68 special status wildlife species in the project vicinity (section 3.7.2.8, *Special Status Wildlife*). Idaho Power does not propose to develop focused management plans for any special status wildlife species, but proposes to implement cooperative measures for

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[133] Species with special status includes those that federal or state agencies have listed as threatened, endangered, proposed, or candidates for listing, and those designated as sensitive, rare, or in need of special management.

mountain quail and waterfowl, and has identified several specific projects needed to protect wintering big game, bald eagle nests and roosts, bat hibernacula, neotropical migrant songbirds, and colonial nesting waterbirds.

Federal land managers (Interior and the Forest Service) and other parties provide numerous recommendations regarding the protection and management of special status species. We review these in sections 3.7.2.2, 3.7.2.8, and 3.8.2.8 through 3.8.2.12. They include Interior-34, a plan to manage threatened, endangered, and special status plants and wildlife on BLM-administered lands; Interior-78, a plan for sensitive plant species management; Interior- 80, a plan to manage mountain quail; Interior-81, a plan to manage bald eagles; Interior- 82, a plan to manage southern Idaho ground squirrels; Interior- 83, incorporating bat protection measures into the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan; Interior-84, a plan to manage northern Idaho ground squirrels; and Interior-85, incorporating amphibian and reptile protection measures into the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan.

The Forest Service also provided conditions to guide protection of special status plants and animals. Forest Service preliminary 4(e) condition no. 8 specifies a strategy for managing and monitoring threatened and endangered species on National Forest System lands affected by the project. Forest Service modified 4(e) condition no. 9 specifies a plan for managing sensitive species on National Forest System lands affected by the project.

Additionally, IDFG-33 indicates support of Idaho Power's approach to special status plants. ODFW-65 addresses a plan to manage threatened, endangered and sensitive plants and wildlife. ODFW-34 calls for a bald eagle management strategy.

Based on our analysis of Idaho Power's proposals and agency recommendations, we identified in the draft EIS the need to consolidate the various proposals into a single project-wide Threatened, Endangered, and Sensitive Species Management Plan covering Forest Service, BLM, and Idaho Power lands within the project boundary and at locations directly affected by project operations, including along the river downstream of Hells Canyon dam. The Threatened, Endangered, and Sensitive Species Management Plan would have both plant and wildlife elements.

In the draft EIS, we recommended that Idaho Power consult with FWS, the Forest Service, IDFG, ODFW, the tribes, and other interested parties to develop and implement a Threatened, Endangered, and Sensitive Species Management Plan. Our recommendation remains the same in this final EIS. The purpose of the plan would be to protect and manage threatened, endangered, and sensitive species and their habitats that may be affected by project operation or project-related activities. Idaho Power has already completed a literature review, including searches of agency databases; compiled a large amount of information about threatened, endangered, and sensitive species in the vicinity; conducted extensive field surveys; analyzed and rated threats to threatened, endangered, and sensitive species resulting from a variety of factors; developed preliminary recommendations for many project-wide BMPs and site-specific protective measures; and is in the process of developing a GIS database to track threatened, endangered, and sensitive species and habitat in relationship to project facilities and activities. The Threatened, Endangered, and Sensitive Species Management Plan should bring this information together to serve as a foundation for future monitoring and management efforts.

In their comments on the draft EIS, several agencies requested that we clarify the nature of the plan envisioned in the Staff Alternative and indicate which species we intend for the plan to address. The paragraphs below respond to these comments, providing additional framework and detail for the plan. At a minimum, we recommend that the plan include the following elements:

- Initial species list—The initial list should include threatened, endangered and sensitive species that occur within the project boundary or on lands affected by project operation or project-related activities, as shown in table 106. For each species, the list should reference the relicensing studies that documented occurrence and/or evaluated project effects. The list should be accompanied by maps showing locations of threatened, endangered, and sensitive species and habitats in relation to project features.

- Updating the species list—The plan should provide for annual consultation, review, and updating of the list. Species would be added or removed according to changes in their status or changes in the potential for project effects (e.g., construction of new facilities).
- Conducting baseline surveys—The plan should provide for baseline surveys of species currently on the list if no surveys have been completed at sites where project operations or project-related activities could affect them. Baseline surveys should also be conducted for species that may be added to the list if they occur at sites where the project could affect them.
- Preparing biological evaluations—Where Forest Service Sensitive species may be affected, Idaho Power should consult with the Forest Service to prepare a draft biological evaluation, in accordance with modified 4(e) condition no. 1 (*Implementation of Activities on National Forest System Lands*).
- Monitoring project effects—For Forest Service Sensitive species, the plan should include monitoring to identify project effects at confirmed sensitive species sites every 2 years for 6 years following license issuance and at 3-year intervals thereafter, unless a determination can be made at year 6 that no additional monitoring is necessary. For bald eagles, Idaho Power should conduct annual nesting, productivity, and winter surveys. For other threatened, endangered, and sensitive species, Idaho Power should consult with the agencies and tribes to determine an appropriate monitoring frequency, based on site-specific conditions.
- Implementing protective measures—The plan should provide for designing and implementing protection, mitigation, enhancement or restoration measures if monitoring results show project-related effects.
- Effectiveness monitoring and adaptive management—The plan should include follow-up monitoring to measure the effectiveness of any protective measures that are implemented, and use of this information to modify and improve the Threatened, Endangered, and Sensitive Species Management Plan.
- Consultation, reporting, and updating the Threatened, Endangered, and Sensitive Species Management Plan—The plan should provide for annual reporting and consultation, with updates to the plan as needed.
- Coordination and cooperation—We anticipate that many measures identified as being necessary for species or habitat protection would involve not only Idaho Power, but also adjacent land owners and managers, and the plan should include a mechanism for formalizing coordination and cooperation between the Forest Service, BLM, and private landowners. We recommend Idaho Power establish an advisory board, like the rare plant advisory board, to help implement cooperative wildlife measures.

The Staff Alternative calls for Idaho Power to address all the special status species for which agencies or tribes filed recommendations, with the exception of osprey and peregrine falcon. Species included in the Staff Alternative are shown in tables 106 and 107.

Table 106. Special status and rare endemic plants identified for inclusion in management and monitoring plans by agencies, tribes, or staff in relation to Staff Alternative.

Species	Staff Alternative
American wood sage (*Teucrium canadense* var. *occidentale*) Bartonberry (*Rubus bartonianus*) Hazel's prickly phlox (*Leptodactylon pungens* ssp. *hazeliae*) MacFarlane's four-o'clock (*Mirabilis macfarlanei*) Membrane-leaved monkeyflower (*Mimulus hymenophyllus*) Oregon bolandra (*Bolandra oregana*) Porcupine sedge (*Carex hystricina*) Schweinitz flatsedge (*Cyperus schweinitzii*) Shining flatsedge (*Cyperus rivularis*) Spacious monkeyflower (*Mimulus ampliatus*) Spalding's catchfly (*Silene spaldingii*) Stalk-leaved monkeyflower (*Mimulus patulus*)	For Forest Service Sensitive species, monitor known sites every 2 years for the first 6 years following license issuance; determine after year 6 whether surveys should continue at 3-year intervals. For other species, consult with agencies, tribes, and other stakeholders to determine a monitoring schedule, based on site-specific information (i.e., risk of disturbance). For all species, identify and implement protective measures, as needed, and monitor effectiveness. For all species, survey if new ground-disturbance is proposed in suitable habitat.

Table 107. Special status wildlife identified for inclusion in monitoring and management plans, or for which agencies, tribes or staff recommended specific management measures, in relationship to Staff Alternative.

Species	Staff Alternative
Bald eagle (*Haliaeetus leucocephalus*)	Develop and implement cooperative nest site management plans for nests associated with project reservoirs; conduct 1 annual nesting (March/April) and 1 annual productivity (June/July) survey at these nest sites. Conduct 1 annual fall (October/November) and 1 annual winter (February/March) roost survey and develop cooperative roost site management plans. Conduct 1 annual winter survey to cover all project reservoirs, timed to match regional surveys. Use existing information (GIS overlays of project facilities, project-related activities, nest sites, and HCRMP protective designations) to evaluate whether new protective measures are needed, and re-evaluate when activities are planned that would affect habitat or cause noise disturbance. Habitat enhancement is not necessary because HCRMP BMPs would protect nest sites, and no evidence has been filed that habitat is limiting.
Mountain quail (*Oreortyx pictus*)	Implement cooperative management measures identified by Interior, ODFW and IDFG.
Great blue heron nesting (*Ardea herodias*)	Design and implement site-specific protective measures as part of Powder River Wildlife Management Area Plan.
Columbia spotted frog (*Rana luteiventris*)	Monitor known site; develop and implement site-specific protection, management, enhancement, restoration measures as needed; monitor effectiveness.
Other special status amphibians and reptiles	Implement Interior-85 regarding mapping and protection of snake dens as encountered; continued protection of springs and seeps; acquisition

Species	Staff Alternative
	of wetlands and springs as part of riparian habitat; mapping of bullfrogs encountered; bullfrog management on a site-specific basis.
Townsend's big-eared bat (*Corynorhinus townsendii pallescens*)	Survey project facilities, develop and implement site-specific protection, management, enhancement, restoration measures as needed, including Interior-82; monitor effectiveness.
Spotted bat (*Euderma maculatum*)	Survey project facilities, develop and implement site-specific protection, management, enhancement, restoration measures as needed; monitor effectiveness.
Other special status bats	Survey project facilities, develop and implement site-specific protection, management, enhancement, restoration measures as needed; monitor effectiveness.
Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*)	Survey if suitable habitat occurs on lands acquired for wildlife habitat mitigation; if present, implement protective measures.
Southern Idaho ground squirrel (*Spermophilus brunneus endemicus*)	Survey if suitable habitat occurs on lands acquired for wildlife habitat mitigation; monitor known sites; implement Interior-83.

We incorporated most aspects of the recommendations into the Staff Alternative's more comprehensive plan, but rejected a few.

Our review of federal and state databases does not indicate any special status designation for osprey. Surveys found them to be uncommon in the project area (Turley and Holthuijzen, 2003b), and osprey were not identified as being of concern in evaluations of project operations and project-related activities (Dumas et al., 2003b; Edelmann et al., 2003b). This species would continue to be protected by the Migratory Bird Treaty Act. Also, Idaho Power's HCRMP includes BMPs and habitat designations that would protect habitat for the osprey.

One peregrine falcon eyrie is located in the vicinity of the Hells Canyon boat launch (Akenson, 2000), but no project effects were identified (Dumas et al., 2003b; Edelmann et al., 2003b). Like the osprey, existing laws would continue to apply to this species.

In the draft EIS, we rejected elements of Forest Service preliminary 4(e) condition no. 9, which specified that Idaho Power should conduct surveys for sensitive species on all National Forest System lands within one-fourth mile of the project boundary and within 50 meters of the shoreline along the Snake River between Hells Canyon dam and the confluence of the Salmon River. The preliminary condition specified that Idaho Power conduct the surveys annually for the first 5 years of any new license and at 2-year intervals thereafter. We also rejected the specification for development of a separate plan for the Forest Service. The Forest Service subsequently submitted modified 4(e) condition no. 9. While still calling for a separate plan for Forest Service Sensitive species, modified FS-9 specifies surveys on National Forest System lands affected by the project only if activities are proposed that could adversely affect sensitive species, without specifying an arbitrary distance. It also reduces the survey schedule, calling for surveys of confirmed Forest Service Sensitive species sites every 2 years for the first 6 years of any new license period, and then every 3 years thereafter, with a determination after year 6 of whether surveys need to be continued. We now include FS-9 in the Staff Alternative because it would benefit Forest Service sensitive species, could be accomplished at a reasonable cost, and would ensure consistency with the HCNRA Comprehensive Management Plan and Wallowa-Whitman and Payette National Forest Land and Resource Management Plans.

For non-National Forest System lands and other special status species, we recommend that Idaho Power consult with the agencies to determine appropriate monitoring schedules.

We do not include in the Staff Alternative ODFW-64, which recommends bald eagle habitat enhancement, because we could find no evidence in the record that habitat is limiting. Also, Idaho Power's HCRMP provides BMPs and habitat designations that should be protective of large trees and riparian habitat.

We do not include ODFW-65, which recommends that Idaho Power protect and monitor sensitive flora and fauna within 0.25 mile of the Snake River between Hells Canyon dam and the Salmon River, and within 0.5 mile of the project boundary along the reservoirs. We recognize that project effects on some habitats and some species may extend outside the project boundary, but conclude that effects would vary depending on factors such as site-specific conditions and species' habitat requirements and life histories, rather than extending an arbitrary distance.

We do not include Interior-80, because we conclude that the objectives for mountain quail could be more effectively addressed through implementation of other measures (ODFW-63, IDFG-30).

With the plan we include in the Staff Alternative, additional surveys and monitoring would focus on identifying and preventing adverse project effects, not on inventory or trend evaluation. In the case of plants, additional surveys would be conducted at sites where ground disturbance regularly occurs or is planned in order to provide information useful in planning and implementing projects during any new license period, and to support Idaho Power's preparation of biological evaluations to address potential effects of any proposed actions on federal lands. For wildlife, additional surveys would be conducted if sites are affected by ongoing project activities or if proposed measures would cause ground disturbance or habitat loss or alteration (or noise disturbance, in the case of wildlife).

Addressing federally listed species within the same plan as other special status species would result in a more coherent, comprehensive plan for rare plants, maximize the efficiency of field efforts, and minimize the need for consultation that might otherwise be duplicative. Limiting the scope of the plan to areas within the project boundary and locations directly affected by project operations would address agency provisions for protection of threatened and endangered species, while assuring that the plan has a nexus to the project and its direct effects. Relying on a flexible schedule based on site-specific threats to rare plant populations and special status wildlife would be both more effective and more economical than relying on a pre-determined surveying and monitoring schedule.

The consolidated, project-wide Threatened, Endangered, and Sensitive Species Management Plan included in the Staff Alternative would specifically address timing restrictions to prevent disturbance to bald eagles and monitoring of nesting, productivity, roosting, and winter use. Although the plan would not include as many winter surveys as Interior recommends or as much habitat enhancement as ODFW recommends, it is otherwise consistent with agency goals of protecting this listed species.

Additionally, the plan would include measures to protect the northern Idaho ground squirrel if this species is found to occur on lands Idaho Power proposes to acquire as mitigation for project effects. The plan also would include measures to protect habitat and reduce disturbance to southern Idaho ground squirrels, bats, amphibians and reptiles, as recommended by Interior. Finally, we recommend bat surveys because no information about their use of project facilities is available, and O&M and project-related recreation have the potential to adversely affect bats.

We estimate the annualized cost of developing and implementing this consolidated Threatened, Endangered, and Sensitive Species Management Plan at $132,500. The increase over our estimate of $28,900 in the draft EIS reflects new cost information provided by Idaho Power in its April 30, 2007, filing and our adoption of the survey planning, scope, and frequency identified in FS-9 for sensitive species on National Forest System lands within the project boundary and on National Forest System lands affected by the project. This cost also includes Idaho Power's proposed cooperative measures for rare plants and agency consultation and reporting, as well as planning and field efforts for species-specific surveys and management where such species are known to occur (e.g., bald eagles) or where they may be detected (e.g., special status bats). We include the plan in the Staff Alternative because our assessment indicates that the benefits to wildlife species would outweigh the cost of developing and implementing the plan.

5.2.5.2 Noxious Weed and Exotic Invasive Plant Management

Reservoir fluctuations and flow fluctuations can cause soil disturbance that creates conditions that promote the establishment and spread of noxious weeds and invasive exotic plants. Project maintenance, management activities, and project-related recreation can also cause soil disturbance and act as vectors for the spread of weeds.

Idaho Power proposes to develop an integrated management plan to coordinate priorities and actions for preventing, eradicating, containing, and controlling non-native invasive plants and noxious weeds along the Snake River corridor from Weiser to the Salmon River confluence, focusing on riparian species and habitats in particular. Idaho Power proposes to establish a noxious weed advisory board as the primary mechanism for coordination and implementation of weed management measures. Idaho Power would consult with federal and state resource management agencies in developing and implementing the plan, and would participate in cooperative efforts with existing Cooperative Weed Management Areas, landowners, land managers, and other interested individuals and organizations.

IDFG supports Idaho Power's proposed weed management measures, and indicates that the agency would cooperate with Idaho Power and other stakeholders to implement the weed management plan. Interior recommends a similar plan, further specifying a full inventory of project-affected and Idaho Power-owned lands, to be completed within 3 years of license issuance. Interior also recommends that Idaho Power submit to BLM a plan for use or application of pesticides on project lands or non-project lands adjacent to BLM-administered lands, and prepare an annual report detailing the use of pesticides.

The Forest Service modified 4(e) condition no.7 and ODFW-66 are also similar to Idaho Power's proposal, except that they call for Idaho Power to establish a new Hells Canyon Cooperative Weed Management Area as part of an integrated weed management plan. The Forest Service and ODFW outline specific elements to be included in the plan to address goals and objectives, responsibilities, schedules, lands for cooperative efforts, data gaps, 5-year updates, and other subjects.

In section 3.7.2.3, *Noxious Weed and Exotic Invasive Plant Management*, we point out that noxious weeds and invasive non-native plants are a growing threat throughout the west. Project operations and human activity, in addition to wind, water, and animal transport, would continue to serve as vectors for weeds. Weeds will likely continue to spread, even with an appropriate management plan in place, but ongoing, coordinated efforts would help to slow this process.

In the Staff Alternative, we include Idaho Power's proposed noxious weed control and non-native invasive weed management plan, including establishment of a Noxious Weed Advisory Board. The integrated, project-wide plan would address monitoring and management of weeds on Idaho Power, Forest Service and BLM-administered lands within the project boundary (including an annual pesticide report to BLM). It would also have Idaho Power participate in cooperative projects implemented outside the project boundary, if such projects are shown to address project effects or protect project resources.

As specified in FS-7, the Staff Alternative includes establishment of a Cooperative Weed Management Area as a mechanism for building cooperative relationships among agencies, landowners, land managers and other individuals and organizations involved in managing weeds, while a Noxious Weed Advisory Board (which could include members who are also involved in the Cooperative Weed Management Area) would develop and implement the Integrated Weed Management Plan. Under the Staff Alternative, Idaho Power would allow for a 60-day review and comment period by the agencies and tribes before filing the plan with the Commission. Agencies to be consulted should include Forest Service, FWS, IDFG, IDPR, ODFW, county weed boards, and concerned tribes. As part of the plan, Idaho Power would be consulting frequently, but informally, with cooperating agencies and tribes regarding additions/deletions to the list of weed species likely or known to occur in the project area; results of monitoring; outcomes of any treatments that were implemented; and plans for additional management measures. The plan would be formally updated at 5-year intervals to identify new species or areas of concern, evaluate program success, and consider new or alternative treatments.

Except in one respect, the Staff Alternative would be consistent with agency recommendations. The Staff Alternative does not include a full inventory of project-affected and Idaho Power-owned lands within 3 years of license issuance, as recommended by Interior. Relicensing studies (Krichbaum, 2000) provide information about weed species that are present, their density and distribution, and the factors that are contributing to their spread, and serves as an adequate starting point for prioritizing and then implementing weed control projects without a 3-year delay. Idaho Power's proposal would address inventories through its focus on weed prevention as the most effective, economical approach to weed management. Prevention requires early detection, which requires regular surveys of high-risk areas. The outcome of this approach should be consistent with Interior's recommendation.

We estimate the annualized cost of this measure at $167,200. The increase over our estimate of $55,000 in the draft EIS is based on new cost information provided by Idaho Power in its April 30, 2007, filing. It is also based on explanations the Forest Service provided with its modified 4(e) conditions, which led us to adopt FS-7 regarding survey and management of weeds on National Forest System lands within the project boundary and on National Forest System lands affected by the project. We conclude that it is reasonable for Idaho Power to address project effects where they occur, rather than limiting mitigation measures to lands within an administrative boundary. Forest Service comments also explained that a Cooperative Weed Management Area would complement, rather than duplicate, the functions of the Noxious Weed Advisory Board, and consequently, we include it in the Staff Alternative.

In addition to the items above, the total annualized cost of $167,200 includes Idaho Power's proposed establishment of an advisory board and implementation of cooperative weed projects, as well as development and implementation of a comprehensive plan. It also includes agency consultation and reporting, and establishment of a Cooperative Weed Management Area. We include this plan in the Staff Alternative because we find that the benefits in terms of noxious weed and invasive species management would outweigh the cost.

5.2.5.3 Road, Transmission Line, and Right-of-Way Management

The project's road and transmission line rights-of-way must be managed to maintain safe and efficient operating conditions, but management activities (e.g., brushing, mowing, herbicide treatment, removal of hazard trees) may adversely affect native plant communities and the wildlife species that use them. In section 3.7.2.4, *Road, Transmission Line, and Right-of Way Management,* we note that Idaho Power's management activities may also promote the establishment and spread of noxious weeds and exotic plants, which, in turn, also adversely affect native plant communities. Further, management activities have the potential to disturb wildlife. Disturbance during the winter can cause physiological stress to big game and communally roosting bald eagles. Disturbance during the breeding season can impair reproductive success of many bird species.

As a result of the Commission's orders dated March 31, 2005, and October 25, 2005, the only transmission line remaining within the Hells Canyon Project boundary is transmission line 945.[134] Transmission line 945 is located entirely within Hells Canyon. It runs along the eastern shore of Hells

[134] The Staff Alternative does not include agency recommendations that address non-jurisdictional transmission lines, because they are outside the scope of this relicensing. For this reason, we do not discuss these recommendations further.

Canyon reservoir from Oxbow dam to Hells Canyon dam, a distance of about 22 miles. The line runs parallel to a paved road (Hells Canyon Road). Several short spur roads lead off the Hells Canyon Road to provide maintenance access to transmission line 945.

Idaho Power, in separate measures for botanical and wildlife resources (shown in section 5.1.1 as Idaho Power measure nos. 16P, 20P, and 21P), proposes to develop transmission line operation and maintenance plans to address the effects of right-of-way management. The primary components of the plans would include: (1) development of BMPs for O&M activities along transmission line 945 and service roads, including scheduling the timing and location of O&M activities so that they would occur outside critical periods for plants, raptors, nesting neotropical migrant birds and wintering big game; (2) restoring and revegetating disturbed sites; and (3) managing noxious weeds and invasive exotic plants. Idaho Power would consult with the Forest Service on the development of BMPs because transmission line 945 and the service roads traverse National Forest System lands.

In section 3.7.2.4, *Road, Transmission Line, and Right-of Way Management*, we review recommendations from ODFW and preliminary conditions from the Forest Service relating to various aspects of Idaho Power's proposals, and conclude that Idaho Power's proposals would generally meet the objectives of the agencies, including FS-11, ODFW-67, ODFW-69, ODFW-70, and ODFW-72. Accordingly, we include Idaho Power's proposed measures in the Staff Alternative, but combine them into a single measure requiring Idaho Power to develop and implement a transmission line operation and maintenance plan for transmission line 945 to address protection and enhancement of wildlife and botanical resources, including those that occur on any National Forest System lands crossed by the transmission line.

As included in the Staff Alternative, the plan would include a provision to monitor raptor electrocution and evaluate collision potential, and to retrofit as needed. It also includes Idaho Power's proposed measures to protect wildlife and botanical resources, as well as agency consultation and reporting. We include this plan in the Staff Alternative because we find that the benefits of improved transmission line and right-of-way management would outweigh the estimated annualized cost of $11,900.

5.2.5.4 Upland and Riparian Habitat Acquisition

Continued operation of the Hells Canyon Project would adversely affect more than 20,000 acres of wildlife habitat. Idaho Power's studies indicated that most impacts would be associated with reservoir fluctuations that reduce the abundance and connectivity of riparian habitat, limit waterfowl brooding habitat, decrease the suitability of shoreline areas for many wildlife species, and contribute to shoreline erosion.

The presence and operation of the reservoirs also reduces the habitat capability of mule deer winter range and increases annual winter mortality. Mule deer are very important in the region, in terms of their ecological role, as a cultural resource, and for the hunting, viewing, and wildlife appreciation opportunities they provide. They are also an important economic resource for Oregon and Idaho. ODFW stated that hunting in Baker County likely yielded between $1.43 and $2.9 million in 2005, based on 12 days per hunter, each spending between $30 and $60 per day (ODFW, February 21, 2007). IDFG estimated the economic value of mule deer hunting over the past 10 years at $335,645 to $1,512,632 annually, based on about 4 to 5 days per hunter, each spending approximately $101 per day (IDFG, January 27, 2007).

In section 3.7.2.5, *Upland and Riparian Habitat Acquisition,* we review the preliminary terms, conditions, or recommendations submitted by agencies and tribes regarding acquisition of mitigation lands. While similar in some respects, the recommendations reflect different conclusions about the amount of land the project affects and the amount of land needed for mitigation. In section 3.7.2.5, we summarize Idaho Power's proposal and the minimum acreage that would be acquired under each agency or tribal recommendation.

Idaho Power's proposal would bring a minimum of 20,592 acres of land into the project boundary for management as wildlife habitat through any new license period, together with 2,990 acres already in Idaho Power's ownership, at an estimated annualized cost of $1.8 million. It would provide mitigation for the ongoing project effects on terrestrial resources identified in relicensing studies. Idaho Power would acquire (and at this time, has acquired) parcels of private land that are located adjacent to or near the project reservoirs, at relatively low elevations. These parcels would provide on-site, in-kind habitat, similar to uplands and riparian areas affected by project operation, and would benefit the species identified by the Terrestrial Resources Work Group as having high priority (e.g., big game, raptors, and threatened, endangered, candidate, and sensitive species).

Idaho Power proposes to finalize and implement the plan described in its response to AIR TR-1(a)(i)—Options for Meeting Acreage Targets and TR-1(a)(ii)—Characteristics of IPC's Preferred Options (Edelmann and Huck, 2005) to acquire, enhance and manage approximately 22,761 acres of upland and 821 acres of riparian habitat in the vicinity of the Hells Canyon Project reservoirs. Components of this plan include finalizing and implementing the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan.

We include this measure in the Staff Alternative for the previously mentioned reasons that the plan provides appropriate on-site, in-kind mitigation for effects of project operation, and the proposed parcels address current resource needs as identified during consultation with the Terrestrial Resources Work Group. All four of the major land parcels included in Idaho Power's proposal are located adjacent to Brownlee reservoir, where project effects are most evident. Proposed parcels are about evenly divided between the west and east sides of the reservoir, with adjustments to take advantage of specific opportunities (e.g., presence of high priority habitats, extending habitat connectivity). This measure would be consistent with Forest Service preliminary 4(e) condition no. 6 and IDFG-28.

To date, Idaho Power has acquired 18,298 acres of the first tier parcels. This acreage, plus 2,990 acres already in Idaho Power's ownership, includes 777 acres of riparian habitat, leaving a minimum of 44 acres yet to be acquired.

The total acreage to date includes 12,156 acres in Oregon and 9,132 acres in Idaho. IDFG commented that if the fourth target parcel (the 2903-acre Rocking M Ranch, located in Idaho) cannot be acquired, priority should be given to selecting lands with the highest value for mitigation, whether they are located in Oregon or Idaho (letter from T. Trent, Chief, Natural Resources Policy Bureau, IDFG, to T.J. Welch, Chief, Hydro West Branch 2, Commission, Washington, DC, dated January 27, 2007).

In their comments on the draft EIS and during the 10(j) meetings, Interior and IDFG indicated that the Staff Alternative should provide for acquisition of additional lands at a mitigation ratio higher than 1:1 if target parcels within the "first tier" (the nine parcels identified as the highest priorities by Idaho Power and the TRWG) are unavailable or cannot be acquired within a reasonable amount of time following license issuance. The higher mitigation ratio is intended to compensate for the lower values of replacement parcels (i.e., these parcels could be farther from the project, higher in elevation, more isolated from other lands managed for wildlife, or less capable of supporting high value habitats or species), and/or a longer period of time before Idaho Power could secure the lands and begin to implement enhancement measures.

To address agency concerns about the timely progress of acquiring high value lands, we include a contingency plan in the Staff Alternative. Under the contingency plan, if Idaho Power cannot acquire the remaining acreage of upland and riparian habitat within the "first tier" parcels within 5 years after license issuance, Idaho Power would acquire 5,805 acres (including at least 88 acres of riparian habitat) within the "first tier" within 10 years after license issuance. If this acreage cannot be acquired within 10 years after license issuance, Idaho Power would acquire 8,709 acres (including at least 132 acres of riparian habitat) within the "second tier" parcels.

With FS-6, the Forest Service specifies that within 1 year of license issuance, Idaho Power should consult with the Forest Service to prepare a Land Acquisition and Management Plan that would be incorporated into the IWHP/WMMP. Although Idaho Power has already acquired three of four target parcels, implementation of this measure would be useful in identifying additional parcels to mitigate for project effects on riparian habitat along the Snake River downstream of Hells Canyon dam. These additional parcels would include 49 acres of riparian habitat to mitigate for ongoing project effects (interruption of sediment supply, flow fluctuations) on sandbar willow in shore and bottomland wetland, consistent with FS-6. We did not include this aspect of FS-6 in the Staff Alternative in the draft EIS, but now adopt it based on calculations the Forest Service provided in its justification for modified 4(e) conditions. Although we conclude that high flows, rather than project operations, are the primary factor that limits the development of riparian vegetation within shore and bottomland wetland, we accept the Forest Service estimate that project operations may prevent the establishment of native willows on 49 acres within this zone.

The additional parcels would also include 13.2 acres of riparian habitat to mitigate for anticipated effects (reduced hydrologic support) of the Staff Alternative flow regime on riparian habitat. In the draft EIS, we recommended that Idaho Power enhance 13.2 acres of riparian habitat downstream of Hells Canyon dam. We now recommend Idaho Power acquire the land needed to mitigate for project effects on this habitat, as well as the 49 acres mentioned above, as part of the larger acquisition package. We conclude that long-term management would be most efficient and effective if this additional acreage is consolidated with other lands that Idaho Power would manage under the IWHP/WMMP.

Acquisition, protection and management of 62.2 acres of riparian habitat would exceed the 56.3 acres specified in FS-6, which was based on the assumption that Idaho Power's proposed flow regime would be implemented, with slightly less impact on riparian habitat. Idaho Power estimates that it must acquire about 25 acres of upland habitat for every acre of riparian habitat. Thus, acquisition of an additional 62.2 acres of riparian habitat would add approximately 1,493 acres of upland to the Staff Alternative. The Staff Alternative's contingency plan would apply to this acreage, as well. We estimate the annualized cost of acquiring 62.2 acres (56.3 acres specified by the Forest Service, plus 5.9 additional acres to account for effects of implementing the staff-recommended flow regime) would be $177,300, which we conclude would provide sufficient benefits in terms of riparian habitat mitigation to be worth the cost.

We do not include ODFW-61 or Interior-76 regarding acquisition of mitigation lands because they call for land acquisition greater than is needed to mitigate for ongoing impacts. Our analysis (section 3.7.2.5, *Upland and Riparian Habitat Acquisition*) indicates that mitigation ratios of greater than 1:1 are not appropriate, given that Idaho Power's proposal provides on-site, in-kind habitat, similar to uplands and riparian areas affected by project operation. Idaho Power's proposal would benefit species affected by project operations and those identified by the Terrestrial Resources Work Group as having high priority.

Part of the justification given by Interior and ODFW for higher mitigation ratios is based on typical wetland mitigation provisions imposed by federal and state regulatory agencies to account for the difficulty in creating or re-establishing wetland functions and values. We note that these concerns do not apply to Idaho Power's proposal, which does not involve wetland creation or re-establishment.

ODFW states that ODFW and Oregon Department of State Land policies call for no net loss of upland habitat quantity or quality, and net benefits for riparian habitat. We recognize that the Staff Alternative may not be consistent with the state's policy. However, the FPA does not require mitigation of all project impacts. We conclude that the Staff Alternative provides substantial benefits by protecting parcels that have high value because of physical factors (relatively low elevation and location adjacent to the reservoirs and adjacent to other lands that are or will be managed for wildlife), and by improving their ecological values through implementation of enhancement measures. Under this alternative, Idaho Power would work with the Integrated Wildlife Habitat Program workgroup to develop site-specific plans for the acquired lands as part of the Wildlife Mitigation and Management Plan. Idaho Power would measure baseline conditions, identify desired conditions and implement treatments to improve habitat values (e.g., by managing livestock; excluding livestock from riparian areas; controlling weeds; seasonally restricting recreation to reduce disturbance; and planting native trees, shrubs and herbaceous species). Idaho Power would monitor the effectiveness of treatments over time, using the results to adaptively manage each site and update the plans as needed.

Interior states that BLM has limited formal guidance for mitigation. Mitigation ratios may be 1:1 or higher, depending on the resource and the distance of acquired lands from the project. Interior's guidance also indicates that it is important to acquire lands that serve a similar functional component, and that the suitability of a site may outweigh the parcel size. The Staff Alternative would be in keeping with this guidance because the target parcels are as close as possible to the project, provide the same acreage of riparian and upland habitat as is affected by ongoing project operations, and serve similar functions (e.g., they provide big game winter range, habitat connectivity, and support for special status species).

We estimate that the annualized cost of implementing ODFW-61, Interior-76, or IDFG-29 would be about \$2.5 million, \$2.9 million, or \$3.3 million, respectively. By contrast, the annualized cost of implementing Idaho Power's proposal would be about \$1.8 million. Because Idaho Power's proposal addresses ongoing project effects at a reasonable cost, we include it in the Staff Alternative, noting that higher costs may be associated with the contingency plan.

As we note in section 3.7.2.5, *Upland and Riparian Habitat Acquisition,* Idaho Power points out that the project reservoirs are relatively recent features, and predicts that banks will continue to erode until shorelines reach equilibrium. Idaho Power's proposal would provide 1:1 mitigation for the acreage of erosion that has been documented to date along reservoir shorelines. Interior recommends Idaho Power conduct a study to determine the feasibility of using riparian plantings to stabilize existing erosion sites, and reduce the acreage of acquisition if plantings are successful. The Forest Service specifies that within 2 years of license issuance, Idaho Power should assess erosion sites already identified, and where warranted and feasible, design and install control measures and then monitor their effectiveness. Where control measures are deemed infeasible, the acreage of these sites would be added to Idaho Power's riparian acquisition program. Idaho Power would then survey for new erosion sites every 5 years and implement control measures when deemed warranted and feasible.

We conclude that Idaho Power's proposed land acquisition would help to mitigate for 90 acres of existing erosion, but would not address erosion control onsite and does not take into account the acreage of erosion that is likely to occur during any new license period. Based on the age of each reservoir, the acreage of existing erosion, and an assumed constant rate of erosion, another 70 acres could be affected during the next 30 years. We therefore include in the Staff Alternative a provision that expands on FS-6, i.e., Idaho Power would develop and implement a long-term stabilization/revegetation program to address erosion sites around project reservoirs. Development of the plan would be preceded by a feasibility assessment and 5-year pilot project. If the results of the pilot project indicate a high likelihood of success at other sites, Idaho Power would implement the program; if not, Idaho Power would acquire 70 acres of riparian habitat and manage them under the Integrated Wildlife Habitat Program/Wildlife Mitigation and Management Plan. Again, the contingency plan would apply to any land acquired to mitigate for erosion.

In the draft EIS, we did not recommend implementation of a 5-year pilot project as part of the feasibility assessment. We have added this recommendation to the Staff Alternative in the final EIS because we concluded that the results of field testing would provide the best basis for decisions about if and how to undertake additional stabilization/revegetation efforts. For the purpose of estimating costs, we assume the pilot project would be successful and a long-term stabilization/revegetation program would be implemented. We estimate the annualized cost of this staff-developed measure at $52,800. We do not include an estimated cost of acquiring additional acreage if the pilot project indicates the program would not be successful.

ODFW-61, Interior-76, and NPT-22 provide for the mitigation of effects of original project construction. We do not include these measures in the Staff Alternative because original project construction is not the focus of relicensing; Commission policy establishes current conditions as the baseline for environmental analysis.

Idaho Power's proposal addresses project effects on 86,408 acres of mule deer winter range between full pool and 2,700 feet elevation, where mule deer winter ecology studies (Edelmann, 2003) indicated that most deer were concentrated and where interactions with the reservoir occurred, and applied a habitat coefficient of 0.19 to estimate project effects on habitat capability and mortality. ODFW-61 provides for mitigation of project effects on a larger area of mule deer winter range than Idaho Power's proposal addresses. ODFW estimates the area of crucial mule deer winter range at 121,337 acres between full pool and 3,200 feet. ODFW states that a habitat coefficient of higher than 0.19 should be applied to account for higher mortality in extremely harsh winters. However, in its comments on the draft EIS, ODFW applies the 0.19 habitat coefficient to 121,337 acres, concluding that the Staff Alternative should include acquisition and management of 23,054 acres of mule deer winter range (1,452 acres of riparian habitat and 21,602 acres of uplands). Staff concludes that Idaho Power's proposed mitigation package, which would total a minimum of 23,582 acres and would likely total at least 24,191 acres, should help to address ODFW's concerns, because most of the lands are located within areas mapped as crucial mule deer winter range (Christensen, 2003) or function as a major migration route for mule deer moving between summer range in Oregon and winter range near Brownlee reservoir. The Staff Alternative would add a minimum of 1,555 acres (62.2 acres of riparian habitat; 1,493 acres of uplands) to this package. While the package includes less riparian habitat than ODFW believes is needed, the mule deer winter ecology studies (Edelmann, 2003) indicate that high quality forbs, low-stature green grasses, bitterbrush, and sagebrush at low elevations on south and southwest facing aspects are most important in harsh winters. Thus, low elevation uplands may be as important, if not more important, than riparian habitats for mule deer during the winter in this area.

Although not included as terrestrial resource measures, the Staff Alternative calls for enhancement of riparian habitat in several tributaries to the project reservoirs. Riparian habitat protection and management aimed at improving fish habitat would also benefit wildlife, including mule deer. Enhancement measures are recommended for Pine, Indian, and Wildhorse creeks and several smaller tributaries, and may be expanded to include the Powder and Burnt River basin tributaries.

In the Staff Alternative, we do not include SPT-5, which calls for Idaho Power to acquire 10,000 acres near the Duck Valley Indian Reservation and transfer title to the Shoshone-Paiute Tribes. The project does not affect this area, and property located at this distance from the project (more than 100 miles) would not meet the TRWG criteria for on-site, in-kind mitigation.

Interior-79, BPT-9, and SPT-7 call for Idaho Power to conduct a HEP to establish pre-dam baseline conditions and/or to determine suitable habitat units for mitigation. We do not include these measures in the Staff Alternative because we conclude that studies completed to date provide a sufficient basis for determining ongoing project effects and mitigation needs.

We estimate the total annualized cost of habitat acquisition (including riparian habitat to mitigate ongoing project effects downstream of Hells Canyon dam and predicted effects of implementing the staff-recommended flow regime) at $1,945, 700. This cost includes preparation of a Land Acquisition and Management Plan, as specified by the Forest Service (FS-6). The increase over our estimate of $1,651,100 in the draft EIS reflects new cost information provided in Idaho Power's filing on April 30, 2007, which indicates additional capital improvements and more intensive management of acquired lands. It also reflects the cost of additional acreage that would be purchased in accordance with FS-6, and implementation of a 5-year pilot project to investigate the feasibility of stabilizing and revegetating eroding shorelines and riverbanks. We include this measure in the Staff Alternative because we conclude that the benefits of this habitat acquisition and management would outweigh the cost.

5.2.5.5 Cooperative Wildlife Management Projects

Reservoir fluctuations at Brownlee reservoir adversely affect riparian habitats along the shoreline and on several small islands at the upper end of Brownlee reservoir, reducing their ability to support nesting and brooding waterfowl. Reservoir fluctuations also contribute to riparian habitat fragmentation along the shoreline, reducing its suitability for mountain quail.

To address project effects on waterfowl, Idaho Power proposes to provide funding, equipment, personnel, logistical support, and expertise to IDFG and ODFW to support habitat enhancement projects on four Snake River islands. Idaho Power purchased the islands as mitigation for the effects of project construction on waterfowl and then conveyed title to the states to manage them. IDFG owns and manages Gold Island (331 acres), while ODFW owns and manages Patch (about 100 acres), Porter (about 70 acres), and Hoffman (60 acres) islands. The states have managed the islands primarily to provide waterfowl and upland game bird habitat, but lack of funding for management activities has resulted in a gradual decline of habitat values. Currently, non-native invasive weeds are the dominant vegetation on all four islands.

IDFG and ODFW make various recommendations regarding funding levels, funding mechanisms, habitat improvement projects, and cooperative management for the islands. These measures recommend that Idaho Power fund the capital cost of equipment purchase ($298,800) and provide $32,000 per year (approximately $57 per acre) during the term of a new license to support habitat management on four islands.

In the draft EIS, we rejected agency recommendations to include Patch and Gold islands in the Staff Alternative because they are located outside the project boundary and are not affected by project operations. We also rejected agency recommendations to provide support for capital improvements because we concluded that while it would be reasonable for Idaho Power to contribute to ongoing agency management efforts, Idaho Power should not be responsible for initiating those efforts. In this final EIS, we modify the Staff Alternative to include all four islands, based on continuing effects of the reservoir fluctuations on waterfowl habitat and further review of onsite opportunities for enhancement (see section 3.7.2.6, *Island Habitat Enhancement Projects*). We now also include a recommendation for Idaho Power to support capital improvements on the island, because we find that Idaho Power could not implement or maintain the enhancement projects without those improvements.

The Staff Alternative would have Idaho Power consult with ODFW and IDFG to identify and implement habitat improvement projects on Porter, Hoffman, Patch, and Gold islands. On Porter, Hoffman, and Patch islands, projects would include purchasing and installing nest platforms and boxes, seeding grain to provide waterfowl forage, enhancing willows and other shrubs, and controlling weeds (ODFW, February 21, 2007). IDFG indicates funding is needed for irrigation and restoration projects on Gold Island (IDFG, January 27, 2007). Idaho Power could contract with the agencies to implement the improvement projects, but Idaho Power would retain ultimate responsibility for complying with the terms of the license. ODFW and IDFG describe the overall cost of managing the islands, but do not explain the basis for determining what Idaho Power's level of support should be. We include in the Staff Alternative support for capital improvements ($298,800), which is consistent with ODFW and IDFG recommendations and would equal an annualized cost of $32,600. We also include in the Staff Alternative an annual funding level of $26,000, as Idaho Power proposes. This cost is slightly higher than O&M costs Idaho Power anticipates it would be applying to other lands it would acquire and manage. A higher level of funding for these islands would account for intensive management and difficult access. The total annualized cost of this measure would be $58,600 under the Staff Alternative. We include this measure because we find that the benefits would outweigh the cost.

Project operation affects potential habitat for the mountain quail by preventing establishment of riparian vegetation along the Brownlee reservoir shoreline and limiting its extent along the shorelines of Oxbow and Hells Canyon reservoirs. Also, grazing on Idaho Power lands could reduce the cover of woody shrubs that provide important cover and forage for mountain quail, and project-related maintenance activities and recreation may cause some disturbance to this reclusive bird.

Idaho Power proposes to cooperate with state and federal wildlife management agencies to develop and implement a mountain quail restoration project by participating in enhancing low-elevation riparian habitat and reintroducing a mountain quail population. Idaho Power anticipates that state and federal wildlife management agencies would take the lead in identifying projects, and Idaho Power would provide funding, equipment, personnel, logistical support, and expertise to support them. ODFW's comments on the 10(j) meetings identified Spring, McGraw, and Fox creeks as potential translocation sites (ODFW, February 21, 2007). IDFG indicated that Indian, Eckels, Allison, and Deep creek drainages are priority areas for translocation projects (IDFG, January 27, 2007). During the 10(j) meetings, Interior suggested that potential sites may be located in the Burnt and Powder River drainages. We analyze Idaho Power's proposal and related recommendations from the Forest Service, Interior, ODFW, and IDFG in section 3.7.2.6, *Cooperative Wildlife Management Projects*.

Idaho Power identified 2,500 acres of scrub-shrub wetland and forested wetland that could provide high-quality mountain quail habitat. Most of this is located along steep tributaries to Oxbow reservoir. Enhancement of existing riparian vegetation in the lower reaches of tributaries and along the reservoir shoreline could improve habitat quality and allow for secure movement of quail, if present, between tributaries. We include in the Staff Alternative a measure whereby Idaho Power would consult with state and federal wildlife management agencies to determine the highest priority for mountain quail projects, i.e., habitat enhancement or translocation.

We do not include Interior-80 in the Staff Alternative, regarding development of a Mountain Quail Management Plan. Under this measure, Idaho Power would fund analysis of pre-project conditions, mitigate for limiting factors that are not related to project operation, and meet population targets that are based on unreliable historical population data. The Commission has established current conditions as the baseline for analysis related to relicensing decisions, and data that could be obtained from a study of pre-project conditions are not necessary to guide the development of measures to mitigate for ongoing project effects. Interior-80 would also have Idaho Power fund planning-level activities that would duplicate state efforts that are already underway, as described in the Idaho Mountain Quail Conservation Plan (Sands et al., 1998). The conservation plan addresses existing conditions and calls for IDFG to establish local working groups to identify and coordinate projects aimed at recovery of this species. Idaho Power's proposal to participate in projects coordinated by the state or by federal agencies would be consistent with this conservation plan. Idaho Power's proposal would also be consistent with IDFG-30 and ODFW-63 recommendations, and may partially meet Interior's objectives for mountain quail management in the Hells Canyon Project area.

Activities included in the Staff Alternative would address on-the-ground habitat improvements, collection of new information about quail habitat requirements and behavior, and/or establishment of new populations in the project area. The estimated annualized cost of this measure is $9,600, which we include in the Staff Alternative because we conclude that the benefit to quail would outweigh the cost.

5.2.5.6 Wildlife Management on Project Lands

In addition to project-related operation and maintenance, Idaho Power manages a variety of other activities on project lands, including residential areas for employees, recreation sites, and specific leases and permits for agriculture and livestock grazing. These activities influence the abundance, distribution, and quality of wildlife habitat. Livestock grazing, in particular, has the potential to damage soils and native plant communities, promote the establishment and spread of invasive weeds, and increase competition with native ungulates for forage.

To address these project effects, Idaho Power proposes to consult with agencies, tribes, nongovernmental organizations, and other entities (which together would function as a work group, similar to the Terrestrial Resources Work Group) to develop and implement an integrated wildlife habitat program. The program would provide guidelines for general stewardship, including restrictions on grazing, recreation, and maintenance activities that would help protect habitat and minimize disturbance to wildlife. The program would tier to the Hells Canyon Resource Management Plan (see section 3.12, *Land Management and Use*) and would be the mechanism for administering Idaho Power's wildlife management policies, environmental measures, and stewardship activities. Idaho Power also proposes to develop a wildlife mitigation and management plan to implement the programmatic goals and objectives and BMPs outlined in the overall program, and to develop site-specific management plans and cooperative projects. Monitoring protocols would be developed as part of the management plans, and would be tailored to the specific management needs identified in the plans.

In section 3.7.2.7, *Wildlife Management on Idaho Power Lands*, we review various recommendations made by resource agencies and tribes regarding wildlife management. All of the recommendations contain similar goals and objectives for protection, management and enhancement; recognize the need for effectiveness monitoring; and propose to use the results of monitoring to adaptively manage habitat. All of the measures indicate that schedules for work planning, implementation, and reporting should be included in the management plan, and all of the measures provide for establishment of a cooperative work group.

In section 3.7.2.7, we conclude that Idaho Power's proposal to implement the resource management plans would benefit wildlife and botanical resources on lands in its ownership and lands the company would acquire as mitigation for project effects. Idaho Power's proposal would help support biodiversity; restore and enhance native shrub-steppe, grassland, and riparian habitat; improve riparian habitat connectivity; and reduce traffic and noise disturbance at sensitive sites. To further minimize disturbance to wildlife, we recommend that Idaho Power include, as part of its WMMP, specific measures regarding scheduling of O&M and implementing a program to inform and educate visitors about protection of sensitive species and habitats. This measure would be consistent with agency recommendations and conditions, including Forest Service modified 4(e) condition no. 5, FS-34, IDFG-28, habitat management aspects of Interior-79 (but not the recommendation regarding HEP), ODFW-59, ODFW-60, ODFW-72, ODFW-73, and SPT-9. It would not necessarily be consistent with NPT-23, which calls for Idaho Power to hold any parcels acquired for mitigation as open and unclaimed lands, to be open to the Tribe's hunting, gathering, and pasturing treaty rights. We conclude that this aspect of management would best be determined on a site-by-site basis.

In the Staff Alternative, we include a provision that Idaho Power establish a terrestrial resource work group to assist in finalizing and implementing the management plans, as described in Idaho Power's response to AIR TR-1. This measure would also be consistent with agency and tribal recommendations, with some exceptions. We do not include certain aspects of BPT-9 because it defines tasks for the work group that have already been completed (e.g., quantifying habitat losses and identifying criteria for land acquisitions).

BPT-9 and SPT-6 call for Idaho Power to fund the tribes' participation in the work group, and we do include that funding in the Staff Alternative. In our analysis in section 3.9.2.4, *Support for Native American Programs*, we find that tribal participation in designing and implementing measures for protection and management of natural resources would be valuable in meeting the natural resource goals, as well as cultural resource goals, identified in the Hells Canyon Resource Management Plan. The cost of this tribal participation is reflected in the estimates we provide below in section 5.2.6.5, *Tribal Participation, Education, and Training.*

Under the Staff Alternative, the IWHP/WMMP would include all lands within the project boundary (including National Forest System and BLM-administered lands, as well as Idaho Power lands) and lands acquired for mitigation. We estimate the total annualized cost of managing these lands would be $1,120,000. This estimate is higher than that shown in the draft EIS, based on new cost information filed by Idaho Power on April 30, 2007. Management costs also include the Land Acquisition and Management Plan identified in FS-5, establishment of a terrestrial resources working group (and long-term coordination with this group), finalizing the IWHP and WMMP, capital improvements and O&M, and measures to prevent or minimize disturbance to wildlife (scheduling O&M; developing and implementing an I&E program). We include these measures in the Staff Alternative because we find the benefits of improved habitat management would be worth the cost.

5.2.6 Cultural Resources

5.2.6.1 Finalization of the Historic Properties Management Plan

Project operations and project-related activities such as recreation can affect cultural resources by exposing sites to natural forces such as water and wind erosion and air pollution, as well as to accidental or intentional destruction by people. To address these issues, the Commission typically requires applicants to prepare and submit draft Historic Properties Management Plans (HPMP) with their license applications. An HPMP contains measures, strategies, and procedures for resource management and protection, and for resolving known or potential project-related adverse effects to historic properties over the term of the license. Idaho Power's license application includes a draft HPMP. The tribes, Idaho State Historical Society, Forest Service, and BLM have all recommended that Idaho Power revise, finalize, and implement the HPMP.

We include in the Staff Alternative a measure documenting the need for Idaho Power to finalize the HPMP, incorporating all provisions of Forest Service 4(e) condition no. 25, and all provisions of Interior 4(e) condition no. 5, in consultation with the SHPOs, tribes, agencies, and Commission within 1 year of license issuance. The Commission is requiring Idaho Power to finalize the HPMP prior to issuance of a new license. The final HPMP must address the issues outlined in the following subsections. In accordance with section 106 of NHPA, the Commission would execute, prior to issuance of a license, a Programmatic Agreement with the SHPOs and Advisory Council (if it chooses to participate) to formally implement the HPMP, with Idaho Power, the tribes, BLM, and the Forest Service as consulting parties to the agreement. The final HPMP would be attached to the final Programmatic Agreement. The estimated annualized cost of the measure is $800. In the following subsections, we discuss various recommendations about what should be included in the final HPMP, and indicate what elements we include in the Staff Alternative.

5.2.6.2 Cultural Resources Monitoring

As noted above, the potential for adversely affecting cultural resources is generally addressed in an HPMP that includes, among other things, site treatment measures designed to avoid, mitigate for, or repair resource damage. In section 3.9.2.2, *Site Treatment*, we point out that a first step in treatment of cultural resources is assessment of their existing condition and periodic monitoring thereafter to determine whether the condition of a given resource has changed, and if so, why. Monitoring may indicate that project operations adversely affect, or are likely to adversely affect, the condition of a resource. In that case, the next step is to develop and implement treatments to repair damage where possible, and prevent further deterioration or loss.

Idaho Power proposes to monitor the condition of selected eligible archaeological sites in the areas of potential effect of the project's three reservoirs, as well as the known burial site at Oxbow reservoir. In the APE downstream of Hells Canyon dam, Idaho Power proposes an initial 3-year program, at the end of which the condition of historic properties sites in this portion of the APE would have been verified and, as necessary, updated. Idaho Power would use results of this initial program to determine appropriate schedules for monitoring over the next three years. This pattern would continue throughout the license term, with the monitoring program being reviewed and revised as needed every 3 years. We include Idaho Power's proposed monitoring in the Staff Alternative, concluding that the protection afforded by monitoring these sites would be worth the annualized cost of $109,100

Forest Service 4(e) condition no. 25 specifies, among other provisions, that Idaho Power's HPMP should provide for periodic monitoring of all identified historic properties, including traditional cultural properties, within the areas of potential effect, with special provisions for photographic documentation of selected rock image sites. Interior 4(e) condition no. 5 specifies that 13 sites on BLM land within the APE be included in the initial monitoring effort.

The Umatilla Tribes and the Forest Service recommend that Idaho Power monitor the condition of traditional cultural properties, including rock art (CTUIR-35b, FS-25), and the Umatilla Tribes also recommend that Idaho Power develop a framework for monitoring traditional cultural properties in consultation with the tribes (CTUIR-35d).

The Nez Perce Tribe's recommendation (NPT-28) that all known historic properties in the area of potential effect be monitored to identify project-related effects is similar to the Forest Service's preliminary 4(e) condition no. 25.

The Idaho State Historical Society (ISHS-2) recommends that the monitoring program include confirmation of information on the archaeological site records Idaho Power submitted in association with relicensing, and that Idaho Power ensure that its cost estimates for monitoring are sufficient to cover this additional work.

We conclude in section 3.9.2.2, *Site Treatment*, that an initial 3-year program during which the conditions of all National Register listed and eligible resources (including not only archaeological sites but also rock art and other traditional cultural properties) are assessed, verified and updated as appropriate (which is consistent with Forest Service 4(e) condition no. 25 and also with Interior 4(e) condition no. 5) and existing site data are corrected or brought up to current conditions (as recommended by the Idaho Historical Society) would provide an informed starting point for the program. Review of the program and its findings every 3 years, as proposed by Idaho Power, would provide Idaho Power with an opportunity to make any necessary adjustments to monitoring methods and the frequencies with which various sites are monitored based on ongoing review of site conditions and project-related effects. We therefore include these measures, extended to the entire APE, in the Staff Alternative and conclude that they are worth the estimated annualized cost of $187,800.

5.2.6.3 Cultural Resource Site Stabilization

Water level fluctuations can destabilize soils and lead to seepage failure that affects not only shorelines but also archaeological materials that may be present in those soils. Erosion of soils containing archaeological materials can result in displacement or loss of artifacts, and also to exposure of artifacts where they may be vulnerable to unauthorized collecting or inadvertent damage.

Idaho Power proposes to stabilize 7 archaeological sites on Brownlee reservoir that are affected by project operations and approximately 20 sites between Hells Canyon dam and the confluence with the Salmon River that show evidence of active erosion potentially attributable to project operation. Idaho Power also proposes to recover archaeological data at four sites on Brownlee reservoir to prevent possible erosion damage. We include these measures in the Staff Alternative, concluding that the protection they would afford these sites would be worth the combined annualized cost of $176,800. Idaho Power proposes to coordinate with the appropriate SHPO, land management agency (or other landowner), and tribes to develop stabilization measures appropriate to each individual site.

Over the license term, periodic monitoring of all eligible cultural resources in the area of potential effect (as discussed in the preceding section) would ensure that if project-related effects to other resources (additional to the 27 archaeological sites proposed by Idaho Power) are identified, appropriate treatments could be developed and implemented in consultation with the tribes, agencies, and SHPOs.

We conclude in section 3.9.2.1, *Effects of Project Operations on Cultural Resources*, that continued project operation presents the possibility that sites on all three project reservoirs could experience erosion from water level fluctuations in the future. Idaho Power recognized this possibility early in its pre-application process when it proposed in its Formal Consultation Package to examine the effects of reservoir water level fluctuations on cultural resources. Consultation with the Cultural Resources Work Group led to Idaho Power's deferral of this work, which we estimate to cost $1,900 on an annualized basis. In its draft HPMP, Idaho Power indicates its plan to obtain information to complete this analysis during its periodic monitoring of archaeological sites on the reservoirs. To avoid any doubt about this proposed step, we include in the Staff Alternative a provision that Idaho Power develop and implement the deferred monitoring and analysis, and then integrate the results into subsequent monitoring and management efforts to be undertaken over the license term under the provisions of a finalized HPMP.

5.2.6.4 Ethnographic and Oral History Studies

The Shoshone-Paiute, Nez Perce, Burns Paiute, and Shoshone-Bannock Tribes have made generally similar recommendations that Idaho Power provide funding to undertake, expand or complete ethnographic and oral histories of these tribes (SPT-9, NPT-25, BPT-16, and SBT-3).

As part of relicensing activities, Idaho Power funded a Hells Canyon-area ethnographic overview as well as oral history studies for each of the tribes. Oral histories from the Warm Springs Tribes, Umatilla Tribes, and Burns Paiute Tribe were included as technical report appendices in the draft and final license applications. The Nez Perce Tribe submitted its oral history to Idaho Power in 2005; the document was filed with the Commission in February 2007. Idaho Power's funding of the ethnography and oral history studies offered the tribes the opportunity to identify traditional cultural properties and to provide information that Idaho Power could use in its management and protection of resources and places in the project that are of importance in the area's Native American cultural traditions (refer to section 3.9.2.4, *Support for Native American Programs*). Completion of oral history studies by the Shoshone-Paiute and Shoshone-Bannock Tribes would complement the studies already completed by the other tribes, and would contribute additional information toward effective and appropriate management of traditional cultural properties and sacred sites in the project.

Accordingly, we include in the Staff Alternative a measure whereby Idaho Power would renew its offer to arrange for and fund the development of oral histories for the Shoshone-Bannock and Shoshone-Paiute Tribes, in amounts comparable with the funding Idaho Power allocated for the other tribes' studies. The estimated one-time cost of this measure is $100,000 ($50,000 for each oral history).

5.2.6.5 Tribal Participation, Education, and Training

In consultation with each of the tribes, Idaho Power proposes to provide support for tribal programs and tribal participation in resource management in the project. Specifically, Idaho Power proposes to: (1) fund costs of tribal staff time and travel costs associated with tribal-related implementation of environmental measures; (2) support educational development programs, including scholarships/training; and (3) support ongoing and future cultural enhancement projects in consultation with each tribe. Idaho Power proposes to allocate $1 million in support of each tribe (total $6 million) over the term of the license, equating to a total annualized cost of $200,400.

The Burns Paiute, Shoshone-Paiute, and Shoshone-Bannock Tribes have recommended generally that Idaho Power support tribal participation in natural and cultural resource management of the Snake River and its tributaries (BPT-16, SPT-12, and SBT-3). The Umatilla Tribes recommend that Idaho Power provide $1 million to the tribes to facilitate consultation and coordination on matters pertaining to cultural resources (CTUIR-35j). The Burns Paiute Tribe recommends establishment and continued funding of a tribal education scholarship fund that would be administered by the tribe, and also recommends that Idaho Power provide annual funding to support the tribe's participation in cultural resources management in the project (BPT-11 and BPT-15). The Shoshone-Paiute Tribe recommends that the funding measures for each tribe be increased to $10 million (SPT-15). The Nez Perce Tribe recommends that Idaho Power grant each tribe its share of the funds in a lump sum at the beginning of the license term, for the tribe to use for license-related programs (NPT-31).

In section 3.9.2.4, *Support for Native American Programs*, we conclude that informed participation by groups for whom project-area resources are of both historic and ongoing cultural importance could contribute significantly to management and protection of such resources. To that end, we have included in the Staff Alternative Idaho Power's six proposed measures to promote tribal participation in cultural resource management and to support cultural enhancement and interpretation projects of the tribes. However, we delete the funding of scholarships from the Staff Alternative because of the lack of nexus with project effects. Although we recognize the benefit to the tribes that would result from Idaho Power's commitment to tribal programs, there is no nexus between that funding and the project and its effects. The resulting cost impact is to reduce the annualized cost of Idaho Power's proposed measures by $70,200. We note, however, that if this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license. We also do not include in the Staff Alternative recommendations to increase the funding to $10 million per tribe or to pay the funds in a lump sum because those measures cannot be tied to project effects and thus lack nexus to the project.

5.2.6.6 Cultural Resources Interpretation

Idaho Power proposes to create, install and maintain 14 informational kiosks at various locations throughout the project, focusing on the Native American presence and land use in the project area (6 kiosks), European-American occupation (4 kiosks), and the Asian-American experience (4 kiosks). Idaho Power also proposes to provide financial assistance in the form of grants to local communities and organizations to support the acquisition, display, and curation of museum collections, and for other public information and outreach projects focusing on the European-American and Asian-American presence in the Hells Canyon area.

Informational/interpretive kiosks proposed by Idaho Power, placed in appropriate locations in the landscape, would be an effective way to introduce visitors to the cultural history and resources of the Hells Canyon area (see section 3.9.2.3, *Cultural Resources Interpretation*). They also could potentially contribute to resource protection by noting legal penalties for vandalism and looting, and by making visitors aware of activities that could inadvertently damage or destroy resources. Accordingly, we include the kiosk installation measures proposed by Idaho Power in the Staff Alternative. We also include Idaho Power's proposed grant program to assist local community museums as a measure to enhance public appreciation of the area's European-American and Asian-American cultural heritage and resources. We conclude that these measures would provide sufficient benefits to be worth the combined annualized cost of $21,900. Similar grant programs to the tribes, as proposed by Idaho Power and discussed above, would provide effective support for interpretation of Native American traditions and resources without the need for Idaho Power to build and operate a Native American cultural center as recommended by the tribes.

5.2.6.7 Other Cultural Resource Management Issues

The Umatilla Tribes (CTUIR-24) recommend that the area of potential effect be expanded to the confluence of the Snake and Clearwater rivers, and that the added land be surveyed for cultural resources. The Nez Perce Tribe (NPT-30) recommends that the area of potential effect extend beyond the confluence of the Snake and Salmon rivers to the upper limit of the next downstream reservoir, near Asotin, Washington. The Idaho State Historical Society (ISHS-5) recommends that archaeological surveys be conducted along the reach of the Snake River between the Salmon and Grande Ronde rivers. The Shoshone-Paiute Tribe (SPT-11) recommends that the area of potential effect, and therefore the provisions of the HPMP, include all lands between the confluence of the Snake and Salmon rivers upstream to Shoshone Falls. We do not include expansion of the area of potential effect in the Staff Alternative because: (1) the recommendations of the tribes and the Idaho State Historical Society to expand the area of potential effect do not provide an empirical basis for attributing erosional impacts to cultural resources below the Salmon River to project operations and (2) extension of the Hells Canyon Project's area of potential effect to Shoshone Falls would not afford historic properties upstream of this project any greater protection than they now receive. However, we recognize that new information or changing circumstances over the term of a new license could make it necessary or desirable to revise the APE, as well as the HPMP in which the APE is defined. Idaho Power's draft HPMP does not provide for such a revision, although it does state that the archaeological monitoring program would be reviewed every 3 years. To clarify our intent that the HPMP should be a "living document" that responds to circumstances that will inevitably change over time, we therefore include in the Staff Alternative a recommendation that the final HPMP include provisions for review, and as necessary revision, of the HPMP in consultation with the SHPOs, tribes, Forest Service, and BLM every 6 years over the license term. This measure is also consistent with Forest Service 4(e) condition no. 25. We estimate the annualized cost of this measure at $1,700.

The Idaho State Historical Society (ISHS-7) and the Umatilla (CTUIR-27), Nez Perce (NPT-32), Shoshone-Paiute (SPT-12), and Burns Paiute (BPT-15) Tribes recommend formation of a standing organization (variously called a task force, advisory committee, or work group) specifically concerned with implementation of the HPMP for the project. Such an organization composed of representatives from all the tribes, land management agencies, other landowners, and SHPOs would give these directly concerned parties a voice in the management and protection of cultural resources in the project over the license term. There are many kinds of cultural resources in the project area, and committee members' contributions of knowledge and recommendations would inform Idaho Power's decision-making and would facilitate Idaho Power's adaptation, as necessary, of the HPMP to address the changing circumstances inevitable over the period of any new license. We therefore include this measure as part of the Staff Alternative. The cost for this measure is included in the $50,000 annualized estimate for Technical Advisory Committees given in section 5.2.8.1, *Land Use Management*.

The Umatilla Tribes (CTUIR-35h) recommend that Idaho Power conduct periodic training sessions to enhance staff understanding of cultural resources and their importance to the tribes. In its draft HPMP, Idaho Power has already proposed to develop a company-wide education program, particularly for departments involved in construction and other potentially ground-disturbing activities. Such a program would appropriately include discussion of the different kinds and significance of cultural resources in the project area as a way of enhancing employees' understanding of issues that would influence planning and implementation of project-related activities. We therefore do not include the Umatilla Tribes' recommendation in the Staff Alternative.

The Umatilla Tribes (CTUIR-35i) recommend that Idaho Power re-survey the area of potential effect every 10 years to identify cultural resources beyond those identified to date. Recognizing the possibility that additional archaeological sites may be discovered in the area of potential effect over the license term, Idaho Power in its draft HPMP has already specified the actions it would take, and the guidelines it would follow, should previously unidentified resources be encountered in the course of project operations. An HPMP revised in accordance with Forest Service 4(e) condition no. 25 would also include provisions for adaptive management strategies and also for determining when and under what circumstances re-survey may be necessary. We therefore do not include the Umatilla Tribes' recommendation in our Staff Alternative.

The Umatilla Tribes (CTUIR-33) recommend that artifacts recovered in the area of potential effect as a result of project operations be reburied on site or curated at a federally recognized repository. Under federal law, disposition of archaeological materials recovered on federal land is the responsibility of the land-managing agency. Because Idaho Power has not indicated how it would treat archaeological materials recovered from state, county and private land, we include in the Staff Alternative a requirement that Idaho Power include in the final HPMP a policy, developed in consultation with the SHPOs and tribes, regarding disposition of archaeological materials recovered from non-federal land. The cost of this measure would be included in the overall cost for finalization and implementation of the HPMP.

BLM (Interior-36) recommends that Idaho Power evaluate, and then protect or mitigate, scientifically important paleontological resources discovered in the course of project operations. Idaho Power's draft HPMP already provides for development and implementation of site-specific treatment plans for newly-discovered paleontological resources in consultation with BLM and in accordance with BLM's Paleontological Resources Manual. Because we find no reason to recommend exclusion or modification of the HPMP's existing provisions regarding paleontological resources, we therefore do not include BLM's recommendation in the Staff Alternative.

The Idaho State Historical Society recommends that Idaho Power provide funding to student and professional/academic researchers to support study of archaeological materials recovered during previous investigations in the project area that have not been analyzed or formally reported on (ISHS-2-1). While we recognize that such study could potentially enhance the state of knowledge concerning the cultural history of the project area, we conclude that it would not contribute materially toward management and protection of those resources extant and still in place within the project, and do not include this measure in the Staff Alternative. However, this would not preclude Idaho Power from collaborating on its own with institutions, students, and professional/academic researchers and allowing them access to archaeological materials in its possession.

The Idaho State Historical Society and the Nez Perce Tribe recommend that Idaho Power update the 1984 National Register nomination for the Hells Canyon Archaeological District, to incorporate the numerous additional sites identified during the relicensing surveys (ISHS-6 and NPT-27). In the draft EIS, we included this measure in the Staff Alternative because a number of new sites have been recorded since 1984 and implementing the measure would not add significantly to Idaho Power's costs over the term of a new license. However, we have reconsidered our position on this measure. We recognize that section 106 of NHPA requires the Commission to identify historic properties (resources already listed in or eligible for inclusion in the National Register) that may be affected by its actions. However, as noted by Idaho Power in its comments on the draft EIS, NHPA does <u>not</u> require the Commission, or a licensee, to nominate historic properties to the National Register. Section 110 of NHPA does require federal agencies that own or manage land to identify historic properties on that land and to nominate them for listing in the National Register. Because the Commission does not own or manage land, the requirements of section 110 are not applicable to relicensing of the Hells Canyon Project. Thus, we do not include this measure in the Staff Alternative.

In the draft EIS, we also considered the fact that over time, buildings evaluated in 2003 as ineligible for the National Register because they were at that time under 50 years of age would need to be reexamined to determine their eligibility under the standard National Register Criteria, potentially resulting in a large number of historic buildings that could be affected by project operations. Through an oversight, that document's Staff Alternative did not include a measure regarding future evaluation of buildings in the project. We therefore include in the Staff Alternative a measure for developing and implementing a schedule and methodology for re-evaluating buildings and structures as they reach 50 years of age. The estimated annualized cost of the measure is $3,000.

5.2.7 Recreation Resources

5.2.7.1 Recreation Plan

The Hells Canyon Project includes some of the most important recreational resources in the region, and acts as a gateway to the upstream end of the nationally significant Hells Canyon whitewater boating run. Idaho Power proposes to implement a project Recreation Plan designed to achieve 10 objectives that we list in section 3.10.2.2, *Recreation Plan*.

The proposed Recreation Plan would formalize Idaho Power's responsibilities to provide and maintain recreational resources throughout the project area, including those formal and dispersed recreational sites managed by others that provide public access to the project. The plan would provide a framework for Idaho Power to implement the recreational site improvements (discussed in section 3.10.2.3, *Recreational Site Improvements*) and coordinate management of recreational resources with the many land managers that have jurisdiction over project lands, and monitor recreational use and needs over the term of any new license. In section 3.10.2.2, we find that these measures would provide substantial improvements to management and delivery of recreational resources and would substantially expand recreational opportunities within the project. We estimate the annualized cost of implementing all the components and site-specific enhancements of the Recreation Plan would be about $1.2 million.

In section 3.10.2.2, we find that some of the standards and procedures included in Interior's preliminary 4(e) condition no. 6 would improve the proposed Recreation Plan and benefit recreational opportunities by establishing procedures for communication and consultation with other land managers. Interior's condition to establish a stakeholder workgroup would help ensure that appropriate consultation occurs as the plan is being developed and implemented without including too many stakeholders in a manner that slows planning and delivery of the plan. Similarly, Interior's specification regarding protocols for consultation with agencies would ensure that Interior and other agencies have reasonable opportunities to provide input into the finalization and implementation of the plan. Interior's specification with respect to including an ADA discussion in the proposed Recreation Plan would help ensure that an appropriate level of barrier-free access is achieved and maintained for the term of any new license. We also find in section 3.10.2.2 that several of the administrative components of Forest Service 4(e) condition FS-12 would help ensure that the proposed Recreation Plan addresses Forest Service standards for any improvements constructed on National Forest System lands.

Based on our analysis in section 3.10.2.2 and our review of agency and tribal conditions and recommendations, we include Idaho Power's proposed Recreation Plan in the Staff Alternative, but we modify it to include standards for construction that meet the disparate agency requirements; consideration of ADA standards; a description of how Idaho Power would plan, design, and construct new facilities (including a detailed description of each measure to the conceptual design level); and a description of how Idaho Power would comply with various federal and state standards for site development, help define appropriate procedures for implementing the plan, and help ensure that adequate standards are met for all recreational improvements over the term of any license issued. Also, we indicate that the plan would be finalized in consultation with the primary land managers, including the Forest Service, BLM, IDPR, IDFG, ODFW, OPRD, and the Oregon and Idaho counties around the Hells Canyon Project. The staff modifications would add an estimated annualized cost of $7,600 to Idaho Power's proposed plan.

The Burns Paiute Tribe (BPT-19) recommends that Idaho Power prepare an Integrated Comprehensive Recreational Plan, subject to approval by the federal agencies and the Burns Paiute Tribe. The plan recommended by the Burns Paiute Tribe appears to be generally consistent with Idaho Power's proposal and would include measures to provide interpretive signage for education and information that would be developed in consultation and with approval of the Tribe. The Tribe also recommends that it have the authority to review and approve the selection of all contractor(s) and sub-contractor(s), and, whenever possible, that tribal preference would be exercised to develop and increase competencies and capacities of the tribe.

In implementing its Recreation Plan, Idaho Power may select any contractor to do the work. However, we note that Idaho Power's proposed plan would include consultation with agencies, tribes, and other stakeholders prior to implementing the measure, which would be the appropriate time for Interior and/or the Burns Paiute Tribe to comment on the plan and any proposed contractors.

5.2.7.2 Recreation Site Improvements

As part of the proposed Recreation Plan (discussed immediately above), Idaho Power proposes to improve existing recreational sites and upgrade some informal recreational facilities to provide an improved level of service. These proposed measures are summarized in section 3.10.2.3, *Recreation Site Improvements*, as are the various agency recommendations regarding Idaho Power's proposal.

Idaho Power's proposal is consistent with Forest Service 4(e) conditions FS-13, 14, 15, 16, and 17, which specify site improvements at Big Bar, Eagle Bar, Eckles Creek, Deep Creek Stairway, and pullouts and signage along the Hells Canyon Road.

Idaho Power's proposal is also consistent with Interior 4(e) conditions Interior-8, 9, 10, 11, 15, and 17, which specify a boat moorage plan as well as site improvements to Airstrip, Bob Creek, Westfall, Swedes Landing, Spring, Oxbow, and Copper Creek recreational sites. Idaho Power's proposal is also consistent with Interior-18, which specifies development of a low-water boat launch at or in the vicinity of Swedes Landing. We estimate the incremental annualized cost for these measures is $39,600.

In section 3.10.2.3 we find that, overall, Idaho Power's proposed site improvement measures at existing sites would increase recreational opportunities by providing new facilities and would enhance visitors' recreational experiences. These measures represent a substantial improvement over existing conditions and would provide additional capacity in an area where existing project recreational facilities would continue to receive heavy recreational use, particularly on some weekends and holidays. We find that these measures would address recreational needs associated with growing recreational demand, changing recreational needs, and, in cases, deferred maintenance. Accordingly, we include in the Staff Alternative Idaho Power's proposed recreation site improvements. We estimate that the annualized cost of implementing Idaho Power's proposed site improvements (as a component of the total Recreation Plan costs described above) would be about $635,900.

We supplement Idaho Power's proposal in six specific areas, summarized in the following paragraphs and discussed more fully in section 3.10.2.3. Interior's modified 4(e) condition no. 16 specifies site planning and enhancements at the Oasis recreation site. The Oasis site is the most southern recreational site within the project boundary that provides access to project lands and waters. It is within the backwater influence of Brownlee reservoir, and lies within the project boundary. Unlike the more remote sites within the project, Oasis is near Interstate 84 and is easily accessible by road from Weiser and other nearby population centers. It provides unique recreational access to both riverine and lake areas, a characteristic that is somewhat limited in the area, and we therefore anticipate growing use. In the Staff Alternative, we include a provision that the Recreation Plan include development and implementation of a plan for an initial round of site improvements that would define and contain parking and formalize areas for other recreational uses, and, if needed, install improved toilets. We estimate the additional annualized cost of the measure to be $4,400.

Interior's modified 4(e) condition no. 12 specifies site planning and enhancements at the Steck recreation site. Interior's specification to expand Steck recreation site in anticipation of future recreational use does not appear to be needed at this time, since facilities at the site have substantial capacity to meet current use. However, we find in section 3.10.2.3 that it is likely that growing future use would degrade the existing facilities and ultimately require expansion and upgrades. Therefore, we include in the Staff Alternative Idaho Power's proposal to include Steck recreation site in the Recreation Adaptive Management Plan (see section 3.10.2.9). We find that it would allow Idaho Power and BLM to address future recreational requirements, including expansion of the site if needed, over the term of any new license issued. We estimate that the additional annualized cost of the measure would be $3,800.

During the spring freshet, sediment deposition occurs where inflow meets the backwater from Brownlee reservoir adjacent to Farewell Bend State Park. Developing and implementing a plan to remove the sediments in a systematic manner would improve public access to the reservoir, improve aesthetics of the docks, and address project-related effects on the park's irrigation pumps. In section 3.10.2.3, we find that seasonal fluctuations of Brownlee reservoir and boat wave action cause erosion along almost 80 percent of the Farewell Bend State Park shoreline. Therefore, we include in the Staff Alternative measures to harden and protect the shoreline as part of the final Recreation Plan (OPRD-2). We conclude that these measures would help reduce project-related losses of recreational land and infrastructure, help protect riparian habitats from further degradation, and improve aesthetic characteristics of the site. We estimate that the additional annualized cost of the measure would be $4,200.

In modified 4(e) condition no. 13, Interior specifies an enhancement plan for Jennifer's Alluvial Fan. Currently, the informal recreational site is about 6 acres with no facilities, and it is used for project-related camping and fishing activities. Interior indicates that recreational use of the area has created problems with litter, disposal of human waste, vehicle damage to shoreline areas, and erosion damage at the entry/exit point of the site. Given the type of project-related use at the site, and the impact from existing use patterns, we find that the site needs a certain amount of formalization to meet existing and projected future use. Therefore, we include in the Staff Alternative a measure to develop and implement a site plan that includes basic infrastructure such as toilet facilities, vehicular barriers, signage, and regular maintenance. This measure would help improve the site condition and would help protect the surrounding area from prohibited recreational activities. We estimate that the additional annualized cost of the measure would be $9,800.

As part of its modified 4(e) condition no. 19, the Forest Service specifics lengthening the boat ramps at its recreational sites on Hells Canyon reservoir if proposed project operations that would extend the lower drawdown level another 5 feet under existing conditions would adversely affect reasonable boat access. In section 3.10.2.3, we find that the measure would help ensure that reasonable public access to Hells Canyon reservoir continues from Big Bar and Eagle Bar, the only Forest Service-managed sites on Hells Canyon reservoir that provide boat access. We note that the condition does not define "prolonged" drawdown. We recommend that Idaho Power, as part of the Recreation Plan, define the conditions under which boat ramp extensions would be needed. We also recommend that, as part of the Recreation Plan, Idaho Power assess the need for extending other public boat ramps at Hells Canyon reservoir, including systematic evaluation of existing boat ramps based on the elevation at the bottom of each primary boat ramp, the amount of time that boat access would be limited under atypical conditions, and whether extending the boat ramp is needed to support public access to the reservoir. Given the uncertainty of whether boat ramp extensions would actually need to be constructed, the Staff Alternative does not include the cost of such construction.

As part of its modified 4(e) condition no. 21, the Forest Service specifies enhancements to the Hells Canyon Creek boat launch to improve safety and meet recreational needs. The Hells Canyon Creek boat launch site is the only area for boaters, and the primary area for anglers, to access the Snake River immediately downstream of the project. Given the national significance of the boating run downstream of the project, the launch site represents minimal and reasonable access to the Snake River downstream of the project, and we conclude that improving the site to enhance access and safety, provide potable water, and provide a portable waste disposal system is required for project recreation purposes. Accordingly, we include these improvements in the Staff Alternative, with the provision that the project boundary be adjusted to include the launch site and access thereto. We estimate that the additional annualized cost of the measure would be $36,100

We do not include two recommended measures in the Staff Alternative that do not appear to have a project nexus. Interior-28 recommends that Idaho Power develop and implement a plan for major facility upgrades at Heller Bar, a site considerably downstream and outside of the project boundary. IDFG-8 recommends that Idaho Power fund development of angler access sites that would also be downstream and outside of the project boundary, with no clear nexus to the project's recreational resources. In section 3.10.2.3, we find that although the recommended measures could improve site conditions outside the project, there is no indication that recreational use of these sites is project related or that project operations adversely affect the site. We estimate the annualized cost for the Heller Bar measure would be $38,000. IDFG did not recommend any particular level of access site development in its recommendation (IDFG-8), but we estimate a minimum annualized cost of $20,000 to develop and maintain each site.

5.2.7.3 Sanitation and Litter Management

The project provides recreational opportunities for many thousands of visitors from the region. Due to this intense use, litter and human waste problems occur along the project shorelines, which can create public health and safety impacts and aesthetic impacts, and can detract from recreational experiences.

In section 3.10.2.4, *Sanitation and Litter Management*, we discuss Idaho Power's proposal to enhance its existing Litter and Sanitation Plan for the project by providing additional portable and vault toilets at appropriate dispersed recreational sites and by implementing a biannual litter pickup program throughout the project area. Idaho Power would develop the plan in consultation with the appropriate parties and would implement the Litter and Sanitation Plan for the term of any new license. We conclude there that Idaho Power's litter and sanitation proposal would address an important recreational issue that affects both the quality of the recreational experience and the environmental attributes of the dispersed sites. Accordingly, we include Idaho Power's proposed measure in the Staff Alternative. We estimate that the annualized cost of the measure would be $61,600.

Additionally, however, we supplement the proposal in two ways. Idaho Power proposes, and Interior's 4(e) condition no. 7 specifies, the installation of floating restrooms on Brownlee and Oxbow reservoirs. Although it is not entirely clear from the record, we assume that these recommendations are associated with Idaho Power's proposal to install moorings for overnight camping, which is also consistent with Interior-8, the boat moorage plan. If the final locations of the mooring sites are associated with shoreline facilities, the recommended floating restrooms do not appear to be needed. If the location of the moorings is more than 1 mile from a developed public access site, then floating restrooms would provide an appropriate level of service. Accordingly, in the Staff Alternative we include a provision that Idaho Power consult with the appropriate parties to confirm the need for, location of, and maintenance standards for floating restrooms. The estimated annualized cost for this measure is $66,800.

Lastly, modified Forest Service 4(e) condition no. 21 specifies that Idaho Power design, construct and maintain a gray water and sanitary cleaning system capable of cleaning portable human waste carry-out systems at the Hells Canyon Creek area, which is the only area for boaters and anglers to access the Snake River immediately downstream of the project. The area is very remote and is accessible only along one project road. The specified sanitation measures appear to be necessary infrastructure to support reasonable public access to trips into the HCNRA. We conclude that this measure would benefit project purposes, and include it as an element of the Litter and Sanitation Plan in the Staff Alternative. The estimated annualized cost is reflected in the cost estimate for other improvements at the Hells Canyon Creek boat launch (see section 5.2.7.2, *Recreation Site Improvements*).

We do not include one recommended measure in the Staff Alternative because it does not appear to have a project nexus. In section 3.10.2.4, we find that there is no indication in the record that Oregon State Marine Board's recommendation (OSMB-5) to develop a dump station for boat holding tanks at the upstream end of the project is needed. Boaters and recreational vehicle campers have options to pump holding tanks along major highways throughout the region, and there is no evidence in the record to suggest that these regional facilities are insufficient to meet project-related visitor demand for such services. We estimate the cost for this measure to be $41,800.

5.2.7.4 Information and Education

Idaho Power proposes to develop an Information and Education Plan that includes: (1) review and selection of appropriate themes; (2) review and selection of appropriate interpretive media to be used; (3) development of a web site and toll-free phone number accessing pertinent recreation-related information; and (4) review and selection of prioritized sites where the interpretive media would be located. Idaho Power would implement the plan in consultation with the appropriate parties, and operate and maintain the facilities and amenities resulting from the plan. Agency and tribal recommendations generally support Idaho Power's proposal (refer to section 3.10.2.5, *Information and Education*).

The proposed Information and Education Plan would promote protection and preservation of cultural, natural, and historical resources by providing educational and interpretation materials at primary recreational sites. The plan would also provide consistency of information and education materials between recreational sites, which would help give recreational users the sense of coherent management throughout the project area. As described by Idaho Power, the plan does not specify the location or type of materials that would be developed. Including this information in the plan, as well as operational and maintenance activities and any scheduled updates to the information and education materials, would help ensure that the plan can be successfully managed over the term of any new license. We include Idaho Power's development and implementation of an Information and Education Plan in the Staff Alternative. The estimated annualized cost of developing and implementing the plan is $149,800.

In the Staff Alternative, we modify the proposed measure to require that the plan include specification of the location and types of information materials to be provided at each location. Additionally, in section 3.10.2.5, we agree with NMFS-20 and OSMB-6 that the plan should include the provision of information about anadromous fish and invasive species. In the Staff Alternative, therefore, we supplement Idaho Power's proposal to include this provision. Idaho Power contributes substantial resources annually toward the improvement of anadromous fish runs, without which certain populations of salmon would be further stressed. Including in the plan information about the effects of hydroelectric projects and other human activities on anadromous fish runs, and the efforts underway to improve and protect these runs within the context of modern energy demands, would help place this issue in a contemporary context. Including information about invasive species would help inform visitors about the incremental role individual boaters play in spreading non-native species and about the potential harm these plants and animals can cause. The estimated annualized cost of these staff modifications is $1,400.

5.2.7.5 Trails

Of the numerous recreational and hiking trails that provide access to public lands managed by federal agencies near the project, many begin along project roads or at project-related recreational sites. Idaho Power proposes to maintain trailheads within the project, but does not propose any specific measures for trails outside the project boundary. Idaho Power states that funding for trail improvements and maintenance of trails located on federal lands outside the project boundary should remain the responsibility of the Forest Service.

In its modified 4(e) condition no. 20, the Forest Service specifies that Idaho Power perform trail maintenance on Forest Service trails accessed from the Hells Canyon reservoir and Hells Canyon Creek launch site. In section 3.10.2.6, *Trails*, we find that recreational use within the project boundary is primarily associated with the project reservoirs, including boating, fishing and camping. With the exception of a few specific trails within the project boundary, little evidence in the record suggests that use of hiking trails originating at the project are related to a project purpose. In our analysis in section 3.10.2.6, we do not find a clear nexus between project operations and recreational use of Forest Service-managed trails outside of the project boundary. We conclude that Idaho Power addresses the primary project-related effects on Forest Service managed trails originating within the Hells Canyon Project by proposing to maintain pull-out and parking areas along Hells Canyon Road and improving sanitation and increasing litter patrols throughout the project. Therefore, we do not include this Forest Service condition in the Staff Alternative. The estimated annualized cost of this condition is $3,000.

Interior, in its modified 4(e) condition no. 3, specifies that, as part of an integrated travel and access management plan for BLM-administered lands, Idaho Power develop and implement a plan for non-motorized use of trails connecting recreation sites along the Oregon side of Hells Canyon reservoir and conduct a feasibility study for developing a trail system along the Hells Canyon, Brownlee, and Oxbow reservoirs connecting Farewell Bend State Park to the HCNRA. We conclude that Interior has not established a clear need for the recommended trail system to provide reasonable public access to the project or between project facilities, and we do not include this measure in the Staff Alternative. The estimated annualized cost if this measure is included in the cost of measures discussed below under *Road Management Plan.*

5.2.7.6 Operation and Maintenance at Forest Service and BLM Sites

In section 3.10.2.7, *Operation and Maintenance of Forest Service and BLM Sites,* we discuss Idaho Power's proposal to continue operation and maintenance of its parks and recreation facilities and to perform operation and maintenance at Idaho Power-enhanced BLM and Forest Service reservoir-related recreational sites within the project boundary. This proposal would ensure that these facilities are adequately maintained for the license term and we include this measure in the Staff Alternative at an estimated annualized cost of $85,300.

Forest Service modified 4(e) condition no. 18 specifies that Idaho Power perform O&M necessary to meet Forest Service Standards. In section 3.10.2.7, we find that the condition appears to be primarily concerned with Idaho Power developing O&M standards in consultation with the Forest Service as part of the Recreation Plan. Idaho Power has agreed to implement FS-18 under its Settlement Agreement with the Forest Service. We include FS-18 in the Staff Alternative; the cost is reflected in the $85,300 annualized cost of Idaho Power's proposed operation and maintenance plan.

Forest Service modified 4(e) condition no. 21 specifies that, among other things, Idaho Power perform 100 percent of the O&M necessary to maintain the Forest Service-specified improvements at the Hells Canyon launch and 50 percent of the remaining O&M needs at the Hells Canyon Creek launch. As discussed in section 3.10.2.3, *Recreation Site Improvements*, we find a clear nexus between the project and providing reasonable public access to the Snake River downstream of the project. For that reason, we recommend including the site in the project boundary (see section 5.2.8.3). However, we also acknowledge that the launch is on Forest Service-managed lands and many of the activities that occur at the launch may not be project related. Because of the importance of the launch area and to ensure that the site is adequately maintained for the term of any new license, we include in the Staff Alternative a provision for Idaho Power to develop a detailed agreement with the Forest Service regarding O&M as part of the final Recreation Plan. It is, however, Idaho Power's responsibility to ensure that the site is maintained.

Interior specifies as part of its site-specific modified 4(e) measures that Idaho Power perform O&M at all BLM-administered recreational sites. Idaho Power does not propose to handle O&M at BLM sites within the project boundary except where Idaho Power is proposing site enhancements. In section

3.10.2.7 we note that, regardless of which party provides or funds O&M services, the Commission would hold Idaho Power, as the licensee, responsible for the proper implementation of any measure included in any license for the project. Therefore, the Staff Alternative indicates that Idaho Power should prepare an O&M plan for each site within the project boundary that describes the maintenance standard applicable to the site and indicate how that standard will be met, to ensure an appropriate level of O&M at all developed Forest Service and BLM sites within the project boundary. Idaho Power may enter agreements with the agencies to cost-share O&M and other capital measures, but it is ultimately the licensee's responsibility to ensure that recreational resources that provide public access to the project are maintained at an adequate level.

5.2.7.7 Adaptive Management

Idaho Power proposes to develop a Recreation Adaptive Management Plan to identify and address recreation management, measures, and facility needs for the project over the term of any new license. Idaho Power would use recreational monitoring as the basis for evaluating and recommending any changes to the Recreation Plan that may be needed. Proposed monitoring would include annual informal onsite observations and traffic counters, as well as a more detailed recreational survey of social indicators and general recreational use every 6 years. Idaho Power would prepare summary reports for stakeholders annually and a comprehensive report every 6 years in coordination with FERC Form 80 (Licensed Hydropower Development Recreation Report) filing. Consultation with agencies and entities would occur in coordination with FERC Form 80 filing.

We review numerous conditions, alternative conditions, and recommendations pertaining to ongoing recreation management in section 3.10.2.9, *Adaptive Management*. In that section, we conclude that Idaho Power's proposed Recreation Adaptive Management Plan would provide a flexible tool that could accommodate changing use over time, and we include it in the Staff Alternative. Idaho Power's consultation list includes the primary recreational managers in the project area, and the plan would provide a substantial level of coordination and consultation. The estimated annualized cost of developing and implementing the Recreation Adaptive Management Plan is $108,100.

Interior modified 4(e) condition no. 14 specifies development of a management plan for dispersed sites, which are undeveloped or informal sites. We note that Idaho Power's proposed Recreation Adaptive Management Plan does not include the numerous dispersed recreational sites throughout the project area. These sites may be the appropriate locations for further development if the Recreation Adaptive Management Plan identifies a need for more development in the future. Therefore, and based on our analysis in section 3.10.2.9, we include in the Staff Alternative a modification of Idaho Power's measure, indicating that the Recreation Adaptive Management Plan's scope should include dispersed site management, and that it include detailed procedures for recreational use monitoring and reporting. The estimated annualized cost of the staff additions is $69,000.

5.2.8 Land Management and Aesthetics

5.2.8.1 Land Use Management

Project facilities and operations can be incompatible with other land and water uses within the project boundary, such as when development of a recreation facility leads to shoreline erosion or adverse effects on wildlife habitat or cultural resources. Land management issues also include the adequacy of buffers that separate incompatible uses, and the adequacy of management measures designed to protect natural and cultural resources.

Idaho Power proposes to implement the Hells Canyon Resource Management Plan (HCRMP) to guide land management decisions within the project boundary. The plan has already been developed and includes defining buffers between incompatible uses and establishing and maintaining compatibility between and among the various land and water uses in the project. Various policies within the plan require the development of implementation tools and programs as well as management plans specific to a resource or issue, and would include an information and education program; evaluation of dispersed recreation sites; evaluation of recreation/riparian interfaces; establishment of O&M standard practices; a GIS atlas; land and water use classifications; an Idaho Power interdisciplinary team; a program for coordinating with other parties, including forums for coordination and evaluation of existing agreements and new agreements and partnerships with agencies; and establishment of best management practices.

The Forest Service (FS-1) specifies that Idaho Power obtain approval for site-specific project designs prior to any habitat or ground-disturbing activities on Forest Service lands and that if any Forest Service lands are added to the project boundary that Idaho Power obtain special-use authorization for occupancy and use of these lands. FS-2 specifies that Idaho Power prepare a resource coordination plan to establish a process for information exchange and to coordinate efforts for implementing license conditions, such as any required management plans, and ongoing project O&M activities potentially affecting Forest Service lands. This plan would include annual Forest Service consultation requirements; documentation of efforts to monitor project effects on other resources and effectiveness of required enhancement measures; means for revising or improving implementation strategies as needed; and standard operating procedures for activities on Forest Service lands.

Interior-1 specifies that Idaho Power consult and cooperate with BLM prior to initiating activities on BLM-administered lands within the project boundary. Interior's condition would require Idaho Power, among other things, to prepare site-specific plans for approval by BLM, including a safety-during-construction plan and a spoils disposal plan prior to any ground disturbing activities on BLM-administered lands. Interior-2 specifies that Idaho Power prepare and provide a written report in consultation with BLM documenting and/or evaluating measures necessary for the continued protection and utilization of BLM-administered lands and resources within the project boundary.

The Burns Paiute Tribe (BPT-3) recommends that Idaho Power establish and fund a resource coordinating committee comprising involved stakeholders to review and maintain oversight over the implementation of project activities, including the implementation of mitigation, adaptive management, and license implementation decision-making. AR/IRU recommend (AR/IRU-3) that the final license include an adaptive management approach and that a Technical Advisory Committee be convened to oversee adaptive management in the license. The Technical Advisory Committee, which would include the various stakeholders, would oversee study design and implementation, develop mitigation measures based on those studies, and oversee implementation and monitoring of the measures.

Including the proposed HCRMP and its common policies and including the proposed implementation tools in consultation with stakeholders would help ensure that compatibility among land uses is achieved and maintained by determining appropriate land and water uses and applying standard approaches to managing human use and resource protection. However, the proposed HCRMP includes only a few details about how the plan would be implemented. Including additional details regarding implementation of the HCRMP, such as identifying which policies require the development of specific management plans, and identifying additional implementation programs that might be necessary to address project effects on other resources, would help ensure that policies are acted upon, stakeholders understand Idaho Power's intent, and resources are protected while allowing for human use and necessary project operations. We include Idaho Power's proposed HCRMP in the Staff Alternative, and indicate that the additional details should be provided. We estimate the extra cost of the staff modifications to be $1,500 on an annualized basis.

The HCRMP calls for development of several programs to facilitate coordination and consultation between Idaho Power and local, state and federal agencies as well as other stakeholders. Post-license consultation is also required in the development and implementation of plans for aquatic, terrestrial, cultural, and recreation resources. Formation of an oversight committee, as recommended by the Burns Paiute Tribe (BPT-3) and AR/IRU (AR/IRU-3), would provide a standing forum for consultation and coordination. Similarly, formation of resource-specific Technical Advisory Committees would facilitate ongoing consultation on resource plans and programs required by a new license. We include the creation and support of an advisory oversight committee and resource-specific Technical Advisory Committees by Idaho Power in the Staff Alternative to facilitate the normal FERC consultation process on the development and implementation of plans required by the new license and to provide a forum for consultation on the ongoing implementation of license provision using adaptive management principles. We estimate the annualized cost of this measure to be $50,000. FS-1 and FS-2 specify a separate plan to address consultation with the Forest Service. We include these measures in the Staff Alternative, but find that this condition would be better met through development and implementation of the HCRMP, including details on consultation, coordination, and reporting. The scope of activities would be limited to Forest Service lands within the project boundary. We estimate that the annualized cost to Idaho Power in addition to implementing the proposed HCRMP is $1,000 for FS-1 and $6,100 for FS-2.

Interior-1 and -2, which we include in the Staff Alternative, appear to be generally consistent with the consulting and coordination measures in Idaho Power's HCRMP, but may require additional study analysis in the plan and may require additional time to implement. We estimate the annualized cost of these measures to be $4,400, and $5,000 respectively.

5.2.8.2 Law Enforcement and Fire Protection

Disturbances requiring law enforcement at the project occur throughout the year and peak during the summer recreational season. Issues include conflicts between users and the timeliness of response to safety-related incidents in remote areas such as the HCNRA. Various stakeholders have commented that the level of resources for and support of emergency services provided by Idaho Power is not sufficient to provide for visitor safety.

Idaho Power proposes to continue to support local law enforcement, indicating that such support improves public safety in the project area by decreasing emergency response times and increasing law enforcement presence. Additionally, Idaho Power proposes to sponsor biannual meetings regarding law enforcement issues, resources, and responsibilities; provide access to its property and facilities; and contribute to the O&M costs associated with this measure.

In section 3.12.2.3, *Law Enforcement*, we describe preliminary conditions and recommendations of Interior (Interior-4), ODFW (ODFW-85), and the Oregon State Marine Board (OSMB-1, -2, and -3). In that section, we point out that the responsibility of funding law enforcement activities on private, state, and federal lands, including the funding of law enforcement personnel as specified by Interior and recommended by the Oregon State Marine Board and ODFW, lies with the county, state, and federal agencies having jurisdiction over those areas. Therefore, we do not include Idaho Power funding of third parties for law enforcement activities in the Staff Alternative.

Because several state and federal agencies and counties have land management and law enforcement responsibilities within the project area, we see the merit of Idaho Power coordinating these efforts through biannual meetings, as specified by Interior (Interior-4) and recommended by the Oregon State Marine Board and ODFW. Including such meetings in a law enforcement plan would assist in evaluating and coordinating law enforcement activities. We modify Idaho Power's Policy 6.3.8.4 of the HCRMP to state that Idaho Power will sponsor biannual meetings and continue to coordinate with law enforcement agencies with jurisdiction within the planning area on a regular basis. We estimate that the additional annualized cost of this measure would be $5,000.

The project includes a mix of private and public lands adjacent to large tracts of undeveloped lands. Fires started on Idaho Power-owned lands within the project could rapidly spread to adjacent properties or onto the large public tracts. Fire suppression is the responsibility of the counties and the federal land managers, but, given the rural character of the project, it is unclear whether this is sufficient to protect the health, safety, and welfare of project visitors.

Idaho Power proposes as part of the HCRMP to continue to coordinate with public agencies regarding the occurrence of controlled and uncontrolled fires, to suppress fires on its property, and to cooperate with agencies to manage visitor access during uncontrolled fires. In section 3.12.2.4, *Fire Protection*, we review Interior preliminary 4(e) condition no. 4 and Forest Service preliminary 4(e) condition no. 3 and conclude that the HCRMP lacks sufficient detail in the area of fire protection. Accordingly, we include in the Staff Alternative a provision that, in finalizing the HCRMP, Idaho Power include fire protection plan details including how Idaho Power would suppress fires on its lands and how it would manage and communicate with project visitors during evacuations. Also, developing a fire prevention plan for lands within the project boundary as specified by Interior and the Forest Service could help prevent potential fires from spreading beyond project lands and would aid county and agency personnel if a fire were to move beyond the project boundary. The plan would cover all lands within the project boundary, including private and public recreational sites. Idaho Power would be the appropriate entity to coordinate fire prevention efforts on project lands, but Idaho Power would bear the responsibility for funding only efforts required within the project boundary. The cost of these measures is included in the overall cost of developing and implementing the HCRMP.

5.2.8.3 Boundary Modifications

The FPA requires the project licensee to provide safe public access to project lands and waters and include those lands necessary for project purposes in the project boundary. In accordance with this law, the Commission requires that the project boundary contain the primary recreational facilities used to access project waters, as well as the lands necessary to ensure access for the term of the license, and the lands necessary to ensure an appropriate buffer between the project and neighboring lands.

Idaho Power proposes to remove 3,800 acres of federal land from the existing boundary. The new boundary would follow the same contour line as that followed on private lands, rather than following the metes and bounds system that was used to determine the project boundary on federal lands. We discuss this issue in section 3.12.2.5, *Boundary Modifications*.

We conclude there that standardizing the boundary at the same contour line on both private and federal lands appears to be a sound approach to setting the project boundary. Including all dispersed recreation sites within 200 yards of project waters in the proposed project boundary and defining them on a map that includes the project boundary would clarify which sites would be included within the project boundary and would help ensure that dispersed sites are maintained in place to provide project access. The recreation sites that Interior recommends for inclusion in the project boundary—Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites—are currently at least partially located within the project boundary and provide access to the reservoirs. As discussed above, we also recommend including the Hells Canyon Launch area and the Deep Creek trail in the project boundary. Including these recreation sites within the project boundary is appropriate. Additionally, all lands acquired for wildlife mitigation purposes should be included within the project boundary. We estimate that the annualized costs of mapping and monitoring these additional lands would be $1,000.

As part of any new license, Idaho Power would provide a revised exhibit G (project boundary map) that would include a detailed description and maps of the project boundary. We conclude that this information, supplemented by Idaho Power's plan and the Forest Service's condition (FS-26) to provide aerial photos marked with the project boundary, would provide sufficient definition of the boundary. Surveys may be necessary before any ground disturbing activities are undertaken to verify the boundary on the ground. This is true for all project lands, not just Forest Service lands. Such surveys would ensure that natural and cultural resources are not compromised and that ground disturbing activities occur only within the project boundary. We do not estimate a cost for this measure because it requires a one-time effort associated with Idaho Power's filing of a revised exhibit G.

5.2.8.4 Road Management Plan

Idaho Power-owned or maintained roads within the project area provide both public access to project lands and waters and Idaho Power access to project developments. Project roads may have adverse effects on cultural and natural resources by allowing public access to areas where these resources occur. Appropriate project road management provides for safety and protection of environmental resources while continuing to provide reasonable public access to the project.

Idaho Power proposes to continue maintenance of roads that it owns and/or maintains: Oxbow-Hells Canyon Road, 22 miles; Homestead Road from Oxbow, Oregon, to Ballard Creek, 6 miles; and Brownlee-Oxbow Road, 12 miles. In addition, Idaho Power proposes to develop a Road Management Plan as an element of the HCRMP to increase the effectiveness and efficiency of efforts to manage, maintain, and enhance travel and access to not only project lands but also lands within the vicinity of the project and assist in the assessment of Idaho Power's role and responsibilities with regard to travel and access to the Project. The plan is also intended to foster coordination, cooperation and integration of efforts between the Licensee and the various entities with jurisdiction for roads.

As proposed by Idaho Power and recommended by ODFW (ODFW-76) and specified by the Forest Service as part of its modified 4(e) condition no. 12, a Road Management Plan would improve access management by considering appropriate traffic levels to protect natural and cultural resources while providing reasonable public access. Such a plan would increase public safety by providing for road maintenance and management consistent with recreational demand and the goals of the HCRMP on those roads within the project boundary. We include the Road Management Plan in the Staff Alternative and estimate that the annualized cost of Idaho Power's proposed plan is $27,800. This cost is included in the total HCRMP costs. We estimate minor additional annualized costs associated with fulfilling ODFW-76 to be $1,100.

Idaho Power's proposed plan lacks certain details that would be necessary to ensure public access and protect project-related environmental resources. In its comments on the draft EIS, Idaho Power clarifies that the Road Management Plan would include an atlas as part of the GIS system. To ensure that road management measures are part of the GIS system, we continue to include in the Staff Alternative additional measures to be included in the plan. The first is a provision that Idaho Power include in the Road Management Plan development of a road atlas as part of the proposed GIS system that depicts locations of natural areas and describes cultural resources designed to limit conflicts between human use and valuable resources. The second staff-developed provision is that Idaho Power, in consultation with federal land managers and adjacent local governments, provide as part of the plan information detailing which roads are required for project purposes. We note that any such roads would need to be included within the project boundary. Finally, the road management plan, as modified by staff, would include a maintenance schedule describing Idaho Power's maintenance responsibilities on all project roads. We estimate the annualized cost of these extra Road Management Plan provisions to be $1,500.

Interior's modified 4(e) condition no. 3 specifies that Idaho Power develop an integrated travel and access management plan for BLM-administered lands affected by the project, to be incorporated into the Interior-recommended comprehensive recreation management plan and coordinated with the Interior-recommended integrated wildlife habitat program and wildlife mitigation and management plan. However, most of the roads listed in the condition are outside of the project boundary and are managed by county and state governments. Interior has not established in the record a clear nexus between project operations and the need for road maintenance on all of the county and state roads outside of the project boundary. Given the numerous roads that provide access to the project, it appears that this measure overstates the licensee's responsibility to provide reasonable public access to the project. Further, it is the responsibility of state and county governments to maintain roads that are within their jurisdiction and that are used for non-project purposes. Therefore, we do not include this measure in the Staff Alternative. We estimate the additional annual cost of this measure, if included in the Staff Alternative, would be $15,100.

5.2.8.5 Aesthetic Resource Management

As part of its settlement with the Forest Service and consistent with modified terms and conditions FS-22, Idaho Power also proposes to develop an aesthetic improvement plan for the Hells Canyon Dam Site and Recreational Portal. The proposal and FS-22 call for Idaho Power to enhance the upper deck, entrance, and egress areas of Hells Canyon dam that will be incorporated into the Scenery Management Plan and file the aesthetic improvement plan with the Commission for approval. Alterations may include changes in fencing material, color of materials, screening of stop blocks, parking, signage, pedestrian walkways, interpretation, viewing areas and landscaping provided that such alterations are consistent with the FERC approved security plan for the Dam. A schedule for implementation, to be conducted by the Licensee, would be included in the aesthetic improvement plan.

Idaho Power originally proposed to implement aesthetic measures as part of the HCRMP (see section 3.12.2.1, *Land Use Management Plan*) in which goals and objectives as well as policies and guidelines for aesthetic standards are discussed. Now, as part of its settlement with the Forest Service and consistent with modified terms and condition FS-24, Idaho Power proposes to prepare a Scenery Management Plan for project facilities and operations on Forest Service lands within the project boundary and adjacent to the project boundary within 1 year of license issuance. This plan would include: existing transmission lines and associated service roads; design standards and guidelines for physical structures and landscaping; general aesthetic clean-up and implementation; replacement of guardrails and jersey barriers; mitigation of contrast from project facilities; and enhancement of other facilities.

Interior-25 recommends that Idaho Power develop a visual resource management plan (VRMP) for project facilities to address the design, maintenance, and construction of project facilities (both existing and future) in order to preserve or enhance visual resource values. Interior would have the VRMP apply to the following facilities: (1) dams, bypass canals, spillways (concrete structures); (2) switch yards, power houses, buildings, penstocks, powerlines (metal structures); (3) project recreation facilities including campgrounds and day-use sites; and (4) powerline access corridors and cutbanks. The annualized cost of this measure, which we include in the Staff Alternative, would be $2,500.

Based on our analysis presented in section 3.11.2.2, *Aesthetic Improvements and Resource Managemen*t, we conclude that development and implementation of an aesthetics improvement measures would improve the aesthetic character of the Hells Canyon Project by creating a framework of aesthetic design standards and guidelines under which Idaho Power would plan, develop and rehabilitate project facilities over the term of a new license. Including the aesthetic measures proposed by Idaho Power would improve the scenic integrity of the landscape within the project vicinity, and we include them in the Staff Alternative. We estimate the annualized cost of Idaho Power's proposal to be $168,800.

5.3 SUMMARY OF 10(j) RECOMMENDATIONS AND 4(e) CONDITIONS

5.3.1 Fish and Wildlife Agency Recommendations

Under the provisions of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. In response to our REA notice, the following fish and wildlife agencies submitted recommendations for the project: NMFS (letter filed January 25, 2006), Interior (letter filed January 27, 2006), ODFW (letter filed January 25, 2006) and IDFG (letter filed January 26, 2006).

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. Table 108 lists the federal and state recommendations filed pursuant to section 10(j) and indicates whether the recommendations are included under the Staff Alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document.

In the draft EIS, of the 173 recommendations that we considered to be within the scope of section 10(j), we wholly included 92 measures in the Staff Alternative, included 27 in part, and did not include 54. Following publication of the draft EIS, we held a meeting with the fish and wildlife agencies to try to resolve inconsistencies with the FPA and to provide both agency personnel and FERC staff the opportunity to clarify their positions on various measures that we did not adopt as part of the Staff Alternative. The 10(j) meeting was held in Boise, Idaho, on December 5 to December 7, 2006; other interested parties, including representatives of Idaho Power, several tribes, and other organizations, also participated. We filed a meeting summary on January 12, 2007. Comments on the meeting summary were filed by IDFG (January 30, 2007), NMFS (February 8, 2007), the Forest Service (February 12, 2007), ODFW (February 21, 2007), and Interior (March 15, 2007). As a result of the meeting and subsequent clarifications, as well as, the agencies' comments on the draft EIS, we revised our recommendation concerning several 10(j) measures. Among the measures we now adopt as part of the Staff Alternative are: (1) the FWS modified fishway prescription; (2) enhancement measures to support redband and bull trout restoration in portions of the Powder and Burnt River basins; (3) funding for the development and implementation of Hatchery and Genetic Management Plans for each mitigation hatchery; (4) development and implementation of an invertebrate monitoring plan to evaluate trends in the abundance and distribution of rare and sensitive species of mollusks; (5) assessment of water quality-related effects on white sturgeon, genetic monitoring, and translocation of reproductive-sized white sturgeon into the Swan Falls-Brownlee reach; (6) evaluation of fall Chinook salmon egg-to-fry survival; and (7) habitat management of 4 state-owned islands rather than 2 islands.

In this final EIS, of the 173 recommendations that we consider to be within the scope of section 10(j), we wholly include 110 in the Staff Alternative, include 18 in part, and do not include 45. We discuss the reasons for not including those recommendations in section 5.2, *Discussion of Key Issues.* Table 108 indicates the basis for our preliminary determinations concerning measures that we consider inconsistent with section 10(j).

5.3.2 Interior and Forest Service 4(e) Conditions

In section 2.3.1.3, *Section 4(e) Federal Land Management Conditions*, we list the modified 4(e) conditions submitted by Interior and the Forest Service, and note that section 4(e) of the FPA, 16 U.S.C. § 797(e), provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our Staff Alternative. Table 109 summarizes our staff conclusion with respect to the modified 4(e) conditions. Of the 44 modified 4(e) conditions submitted by Interior and the Forest Service, we include in the Staff Alternative 36 conditions as specified by the agency and include 4 slightly modified to adjust the scope of the measure. We note that one condition (regarding reservation of authority) would be addressed in the license order, and do not include the remaining 3 conditions for reasons summarized in table 109 and discussed in more detail in section 5.2, *Discussion of Key Issues*.

Table 108. Fish and wildlife agency recommendations for the Hells Canyon Project. (Source: Staff).

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
IDFG-1a	Continue Idaho Power's fall Chinook spawning program, which includes providing stable flows.	Yes	$0[a]	Adopted
IDFG-1b	Conduct juvenile entrapment and stranding study to assess effects of load following on juvenile fall Chinook salmon, establish long-term monitoring sites and operating protocols.	Yes	$28,700	Adopted, except that an initial ramping rate of 4 inches per hour would be required and additional operating protocols would be developed through adaptive management.
IDFG-2	Continue to conduct shallow redd surveys and monitor temperature; distribute temperature monitors broadly so that differences in emergence timing between reaches can be predicted.	Yes	$0[a]	Adopted; temperature monitoring protocol would be addressed in proposed fall Chinook spawning and incubation flow management plan.
IDFG-3a	Investigate effects of hatchery steelhead on federally listed steelhead.	Yes	$46,200	Adopted
IDFG-3b	Develop locally adapted steelhead broodstock.	Yes	$10,500	Adopted
IDFG-3c	Expand Oxbow hatchery Chinook rearing.	Yes	$293,500	Adopted
IDFG-3d	Make improvements to Niagara Springs Hatchery.	Yes	$136,600	Adopted
IDFG-4	Establish anadromous fish hatchery goals, based on adult returns and societal use.	Yes	$0	Adopted, cost is included in NMFS-13j
IDFG-5a	Fund fish hatchery performance evaluations.	Yes	Not estimated	Adopted
IDFG-6a	Purchase a new fish marking unit.	Yes	$81,400	Adopted
IDFG-6b	Upgrade facility to reduce pathogens at Pahsimeroi hatchery.	Yes	$649,000	Adopted
IDFG-7	Purchase new adult fish transport vehicle.	Yes	$18,300	Adopted
IDFG-8	Provide fund to improve public angler access to several fisheries.	No, recreation measure	Not estimated	Not adopted
IDFG-9	Fall Chinook incubation survival monitoring upstream of Brownlee reservoir.	Yes	$20,000	Not adopted[d] (see section 5.2.4.3)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
IDFG-10a	Monitor Pacific lamprey population status downstream of the project.	No[c]	$8,300	Not adopted
IDFG-10b	Participate in the Columbia River basin Lamprey Technical Work Group	No	$5,000	Adopted
IDFG-11	Develop a native salmonid plan.	Yes	$2,500	Adopted
IDFG-12	Implement a pathogen risk assessment.	Yes	$40,000	Adopted
IDFG-13	Initiate a fish passage program, but do not translocate adult bull trout into Indian Creek or Wildhorse River unless adverse effects from brook trout can be addressed.	Yes	Not estimated	Adopted
IDFG-14	Design, construct and operate improved adult collection facilities at Hells Canyon dam.	Yes	$658,500	Adopted
IDFG-15	If the Oxbow trap is not constructed reallocate funds ($7 million) to alternative habitat enhancement projects.	No[c]	$270,200	Not adopted
IDFG-16	Expand tributary habitat enhancement program to include the Weiser River drainage and include a mechanism for re-allocating funds not used for fish passage or other measures.	No, no nexus to project	Not estimated	Not adopted
IDFG-17	Supplement nutrients for resident salmonids using spawned carcasses or carcass analogs, consider supplementing nutrients in the Weiser River recovery subunit until brook trout suppression efforts in Indian Creek and the Wildhorse River have been effective.	Yes	$40,000	Adopted, except for consideration of Weiser River[d] (see section 5.2.4.5)
IDFG-18	Conduct Eagle Creek presence/absence survey to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek Basin.	No[c]	$42,700	Adopted
IDFG-19	Design, construct, and monitor a weir facility at Pine Creek designed to collect bull trout (sized for fall flows).	Yes	$365,500	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
IDFG-20	Explore feasibility of methods to control brook trout in Indian Creek, reallocate funding to other measures if not feasible.	Yes	$50,000	Adopted, except for reallocation of funds.
IDFG-21	Use the White Sturgeon Conservation Plan to contribute to the long-term goal of restoring healthy white sturgeon populations.	Yes	Not estimated	Adopted
IDFG-22	Assess water quality-related effects on early life stages of white sturgeon in the Swan Falls-Brownlee reach.	No[c]	$24,000	Adopted
IDFG-23	Translocate reproductive-sized white sturgeon into the Swan Falls-Brownlee reach to increase spawner abundance and population productivity, if water quality is found to be adequate.	Yes	$20,600	Adopted
IDFG-24	Evaluate the genetic implications of hatchery supplementation on wild stocks of white surgeon before developing an experimental conservation aquaculture program.	No[c]	$1,080	Adopted; evaluation of genetic implications would be addressed in the development of the Conservation Aquaculture Plan.
IDFG-25	Make periodic population assessments to monitor white sturgeon populations in the Swan Falls-Brownlee, Brownlee-Hells Canyon, and Hells Canyon-Lower Granite reaches of the Snake River.	Yes	$82,100	Adopted
IDFG-26	Monitor genotypic frequencies of white sturgeon between Shoshone Falls and Lower Granite dams.	No[c]	$2,300	Adopted, except that monitoring of genotypic frequencies upstream of Swan Falls dam is not included because this is addressed in license articles for Idaho Power's upstream projects.
IDFG-27	Implement proposed reservoir level restrictions to benefit warmwater fish; if economic or system emergencies occur that require changes in the operational regime, consult IDFG and ODFW to evaluate alternative strategies to protect warmwater fisheries.	Yes (except for the consultation requirement)	$1,080	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
IDFG-28	Acquire and manage 23,582 acres as mitigation for project effects.	Yes	$1,651,100	Adopted
IDFG-29	Acquire and manage 47,164 acres if initial target lands are unavailable.	Yes	$3,323,100	Not adopted[d] (see section 5.2.5.4)
IDFG-30	Enhance low-elevation riparian habitat and participate in mountain quail projects for 5 years.	Yes	$9,600	Adopted
IDFG-31	Fund habitat management on four state-owned islands.	Yes	$42,900	Adopted
IDFG-32	Implement cooperative weed control, site monitoring, and reseeding.	Yes	$50,000	Adopted
IDFG-33	Implement cooperative protection and monitoring of rare plant sites.	No[c]	$6,000	Adopted; included in threatened, endangered, and sensitive species management
Interior-37a	Develop and implement a plan to improve habitat conditions in Pine Creek and associated tributaries.	Yes	$535,200	Adopted
Interior-37b	Design, construct, and monitor a weir facility at Pine Creek designed to collect bull trout (sized for fall flows)	Yes	$365,500	Adopted
Interior-37c	Conduct population monitoring activities, including periodic weir monitoring or radio telemetry studies of bull trout in Pine Creek.	Yes	$20,000	Adopted; cost is included with weir O&M
Interior-37d	Explore and implement, if necessary, measures to control brook trout in Pine Creek	Yes	$50,000	Adopted
Interior-38a	Develop and implement a plan to improve habitat conditions in Indian Creek and associated tributaries	Yes	$76,500	Adopted
Interior-38b	Operate and maintain a permanent weir structure at the mouth of Indian Creek if trigger criteria identified in Interior’s modified fishway prescription are met.	Yes	$182,700	Adopted
Interior-38c	Conduct population monitoring activities, including periodic weir monitoring or radio telemetry studies of bull trout in Indian Creek.	Yes	$20,000	Adopted; cost is included with weir O&M.

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-38d	Explore and implement, if necessary, measures to control brook trout in Indian Creek.	Yes	$50,000	Adopted
Interior-39a	Develop and implement a plan to improve habitat conditions in the Wildhorse River and associated tributaries.	Yes	$316,700	Adopted
Interior-39b	Operate and maintain a permanent weir structure at the mouth of the Wildhorse River if trigger criteria identified in Interior's modified fishway prescription are met.	Yes	$365,500	Adopted
Interior-39c	Conduct population monitoring activities, including periodic weir monitoring or radio telemetry studies of bull trout in the Wildhorse River.	Yes	$20,000	Adopted; cost is included with weir O&M.
Interior-39d	Explore and implement, if necessary, measures to control brook trout in the Wildhorse River.	Yes	$50,000	Adopted
Interior-40	Conduct presence absence surveys for bull trout and evaluate habitat conditions within Eagle Creek, and depending on survey results, determine the feasibility of introducing bull trout into suitable habitats in Eagle Creek.	Yes	$42,700	Adopted
Interior-41	Reintroduce anadromous salmon and steelhead to restore marine-derived nutrients.	Yes	$50,000	Adopted, but would use surplus hatchery fish from unlisted stocks only
Interior-42	Satisfy existing water quality standards in Oxbow and Hells Canyon reservoirs.	Yes	Not estimated	Not adopted[b] (see section 5.2.3.1)
Interior-43a	Develop Oxbow Bypassed Reach conservation flow plan.	Yes	$5,500	Not adopted[d] (see section 5.2.4.7)
Interior-43b	Implement Oxbow Bypassed Reach conservation flow plan to meet state water quality standards and life history requirements for bull trout.	Yes	$1,600,000[e]	Not adopted[d] (see section 5.2.4.7)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-44	Conduct two-phased study of operational effects on bull trout with 12-inch-per-hour ramping rate measured within 1 mile downstream of Hells Canyon dam in Phase 1 and ROR operation in Phase 2	Yes	$5,000,000	Not adopted[d] (see section 5.2.4.2)
Interior-45	Develop a plan for providing bull trout passage past Hells Canyon and Oxbow dams, operating permanent monitoring weirs on Pine and Indian Creeks.	Yes	$2,700	Adopted
Interior-46a	Develop a phased plan for restoring passage of anadromous fish to Pine Creek, Indian Creek, the Wildhorse River, and Eagle Creek.	Yes	$2,700	Not adopted[d] (see section 5.2.4.3)
Interior-46b	Design, construct and operate improved adult collection facilities at Hells Canyon dam.	Yes	$658,500	Adopted
Interior-46c	Design, construct and operate a juvenile spring Chinook collection facility on Eagle Creek.	Yes	$411,200	Not adopted[d] (see section 5.2.4.3)
Interior-47a	Fall Chinook incubation survival monitoring upstream of Brownlee reservoir.	No[c]	$20,000	Not adopted[d] (see section 5.2.4.1)
Interior-47b	Develop and refine plans to provide downstream passage of fall Chinook salmon around the project reservoirs.	Yes	$10,000	Not adopted[d] (see section 5.2.4.3)
Interior-48	Establish hatchery production goals based on adult returns.	Yes	$16,700	Not adopted [b] (see section 5.2.4.8)
Interior-49	Transfer surplus hatchery fish for put-and-take fisheries.	No, recreation measure	$80,900	Adopted
Interior-50a	Implement water quality improvement measures elsewhere in the basin to aid in sturgeon recovery.	No, no nexus to project	Not estimated	Not adopted
Interior-50b	Determine which Idaho Power facilities need to have their trashracks replaced to protect juvenile sturgeon from entrainment.	Yes	Not estimated	Not adopted[b] (see section 5.2.4.10)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-50c	Implement ROR operations at Lower Salmon Falls, Bliss, C.J. Strike projects during sturgeon spawning, incubation and early life stages.	No, no nexus to project	Not estimated	Not adopted
Interior-51	Update and implement White Sturgeon Conservation Plan including specific measures endorsed by Interior including assessment of water quality impacts on early lifestages, sturgeon translocation, experimental conservation aquaculture program, population monitoring and monitoring of genotypic frequencies.	Yes	$170,800	Adopted
Interior-52	Complete and implement a White Sturgeon Conservation and Action Plan.	Yes	$2,700	Not adopted[b] (see section 5.2.4.10)
Interior-53	Construct and operate a white sturgeon hatchery facility for supplementing sturgeon populations from Shoshone Falls to Hells Canyon dam.	Yes	$259,200	Adopted, except that Idaho Power would have the discretion on whether to construct a hatchery or lease hatchery space and the need for hatchery supplementation would be determined via a feasibility assessment.
Interior-54	Seasonal run-of-river operations to protect sturgeon spawning and early lifestages below Hells Canyon dam.	Yes	Not estimated	Not adopted[b] (see section 5.2.4.2)
Interior-55	Install protective trash racks at CJ Strike and Bliss dams to protect white sturgeon.	No, no nexus to project	Not estimated	Not adopted
Interior-56	Complete and implement a Pacific lamprey management plan including monitoring and evaluation to determine the downstream passage routes and timing, estimate survival through the project, and effects of reservoir and river fluctuations on rearing habitat.	Yes	$10,000	Not adopted[d] (see section 5.2.4.3)
Interior-57	Determine structural measures needed to mitigate for project effects to Pacific lamprey.	Yes	$2,624,900[f]	Not adopted[d] (see section 5.2.4.3)
Interior-58	Develop and implement a Native Fish Management Plan for native resident and anadromous fish.	Yes	Not estimated	Adopted; the measures specified by Interior are included in Idaho Power's proposed native salmonid plan.

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-59	Complete an action plan and implementation schedule to correct fish passage barriers at road crossings and culverts.	Yes	Not estimated	Adopted, but in developing tributary habitat enhancement plan, select and prioritize those tributary barriers for which removal would provide access to useable habitat for bull trout and/or redband trout. Otherwise, barrier removal should be delayed until habitat conditions improve to the point where the barrier removal would provide access to useable habitat.
Interior-60	Complete a stock assessment of anadromous and resident fish populations.	Yes	$1,080	Not adopted[d] (see section 5.2.4.3)
Interior-61	Turbine vent Brownlee units 1, 2, 3, 4, and possibly Brownlee unit 5 and the three Hells Canyon units.	Yes	$17,000	Not adopted[b] (see section 5.2.3.1)
Interior-62ai	Construct total dissolved gas-abatement structures on Hells Canyon dam.	Yes	$407,600	Adopted
Interior-62aii	Construct total dissolved gas-abatement structures on Brownlee dam.	Yes	$354,700	Adopted
Interior-62b	Monitor effectiveness of total dissolved gas-abatement measures.	Yes	$14,100	Adopted
Interior-63	Oxbow Bypassed Reach flow and DO supplementation to support primary production, native invertebrates, and resident fishes.	Yes	$2,048,000[g]	Not adopted[d] (see section 5.2.4.7)
Interior-64	Comply with IDEQ and ODEQ water quality certifications.	No[c]	Not estimated	Adopted
Interior-65	Take river flow and stage measurements for licensed operations and compliance for the Snake River in Hells Canyon within 1 mile below Hells Canyon dam or at U.S. Geological Survey Gage No. 13290450.	Yes	Not estimated	Not adopted[b] (see section 5.2.4.2)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-66	Monitor a series of modified operations to determine effects on aquatic species downstream of the Hells Canyon dam including : (1) peak-loading with 12 inches per hour ramping rate; (2) same but with DO enhancement measures; and (3) year-round run-of-river.	Yes	$5,000,000	Not adopted[d] (see section 5.2.4.2)
Interior-67	Monitor water quality downstream of Hells Canyon dam twice per month.	Yes	$200,000	Not adopted[d] (see section 5.2.3.1)
Interior-68	Monitor beaches, cobble bars, and sand bars to determine rate of depletion.	Yes	$28,800	Adopted
Interior-69	Monitor the quantity and quality of all known gravel deposits.	Yes	$40,000	Adopted, except that representative monitoring sites would be selected as specified in Idaho Power's fall Chinook spawning and gravel management plan.
Interior-70	Conduct biannual monitoring of benthic macroinvertebrates to assess changes in the composition of benthic macroinvertebrates, with emphasis on species and taxonomic groups useful in determining water quality.	Yes	$57,000	Adopted; DO measures should be implemented consistent with the timing specified in the water quality certificate, and monitoring should be designed to evaluate operational effects without the operational restrictions identified in Interior-66.
Interior-71	Conduct biannual monitoring of benthic macrophytes and algae.	Yes	$14,200	Adopted with same exceptions as Interior-70.
Interior-72	Conduct zonal distribution surveys and monitoring of keystone and sensitive benthic species to assess the effects of peak-loading operations on the benthic community.	Yes	$28,500	Adopted with same exceptions as Interior-70.
Interior-73	Monitor known colonies of the Hells Canyon rapids snail and the short-faced limpet to assess the species response to dissolved oxygen enhancement and operational modifications.	Yes	$14,200	Adopted with same exceptions as Interior-70.

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-74	Establish and monitor experimental populations of Hells Canyon rapids snail and/or the short-faced limpet in the 10-mile reach immediately below Hells Canyon dam.	Yes	$14,200	Not adopted, but we recognize that the measure may be included in the monitoring plan if the parties so desire, based on monitoring results.
Interior-75	Establish and monitor experimental populations of the western ridged mussel in appropriate habitat in the Snake River below Hells Canyon dam	Yes	$14,200	Not adopted, but we recognize that the measure may be included in the monitoring plan if the parties so desire, based on monitoring results
Interior-76	Acquire and manage 41,747 acres as mitigation for project effects on wildlife.	Yes	$2,941,400	Not adopted[d] (see section 5.2.5.4)
Interior-77	Develop and implement Integrated Weed Management Plan for project lands, including cooperative projects on adjacent lands.	Yes	$136,700	Adopted, except that a full inventory would not be conducted within 3 years of license issuance
Interior-78	Develop and implement Sensitive Plant Species Management Plan, survey and monitor sensitive plants.	No, plant species measure	$6,100	Not adopted, but most aspects would be incorporated into Threatened, Endangered, and Sensitive Species Management Plan
Interior-79	Develop and implement IWHP and WMMP, including establishment of pre-dam baseline conditions.	Yes	$1,026,700	Adopted, except for establishment of pre-dam conditions.
Interior-80	Develop and implement Mountain Quail Management Plan.	Yes	$31,800	Not adopted,[d] but mountain quail measures included in Cooperative Wildlife Management Projects
Interior-81	Develop and implement Bald Eagle Management Plan for some project lands and reservoirs.	Yes	$10,500	Adopted, except that nest survey area would be extended, and the number of winter surveys would be reduced
Interior-82	As part of Threatened, Endangered, and Sensitive Species Management Plan, implement measures to protect Townsend's big-eared bat maternity sites and hibernacula.	Yes	$1,500	Adopted
Interior-83	As part of Threatened, Endangered, and Sensitive Species Management Plan, implement measures to protect southern Idaho ground squirrel.	Yes	$1,200	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
Interior-84	Develop and Implement Northern Idaho Ground Squirrel Management Plan.	No, no nexus to project	$6,100	Not adopted, but would be addressed if Idaho Power acquires lands that support this species
Interior-85	As part of Threatened, Endangered, and Sensitive Species Management Plan, implement measures to protect special status amphibians and reptiles.	Yes	$1,000	Adopted
NMFS-1	Provide stable flows between 8,500 and 13,500 cfs below Hells Canyon dam throughout fall Chinook spawning season.	Yes	Not estimated	Adopted
NMFS-2	Provide instantaneous minimum flows below Hells Canyon dam that are equal to, or greater than, the stable flows provided during the preceding fall Chinook spawning period throughout the incubation period.	Yes	Not estimated	Adopted
NMFS-3	Monitor the natural construction of fall Chinook salmon redds in the mainstem Snake River between Lower Granite reservoir and Hells Canyon dam.	Yes	$125,000	Adopted
NMFS-4	Release flows sufficient to ensure that the largest juvenile entrapment areas are reconnected with the mainstem Snake River for at least 2 hours on a daily basis.	Yes	Not estimated	Not adopted[b] (see section 5.2.4.2)
NMFS-5	Develop and implement a stranding and entrapment monitoring plan.	No[c]	$28,700	Adopted
NMFS-6	Complete study of fall Chinook spawning gravel.	No[c]	$20,000	Adopted
NMFS-7	Evaluate fall Chinook egg-to-fry survival in at least two representative spawning areas downstream of Hells Canyon dam in 2015 and every 5 years thereafter.	No[c]	$20,000	Adopted (component of measure 110P)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
NMFS-8	Refill Brownlee reservoir to within 1 foot of the April 15 and April 30 minimum elevations necessary to meet the Corps flood control requirements and coordinate refill with NMFS.	Yes	Not estimated	Adopted
NMFS-9	Refill Brownlee reservoir to full pool by June 20, release 237 kaf of stored water from Brownlee reservoir between June 21 and July 31 (release at least 150 kaf of this water by July 15) and not refill until after August 31.	Yes	Not estimated	Adopted
NMFS-10	Construct total dissolved gas-abatement structures on Hells Canyon dam.	Yes	$407,600	Adopted
NMFS-11	Construct total dissolved gas-abatement structures on Brownlee dam.	Yes	$354,700	Adopted
NMFS-12	Evaluate and implement the most effective methods to augment Hells Canyon outflow DO levels in late summer and fall.	Yes	$10,900	Adopted
NMFS-13a	Make improvements to the Oxbow fish hatchery	Yes	$331,000	Adopted
NMFS-13b	Expand fall Chinook rearing program at Oxbow hatchery.	Yes	$282,300	Adopted
NMFS-13c	Monitor and evaluate hatchery performance at Oxbow hatchery.	Yes	$46,200	Adopted
NMFS-13d	Make improvements to the Pahsimeroi fish hatchery to control pathogens.	Yes	$690,300	Adopted
NMFS-13e	Develop a locally adapted steelhead broodstock at Pahsimeroi hatchery.	Yes	$690,300	Adopted
NMFS-13e	Complete upgrades to the Niagara Springs fish hatchery, acquire additional smolt tanker, acquire a fish marking unit.	Yes	$251,200	Adopted
NMFS-13f	Monitor and evaluate hatchery performance at Pahsimeroi hatchery.	Yes	$690,300	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
NMFS-13g	Monitor and evaluate hatchery performance at Niagara Springs hatchery.	Yes	$46,200	Adopted
NMFS-13h	Complete upgrades to Rapid River fish hatchery facilities, distribute carcasses, construct offsite smolt acclimation/adult collection facility.	Yes	$336,700	Adopted
NMFS-13i	Monitor and evaluate hatchery performance at Rapid River hatchery.	Yes	$46,200	Adopted
NMFS-13j	Provide funding to develop and implement Hatchery Genetic Management Plans and hatchery program evaluations	No[b]	$66,700	Adopted
NMFS-13k	Mark all releases with adipose clip.	Yes	Not estimated	Adopted
NMFS-13l	Screen hatchery water intakes to meet NMFS juvenile fish screen criteria.	Yes	$1,100	Adopted
NMFS-13m	Assess and minimize impacts of Hatchery steelhead to listed ESUs.	Yes	$8,300	Adopted
NMFS-14a, b, c, and f	Contribute $10 million annually for 5 years and $5 million annually thereafter to fund water quality improvement projects in the Snake River basin upstream of Hells Canyon dam. Fund an aquatic resources committee to evaluate and prioritize projects and redirect funding if necessary to achieve water quality and egg-to-fry survival goals.	No, no nexus to project	$9,278,400	Not adopted
NMFS-14d	Monitor Snake River water quality downstream of Brownlee and Hells Canyon dams along with four sites between Bliss dam and Brownlee reservoir.	Yes, except the upper sites have no nexus to project	$150,000	Adopted, with exception of sites downstream of Bliss, C.J. Strike, and Swan Falls dams
NMFS-14e	Fall Chinook incubation survival monitoring upstream of Brownlee reservoir.	Yes	$20,000	Not adopted[d] (see section 5.2.4.3)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
NMFS-15	Measure flows and ramping rates within 1 mile downstream of Hells Canyon dam.	Yes	$10,000	Not adopted[b], but flow gaging plan will be developed to implement flow and water quality monitoring within 5 miles of Hells Canyon dam
NMFS-16	Within 20 years, begin passage and reintroduction studies of fall Chinook salmon in the Snake River downstream of Bliss, C.J. Strike and Swan Falls dams.	Yes	$17,300	Not adopted[d] (see section 5.2.4.3)
NMFS-17	Within 20 years, begin passage and reintroduction studies of spring/summer Chinook salmon and steelhead in three tributaries to be selected in consultation with agencies.	Yes	$54,600	Not adopted[d] (see section 5.2.4.3)
ODFW-1	Establish and convene a Hells Canyon Project Coordinating Committee upon license issuance.	No[c]	$500	Not adopted
ODFW-2	Develop, fund and implement a long-term program to achieve specified target population sizes of anadromous fish above the project and to reconnect resident fish populations isolated below, within, and above the project.	Yes	$6,127,200	Not adopted[d] (see section 5.2.4.3)
ODFW-3	Develop and implement a fish passage plan for native migratory resident and anadromous species to include spring, summer and fall Chinook salmon, summer steelhead, Pacific lamprey, bull trout, redband trout and white sturgeon.	Yes	$6,127,200	Not adopted[d] (see section 5.2.4.3)
ODFW-4	Establish a Fish Passage and Reintroduction Committee.	No[c]	$500	Not adopted
ODFW-5	Consult with ODFW in development of fishway and trap designs.	No[c]	$0	Adopted; costs would be included in the facility design process
ODFW-6	Prepare and implement a written post-construction evaluation plan for the construction and modification of the Hells Canyon dam fish trap.	Yes	$0	Adopted; costs would be included in the facility design process
ODFW-7	Maintain all fishways and traps in proper order.	Yes	$0	Adopted; costs would be included in O&M

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-8	Develop a fishway and trap operation and maintenance plan.	Yes	$0	Adopted; costs would be included in O&M
ODFW-9	Provide ODFW personnel access to the Hells Canyon Project site and pertinent project records to inspect fishways and traps.	No[c]	$0	Adopted; costs would be included in O&M
ODFW-10	Design, construct and operate improved adult collection facilities at Hells Canyon dam.	Yes	$658,500	Adopted
ODFW-11	Design and construct a fish trap and sorting facility at Oxbow dam for passing anadromous and resident fish within 10 years, and evaluate whether delay, injury, or mortality of adult salmonids occurs at the Oxbow powerhouse or bypassed reach. The facility would be similar in design and operation to the Hells Canyon trap.	Yes	$270,200	Adopted, except that construction would occur after trigger criteria specified in Interior's modified fishway prescription have been attained.
ODFW-12	Install and maintain a downstream fish passage and collection facility at Hells Canyon dam within 10 years.	Yes	$2,624,900	Not adopted[d] (see section 5.2.4.3)
ODFW-13	Design and implement a study of fish predators in Hells Canyon reservoir.	No[c]	$48,000	Not adopted
ODFW-14	Initiate studies of spring Chinook salmon and summer steelhead migration into and from Pine Creek, and egg to fry, in-reservoir, turbine and spill survival. Initiate studies within 1 year, install smolt collection facility in 2009 if warranted.	Yes	$837,300	Not adopted[d] (see section 5.2.4.3)
ODFW-15	Initiate studies of spring Chinook salmon and summer steelhead juvenile and adult migration behavior and survival in Eagle, Daly and Goose creeks. Initiate studies by 2012, design and install smolt collection facility in 2017 if warranted.	Yes	$485,100	Not adopted[d] (see section 5.2.4.3)

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-16	Monitor fall Chinook egg survival in Swan Falls reach every 5 years, starting in year 15 initiate adult and juvenile fall Chinook migration studies, design and construct smolt collection facilities once egg survival is sufficient, assess facility efficiency and performance and implement necessary modifications.	Yes	$1,203,200	Not adopted[d] (see section 5.2.4.3)
ODFW-17	Develop a detailed upstream and downstream passage plan for Pacific lamprey mid-way through the license term and a schedule for implementation.	Yes	$2,624,900[f]	Not adopted[d] (see section 5.2.4.3)
ODFW-18	Develop fish passage plan for bull trout and/or redband trout, conduct bull trout population viability analysis, conduct radio tag studies of bull trout collected in the Hells Canyon trap, develop and implement protocols for capturing and managing bull trout at Pine and Eagle Creek weirs, if constructed.	Yes	$54,900	Adopted
ODFW-19	Develop and implement a fish passage plan for white sturgeon if this is determined to be feasible.	Yes	$4,756,800[h]	Not adopted[d] (see section 5.2.4.10)
ODFW-20	Develop and implement measures to address key limiting factors if passage and reintroduction efforts are terminated for a species in a selected tributary or reach (develop alternative mitigation measures in these cases).	Yes	$5,000,000	Not adopted[b] (see section 5.2.4.3)
ODFW-21	Implement a pathogen risk assessment.	Yes	$40,000	Adopted
ODFW-22	Evaluate anadromous and resident fish populations to pass for reintroduction, review stock performance every 5 years.	Yes	$7,700	Not adopted[d] (see section 5.2.4.3)
ODFW-23	Fund fish habitat enhancement measures to mitigate for ongoing and unavoidable losses.	No[c]	Not estimated	Not adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-24	Monitor bull trout emigration and immigration from tributaries, redband trout abundance and redd surveys assess proportion of resident and anadromous forms of rainbow trout, conduct steelhead and Chinook spawning surveys to assess spawning escapement, distribution and timing of spawning.	Yes	$50,000	Not adopted[d] (see section 5.2.4.10), except that bull trout and redband trout monitoring would be conducted as part of the bull trout passage plan identified in Interior's modified fishway prescription.
ODFW-25a	Implement monitoring and evaluation program for Pahsimeroi hatchery.	Yes	$46,200	Adopted
ODFW-25b	Implement monitoring and evaluation program for Oxbow hatchery.	Yes	$46,200	Adopted
ODFW-25c	Implement monitoring and evaluation program for Niagara Springs hatchery.	Yes	$46,200	Adopted
ODFW-25d	Implement monitoring and evaluation program for Rapid River hatchery.	Yes	$46,200	Adopted
ODFW-26	Develop a Hatchery Production Plan.	Yes	$42,700	Adopted, except for replacing smolt production goals with escapement goals (see section 5.2.4.8).
ODFW-27	Investigate and supply alternative fisheries in Oregon.	Yes	$0	Adopted. As part of the proposed hatchery management plan, Idaho Power would consult with resource agencies and tribes to determine the best use of surplus hatchery fish, and tributary enhancements would improve or restore fisheries in Pine Creek, the Wildhorse River and in tributaries to the Powder River.
ODFW-28	Expand Oxbow Hatchery for fall Chinook rearing.	Yes	$282,300	Adopted
ODFW-29	Expand Oxbow Hatchery for fall Chinook broodstock collection, spawning, and upgrading hatchery facilities.	Yes	$282,300	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-30	Continue hatchery operations at Oxbow, Rapid River, Pahsimeroi, and Niagara Springs hatcheries to meet target goals and added responsibilities related to anadromous fish reintroduction (fund).	Yes	Not estimated	Adopted
ODFW-31	Manage project operations to meet objectives for anadromous fish migration, fall Chinook spawning and rearing, redband and bull trout rearing, white sturgeon spawning, and reservoir fisheries.	Yes	Not estimated	Adopted
ODFW-32	Shape BOR flow augmentation releases by pre-releasing 100 kaf of storage from Brownlee reservoir from June 21 to August 31 and refilling Brownlee reservoir with an equivalent of BOR water when that water reaches Brownlee reservoir. Attempt to hold Brownlee reservoir full through July 4, and thereafter coordinate releases from Brownlee reservoir, up to 237 kaf, by August 7. Consult with the Corps for a Brownlee reservoir target refill date of June 20 after flood season.	Yes	$9.29 million	Not adopted (see section 5.2.2.3).
ODFW-33	Implement 6-inch-per hour ramping rate from December 12th through March 20th, four inch-per-hour ramp rate and minimum flow of 11,500 cfs from March 21st through June 21st, 6-inch-per-hour ramp rate with a maximum 10,000 cfs daily flow change limit from June 22nd through September 30th, 6-inch-per-hour ramp rate from October 1st through October 20th, and no ramping from October 21 through December 11.	Yes	$17.6 million	Not adopted[d] (see section 5.2.4.2)
ODFW-34	Continue fall Chinook spawning flow program.	Yes	Not estimated	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-35	Fund and participate in annual spawning surveys for fall Chinook salmon in the Snake River downstream of Hells Canyon dam, conduct deep-water surveys every 5 years or when escapement exceeds 10,000, 15,000, and 20,000 adults, whichever comes first, consult with ODFW and ODEQ on location and frequency of temperature monitoring.	Yes	$125,000	Adopted; temperature monitoring protocol and frequency of deep-water redd surveys would be addressed in proposed fall Chinook spawning and incubation flow management plan.
ODFW-36a	Develop, fund, and implement a native salmonid plan including a habitat enhancement program, a permanent monitoring weir at Pine Creek, a bull trout survey in Eagle Creek, input of nutrients, and passage measures.	Yes	$520,000	Adopted
ODFW-36b/37	Investigation of turbine and spill related mortality.	No[c]	$85,500	Not adopted
ODFW-38	Develop and implement a plan to improve habitat conditions in the Pine, Powder and Burnt River basins.	Yes	$750,000	Adopted
ODFW-39	Investigate, fund and implement nutrient supplementation in all tributaries to the project.	Yes	$80,000	Adopted
ODFW-40	Design, construct and operate a weir/trap on Pine Creek designed to collect anadromous smolts (sized to accommodate spring flows) within 3 years.	Yes	$783,000	Adopted
ODFW-41	Conduct Eagle Creek presence/absence survey to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek Basin.	No[c]	$42,700	Adopted
ODFW-42	Update and implement White Sturgeon Conservation Plan including evaluating bioaccumulation of contaminants in sturgeon, assessment of water quality impacts on early lifestages, sturgeon translocation, funding habitat enhancement, population monitoring, and monitoring of genotypic frequencies.	Yes	$274,900	Adopted, with the exceptions identified for measures ODFW-43 and ODFW-44, described below.
ODFW-43	Evaluate bioaccumulation of contaminants in white sturgeon in Hells Canyon and Oxbow reservoirs and upstream of Brownlee reservoir.	No[c]	$32,100	Adopted, except Idaho Power would be responsible only for the collection of samples for analysis by others.

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-44	Provide a minimum of $100,000 annually to fund water quality and habitat improvement measures elsewhere in the basin to aid in sturgeon recovery	No, no nexus to project	$100,000	Not adopted. Although we do not adopt the specific funding level recommended by ODFW, we adopt numerous other measures that would improve water quality conditions and improve sturgeon habitat in the project area (measures 4P, 5P, 103–109P, and 8Pc).
ODFW-45	Make periodic population assessments to monitor white sturgeon populations in the Swan Falls-Brownlee, Brownlee-Hells Canyon, and Hells Canyon-Lower Granite reaches of the Snake River.	No[c]	$82,100	Adopted
ODFW-46	Assess water quality-related effects on early life stages of white sturgeon in the Swan Falls-Brownlee reach.	No[c]	$24,000	Adopted
ODFW-47	Translocate reproductive-sized white sturgeon into the Swan Falls-Brownlee reach to increase spawner abundance and population productivity, if water quality is found to be adequate and if genetic and demographic risks to the donor population are found to be acceptable.	Yes	$20,600	Adopted
ODFW-48	Monitor genotypic frequencies of white sturgeon between Shoshone Falls and Lower Granite dams.	No[c]	$2,300	Adopted, except that monitoring of genotypic frequencies upstream of Swan Falls dam is not included because this is addressed in license articles for Idaho Power's upstream projects.
ODFW-49	Develop, fund and implement Pacific lamprey habitat enhancement measures and lamprey monitoring.	Yes	$105,000	Not adopted[d] (see section 5.2.4.3)
ODFW-50	Monitor warmwater fish populations including sampling techniques appropriate for monitoring catfish abundance (recommendation modified during 10(j) meeting).	Yes	$250,000	Adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-51	Brownlee target refill date of June 30, beginning on May 21 the reservoir would not be drafted by more than one foot for the next 30 days and will not be drafted below 2069 msl through July 4 unless flow augmentation occurs before July 4.	Yes	Not estimated	Adopted
ODFW-52	Conduct studies of food habits of Brownlee reservoir warmwater fish species, including effects of reservoir operations on zooplankton production.	No[c]	$28,500	Not adopted
ODFW-53	Implement a gravel monitoring program and implement a gravel augmentation program if effects are detected.	Yes	$27,600	Adopted, except that gravel augmentation would occur only if adverse effects on fall Chinook production occur.
ODFW-54a	Develop total dissolved gas-abatement plan.	Yes	$2,200	Adopted
ODFW-54b	Monitor effectiveness of total dissolved gas-abatement measures.	Yes	$14,100	Adopted
ODFW-54c	Construct total dissolved gas-abatement structures on Hells Canyon dam.	Yes	$407,600	Adopted
ODFW-54d	Construct total dissolved gas-abatement structures on Brownlee dam.	Yes	$354,700	Adopted
ODFW-54e	Construct total dissolved gas-abatement structures on Oxbow dam, if necessary to satisfy water quality standard.	Yes	$287,900	Adopted, except that implementation would not occur until Brownlee spillway deflectors are constructed and evaluated.
ODFW-55	Develop and implement plan to avoid project-caused exceedances of Oregon's dissolved oxygen standards.	Yes	$2,200	Adopted
ODFW-56	Develop and implement temperature management plan.	Yes	$5,500	Adopted
ODFW-57	Evaluate bioaccumulation of mercury, dieldrin, and DDT/DDE in Brownlee reservoir fish.	No[c]	$21,400	Adopted, except that ODEQ and IDEQ would be responsible for analyzing bioacccumulants in samples collected by Idaho Power.

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-58	Develop and implement a plan to monitor temperature, total dissolved gas, dissolved oxygen, and other water quality parameters.	Yes	$4,400	Adopted
ODFW-59	Develop and implement Terrestrial Resources Management and Mitigation Plan.	Yes	$0	Adopted; included in IPC-90
ODFW-60	Establish a Terrestrial Resources Work Group, with pre-defined roles, responsibilities, and schedules.	No[c]	$12,500	Adopted, except that group would define roles, responsibilities and schedules.
ODFW-61	Acquire and manage 35,739 acres as mitigation for project effects on wildlife.	Yes	$2,518,100	Not adopted[d] (see section 5.2.5.4)
ODFW-62	Fund habitat management on four state-owned islands.	Yes	$58,600	Adopted, with ODFW-recommended capital cost, Idaho Power-proposed annual O&M funding.
ODFW-63	Enhance low-elevation riparian habitat and participate in mountain quail projects for 5 years.	Yes	$9,600	Adopted
ODFW-64	Develop and implement Bald Eagle Management Plan and enhance eagle habitat.	Yes	$10,500	Adopted, except that habitat would not be enhanced.
ODFW-65	Protect and monitor sensitive flora and fauna species within 1/4 to 1/2 mile of reservoirs and river downstream to Salmon River confluence.	No, no nexus to project (includes lands and species not affected by project).	$21,100	Not adopted, but special status species affected by the project would be addressed in Threatened, Endangered, and Sensitive Species Management Plan
ODFW-66	Control and monitor exotic and invasive vegetation, and establish a Cooperative Weed Management Area.	Yes	$136,100	Adopted
ODFW-67	Develop and implement an Integrated Transmission Line Operation and Maintenance Plan for 700 miles of transmission lines.	No, no nexus to project (lines not jurisdictional)	$310,900	Not adopted
ODFW-68	Develop and implement T-Line Management Plan for Line #907.	No, no nexus to project (line not jurisdictional)	$10,500	Not adopted

Agency/ Recommenda-tion Number	Recommendation	Within the Scope of 10(j)?	Annualized Cost	Adoption Status in Staff Alternative and Basis for Preliminary Determination of Inconsistency
ODFW-69	Develop and implement a detailed bird electrocution monitoring plan for transmission line 945 and implement measures to minimize risk of electrocution.	Yes	$1,000	Adopted, except that monitoring would be included in transmission line O&M plan, instead of requiring separate detailed plan.
ODFW-70	Monitor bird collisions on transmission lines 923 and 951 and implement measures to minimize risk of collision.	No, no nexus to project (lines not jurisdictional).	$1,000	Not adopted
ODFW-71	Conduct study of harsh winter effects on mule deer.	No[c]	$18,600	Not adopted[b]
ODFW-72	As part of WMMP, schedule O&M to minimize disturbance on deer winter range.	Yes	$1,000	Adopted
ODFW-73	As part of WMMP and Transmission Line Management Plan, develop and implement I&E program to minimize risk of wildlife disturbance.	Yes	$1,500	Adopted
ODFW-74	Protect wildlife under emergency conditions.	No[c]	$0	Not adopted

[a] Continuation of existing measure; no incremental cost.

[b] Preliminary findings that recommendations found to be within the scope of section 10(j) are inconsistent with the substantial evidence standards of section 313(b) of the FPA are based on a lack of evidence to support the reasonableness of the recommendation or a lack of justification for the measure.

[c] Not a specific measure to protect, mitigate, or enhance fish and wildlife resources. This includes studies that could have been completed pre-licensing, research studies, personnel access, consultation, administrative conditions, or measures that lack specific details.

[d] Preliminary findings that recommendations found to be within the scope of section 10(j) are inconsistent with the comprehensive planning standard of section 10(a) of the FPA, including the equal consideration provision of section 4(e) of the FPA, are based on staff's determination that the costs of the measures outweigh the expected benefits.

[e] Cost estimate assumes a minimum bypass flow of 1,000 cfs to improve water quality.

[f] Cost estimate assumes that a downstream passage facility would be required at Hells Canyon dam.

[g] Cost estimate assumes 1,000 cfs bypassed flow and oxygenation supplementation.

[h] Cost estimate assumes upstream and downstream passage facilities would be installed at Hells Canyon and Brownlee dams.

EPAct provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary conditions. In the draft EIS, we included in the Staff Alternative 19 of Idaho Power's 23 alternative conditions. Both Interior and the Forest Service submitted modified conditions. In its comments on the draft EIS, Idaho Power recommended that we adopt the modified conditions as filed by Interior and the Forest Service. Table 109 summarizes our position on the modified conditions.

Table 109. Interior and Forest Service modified 4(e) conditions for the Hells Canyon Project. (Source: Staff)

4(e) Conditions	Agency	Annualized Cost	Included in Staff Alternative?[a]
1. Follow BLM requirements for Idaho Power activities on or affecting BLM-administered lands	Interior-1	$4,400	Yes
2. Prepare a report documenting and/or evaluating measures for the protection and use of BLM lands	Interior-2	$5,000	Yes
3. Develop and implement a travel and access management plan	Interior-3	$15,100	No; project provides adequate public access without the specified trail system, and the applicant is not responsible for maintaining county and state roads outside the project boundary (see section 5.2.7.5).
4. Develop and implement a Law Enforcement and Emergency Services Plan	Interior-4	$5,100	No; law enforcement is an agency responsibility (see section 5.2.8.2).
5. Review and adapt the Historic Properties Management Plan, with special conditions for BLM resources	Interior-5	Costs included in specific measures	Yes
6. Develop and implement an integrated Comprehensive Recreation Management Plan	Interior-6	$7,600	Yes.
7. Develop and implement a Litter and Sanitation Plan	Interior-7	$66,800	Yes
8. Develop and implement a Project Boat Moorage Plan	Interior-8	$5,000	Yes.
9. Develop and implement a Site Enhancement Plan for BLM's Airstrip, Bob Creek Section C, and Westfall sites	Interior-9	$4,600	Yes.
10. Develop and implement a Swedes Landing Enhancement Plan	Interior-10	$5,000	Yes
11. Develop and implement a Spring Recreation Site Enhancement Plan	Interior-11	$5,000	Yes

4(e) Conditions	Agency	Annualized Cost	Included in Staff Alternative?[a]
12. Develop and implement a Steck Recreation Site Enhancement Plan	Interior-12	$3,800	Yes.
13. Develop and implement a Jennifer's Alluvial Fan Site Enhancement Plan	Interior-13	$9,800	Yes
14. Develop and implement an Idaho Dispersed Sites Plan	Interior-14	$69,000	Yes
15. Develop and implement an Oxbow Boat Launch and Carter's Landing Enhancement Plan	Interior-15	$10,000	Yes.
16. Develop and implement an Oasis Site Enhancement Plan	Interior-16	$4,400	Yes
17. Develop and implement a Copper Creek Site Enhancement Plan	Interior-17	$5,000	Yes
18. Develop and implement a Low Water Boat Launch Plan	Interior-18	$5,000	Yes
19. Obtain Forest Service approval of site-specific designs prior to start of Idaho Power activities on National Forest System lands	FS-1	$1,000	Yes, except we limit scope to Forest Service lands in the project boundary.
20. Prepare and implement a Resource Coordination Plan	FS-2	$6,100	Yes, except we limit scope to Forest Service lands in the project boundary.
21. Prepare and implement a Fire Prevention Plan	FS-3	$2,000	Yes
22. Create a Sandbar Maintenance and Restoration Fund	FS-4	$545,100	Yes
23. Prepare an Integrated Wildlife Habitat Program and a Wildlife Mitigation and Management Plan	FS-5	$25,000	Yes
24. Prepare and implement a Land Acquisition and Management Program	FS-6	$160,500	Yes
25. Prepare an Integrated Weed Management Plan	FS-7	$30,500	Yes
26. Prepare a Threatened and Endangered Species Management and Monitoring Strategy	FS-8	$100	Yes
27. Prepare and implement a Sensitive Species Management Plan	FS-9	$62,500	Yes

4(e) Conditions	Agency	Annualized Cost	Included in Staff Alternative?[a]
28. Implement the Mountain Quail Habitat Enhancement Program	FS-10	$9,600	Yes
29. Develop and implement a Transmission Line Operation and Maintenance Plan	FS-11	$1,200	Yes
30. Finalize and implement the Hells Canyon Complex Comprehensive Recreation Management Plan	FS-12	$46,500	Yes
31. Develop and implement a Big Bar Site Development Plan	FS-13	$10,000	Yes
32. Implement the Eagle Bar Site Development Plan	FS-14	$28,600	Yes
33. Implement the Eckels Creek Dispersed Site Development Plan	FS-15	$5,700	Yes
34. Conduct condition and safety inspection of Deep Creek Stairway/Trail #218 and correct any deficiencies	FS-16	$11,700	Yes
35. Improve and maintain parking and signage at four Forest Service roadside parking areas along the reservoir	FS-17	$75,000	Yes
36. Operate and maintain Eagle Bar, Eckels Creek, Big Bar, Hells Canyon reservoir parking areas, Black Point Viewpoint, and dispersed areas pursuant to the Recreation Plan	FS-18	Costs included in site-specific measures	Yes
37. Extend boat ramps on Hells Canyon reservoir if needed to provide reasonable public access under proposed operations.	FS-19	$100,000 total one-time cost	Yes
38. Perform trail maintenance on nine specified trails	FS-20	$10,000	No; no clear nexus between project operations and recreational use of Forest Service-managed trails outside of the project boundary (see section 5.2.7.5).
39. Design, construct, and maintain facility enhancements at the Hells Canyon Creek launch site and Visitor Center	FS-21	$36,100	Yes
40. Develop and implement an aesthetic improvement plan for the upper deck, entrance, and egress areas of Hells Canyon dam	FS-22	$0[b]	Yes, except we limit measures to Forest Service lands and exclude restroom and measures that could compromise security.

4(e) Conditions	Agency	Annualized Cost	Included in Staff Alternative?[a]
41. Condition 23 in draft EIS (design standards and landscaping) has been incorporated into FS-24	FS-23	NA	NA.
42. Prepare and implement a Scenery Management Plan for Forest Service lands	FS-24	$1,000	Yes, except we adopt standards developed by Aesthetics Subgroup. Included in Idaho Power's proposed measure 75P.
43. Finalize and implement the Historic Properties Management Plan	FS-25	$800	Yes
44. Provide Forest Service with a map and aerial photos depicting the approximate location of the project boundary in a form compatible with the Forest Service GIS	FS-26	$2,000	Yes.
45. Reserve authority by the Commission to require any additional measures necessary for protection and use of public land reservations under Forest Service authority	FS-27	$0	Not applicable; would be addressed in license order.

[a] Measures noted as "Yes, except…" indicate that we include a modified version of the condition in the Staff Alternative. Modifications are based on our staff analysis, and may reflect points raised in Idaho Power's alternative conditions.

[b] Included in the Hells Canyon Resource Management Plan; no incremental cost.

[a] Included in HCRMP; no incremental cost.

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

5.4.1 Section 10(a)(2) Comprehensive Plans

Section 10(a)(2) of the FPA requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving waterways affected by the project. Under section 10(a)(2), federal, state and local agencies filed comprehensive plans that address various resources in Oregon and Idaho. The 47 plans listed below address resources applicable to the project. Based on our review and analysis, we conclude that the project as proposed by Idaho Power and as described in the Staff Alternative would be consistent with the plans.

5.4.1.1 Plans Applicable to Both Idaho and Oregon

Forest Service. 2003. Hells Canyon National Recreation Area comprehensive management plan. Department of Agriculture, Baker City, Oregon. June 2003.

Northwest Power and Conservation Council. 2000. Columbia River basin fish and wildlife program. Portland, Oregon. Council Document 2000-19. (1984, 1987, 1994, 2000, amended 2003 as Council Document 2003-4).

Northwest Power and Conservation Council. 2005. The Fifth Northwest electric power and conservation plan. Portland, Oregon. Council Document 2005-07.

Northwest Power and Conservation Council. 1988. Protected areas amendments and response to comments. Document 88-22 (September 14, 1988).

Northwest Power and Conservation Council. 2003. Mainstem amendments to the Columbia River basin fish and wildlife program. Portland, Oregon. Council Document 2003-11.

5.4.1.2 Plans Applicable to Idaho

Bureau of Land Management. Forest Service. 1991. Snake River final activity/operations plan. Department of the Interior, Idaho Falls, Idaho. Department of Agriculture, Idaho Falls, Idaho. February 1991. 101 pp. and appendices.

Bureau of Land Management. 1988. Cascade Resource Management Plan. Department of Interior. Boise, Idaho. July 1, 1988.

Bureau of Land Management. 1983. Lower Salmon River Recreation Area Management Plan. Department of the Interior. Boise, Idaho. May 1983.

Forest Service. 2003. Payette National Forest land and resource management plan. Department of Agriculture, McCall, Idaho. July 2003.

Forest Service. 1987. Nez Perce National Forest plan. Department of Agriculture, Grangeville, Idaho. October 1987. 171 pp. and appendices.

Idaho Department of Fish and Game. 2001. Idaho fisheries management plan, 2001-2006. Boise, Idaho.

Idaho Department of Fish and Game. 2003. Draft white sturgeon management plan: Status and objectives of Idaho's white sturgeon resources in the Snake River. Boise, Idaho. August 2003.

Idaho Department of Fish and Game. Bonneville Power Administration. 1986. Pacific Northwest rivers study. Final report: Idaho. Boise, Idaho. 12 pp. and appendices.

Idaho Department of Health and Welfare. Division of Environment. 1985. Idaho water quality standards and wastewater treatment requirements. Boise, Idaho. January 1985. 72 pp. and appendices.

Idaho Department of Parks and Recreation. Idaho Statewide Comprehensive Outdoor Recreation and Tourism Plan (SCORTP) 2003-2007. Boise, Idaho.

Idaho Water Resource Board. 1986. State water plan. Boise, Idaho. December 1986.

5.4.1.3 Plans Applicable to Oregon

Bureau of Land Management. U.S. Forest Service. 1996. Status of the Interior Columbia Basin: Summary of scientific findings. Portland, Oregon. November 1996.

Bureau of Land Management. 1993. Wallowa and Grande Ronde Rivers Final Management Plan. Department of the Interior, Baker, Oregon. December 1993. Chapters 1 – 3.

Bureau of Land Management. 1990. Resource assessment of the Powder River. Department of the Interior, Baker, Oregon. August 1990.

Bureau of Land Management. 1990. Resource assessment of the Grand Ronde River. Department of the Interior. Baker, Oregon. August 1990.

Bureau of Land Management. 1989. Baker resource management plan. Department of the Interior, Baker, Oregon. July 1989. 151 pp.

Forest Service. 1990. Wallowa-Whitman National Forest land and resource management plan. Department of Agriculture, Baker City, Oregon. April 1990.

Hydro Task Force and Strategic Water Management Group. 1988. Oregon comprehensive waterway management plan. Salem, Oregon.

Oregon Department of Environmental Quality. 1978. Statewide water quality management plan. Salem, Oregon. November 1978. Seven volumes.

Oregon Department of Fish and Wildlife. 1982. Comprehensive plan for production and management of Oregon's anadromous salmon and trout: Part I. General considerations. Portland, Oregon. June 1, 1982. 33 pp.

Oregon Department of Fish and Wildlife. 1986. Oregon Bighorn sheep management plan. Portland, Oregon. November 1986. 17 pp.

Oregon Department of Fish and Wildlife. 1987. The statewide trout management plan. Portland, Oregon. November 1987. 77 pp.

Oregon Department of Fish and Wildlife. 1987. Warm water game fish management plan. Portland, Oregon. August 1987. 60 pp.

Oregon Department of Fish and Wildlife. 2003. Oregon’s elk management plan. Portland, Oregon. February 2003.

Oregon Department of Fish and Wildlife. 1993. Oregon black bear management plan, 1993-1998. Portland, Oregon. 33 pp. and appendices.

Oregon Department of Fish and Wildlife. 1993 (updated 1999). Oregon wildlife diversity plan. Portland, Oregon. November 1993 (updated January 1999).

Oregon Department of Fish and Wildlife. 1993. Oregon cougar management plan, 1993-1998. Portland, Oregon. 31 pp. and appendices.

Oregon Department of Fish and Wildlife. 2001. Oregon wildlife and commercial fishing codes: 2001-2002. Portland, Oregon.

Oregon Department of Fish and Wildlife. 1995. Biennial report on the status of wild fish in Oregon. Portland, Oregon. December 1995. 217 pp. and appendix.

Oregon Department of Fish and Wildlife. 1995. Comprehensive plan for production and management of Oregon's anadromous salmon and trout: Part III. Steelhead plan. Portland, Oregon. April 26, 1995. 118 pp. and appendices.

Oregon Department of Fish and Wildlife. 1996. Species at risk: Sensitive, threatened, and endangered vertebrates of Oregon. Portland, Oregon. June 1996.

Oregon Department of Fish and Wildlife. 1997. Oregon plan for salmon and watersheds: Supplement 1 Steelhead. Salem, Oregon. December 1997.

Oregon Department of Fish and Wildlife. 1987. Trout mini-management plans. Portland, Oregon. December 1987. 58 pp.

Oregon Department of Transportation. State Parks and Recreation Division. 1987. Recreational values of Oregon rivers. Salem, Oregon. April 1987. 71 pp.

Oregon State Game Commission. 1963-1975. Fish and wildlife resources - 18 basins. Portland, Oregon. 21 reports.

Oregon State Parks and Recreation Department. 2003. Oregon Outdoor Recreation Plan 2003-2007 (SCORP). Salem, Oregon. January 2003.

Oregon State Parks and Recreation Division. No date. The Oregon scenic waterways program. Salem, Oregon. 75 pp.

Oregon State Water Resources Board. 1973. Surface area of lakes and reservoirs. Salem, Oregon. 43 pp.

Oregon Water Resources Commission. 1987. State of Oregon water use programs. Salem, Oregon. 295 pp.

Oregon Water Resources Department. 1985. Biennial Report, 1985–1987.

Oregon Water Resources Department. 1988. Oregon water laws. Salem, Oregon. 240 pp.

Department of the Army, Corps of Engineers. Portland District. 1993. Water resources development in Oregon. Portland, Oregon. 78 pp.

5.4.2 Other Plans

Certain other plans do not qualify as comprehensive plans under section 10(a)(2) of the FPA, but were the subject of comments made during scoping or in response to the Commission's notice that the project was ready for environmental analysis. In the following sections, we discuss the consistency of Idaho Power's Proposed Operations and the Staff Alternative with those plans.

Umatilla, Warm Springs, and Yakama Tribes. 1995. Wy-Kan-Ush-Ma Wa-Kish-Wit: Spirit of the Salmon. The Columbia River Anadromous Fish Restoration Plan of the Nez Perce.

We conclude that the measures proposed by Idaho Power and additional measures included in the Staff Alternative are consistent with *Wy-Kan-Ush-Ma Wa-Kish-Wit: Spirit of the Salmon* and would contribute to meeting the plan's objectives to halt declining trends and increase populations of anadromous fish to levels that support tribal harvest opportunities. Measures proposed by Idaho Power that would contribute to meeting these objectives include: (1) continuation of reservoir operations in the fall, winter, and early spring for protection of fall Chinook spawning and salmon incubation; (2) continuation of fall Chinook redd and temperature monitoring to avoid the risk of dewatering developing salmon embryos; and (3) installation of spillway flow deflectors at Hells Canyon dam and continued preferential use of the upper spillgates at Brownlee dam during spill periods to reduce total dissolved gas concentrations in the Snake River downstream of Hells Canyon dam. Additional measures included in the Staff Alternative that would contribute to meeting plan objectives include: (1) periodic review of water quality monitoring data to determine when conditions in the mainstem Snake River upstream of Brownlee reservoir have improved sufficiently to warrant restoration of fall Chinook salmon; (2) flow augmentation and ramping rate restrictions that should improve in-river juvenile salmon survival; and (3) implementation of a white sturgeon conservation aquaculture plan that would restore white sturgeon populations to levels that support tribal harvest opportunities.

Wallowa County Planning Department. Undated. Wallowa County Comprehensive Land Use Plan.

We conclude that the measures proposed by Idaho Power and additional measures included in the Staff Alternative are consistent with Wallowa County Land Use Plan. The basic purposes of the Plan are to: (1) to protect the custom, culture, and community stability of the county; (2) maintain the agricultural and timber basis of the county; (3) accommodate anticipated development; and (4) make provisions for those uses that may be needed by the county, but that may have such undesirable characteristics as noise, smoke, and odor. The Staff Alternative includes measures that would improve protection of cultural resources, expand recreational opportunities in designated areas, and improve land use management on project lands.

5.5 RELATIONSHIP OF LICENSE PROCESS TO LAWS AND POLICIES

5.5.1 Section 401 of the Clean Water Act—Water Quality Certification

The status of the water quality certifications for the project is discussed in section 2.3.1.1.

5.5.2 Coastal Zone Management Act—Consistency Certification

Section 307(c) of the Coastal Zone Management Act requires that all federally licensed and permitted activities be consistent with approved state Coastal Zone Management Programs. If the project is located within a coastal zone boundary or if a project could affect resources located in the boundaries of the designated coastal zone, the applicant must certify that the project is consistent with the state Coastal Zone Management Program. The Hells Canyon Project is not located within the coastal zone boundary and would not affect resources located within the coastal zone boundary.

5.5.3 Section 18 of the Federal Power Act—Authority to Prescribe Fishways

Fishway prescriptions and recommendations for reservation of authority to prescribe fishways are discussed in section 2.3.1.2.

5.5.4 Endangered Species Act

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered and threatened species or cause the destruction or adverse modification of critical habitats of such species. Fourteen federally listed fish species (Snake River fall Chinook salmon, Snake River spring/summer Chinook salmon, Snake River sockeye salmon, Snake River steelhead, Upper Columbia River spring Chinook salmon, Columbia River steelhead, Lower Columbia River Chinook salmon, Upper Columbia River steelhead, Columbia River chum salmon, Lower Columbia River coho salmon, Lower Columbia River steelhead Upper Willamette River Chinook salmon, Upper Willamette River steelhead, and bull trout), one invertebrate (Idaho springsnail), three federally listed plant species (Howell's spectacular thelypody, MacFarlane's four-o'clock, and Spalding's catchfly), and four federally listed wildlife species (gray wolf, Canada lynx, northern Idaho ground squirrel, and bald eagle) could occur in the project area or in downstream areas potentially affected by project operations. These species were identified as being likely to occur in the project area by FWS in a letter dated November 28, 2005 and by NMFS in a letter dated February 9, 2006. In its letter, NMFS identified the four Snake River ESUs (fall Chinook salmon, spring/summer Chinook salmon, sockeye salmon, and steelhead) and portions of their designated critical habitat as being the most likely to be affected by the project.

By letter dated August 1, 2006, we requested formal consultation with NMFS on the four Snake River ESUs and their critical habitat (letter from T. Welch, Chief, Hydro West Branch 2, Commission, Washington, DC, to K. Kirkendall, FERC Coordinator, NMFS, Portland, OR). We also requested concurrence with our "not likely to adversely affect" determinations on the nine other Columbia River salmon and steelhead ESUs. In its comments on the draft EIS, NMFS did not concur with our determinations for the Columbia River ESUs and indicated that formal consultation would not be initiated because of insufficient information, incorrect baseline, and lack of a defined proposed action. On August 1, 2006, we requested formal consultation with FWS on the bull trout and its critical habitat, as well as the bald eagle. We also requested concurrence with our "not likely to adversely affect" determinations on the MacFarlane's four-o'clock, Spalding's catchfly, gray wolf, and northern Idaho ground squirrel. By letter dated August 31, 2006, FWS indicated that the draft EIS did not meet the information requirements for initiation of formal consultation and that the action alternative was not adequately described (letter from J.L. Foss, Field Supervisor, Snake River Fish and Wildlife Office, FWS, Boise, ID, to M.R. Salas, Secretary, Commission, Washington, DC).

Table 110 shows our determinations regarding the effect of relicensing the Hells Canyon Project on federally listed species. Table 110 also summarizes the basis for our effect determinations. We will request formal consultation with NMFS on all 13 listed ESUs of Snake and Columbia River salmon, and their critical habitat, and with FWS on MacFarlane's four-o'clock and Spalding's catchfly,[135] as well as bull trout.[136] We will also request concurrence from FWS with our findings for the gray wolf and northern Idaho ground squirrel. This final EIS will serve as our biological assessment.

Table 110. Summary of effect determinations for fish, plants, and wildlife.

Species	Species Status	Species Finding	Critical Habitat Finding	Basis for Determination
Snake River fall Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for stranding mortality, effects of gas supersaturation on fry and juveniles, reduced recruitment of spawning gravel
Snake River spring/summer Chinook salmon (*O. tshawytscha*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for adverse effects of gas supersaturation on juvenile and adult fish
Snake River sockeye salmon (*O. nerka*)	Endangered	Likely to adversely affect	Likely to adversely affect	Continued potential for adverse effects of gas supersaturation on juvenile fish
Snake River steelhead (*O. mykiss*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for adverse effects of gas supersaturation on juvenile and adult fish
Upper Columbia River spring Chinook salmon (*O. tshawytscha*)	Endangered	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Middle Columbia River steelhead (*O. mykiss*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.

[135] In the draft EIS, we concluded that relicensing the project with our recommended measures was "not likely to adversely affect" MacFarlane's four-o'clock or Spalding's catchfly. We have modified our findings for these species to "likely to adversely affect" in light of the need for further surveys prior to conducting any ground-disturbing activities.

[136] As discussed in section 3.8.1.14, FWS announced a decision to remove the bald eagle from the list of threatened and endangered species, effective 30 days following publication in the Federal Register (FWS, 2007a). Consequently, there is no longer a need to complete formal consultation for this species.

Species	Species Status	Species Finding	Critical Habitat Finding	Basis for Determination
Upper Columbia River steelhead (*O. mykiss*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Lower Columbia River Chinook salmon (*O. tshawytscha*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Columbia River chum salmon (*O. keta*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Likely to adversely affect	None designated	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Lower Columbia River steelhead (*O. mykiss*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Upper Willamette River Chinook salmon (*O. tshawytscha*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Upper Willamette River steelhead (*O. mykiss*)	Threatened	Likely to adversely affect	Likely to adversely affect	Continued potential for beneficial and adverse effects of flood control operations on water quality and quantity during juvenile migration.
Bull trout (*Salvelinus confluentus*)	Threatened	Likely to adversely affect	Likely to adversely affect	Potential for stranding and turbine mortality, potential effects of gas supersaturation on juvenile and adult fish, impediments to migration, reduction in anadromous food base

Species	Species Status	Species Finding	Critical Habitat Finding	Basis for Determination
Idaho springsnail (*Pyruglopsis idahoensis*)	Endangered	No effect	No effect	Does not occur within or downstream of the project
Howell's spectacular thelypody (*Thelypodium howellii* ssp. *spectabilis*)	Threatened	No effect	None designated	No suitable habitat in the project area; no documented occurrences.
MacFarlane's four-o'clock (*Mirabilis macfarlanei*)	Threatened	Likely to adversely affect	None designated	Suitable habitat in the project vicinity, but no known occurrences on project lands. Project operations unlikely to affect, but surveys needed prior to ground-disturbance at high-probability sites because not all lands surveyed.
Spalding's catchfly (*Silene spaldingii*)	Threatened	Likely to adversely affect	None designated	Suitable habitat in the project vicinity, but no known occurrences on project lands. Project operations unlikely to affect, but surveys needed prior to ground-disturbance at high-probability sites because not all lands surveyed.
Gray wolf (*Canis lupus*)	Endangered/Non-essential Experimental Population	Not likely to adversely affect	None designated	Suitable habitat occurs in the project area; confirmed sightings nearby, and populations anticipated to increase. May be observed more frequently in the future, but species generally avoids concentrated activity.
Canada lynx (*Lynx canadensis*)	Threatened	No effect	No effect	No suitable habitat in the project area; one unconfirmed sighting 70 miles downstream of Hells Canyon dam. May occur as transient.
Northern Idaho ground squirrel (*Spermophilus brunneus brunneus*)	Threatened	Not likely to adversely affect	None designated	No suitable habitat occurs on project lands, but may be present on newly acquired lands, with potential for habitat enhancement.

Species	Species Status	Species Finding	Critical Habitat Finding	Basis for Determination
Bald eagle (*Haliaeetus leucocephalus*)	Delisted, monitor species	Likely to adversely affect	None designated	Present in the project area, with increasing populations. Proposed and recommended measures including implementation of a management and monitoring plan, timing restrictions to minimize disturbance and review of measures to reduce risk of power line collision.

5.5.5 Essential Fish Habitat

Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the Secretary of Commerce regarding all actions or proposed actions that are authorized, funded, or undertaken by the agency that may adversely affect EFH. The Snake River downstream of the project comprises EFH for Chinook and coho salmon.

Idaho Power proposes the following measures that should benefit Chinook EFH in the Snake River: (1) continue reservoir operations in the fall, winter, and early spring for protection of fall Chinook spawning and salmon incubation; (2) continue fall Chinook redd and temperature monitoring to avoid the risk of dewatering developing salmon embryos, but discontinue deep-water redd monitoring until fall Chinook escapement increases significantly; and (3) install spillway flow deflectors at Hells Canyon dam and continue preferential use of the upper spillgates at Brownlee dam during spill periods to reduce total dissolved gas concentrations in the Snake River downstream of Hells Canyon dam.

In section 5.2, *Discussion of Key Issues*, we discuss two additional measures that we include in the Staff Alternative that would benefit EFH: (1) a pilot gravel augmentation program; and (2) measures to increase dissolved oxygen levels downstream of Hells Canyon dam. We conclude that Idaho Power's proposal and the measures that we include in the Staff Alternative would not adversely affect EFH.

5.5.6 National Historic Preservation Act

Relicensing is considered an undertaking within section 106 of the NHPA, as amended (P.L.89-665; 16 USC 470). Section 106 requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register. As the lead federal agency for issuing a license, the Commission is responsible for ensuring that the licensee will take all necessary steps to "evaluate alternatives or modifications" that "would avoid, minimize, or mitigate any adverse effects on historic properties" for the term of any license involving the project. The lead agency also must consult with the SHPO(s), as well as with other land management agencies where the undertaking may have an effect, and with Indian tribes that may have cultural affiliations with affected properties involving the undertaking. The overall review process involving section 106 is administered by the Advisory Council, an independent federal agency.

To meet the requirements of section 106, the Commission would execute a Programmatic Agreement to take into account the effects on historic properties from the operation of the Hells Canyon Project (see section 5.2.6.1, *Finalization of the HPMP*). The terms of the Programmatic Agreement would ensure that Idaho Power would address and treat all historic properties identified within the areas of potential effect through the HPMP. The HPMP entails ongoing consultation involving historic properties for the entire term of any new license.

5.5.7 Pacific Northwest Electric Power Planning and Conservation Act, Columbia River Basin Fish and Wildlife Program, and Mainstem and Subbasin Plan Amendments to the Columbia River Basin Fish and Wildlife Program

Under section 4(h) of the Pacific Northwest Power Planning and Conservation Act, the Northwest Power Planning Council (now known as the Northwest Power and Conservation Council) developed the Columbia River Basin Fish and Wildlife Program (Program) to protect, mitigate, and enhance the fish and wildlife resources associated with development and operation of hydroelectric projects in the Columbia River basin. Section 4(h) states that responsible federal and state agencies should provide equitable treatment for fish and wildlife resources, in addition to other purposes for which hydropower is developed, and that these agencies should take the Program into account to the fullest practical extent. To mitigate harm to fish and wildlife resources, the Council has adopted specific provisions to be considered in the licensing or relicensing of non-federal hydropower projects (appendix B of the Program).

We conclude that the measures described in the Staff Alternative are consistent with most of the objectives of the Columbia River Basin Fish and Wildlife Program and would contribute toward achieving the program's objectives. Measures to reduce total dissolved gas, enhance dissolved oxygen, maintain stable flows during fall Chinook salmon spawning, and minimize the risk of stranding, as well as the provision for flow augmentation water during the fall Chinook salmon outmigration, would assist with meeting the Program objectives of halting declining trends in salmon and steelhead populations above Bonneville dam and allowing for the recovery of fish and wildlife affected by the hydrosystem that are listed under the Endangered Species Act. The tributary enhancement program and planting surplus spring Chinook salmon and steelhead to provide forage for bull trout would contribute to the Program objective of restoring healthy ecosystems and watersheds. In addition to the measures listed above, which would contribute to halting declining trends in salmon and steelhead, development of a new facility on the Yankee Fork to collect, spawn, and incubate steelhead or Chinook salmon eggs and developing a plan to use surplus hatchery salmon and steelhead to provide ceremonial and subsistence fisheries for the Shoshone-Paiute and Burns Paiute tribes would assist with meeting the Program objective of providing abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest. The Staff Alternative does not include measures that would directly address the Program objective of restoring the widest possible set of healthy, naturally reproducing populations of salmon and steelhead; to reintroduce anadromous fish into blocked areas. However, we include several measures that would help to restore and monitor the condition of upstream habitat. In addition, construction of passage facilities on one or more tributaries should assist with the restoration of anadromous fish to areas upstream of and within the project area in the future when habitat is suitable and the concerns of other stakeholders have been addressed through the development of a comprehensive reintroduction plan.

We conclude that the measures included in the Staff Alternative are also consistent with the mainstem amendments of the Columbia River Basin Fish and Wildlife Program and would contribute toward achieving the amendments' objective of assisting the recovery of federally listed species. The Staff Alternative also includes a provision to evaluate the benefits of providing flow augmentation from Brownlee reservoir 6 years after license issuance, which is consistent with provisions in the mainstem amendments that call for federal agencies to report annually on the benefits of flow augmentation; to evaluate the validity of flow targets and flow augmentation actions in the 2000 Biological Opinion on operation of the Federal Columbia River Power System; and to ascertain the nature, extent of, and reasons for a flow-survival relationship through the lower Columbia River System.

We reviewed each of the subbasin plans that have been prepared for subbasins within the Snake River basin. The subbasin plans provide a framework within which fish and wildlife projects to be funded by the Bonneville Power Administration are selected, based on objectives and strategies developed for each subbasin. In table 111, we list measures included in the Staff Alternative that would contribute to meeting specific objectives identified within these subbasin plans. We did not identify any measures included in the Staff Alternative that would impede the attainment of any objectives listed in these subbasin plans.

5.5.8 Wild and Scenic Rivers Act

The Wild and Scenic River Act (P.L. 90-542) and its amendments protect, in their free-flowing conditions, designated rivers and their immediate environments that possess outstanding remarkable values (ORVs). ORVs may include scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Section 7(a) of the act states that FERC shall not license the construction of any dam, water conduit, reservoir, powerhouse, transmission line, or other project works under the FPA on or directly affecting any river designated as a Wild and Scenic River. The Wild and Scenic Rivers Act specifically does not preclude licensing of developments upstream or downstream of designated wild, scenic, or recreational rivers if the development does not invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area on the date of designation of a river as a component of the national wild and scenic rivers system.

Congress added 67.5 miles of the Snake River to the wild and scenic rivers system in 1975. The river is designated in two segments: the wild segment from Hells Canyon dam north to Upper Pittsburg Landing (about 31.5 miles) and the scenic segment from Upper Pittsburg Landing to a point about 36 miles down river. Congress found that the wild portion of the river is free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. Congress also found that the scenic portion of the river is free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. The ORVs for the Snake Wild and Scenic River are broad reaching and include scenery, recreation, geology, wildlife, fisheries, cultural resources, vegetation/botany, and ecology.

Current operations stop most sediment from moving through the project. This, in combination with powerboat wakes and variable releases from the Hells Canyon dam, appears to contribute to sandbar and shoreline erosion downstream of the project. The Forest Service, in its preliminary section 7(a) determination and report filed on January 26, 2006, determined that the continued degradation of sandbars under Idaho Power's proposed operations would adversely affect the scenic, recreational, fish, and wildlife values of the river. The Forest Service also made a preliminary determination that the continued depletion of sand beaches and bars would result in the complete elimination of that resource by the end of a new license period, which would rise to the level of "unreasonable diminution" of scenic and recreational values. The Forest Service specified development of a sandbar maintenance and restoration plan (FS-4) to avoid unreasonably diminishing these values. In the draft EIS, we did not include FS-4 in the Staff Alternative because we considered the small additional sand restoration program to not be worth the potential adverse effects of sand-delivery barges on recreational boating and wildlife. Based on comments on the draft EIS, however, we reevaluated our recommendation and now include FS-4 in the Staff Alternative. Implementation of FS-4 would help restore some of the sand currently trapped by the dams and would assist in replenishing the sandbars that are an important component of the river's scenic and recreational attributes.

Overall, the environmental measures included in the Staff Alternative would help improve water quality passing through the project by increasing dissolved oxygen levels, allowing pesticides and other pollutants to break down in the upper reaches of Brownlee reservoir, and reducing elevated total dissolved gas levels. These measures would help improve water quality in the Wild and Scenic reaches.

Table 111. Measures included in the Staff Alternative relevant to objectives of Columbia River Fish and Wildlife Program subbasin plans. (Source: Staff)

Number	Measure Name	Relevant Staff Alternative Measures
Middle Snake (Shoshone Falls to Hells Canyon Dam)		
1a	Restore aquatic ecosystems and user opportunities impacted by the loss of anadromous fish components.	8P, 11P, 103S, 104S
2a	Achieve white sturgeon population recovery to levels identified in table 5 in the subbasin plan.	11P, 106S
3a	Ensure continued existence of high density (core) redband trout populations.	8P
3b	Ensure continued existence of moderate or low density redband trout (satellite) populations.	8P
4a	Maintain and increase bull trout distribution and abundance (greater than or equal to 500 adults) within Indian and Wildhorse creeks.	8P
4b	Reduce and prevent impacts of brook trout on bull trout where they exist, especially within the Indian Creek drainage	8P
5a	Increase mountain whitefish productivity and production to desirable levels within 15 years through habitat improvements	8P
9a	Support freshwater mollusk conservation and recovery through habitat restoration, ground and surface water conservation, and continued research of environmental factors limiting mollusk growth, survival, and reproduction.	8P
10a	Increase understanding of the composition, population trends, and habitat requirements of the terrestrial communities of the middle Snake subbasins.	12P, 14P, 19P, 12S
11a	Restore flows in limited reaches	8P
11b	Reduce water temperature to meet needs of aquatic focal species	8P, 109P
11c	Reduce instream sedimentation to meet water quality standards	8P
11d	Coordinate with TMDL process to support nutrient reduction efforts in 303 (d) listed stream segments affecting ESA listed or focal species.	4P
11e	Reduce number of artificially blocked stream miles by 2019 to increase fish access to habitat, while screening diversions that negatively affect listed or focal species	8P
11f	Improve aquatic habitat diversity and complexity in tributary systems where focal species populations are limited	8P
12a	Protect existing quality, quantity, and diversity of native habitats.	12P, 13P, 14P, 15P,

Number	Measure Name	Relevant Staff Alternative Measures
		17P, 19P, 14S, 15S
12b	Reduce extent and density of established noxious weeds and invasive exotics.	12P, 15P, 17P, 18P, 20P
14a	Manage grazing to reduce impacts on the aquatic and terrestrial communities in the subbasin. Protect and restore riparian, wet meadow, and native upland habitats.	12,P, 15P, 17P, 14S, 15S
14b	Reduce conflicts between livestock and native wildlife, fish, and plant populations.	72P
16a	Protect mature pine/fir forest habitats.	12P, 15P, 17P, 15S
17a	Protect existing shrub-steppe habitats from additional fragmentation and degradation. Prevent the additional loss of shrub-steppe habitats. Restore areas important for focal species	12P, 15P, 17P, 15S
18a	Protect remaining native grassland remnants.	12P, 15P, 17P, 15S
18b	Restore historic native grassland habitat to natural conditions.	12P, 15P, 17P, 15S
19b	Protect, enhance or restore riparian habitats.	12P, 13P, 14P, 15P, 17P, 11S, 14S, 15S
22a	Protect and foster cultural uses of natural resources in the Middle Snake subbasins.	103S
Bruneau		
7a	Within the next 10 years, increase riparian cover and stream shading in high-priority restoration hydrologic unit codes to levels consistent with the proper functioning condition and site capability. These levels vary, but in small to medium-sized streams (i.e., those measuring less than 5 meters in width), shading should equal between 60 and 80% (Zoellick, 2004).	109P
Owyhee	There are no adopted measures or project effects applicable to objectives stated in this subbasin plan.	
Malheur		
5	Mitigate for the loss of anadromous fish species in the Malheur Subbasin through substitution programs that emphasize the long-term sustainability of native resident fish in native habitats wherever possible.	103S
Boise, Payette and Weiser	There are no adopted measures or project effects applicable to objectives stated in this subbasin plan.	

Number	Measure Name	Relevant Staff Alternative Measures
Burnt/Powder		
1	Improve riparian, floodplain and wetland habitats	8P, 12P, 14P, 15P, 17P, 14S, 15S
2	Improve stream channel processes.	8P
3	Improve Water Quality (temperature, dissolved oxygen, chemical pollutants, biological pollutants, pH, turbidity).	4p, 8P, 109P
4	Improve habitat connectivity and fish passage.	8P
Snake River Hells Canyon (Hells Canyon dam to the Clearwater River)		
1a	Ameliorate negative impacts from operations of the Hells Canyon Project	3P, 4P, 5P, 6P, 7P, 103P, 105P, 106P, 107P, 108P, 109P, 4S, 9S, 101S, 102S, 105S, Operational measures 1, 2, 3 and 5
2a	Increase smolt-to-adult return rates of naturally produced spawning adults to at least 4 to 6% for spring Chinook salmon, 3% for fall Chinook salmon, and 4% for steelhead, as measured at Lower Granite dam, to increase natural production and harvest of fish populations.	4P, 5P, 6P, 103P, 105P, 106P, 107P, 108P, 109P, 4S, 9S, 10S, 101S, 102S, Operational measures 1, 2, and 3
4a	Increase understanding of the composition, population trends, interspecies interactions, habitat requirements, ecosystem processes, and impacts of management activities on terrestrial communities of the Snake Hells Canyon subbasin.	18P, 19P, 21P, 12S
5a	Maintain and enhance populations of focal, sensitive, and threatened and endangered species in the subbasin.	15P, 19P, 21P, 12S, 15S
6a	Mitigate the negative impacts of Hells Canyon Dam on terrestrial species and habitats.	12P, 14P, 17P, 19P, 21P, 11S, 12S, 14S, 15S
8a	Restore natural flow regime that supports and meets the life history needs of aquatic species in the subbasin.	Operational measures 1, 2 and 3
8b	Provide temperature regimes that meet the life stage specific needs of aquatic focal species.	109P

Number	Measure Name	Relevant Staff Alternative Measures
9a	Protect the existing quality, quantity and diversity of native plant communities providing habitat to native wildlife species by preventing the introduction of noxious weeds and invasive exotic plants into native habitats.	18P, 21P
9b	Reduce the extent and density of established noxious weeds and invasive exotics.	18P, 21P
11a	Protect and restore riparian habitats.	11S
Clearwater		
A	Increase the number of naturally spawning adults to achieve goals in table 3 in the subbasin plan within 24 years (timeline is consistent with the Council's Fish and Wildlife Program). This should amount to 4–6% smolt-to-adult return rate for spring-summer Chinook salmon, 3% for fall Chinook salmon, and 4% for steelhead as measured at Lower Granite dam, within next 24 years.	Operational measures 1 and 2
R	Develop an increased understanding of the thermal impacts of Dworshak dam operations on life history characteristics of fall Chinook salmon, other fishes, and associated wildlife species in downstream reaches, and reduce negative impacts by 2010.	Operational measure 2
Imnaha	There are no adopted measures or project effects applicable to objectives stated in this subbasin plan.	
Salmon		
1a	1A: Increase the number of naturally spawning adults to achieve recovery goals in table 6 in the subbasin plan within 24 years (timeline is consistent with the Northwest Power and Conservation Council's Fish and Wildlife Program). This should amount to 4–6% smolt-to-adult return rate for spring-summer Chinook salmon, 3% for fall Chinook salmon (minimum), 4% for sockeye salmon (minimum), and 4% for steelhead (minimum) as measured at Lower Granite dam and in the tributaries.	5P, 105P, 106P, 107P, 108P, 109P, Operational measures 1 and 2,
1b	1B: Achieve goals defined in table 6 in the subbasin plan for the Salmon subbasin through the application of artificial propagation programs. Minimize short- and long-term genetic, ecological, and life history effects on wild populations.	104S
65a	65A: Protect and foster both Indian and non-Indian cultural uses of natural resources in the Salmon subbasin.	104S
Grande Ronde	There are no adopted measures or project effects applicable to objectives stated in this subbasin plan.	
Lower Snake	There are no adopted measures or project effects applicable to objectives stated in this subbasin plan.	

Several measures included in the Staff Alternative would benefit fisheries in the Snake River downstream of the project. The restrictive ramping rates and augmentation of summer migration flows would help improve anadromous fish returns, particularly for fall Chinook salmon. The improved water quality would also improve habitat conditions for native resident fish in the Snake River. Over time, improvements to the fishery could attract additional recreational users to the reach. However, we conclude that any increased recreational use associated with the improved fishery would be marginal and could not be distinguished from general increases in demand for boating and fishing in this section of the Snake River.

Implementing the Staff Alternative recreational measures within the project boundary would have negligible effects on recreational resources in the designated Wild and Scenic reaches. The recreational measures primarily address recreational needs within the project boundary and would neither attract additional visitors to the designated reaches nor affect scenic values or wildlife values of these reaches.

We conclude that implementation of the Staff Alternative would not invade or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the area on the date of designation of the Snake River downstream of Hells Canyon dam as a component of the National Wild and Scenic Rivers System.

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Idaho Power Company, Nathan F. Gardiner, Attorney, Boise, ID
Idaho Power Company, Robert W. Stahman, Vice President, Boise, ID
Idaho Power Company, Vern Porter, General Manager, Boise, ID
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Lincoln County, Chairman, Shoshone, ID
Lower Valley Energy Inc, Todd Gordon Glass, Heller Ehrman, Seattle, WA
Malheur County, County Judge, Vale, OR
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National Marine Fisheries Service, Ritchie Graves, Portland, OR
National Marine Fisheries Service, Keith Kirkendall, Hydro Division, Portland, OR
National Oceanic & Atmospheric Admin., Jane S. Hannuksela, Esq., Seattle, WA
National Marine Fisheries Service, Regional Director, Long Beach, CA
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Nez Perce Tribe, Greg Haller, Lapwai, ID
Nez Perce Water Resource Development, Director, Lapwai, ID
Northwest Resource Information Center, Ed Chaney, Director, Eagle, ID
NW Professional Power Vessel Association, Arthur Leslie Seamans, Executive Director, Lewiston, ID
Northwest Power Planning Council, Peter Paquet, Portland, OR
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Oregon Department of Fish & Wildlife, Colleen E. Fagan, NE Region Hydro Coordinator, La Grande, OR
Oregon Department of Fish & Wildlife, Ken Homolka, Hydropower Program Leader, Salem, OR
Oregon Department of Forestry, Director, Salem, OR
Oregon Department of Justice, Kurt Burkholder, Assistant Attorney General, Portland, OR
Oregon Dept of Land Conservation & Development, Paul Curcio, Director, Salem, OR
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Oregon State Marine Board, Randy H. Henry, Policy Planning Analyst, Salem, OR
Oregon Water Resources Department, Ronald Craig Kohanek, Salem, OR
Oregon Water Resources Department, Phil Ward, Director, Salem, OR
Oregon Department of Environmental Quality, Paul A. DeVito, Bend, OR
Pacific Environmental Advocacy Center, Daniel J. Rohlf, Portland, OR
Payette River Water Users Association, Pioneer Irrigation District, Scott L. Campbell, Moffatt, Thomas, Barrett, Rock & Fields, Boise, ID
Power County Board of County Commissioners, Chairman, American Falls, ID
Richardson, Mark, Clarkston, WA
Shoshone-Bannock Tribes, Shaun Robertson, Fort Hall, ID
Shoshone-Bannock Tribes, Keith Kutchins, Fort Hall, ID
Shoshone-Paiute Tribe, Donald M. Clary, Holland & Knight LLP, Los Angeles, CA
Shoshone-Paiute Tribe, Tim Dykstra, Owyhee, NV
Shoshone-Paiute Tribe, Kyle Prior, Owyhee, NV
U.S. Army Corps of Engineers, Portland, OR
U.S. Army Corps of Engineers, Chief, Walla Walla District, Walla Walla, WA
U.S. Bureau of Indian Affairs, Portland Area Office, Regional Hydro Policy Specialist, Portland, OR

U.S. Bureau of Indian Affairs, FERC Coordinator, Portland, OR
U.S. Bureau of Indian Affairs, Fred Allgaier, Lakewood, CO
U.S. Bureau of Indian Affairs, Stanley Speaks, Regional Director, Portland, OR
U.S. Bureau of Indian Affairs, Superintendent, Elko, NV
U.S. Bureau of Reclamation, Boise, ID
U.S. Bureau of Reclamation, Klamath Basin Area Office, Area Manager, Klamath Falls, OR
U.S. Bureau of Reclamation, Regional Director, Boulder City, NV
U.S. Coast Guard, MSO Portland, Portland, OR
U.S. Department of Agriculture, Jocelyn B. Somers, Portland, OR
U.S. Department of Agriculture, Kenneth D. Paur, Ogden, UT
U.S. Department of the Interior, Office of Environmental Policy & Compl. Regional Environmental Officer, Portland, OR
U.S. Department of the Interior, Office of the Solicitor, Frank S. Wilson, Portland, OR
U.S. Forest Service, Darrington Ranger District, Walt Dortch, Hydropower Coordinator, Darrington, WA
U.S. Forest Service, Hydropower Coordinator, Baker City, OR
U.S. Forest Service, Payette National Forest, Forest Supervisor, McCall ID
U.S. Forest Service, Intermountain Region, Director of Lands, Ogden, UT
U.S. Forest Service, Kristen Bonanno, Negotiation Specialist, Portland, OR
U.S. Forest Service, RHAT-Heritage, Steve Kramer, Colville, WA
U.S. Forest Service, Regional Hydropower Coordinator, Salt Lake City, UT
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U.S. Environmental Protection Agency, John E. Bregar, Coordinator, Seattle, WA
U.S. Environmental Protection Agency, Region 9 - Federal Activities Office, David P. Schmidt, San Francisco, CA
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U.S. Fish and Wildlife Service, Field Supervisor, Boise, ID
U.S. Fish & Wildlife Service, Director, Portland, OR
U.S. Fish & Wildlife Service, FERC Coordinator, Portland, OR
U.S. Fish & Wildlife Service, Upper Columbia River Basin Field Office, Regional Director, Spokane, WA
U.S. Senate, Honorable Mike Crapo, Washington, DC
U.S. Senate, Honorable Larry Craig, Washington, DC
U.S. Senate, Honorable Ron Wyden, Washington, DC
Umatilla Agency, Superintendent, Pendleton, OR
Wallowa County, County Court, Enterprise, OR
Warm Springs Tribe, Elton Greeley, Warm Springs, OR
Washington County Commissioners, Diana Lee Thomas, Commissioner, Weiser, ID

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APPENDIX A

AGENCY IDENTIFIERS FOR MEASURES ADDRESSED IN THE EIS

Appendix A. Agency Identifiers for Measures Addressed in the EIS

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
AR/IRU-1	I	comment	Reopen Idaho Power's Mid-Snake Projects and C.J. Strike project licenses.
AR/IRU-2	II.1	comment	Issue the license for a term of 30 years.
AR/IRU-3	II.2	comment	Convene a technical advisory committee to oversee adaptive management in the license.
AR/IRU-4	II.3	comment	Allow for a license reopener in the event that additional measures/modifications are necessary.
AR/IRU-5	III.1	10a	Work with a subgroup of a Technical Advisory Committee on a fish passage and reintroduction plan.
AR/IRU-6	III.2	10a	Design, fund and implement a Fish Passage and Reintroduction Plan.
AR/IRU-7a	III.3.1	10a	Provide passage of spring Chinook and steelhead into Pine and Indian Creeks.
AR/IRU-7b	III.3.1(sic)	10a	Provide passage of spring Chinook and steelhead into Eagle, Daly and Goose Creeks.
AR/IRU-7c	III.3.3	10a	Consider and implement passage and reintroduction efforts in the Weiser and Payette rivers.
AR/IRU-7d	III.3.4	10a	Implement a pathogen risk assessment to understand the pathogen risks from a reintroduction effort
AR/IRU-8a	III.4.1	10a	Conduct water quality studies under a drawdown and full reservoir scenario.
AR/IRU-8b	III.4.2	10a	Evaluate egg to fry survival of fall Chinook using egg boxes.
AR/IRU-8c	III.4.3	10a	Study juvenile and adult fall Chinook migration through project reservoirs and to potential collection points.
AR/IRU-8d	III.4.4	10a	Initiate fall Chinook reintroduction after sufficient egg survival rates have been demonstrated.
AR/IRU-8e	III.4.5	10a	Design, construct, and test upstream and downstream fish passage facilities.
AR/IRU-8f	III.4.6	10a	Evaluate passage needs at Swan Falls dam and C.J. Strike dam.
AR/IRU-9a	III.5.1, 5.2, 5.3	10a	Construct fish passage facilities at Pine Creek, upgrade the Hells Canyon trap, etc..
AR/IRU-9b	III.5.4	10a	Implement a brook trout eradication program for tributaries into which bull trout will be moved.
AR/IRU-9c	III.5.5	10a	Conduct a fish pathogen risk assessment.
AR/IRU-9d	III.5.6	10a	Conduct long-term monitoring and evaluation of the resident fish passage program.
AR/IRU-10	IV	10a	Undertake a hatchery program consistent with the priority objective of recovery of wild stocks.
AR/IRU-11a	V.1.1	10a	Fund and implement a tributary enhancement program; emphasis on Pine and Indian Creek and Wildhorse River.
AR/IRU-11b	V.1.2	10a	Reintroduce anadromous salmon and steelhead to restore marine-derived nutrients.
AR/IRU-11c	V.1.3	10a	Ensure sufficient flows in the Oxbow bypassed reach to allow fish passage for bull trout.
AR/IRU-11d	V.1.4	10a	Study project effects on bull trout prey base, foraging capability, growth, fecundity and general fitness.
AR/IRU-12a	V.2.1.A	10a	Implement ROR operations at Lower Salmon Falls, Bliss, C.J. Strike projects seasonally for sturgeon.
AR/IRU-12b	V.2.1.C	10a	Monitor success of sturgeon spawning and early life history stages.
AR/IRU-12c	V.2.2	10a	Develop conservation aquaculture program.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
AR/IRU-12d	V.2.3, V.2.6	10a	Study limiting factors in each reach; determine whether passage is necessary to ensure persistence.
AR/IRU-12e	V.2.4, V.2.7	10a	Conduct a white sturgeon passage/connectivity study; implement anti-entrainment and impingement measures.
AR/IRU-12f	V.2.8	10a	Do not undertake sturgeon translocation until limiting factors have been determined and addressed.
AR/IRU-12g	V.2.10	10a	Implement water quality improvement measures elsewhere in the basin to aid in sturgeon recovery.
AR/IRU-13	VI	10a	Implement a Pacific lamprey restoration plan using adaptive management
AR/IRU-14	VII	10a	Require an adaptive management approach to the mitigation of project effects to the benthic community.
AR/IRU-15	VIII.1	10a	Provide a level of suspended fine sediment that mimics naturally occurring levels of turbidity during freshet.
AR/IRU-16	VIII.2	10a	Reduce nutrient and suspended particle delivery from on-land sources instead of providing DO supplementation.
AR/IRU-17a	VIII.3.A	10a	Conduct real time DO monitoring of Brownlee and implement similar systems at Oxbow and Hells Canyon dams.
AR/IRU-17b	VIII.3.B	10a	Increase dissolved oxygen levels by aerating or oxygenating forebay waters and or their outflows.
AR/IRU-17c	VIII.3.B	10a	Use adaptive-management approach in applying this measure.
AR/IRU-18a	VIII.4.1	10a	Monitor TDG in real time during periods of spill or consistent with WQCs to detect TDG violations.
AR/IRU-18b	VIII.4.2	10a	Use an adaptive-management approach using measurements of TDG as an indicator of priority.
AR/IRU-18c	VIII.4.3	10a	Install deflectors to minimize the deep plunge of water immediately downstream of the dam face.
AR/IRU-18d	VIII.4.4	10a	Evaluate if non-plunging discharge should be horizontally separated from plunging over flows.
AR/IRU-18e	VIII.4.6	10a	Develop a compensation program to address losses of aquatic biota when TDG attainment if not feasible.
AR/IRU-19	VIII.5	10a	Continue to investigate installation of a temperature control structure to meet Clean Water Act standards.
AR/IRU-20	VIII.6	10a	Obtain a section 402 CWA permit for any discharges related to turbine operation from the Brownlee project.
AR/IRU-21	IX	10a	Replenish an appropriate portion of the sediments to the Snake River below Hells Canyon dam.
AR/IRU-22	X.1.	10a	Cooperate with BOR to provide flow augmentation.
AR/IRU-23a	X.2.1, 2.2	10a	Implement a ramping rate of 2 inches per hour from Dec. 8 through Oct. 19, and other ramping measures.
AR/IRU-23b	X.2.3	10a	Monitor and identify potential stranding sites and minimize the potential for stranding fall Chinook.
AR/IRU-23c	X.2.4	10a	Measure flows and ramping rates at Hells Canyon dam.
AR/IRU-23d	X.2.5	10a	Study and implement operations with respect to ramping rates to provide an optimal range of benefits.
AR/IRU-24	X.3	10a	Implement a minimum flow that would reduce entrapment during the spring fall Chinook rearing/outmigration.
AR/IRU-25	X.4	10a	Identify and implement restrictions on a range of changes in daily maximum discharge at Hells Canyon dam.
AR/IRU-26	XI.1	10a	Install and operate water quality monitoring stations.
AR/IRU-27	XII	10a	Establish mitigation funds for habitat enhancement and restoration for on and off-site mitigation
AR/IRU-28	XIII.1	10a	Establish a Project Decommissioning Fund.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
AR/IRU-29	XIII.2	10a	Implement conservation programs; non-hydropower renewable energy; demand side management; etc.
BPT-1	G-1	10a	Consult with BPT in a government-to-government relationship regarding activities that affect tribal interests.
BPT-2	G-2	10a	Ensure compliance with all applicable laws, rules and regulations.
BPT-3	G-3	10a	Establish and fund a Resource Coordinating Committee.
BPT-4	.G-4	10a	Escalate costs and payment amounts according to the specified formula.
BPT-5	A-1	10a	Fund the acquisition of upland and riparian habitat in the Malheur River Sub-basin.
BPT-6	A-2	10a	Implement a Habitat and Water Quality Restoration Fund in areas where salmon distribution has been blocked.
BPT-7	A-3	10a	Consider the feasibility and practicality of passage and partial restoration of anadromous fish. .
BPT-8	A-4	10a	Establish and fund an Aquatic Resources Task Force and implement an Integrated Aquatic Resources Program
BPT-9	T-1	10a	Establish and fund a Terrestrial Resources Task Force.
BPT-10	C-1	10a	Comply with all applicable cultural protection laws.
BPT-11	C-2	10a	Create a Burns Paiute Tribal Education Scholarship.
BPT-12	C-3	10a	Establish a Cultural Education Center.
BPT-13	C-4	10a	Complete studies regarding traditional cultural properties and file a Historic Properties Management Plan.
BPT-14	C-5	10a	Provide law enforcement to protect cultural resources (develop monitoring plan).
BPT-15	C-6	10a	Establish a Cultural Resources Task Force.
BPT-16	C-7	10a	Consult and work with BPT on gathering information about cultural sites (fund).
BPT-17	C-8	10a	Establish a cooperative management area in the Snake River and its tributaries.
BPT-18	R-1	10a	Manage reservoir levels and recreation to preserve and protect cultural and natural resources.
BPT-19	R-2	10a	Prepare an Integrated Comprehensive Recreational Plan, a Visual Resource Mgmt. Plan, and interpretive signage.
Corps-1	2	10a	Determine the flood control draft for Brownlee consistent with the November 1998 Procedure.
Corps-2	3	10a	Handle future winter flood control operations for Brownlee reservoir in conjunction with the Corps.
Corps-3	5.2.1.a	10a	Operate the project in the interest of navigation to maintain flow targets continuously throughout the year.
Corps-4	5.2.1.b	10a	Set the minimum release from Hells Canyon dam when Brownlee Reservoir inflow is less than 8,500 cfs.
Corps-5	5.2.1c	10a	Seek a temporary variance from the Corps for flow requirements under certain circumstances.
Corps-6	5.2.1d	10a	Prevent the maximum variation in river stage from exceeding one foot per hour at Johnson's Bar station.
CTUIR-1	II.A	10a	Provide a mitigation and compensation fund for artificial production of fisheries and habitat improvements.
CTUIR-2	II.B	10a	Manage emergency situations that may cause mortality or other harm to fish and wildlife species or their habitats.
CTUIR-3	II.C	10a	Include FERC's standard reopener to reopen the license proceeding if needed.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
CTUIR-4	II.D	10a	Remove or modify Project facilities and restore pre-Project conditions upon project abandonment.
CTUIR-5	II.E	10a	Issue the license for a term of no longer than 20 years.
CTUIR-6	III.1	10a	Timely pass all Upper Snake River water through the project.
CTUIR-7	III.2	10a	Maintain Brownlee reservoir at its upper flood control rule curve from February 28 through April 15 each year.
CTUIR-8	III.3	10a	Shift flood control space from Brownlee reservoir to Lake Roosevelt seasonally in low to average flow years.
CTUIR-9	III.4	10a	Implement actions to make the most efficient use of Brownlee reservoir storage to meet anadromous fish needs.
CTUIR-10	III.5	10a	Restrict ramping rates to 2 inches per hour during fall chinook spawning and certain other conditions.
CTUIR-11a	III.6	10a	Evaluate the feasibility of fish passage technologies for upstream and downstream migration at the project.
CTUIR-11b	III.6	10a	Conduct field tagging studies to determine juvenile and adult lamprey migration times, and other parameters.
CTUIR-11c	III.6	10a	Evaluate effects of reservoir drawdowns on fish passage, water quality, and water velocities.
CTUIR-12a	III.7	10a	Develop and implement a salmon and steelhead reintroduction plan.
CTUIR-12b	III.7.A	10a	Design, construct and operate a juvenile spring Chinook collection facility on Eagle Creek.
CTUIR-12c	III.7.B	10a	Provide a juvenile summer steelhead collection facility on Pine Creek or in the Hells Canyon dam forebay.
CTUIR-12d	III.7.C	10a	Re-introduce spring Chinook in Eagle Creek and summer steelhead in Pine Creek.
CTUIR-12e	III.7.D	10a	Design, construct and operate improved adult collection facilities at Hells Canyon dam.
CTUIR-12f	III.7.F	10a	Design, construct and operate juvenile salmon and steelhead collection facilities in the Weiser and Payette rivers.
CTUIR-12g	III.7.G	10a	Establish an escrow account into which the annualized cost of PME measures is deposited annually.
CTUIR-13	III.8	10a	Develop a plan that promotes rebuilding of white sturgeon populations within the APE.
CTUIR-14	III.9	10a	Maintain a minimum flow of 6,500 cfs immediately below Hells Canyon dam and 13,000 cfs at Lime Point.
CTUIR-15	III.10	10a	Establish and support a single, comprehensive fisheries and aquatic resources management committee
CTUIR-16	III.11	10a	Contribute to the funding of regional evaluations of salmon stocks that are affected by the project
CTUIR-17	III.12	10a	Investigate the status of the Pacific lamprey population in the project area and contribute to research funding.
CTUIR-18	III.13	10a	Ensure passage of juvenile Pacific lamprey through the project and meet downstream passage standards.
CTUIR-19	III.14	10a	Develop a Lamprey Passage Plan
CTUIR-20	III.15	10a	Construct structures on Hells Canyon dam to abate total dissolved gas.
CTUIR-21	III.16	10a	Construct structures on Hells Canyon dam to add dissolved oxygen to the Snake River below the project.
CTUIR-22	III.17	10a	Investigate installation of a temperature control structure at Brownlee reservoir.
CTUIR-23	III.18	10a	Prevent the discharge of point-source pollutants into the Snake River from the project.
CTUIR-24	III.18.C.1	10a	Expand the APE to the confluence of the Snake and Clearwater Rivers and survey the area for cultural resources.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
CTUIR-25	III.18.C.2	10a	Finalize the HPMP.
CTUIR-26	III.18.C.3	10a	Remove all time frames for agencies to consult with tribes regarding undertakings taking place on agency land.
CTUIR-27	III.18.C.4	10a	Create a cultural resource work group.
CTUIR-28	III.18.C.5	10a	Clarify that all PMEs in all categories are undertakings for the purposes of the National Historic Preservation Act.
CTUIR-29	III.18.C.6	10a	Specify what is meant by monitoring.
CTUIR-30	III.18.C.7	10a	Stabilize and protect affected historic properties and maintain any stabilization measures in perpetuity.
CTUIR-31	III.18.C.8	10a	Mitigate sites and clarify that the significance of a given site may be tied to more than its scientific information.
CTUIR-32	III.18.C.9	10a	Clarify that boat wakes on the reservoirs are project-related impacts.
CTUIR-33	III.18.C.10	10a	Ensure that artifacts removed from the APE are reburied on site or curated at a federally recognized repository.
CTUIR-34	III.18.C.11	10a	Clearly delineate roles of other federal agencies that may play a role implementing any part of the HPMP.
CTUIR-35a	III.19	10a	Identify, monitor and mitigate effects to historic properties, and ultimately to better protect those sites.
CTUIR-35b	III.19.A	10a	Develop long-term monitoring framework and plan for archaeological sites.
CTUIR-35c	III.19.B	10a	Develop monitoring plan for rock image sites.
CTUIR-35d	III.19.C	10a	Develop monitoring framework and plan for TCPs.
CTUIR-35e	III.19.D	10a	Enact measures for law enforcement.
CTUIR-35f	III.19.E	10a	Involve public, other agencies, law enforcement in protection efforts.
CTUIR-35g	III.19.F	10a	Discourage use of dispersed recreation sites in the APE.
CTUIR-35h	III.19.G	10a	Conduct sensitivity training for staff.
CTUIR-35i	III.19.H	10a	Resurvey APE every 10 years.
CTUIR-35j	III.19.H	10a	Provide $1 million to tribes to assist their participation in consultation and coordination.
CTUIR-35k	III.19.H	10a	Develop plan for increasing tribal access to tribal fishing sites in APE.
FS-1	1	4e	Obtain FS approval prior to habitat or ground-disturbing activities on Forest Service lands.
FS-2	2	4e	Prepare a Resource Coordination Plan.
FS-3	3	4e	Prepare a Fire Prevention Plan.
FS-4	4	4e	Establish a mitigation fund for use by the Forest Service for the purpose of restoring and maintaining 14 acres of sandbars.
FS-5	5	4e	Prepare an Integrated Wildlife Habitat Program (IWHP) and Wildlife Mitigation and Management Plan (WMMP).
FS-6	6	4e	Prepare a Land Acquisition and Management Plan to be incorporated into the IWHP and WMMP.
FS-7	7	4e	Prepare and implement a cooperative Integrated Weed Management Plan.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
FS-8	8	4e	Prepare a Threatened and Endangered Species Management and Monitoring Strategy.
FS-9	9	4e	Prepare a Sensitive Species Management Plan to be incorporated into the WMMP.
FS-10	10	4e	Implement the Mountain Quail Habitat Enhancement program.
FS-11	11	4e	Develop a transmission line operation and maintenance plan.
FS-12	12	4e	Finalize the Hells Canyon Complex Comprehensive Recreation Management Plan.
FS-13	13	4e	Develop a site development plan for the Big Bar Recreation Area.
FS-14	14	4e	Implement the Eagle Bar site plan proposed in the draft Recreation Plan.
FS-15	15	4e	Implement the Eckels Creek Dispersed Site plan proposed in the draft Recreation Plan.
FS-16	16	4e	Complete a condition and safety inspection of Deep Creek Stairway/Trail #218 and correct any deficiencies.
FS-17	17	4e	Improve and maintain parking/signing at Allison, Kinney, Eckels, and Deep Creek parking lots.
FS-18	18	4e	Perform O&M necessary to meet Forest Service standards for Eagle Bar, Eckels Creek, Big Bar, and other sites.
FS-19	19	4e	Manage Hells Canyon reservoir levels to minimize impacts on recreation resources during the summer.
FS-20	20	4e	Perform trail maintenance for trails designated by the Forest Service.
FS-21	21	4e	Prepare a plan for improvements of the Hells Canyon Creek Launch Site.
FS-22	22	4e	Develop an aesthetic improvement plan for enhancement of Hells Canyon dam.
FS-23	23	4e	There is no FS-23.
FS-24	24	4e	Prepare a Scenery Management Plan for FS lands within the project boundary and adjacent to the project boundary if they are affected.
FS-25	25	4e	Finalize a Historic Properties Management Plan for cultural resources within the APE.
FS-26	26	4e	Provide a project map and aerial photographs depicting the approximate location of the project boundary.
FS-27	27	4e	Implement additional measures as necessary.
FS-28			There is no FS-28
FS-29	1	10a	Maintain a minimum flow of 8,500 cfs downstream of Hells Canyon dam to provide for safe navigation.
FS-30	2	10a	Assess the effects of load following downstream of Hells Canyon dam using the Adaptive Management Program.
FS-31	3	10a	Prepare a Gravel Monitoring Plan.
FS-32	4	10a	Develop, fund and implement a fish passage plan for bull trout.
FS-33	5	10a	Establish, fund and implement a Tributary Habitat Mitigation Fund for spring Chinook and steelhead
FS-34	6	10a	Finalize and implement the Hells Canyon Resource Management Plan, IWHP, and WMMP.
IDFG-1a	III.C.1	10j	Continue Idaho Power's fall Chinook spawning program, which includes providing stable flows.
IDFG-1b	III.C.1	10j	Develop measures to reduce effects of entrapment on juvenile Chinook during the juvenile outmigration period. .

Identifier Used in the EIS	Recommending Entity ID	Recommendation Type	Description of Measure
IDFG-2	III.C.2	10j	Continue to conduct shallow redd surveys and monitor temperature.
IDFG-3	III.C.3	10j	Continue and improve the anadromous fish hatchery facilities and program
IDFG-4	III.C.4	10j	Develop anadromous fish hatchery goals, especially those related to adult return and societal use
IDFG-5	III.C.5	10j	Monitor and evaluate fish hatchery performance and employ an IDFG hatchery evaluation biologist.
IDFG-6	III.C.6	10j	Purchase a new fish marking unit and implement measures to ameliorate whirling disease.
IDFG-7	III.C.7	10j	Purchase and operate an additional transport vehicle for relocating surplus adult fish.
IDFG-8	III.C.8	10j	Improve public angler access to several fisheries.
IDFG-9	III.C.9	10j	Continue monitoring incubation conditions in the historic fall Chinook spawning areas in the Marsing reach.
IDFG-10	III.C.10	10j	Monitor Pacific lamprey downstream and participate in the Columbia River Basin Lamprey Work Group.
IDFG-11	III.E.1	10j	Develop and implement a native salmonid plan
IDFG-12	III.E.2	10j	Implement a pathogen risk assessment plan for the Pine Creek, Indian Creek, and Wildhorse River basins.
IDFG-13	III.E.3	10j	Initiate a fish passage program; do not relocate bull trout until adverse effects from brook trout can be addressed.
IDFG-14	III.E.4	10j	Improve facilities at the existing Hells Canyon dam fish trap by implementing a specified alternative.
IDFG-15	III.E.5	10j	Delay construction of a fish trap at Oxbow dam until the Hells Canyon fish trap can be evaluated.
IDFG-16	III.E.6	10j	Implement a tributary habitat enhancement program.
IDFG-17	III.E.7	10j	Supplement nutrients for resident salmonids using only spawned carcasses or carcass analogs (conduct study).
IDFG-18	III.E.8	10j	Conduct surveys for bull trout in the Hells Canyon Complex
IDFG-19	III.E.9	10j	Design, construct, and monitor a weir facility at Pine Creek
IDFG-20	III.E.10	10j	Explore feasibility of methods to control brook trout in Indian Creek
IDFG-21	III.E.11	10j	Use the white sturgeon conservation plan to contribute to the goal of restoring healthy white sturgeon populations
IDFG-22	III.E.12	10j	Conduct an assessment of degraded water quality impacts on early life stages of white sturgeon.
IDFG-23	III.E.13	10j	Conduct feasibility studies prior to the translocation of reproductive-sized white sturgeon.
IDFG-24	III.E.14	10j	Focus initial conservation efforts to benefit white sturgeon on habitat restoration.
IDFG-25	III.E.15	10j	Conduct long-term population assessments of white sturgeon as proposed by Idaho Power
IDFG-26	III.E.16	10j	Implement a genetic monitoring program of white sturgeon as proposed by Idaho Power
IDFG-27	III.G.1	10j	Implement measures to protect warmwater fish.
IDFG-28	III.I.1	10j	Acquire, protect, and enhance lands to mitigate project impacts.
IDFG-29	III.I.2	10j	Acquire and enhance low elevation upland and riparian habitat to replace habitats affected by the project.
IDFG-30	III.I.3	10j	Develop and fund a mountain quail restoration project adjacent to the project reservoirs.

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IDFG-31	III.I.4	10j	Enhance habitat on Gold, Huffman, Patch, and Porter Islands with increased funding.
IDFG-32	III.I.6	10j	Control the establishment and spread of noxious weeds in the project area.
IDFG-33	III.I.7	10j	Protect rare plant sites affected by disturbance activities in Hells Canyon.
IDFG-34	III.I.8	10a	Manage the Big Bar recreation site for wildlife not intensive recreation.
IDPR-1	IV.C.2	10a	Implement Idaho Power's proposed recreation and aesthetic measures.
Interior-1	1	4e	Consult and cooperate with the BLM prior to initiating activities on BLM-administered lands.
Interior-2	2	4e	Consult with BLM and prepare an annual report summarizing progress on implementation of articles of the license that would affect recreation, cultural, aquatic, and terrestrial resources on BLM-administered within and adjacent to the project boundary.
Interior-3	3	4e	Develop a Travel and Access Management Plan for project and BLM-administered lands affected by the project.,
Interior-4	4	4e	Develop and implement a Law Enforcement and Emergency Services Plan.
Interior-5	5	4e	Revise, finalize, and implement the final Historic Properties Management Plan for historic properties on BLM-administered lands.
Interior-6	6	4e	Prepare a Comprehensive Recreation Management Plan.
Interior-7	7	4e	Develop and implement a litter and sanitation plan for the project.
Interior-8	8	4e	Develop a Project Boat Moorage Plan.
Interior-9	9	4e	Develop an enhancement plan for the BLM sites referred to as Airstrip, Bob Creek section C, and Westfall.
Interior-10	10	4e	Develop an enhancement plan for the BLM Swedes Landing Site (Swedes Plan).
Interior-11	11	4e	Develop an enhancement plan for the BLM Spring Recreation Site.
Interior-12	12	4e	Develop an enhancement plan for the BLM site referred to as Steck Recreation Site.
Interior-13	13	4e	Develop an enhancement plan for the BLM site referred to as Jennifer's Alluvial Fan Site.
Interior-14	14	4e	Develop an improvement plan for site no. 2 below Hells Canyon Dam Bridge (BCHB92)) and a litter and sanitation plan for BCHB(2) and other dispersed sites.
Interior-15	15	4e	Develop an enhancement plan for the BLM site referred to as Carter's Landing and Oxbow Boat Launch.
Interior-16	16	4e	Develop an enhancement plan for the BLM site referred to as Oasis.
Interior-17	17	4e	Develop an enhancement plan for the BLM site referred to as Copper Creek.
Interior-18	18	4e	Develop a Low-Water Boat Launch Plan.
Interior-19	19	4e	Withdrawn
Interior-20	10(a)-1	10a	Coordinate with FWS regarding measures to protect, mitigate damages, and enhance fish and wildlife resources.
Interior-21	10(a)-2	10a	Take appropriate actions to protect fish and wildlife in emergencies or under special conditions.

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Interior-22	10(a)-3	10a	Pass BOR flow augmentation water releases that reach Brownlee reservoir prior to August 29.
Interior-23	10(a)-4	10a	Submit a plan for application of pesticides on project or adjacent non-Project lands to the BLM.
Interior-24	10(a)-5	10a	Develop an Interpretation and Education plan.
Interior-25	10(a)-6	10a	Develop a Visual Resource Management Plan for project facilities.
Interior-26	10(a)-7	10a	Manage reservoir levels to minimize impacts on recreation resources during May, June, and July.
Interior-27	10(a)-8	10a	Conduct a recreation user study at Weiser Sand Dunes and implement and partially fund a Weiser Dune Plan.
Interior-28	10(a)-9	10a	Plan and implement an upgrade of facilities at Heller Bar and develop the Heller Bar Plan.
Interior-29	10(a)-10	10a	Develop and implement a Recreation Land Acquisition and Management Program.
Interior-30	10(a)-11	10a	Modify the Project boundary to include the Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites.
Interior-31	10(a)-12	10a	Establish and convene a Recreation/Aesthetics Resource Work Group.
Interior-32a	10(a)-13	10a	Develop a revised warmwater recreational fisheries plan.
Interior-32b	10(a)-13	10a	Assess access to launch boats; satisfy reservoir-level requirements of Baker County Settlement Agreement.
Interior-33	10(a)-14	10a	Develop a process and schedule for acquiring 14.6 miles of tributary habitat.
Interior-34	10(a)-15	10a	Develop and implement a TES Species Management Plan for BLM-administered lands.
Interior-35	10(a)-16	10a	Fund development and implementation of a Habitat Mitigation and Management Program.
Interior-36	10(a)-17	10a	Evaluate, protect or mitigate any scientifically important paleontological discoveries on BLM lands.
Interior-37a	10(j)-1.1	10j	Develop and implement a plan to improve bull trout habitat conditions in Pine Creek and associated tributaries.
Interior-37b	10(j)-1.2	10j	Operate and maintain a permanent weir structure at the mouth of Pine Creek
Interior-37c	10(j)-1.3	10j	Conduct population monitoring activities, including life history monitoring of bull trout in Pine Creek.
Interior-37d	10(j)-1.4	10j	Determine whether brook trout limit the distribution, numbers, or reproduction of bull trout in Pine Creek.
Interior-38a	10(j)-2.1	10j	Develop and implement a plan to improve bull trout habitat conditions in Indian Creek and associated tributaries.
Interior-38b	10(j)-2.2	10j	Operate and maintain a permanent weir structure at the mouth of Indian Creek
Interior-38c	10(j)-2.3	10j	Conduct population monitoring activities, including life history monitoring of bull trout in Indian Creek.
Interior-38d	10(j)-2.4	10j	Determine whether brook trout limit the distribution, numbers, or reproduction of bull trout in Indian Creek.
Interior-39a	10(j)-3.1	10j	Develop and implement a plan to improve bull trout habitat in the Wildhorse River and associated tributaries.
Interior-39b	10(j)-3.2	10j	Operate and maintain a permanent weir structure at the mouth of the Wildhorse River
Interior-39c	10(j)-3.4	10j	Conduct population monitoring activities, including life history monitoring of bull trout in the Wildhorse River.
Interior-39d	10(j)-3.3	10j	Determine whether brook trout limit bull trout in the Wildhorse River.
Interior-40	10(j)-4.1	10j	Conduct presence absence surveys for bull trout and evaluate habitat conditions within Eagle Creek.

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Interior-41	10(j)-5	10j	Implement a program to provide bull trout access to anadromous fish as prey in Pine and Indian Creeks.
Interior-42	10(j)-6	10j	Improve water quality in Oxbow and Hells Canyon reservoirs to meet water quality standards for bull trout.
Interior-43	10(j)-7	10j	Establish a conservation flow in the Oxbow bypass reach sufficient to meet requirements for bull trout.
Interior-44	10(j)-8	10j	Evaluate project effects on bull trout downstream of Hells Canyon dam.
Interior-45	10(j)-9	10j	Conduct activities to provide for the safe and effective passage of bull trout past Hells Canyon dam.
Interior-46a	10(j)-10	10j	Develop and implement a Fish Passage Plan related to the Hells Canyon fish trap and tributary weirs.
Interior-46b	10(j)-10	10j	Design, construct and operate improved adult collection facilities at Hells Canyon dam.
Interior-46c	10(j)-10	10j	Design, construct, and monitor a weir facility at Eagle Creek.
Interior-47a	10(j)-11.a	10j	Evaluate habitat upstream of the project for the reintroduction of naturally spawning fall Chinook salmon.
Interior-47b	10(j)-11.b	10j	Develop and refine plans to provide downstream passage of fall Chinook salmon around the project reservoirs.
Interior-48	10(j)-12	10j	Develop a final set of hatchery production goals.
Interior-49	10(j)-13	10j	Provide put-and-take fisheries in selected rivers.
Interior-50a	10(j)-15.1	10j	Implement water quality improvement measures elsewhere in the basin to aid in sturgeon recovery
Interior-50b	10(j)-14.4	10j	Determine which Idaho Power facilities need to have their trashracks replaced to protect juvenile sturgeon.
Interior-50c	10(j)-14.5	10j	Study the conservation benefits of a seasonal ROR operation at various projects to promote sturgeon spawning.
Interior-51	10(j)-15	10j	Implement the white sturgeon conservation measures proposed in the Final License Application.
Interior-52	10(j)-16	10j	Complete and implement a Final White Sturgeon Conservation and Action Plan.
Interior-53	10(j)-17	10j	Develop and implement a White Sturgeon Conservation Aquaculture Plan.
Interior-54	10(j)-18	10j	Implement seasonal run-of-river operations downstream of Hells Canyon dam for white sturgeon.
Interior-55	10(j)-19	10j	Install protective trash racks at CJ Strike and Bliss dams for the conservation and development of white sturgeon.
Interior-56	10(j)-20	10j	Complete and implement a Pacific Lamprey Management Plan.
Interior-57	10(j)-21	10j	Determine structural measures needed to mitigate for project effects to Pacific lamprey.
Interior-58	10(j)-22	10j	Develop and implement a Native Fish Management Plan for native resident and anadromous fish.
Interior-59	10(j)-23	10j	Implement a schedule to correct fish passage barriers at road crossings and culverts.
Interior-60	10(j)-24	10j	Complete a stock assessment of anadromous and resident fish populations.
Interior-61	10(j)-25	10j	Install a turbine-venting system at the Brownlee development and the units at Hells Canyon dam.
Interior-62a	10(j)-26	10j	Install flow deflectors on Hells Canyon and Brownlee dam spillways.
Interior-62b	10(j)-26	10j	Work with IDEQ and ODEQ to design an effectiveness monitoring plan for the flow deflectors.
Interior-63	10(j)-27	10j	Provide flows and oxygen supplementation to maintain water quality parameters in the Oxbow bypass reach.

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Interior-64	10(j)-28	10j	Comply with the terms set forth by IDEQ and ODEQ for water quality certification under CWA section 401.
Interior-65	10(j)-29	10j	Take river flow and stage measurements within one mile below Hells Canyon dam or at USGS gage #13290450.
Interior-66	10(j)-30	10j	Monitor modified operations to determine effects on aquatic species downstream of the Hells Canyon dam.
Interior-67	10(j)-31	10j	Monitor water quality below Hells Canyon dam at numerous locations at a minimum of twice per month
Interior-68	10(j)-32	10j	Monitor selected beaches, cobble bars, gravel bars, and sand bars to determine rates of depletion.
Interior-69	10(j).33	10j	Monitor quantity and quality of gravel material in the Snake River below Hells Canyon dam.
Interior-70	10(j)-34	10j	Monitor benthic macroinvertebrates to assess changes in the composition of benthic macroinvertebrates.
Interior-71	10(j)-35	10j	Conduct biannual monitoring of benthic macrophytes and algae, emphasizing periphyton.
Interior-72	10(j)-36	10j	Conduct zonal distribution surveys and monitoring of keystone and sensitive benthic species.
Interior-73	10(j)-37	10j	Monitor known colonies of the Hells Canyon rapids snail and the short-faced limpet.
Interior-74	10(j)-38	10j	Establish several experimental populations of Hells Canyon rapids snail and/or the short-faced limpet.
Interior-75	10(j)-39	10j	Establish several experimental populations of the western ridged mussel below Hells Canyon dam.
Interior-76	10(j)-40	10j	Develop a strategy for terrestrial habitat mitigation to mitigate for loss and degradation of terrestrial habitat.
Interior-77	10(j)-41	10j	Develop and implement an Integrated Weed Management Plan incorporated into the IWHP and WMMP.
Interior-78	10(j)-42	10j	Develop and implement a Sensitive Plant Species Management Plan.
Interior-79	10(j)-43	10j	Develop and implement the Hells Canyon Resource Management Plan, IWHP, and WMMP.
Interior-80	10(j)-44	10j	Develop and implement a mountain quail management plan.
Interior-81	10(j)-45	10j	Develop and implement a Bald Eagle Management Plan
Interior-82	10(j)-46	10j	Implement measures to protect Townsend's big-eared bats
Interior-83	10(j)-47	10j	Develop and implement a Southern Idaho Ground Squirrel Management Plan.
Interior-84	10(j)-48	10j	Implement a Northern Idaho Ground Squirrel Management Plan.
Interior-85	10(j)-49	10j	Implement measures to protect amphibians and reptiles
Interior-86	none	Sec18	Reserve authority for Interior to prescribe the construction, operation, and maintenance of fishways at the project.
Interior-87	1.1	Sec18	Continue the trap and haul fishways and monitor permanent weirs and trap and haul fishways.
Interior-87	1.2	Sec 18	Develop and implement a Bull Trout Passage Plan.
ISHS-1	None	10a	Revise the historic properties management plan.
ISHS-2	None	10a	Ensure cost estimated for monitoring cultural sites below Hells Canyon dam is sufficient to complete the work.
ISHS-3	None	10a	Finalize list of sites to be stabilized below Hells Canyon dam.
ISHS-4	None	10a	Establish a fund to support archaeological testing to determine most effective method for stabilizing sites.

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ISHS-5	None	10a	Establish a program to survey the reach of the Snake River between the Salmon and Grande Ronde rivers.
ISHS-6	None	10a	Update and revise the NRHP nomination for the Hells Canyon Archaeological District.
ISHS-7	None	10a	Establish an on-going Cultural Resource Work Group.
ISHS-8	None	10a	Provide funding for analyses of existing but unreported archaeological collections from Hells Canyon.
LVE-1	A	comment	Compensate Wyoming and the Wyoming residents for the use of Wyoming's unused allocation of water.
LVE-2	B	comment	Apportion some of the benefits of project power production to others in the region and the Snake River drainage.
NMFS-1	XII.1	10j	Provide stable flows between 8,500 and 13,500 cfs throughout fall Chinook spawning season.
NMFS-2	XII.2	10j	Provide stable flows throughout the fall Chinook incubation period.
NMFS-3	XII.3	10j	Monitor the construction of fall Chinook salmon redds between Lower Granite reservoir and Hells Canyon dam.
NMFS-4	XII.4	10j	Release flows sufficient to reduce the incidence of juvenile entrapment.
NMFS-5	XII.5	10j	Conduct a juvenile entrapment and stranding study.
NMFS-6	XII.6	10j	Study fall Chinook salmon spawning gravel between Hells Canyon dam and the Salmon River.
NMFS-7	XII.7	10j	Evaluate fall Chinook salmon egg-to-fry survival downstream of Hells Canyon dam.
NMFS-8	XII.8	10j	Refill Brownlee reservoir necessary to meet Corps flood control requirements and coordinate refill with NMFS.
NMFS-9	XII.9	10j	Release 237 kaf of stored water from Brownlee reservoir between June 21 and July.
NMFS-10	XII.10	10j	Design and construct a gas abatement structure at the Hells Canyon dam spillway
NMFS-11	XII.11	10j	Design and construct a gas abatement structure at the Brownlee dam spillway
NMFS-12	XII.12	10j	Increase dissolved oxygen levels in outflows of the Hells Canyon developments during the late summer and fall
NMFS-13	XII.13	10j	Continue funding operation of its Rapid River, Pahsimeroi, Niagara Springs, and Oxbow hatchery facilities.
NMFS-14a	XII.14	10j	Fund water quality improvement projects in the Snake River Basin upstream of Hells Canyon dam.
NMFS-14b	XII.14.d	10j	Monitor water quality upstream of the project and below Brownlee and Hells Canyon dams.
NMFS-14c	XII.14.e	10j	Evaluate fall Chinook salmon egg-to-fry survival downstream of Bliss, C.J. Strike and Swan Falls dams.
NMFS-15	XII.15	10j	Measure flows and ramping rates within 1 mile downstream of Hells Canyon dam.
NMFS-16	XII.16	10j	Conduct passage and reintroduction studies of fall Chinook salmon upstream of the project.
NMFS-17	XII.17	10j	Conduct passage and reintroduction studies of spring/summer Chinook salmon and steelhead in three tributaries.
NMFS-18	XIII.1	10a	Provide shifts in flood control from Brownlee reservoir to Grand Coulee reservoir if requested by the Corps.
NMFS-19	XIII.2	10a	Share excess adult spring Chinook salmon or steelhead hatchery returns with the tribes.
NMFS-20	XIII.3	10a	Design and construct an anadromous fish interpretive display near Brownlee dam.
NMFS-21	X	10a	Include a general reservation of authority for NMFS to prescribe fishways.

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NMFS-22	XI	10a	Include a specific ESA reopener provision.
NPPVA-1	none	comment	Continue flows of 8,500 cfs above the Salmon River-Snake River confluence and 11,500 cfs below the Salmon.
NPT-1	II.1	10a	Continue Idaho Power's fall Chinook spawning program which includes providing stable flows.
NPT-2	II.2	10a	Provide passage of water released from USBR reservoirs and natural flow rights acquired for flow augmentation.
NPT-3	II.3	10a	Limit ramping rate to 2 inches per hour from April through May to protect rearing fall Chinook from stranding.
NPT-4	II.4	10a	Limit ramp rates to 2 in/hour if Lower Granite flows fall below 30,000 cfs during the fall Chinook outmigration.
NPT-5	II.5	10a	Maintain Brownlee reservoir at its upper flood control rule elevation from Feb 28 - April 15 of each year
NPT-6	II.6	10a	Consider shifting flood control requirements from Brownlee reservoir to Lake Roosevelt reservoir.
NPT-7	II.7	10a	Draft and refill Brownlee reservoir by a timetable for summer flow augmentation and for fall Chinook spawning.
NPT-8a	II.8	10a	Fund implementation of the Snake River-Hells Canyon TMDL in lieu of providing fish passage of fall Chinook.
NPT-8b	II.8	10a	Evaluate egg to fry survival of fall Chinook.
NPT-8c	II.8	10a	Fund studies for salmon and steelhead collection in the Payette and Weiser rivers and Pine and Eagle creeks.
NPT-9	II.9	10a	Coordinate Snake River fall Chinook artificial production through U.S vs. Oregon.
NPT-10	II.10	10a	Develop a management agreement for Rapid River spring Chinook production.
NPT-11	II.11	10a	Develop a management agreement for Pahsimeroi summer Chinook production.
NPT-12	II.12	10a	Develop a management agreement for steelhead production from Niagara Springs and Oxbow hatcheries.
NPT-13	II.13	10a	Investigate installation of a temperature control structure at Brownlee reservoir
NPT-14	II.14	10a	Maintain a minimum flow no higher than 6,500 cfs below Hells Canyon dam and 13,000 cfs at Lime Point.
NPT-15	II.15	10a	Construct structures on Hells Canyon and Brownlee dams and develop a plan to abate total dissolved gas.
NPT-16	II.16	10a	Construct structures on Hells Canyon dam to add DO along with injecting oxygen in Brownlee reservoir.
NPT-17	II.17	10a	Develop and implement a plan to prevent the discharge of point source pollutants into the Snake River.
NPT-18	II.18	10a	Implement White Sturgeon conservation Plan.
NPT-19	II.19	10a	Investigate the status of and project effects on the Pacific lamprey population in the project area
NPT-20	II.20	10a	Monitor the movement of sand, silt and gravel from above, through and below the project area.
NPT-21	II.21	10a	Restore sandbars to their pre-project number and size.
NPT-22	II.22	10a	Acquire lands to mitigate for impacts on wildlife habitat caused by the filling of the three project reservoirs.
NPT-23	II.23	10a	Hold lands purchased as open and unclaimed lands that will be open to the Tribe's use under treaty rights.
NPT-24	II.24	10a	Provide a fund to purchase replacement fishing grounds for the Nez Perce Tribe in the Hells Canyon area.
NPT-25	II.25	10a	Conduct and fund additional oral history studies of Nez Perce sites.

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NPT-26	II.26	10a	Finalize the Historic Properties Management Plan.
NPT-27	II.27	10a	Update the Hells Canyon National Register District Nomination.
NPT-28	II.28	10a	Monitor all historic properties that may be affected by the project with increased funding.
NPT-29	II.29	10a	Increase the number of sites and funding of site treatment/mitigation/stabilization.
NPT-30	II.30	10a	Extend the Area of Potential Effects downstream from Salmon River confluence to Asotin, Washington.
NPT-31	II.31	10a	Provide the $1,000,000 FLA funds in a lump sum at the beginning of the license.
NPT-32	II.32	10a	Establish a cultural resources advisory committee.
NPT-33	II.33	10a	Seek to employ qualified Nez Perce Tribal members in all contracts and work performed pursuant to this license.
NPT-34	II.A	10a	Manage emergency situations that may cause harm or mortality to fish and wildlife species or habitats.
NPT-35	II.B	10a	Include FERC's standard reopener to reopen the license to protect and enhance fish and wildlife.
NPT-36	II.C	10a	Remove or modify Project facilities and restore pre-Project conditions upon project abandonment
NPT-37	II.D	10a	Issue the license for a term of no longer than 30 years.
ODFW-1	10(j)-1	10j	Establish and convene a Hells Canyon Project Coordinating Committee upon license issuance.
ODFW-2	10(j)-2	10j	Implement a long-term program to establish sustainable anadromous fish runs above the project.
ODFW-3	10(j)-3	10j	Develop and implement a Fish Passage Plan for native migratory resident and anadromous species.
ODFW-4	10(j)-4	10j	Establish a Fish Passage and Reintroduction Committee.
ODFW-5	10(j)-5	10j	Consult with ODFW in development of fishway and trap designs.
ODFW-6	10(j)-6	10j	Implement an evaluation plan for the construction and modification of the Hells Canyon dam fish trap.
ODFW-7	10(j)-7	10j	Maintain all fishways and traps in proper order.
ODFW-8	10(j)-8	10j	Develop a fishway and trap operation and maintenance plan.
ODFW-9	10(j)-9	10j	Provide ODFW access to the Hells Canyon Project site and project records to inspect fishways and traps.
ODFW-10	10(j)-10	10j	Modify and improve the existing Hells Canyon dam fish trap within 2 years.
ODFW-11	10(j)-11	10j	Design and construct a fish ladder and trap at Oxbow dam within 10 years.
ODFW-12	10(j)-12	10j	Develop, install and maintain a downstream fish passage and collection facility at Hells Canyon dam.
ODFW-13	10(j)-13	10j	Design and implement a study of fish predators in Hells Canyon reservoir
ODFW-14	10(j)-14	10j	Provide for passage of spring Chinook salmon and summer steelhead into Pine Creek.
ODFW-15	10(j)-15	10j	Study production potential, migration behavior, and survival of steelhead and spring Chinook salmon.
ODFW-16	10(j)-16	10j	Study production potential, etc. for fall Chinook salmon in the Swan Falls to Brownlee Reach of the Snake River.
ODFW-17	10(j)-17	10j	Develop a detailed upstream and downstream Passage Plan for Pacific Lamprey.

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ODFW-18	10(j)-18	10j	Develop and implement a fish passage plan for bull trout and/or redband trout.
ODFW-19	10(j)-19	10j	Develop and implement a fish passage plan for white sturgeon if this is determined to be feasible
ODFW-20	10(j)-20	10j	Implement measures to address limiting factors if passage and reintroduction efforts are terminated for a reach.
ODFW-21	10(j)-21	10j	Monitor health of upstream and downstream Snake River fish populations.
ODFW-22	10(j)-22	10j	Evaluate anadromous and resident fish populations to pass for reintroduction.
ODFW-23	10(j)-23	10j	Develop and implement a Fish Habitat Protection, Mitigation and Enhancement Plan
ODFW-24	10(j)-24	10j	Evaluate the effects of reintroducing anadromous fish on resident fish populations.
ODFW-25	10(j)-25	10j	Implement a monitoring and evaluation program for all four of Idaho Power's mitigation hatcheries
ODFW-26	10(j)-26	10j	Develop a Hatchery Production Plan
ODFW-27	10(j)-27	10j	Investigate and supply alternative fisheries in Oregon
ODFW-28	10(j)-28	10j	Expand Oxbow Hatchery for fall Chinook salmon broodstock collection, spawning, and rearing
ODFW-29	10(j)-29	10j	Upgrade Oxbow Hatchery facilities
ODFW-30	10(j)-30	10j	Continue hatchery operations at Oxbow, Rapid River, Pahsimeroi, and Niagara Springs hatcheries.
ODFW-31	10(j)-31	10j	Implement project operations to meet specified objectives
ODFW-32	10(j)-32	10j	Cooperate with BOR in providing flow augmentation.
ODFW-33	10(j)-33	10j	Implement ramping rates and minimum flows as described.
ODFW-34	10(j)-34	10j	Implement a Fall Chinook Salmon Spawning and Incubation Protection Program.
ODFW-35	10(j)-35	10j	Fund and participate in annual spawning surveys for fall Chinook salmon downstream of Hells Canyon dam.
ODFW-36a	10(j)-36	10j	Develop, fund and implement a Native Salmonid Plan.
ODFW-36b	10(j)-36-i	10j	Investigate turbine and spill related mortality.
ODFW-37	10(j)-37	10j	Evaluate turbine- and spill-related mortality of native salmonids (entrainment studies).
ODFW-38	10(j)-38	10j	Fund habitat measures in tributaries containing redband trout and bull trout within and above the project.
ODFW-39	10(j)-39	10j	Investigate, fund and implement nutrient supplementation in all tributaries to the project
ODFW-40	10(j)-40	10j	Install and operate a permanent monitoring and collection weir at the mouth of Pine Creek
ODFW-41	10(j)-41	10j	Conduct presence/absence surveys for bull trout in major tributaries associated with the Eagle Creek basin
ODFW-42	10(j)-42	10j	Update and implement measures identified in the White Sturgeon Conservation Plan
ODFW-43	10(j)-43	10j	Evaluate potential impacts to white sturgeon from the bioaccumulation of contaminants.
ODFW-44	10(j)-44	10j	Fund measures to improve water quality and sturgeon habitat within and upstream of the project
ODFW-45	10(j)-45	10j	Conduct white sturgeon stock assessments.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
ODFW-46	10(j)-46	10j	Assess factors limiting sturgeon survival through their incubation and larval life stage below Swan Falls dam.
ODFW-47	10(j)-47	10j	Investigate opportunities for sturgeon translocation to increase production in the Swan Falls to Brownlee reach.
ODFW-48	10(j)-48	10j	Monitor the genotypic frequencies of Snake River white sturgeon between Swan Falls and Lower Granite Dams.
ODFW-49	10(j)-49	10j	Develop, fund and implement Pacific lamprey habitat enhancement measures.
ODFW-50	10(j)-50	10j	Monitor warmwater fish populations and conduct annual creel surveys in all three project reservoirs.
ODFW-51	10(j)-51	10j	Maintain Brownlee reservoir at specified levels with a target refill date of June 30.
ODFW-52	10(j)-52	10j	Conduct studies of food habits of Brownlee reservoir warmwater fish species.
ODFW-53	10(j)-53	10j	Implement a Gravel Monitoring Program to assess spawning gravel for fall Chinook salmon.
ODFW-54	10(j)-54	10j	Develop and implement a plan to meet the TDG allocation for the project.
ODFW-55	10(j)-55	10j	Ensure that the project does not contribute to violation of Oregon's DO standard within or below the project.
ODFW-56	10(j)-56	10j	Develop and implement a temperature management plan.
ODFW-57	10(j)-57	10j	Conduct a study to determine mercury, Dieldrin, and DDT/DDE levels in Brownlee reservoir fish.
ODFW-58	10(j)-58	10j	Implement water quality monitoring measures.
ODFW-59	10(j)-59	10j	Develop and implement a Terrestrial Resources Management and Mitigation Plan.
ODFW-60	10(j)-60	10j	Establish a Terrestrial Resource Work Group.
ODFW-61	10(j)-61	10j	Fund development and implementation of a Land Acquisition and Management Program.
ODFW-62	10(j)-62	10j	Establish a fund to maintain habitat values on Patch, Porter, Huffman and Gold islands.
ODFW-63	10(j)-63	10j	Fund and participate in cooperative mountain quail reintroduction program.
ODFW-64	10(j)-64	10j	Develop a Bald Eagle Management Strategy (monitor, fund, complete surveys).
ODFW-65	10(j)-65	10j	Develop a Sensitive Species Management Plan.
ODFW-66	10(j)-66	10j	Develop an Integrated Weed Management Plan and establish a Noxious Weed Advisory Board.
ODFW-67	10(j)-67	10j	Develop and implement an integrated Transmission Line Operation and Maintenance Plan.
ODFW-68	10(j)-68	10j	Prepare and implement a riparian and riverine vegetation management plan along the Imnaha River.
ODFW-69	10(j)-69	10j	Monitor for bird electrocution mortalities along transmission lines.
ODFW-70	10(j)-70	10j	Minimize risks of bird collisions with transmission lines.
ODFW-71	10(j)-71	10j	Study the effects of harsh winters on mule deer.
ODFW-72	10(j)-72	10j	Avoid road O&M activities on crucial winter range during winter months (road closures).
ODFW-73	10(j)-73	10j	Develop and implement a public Information and Education program regarding human disturbance of wildlife.
ODFW-74	10(j)-74	10j	Prevent further loss of fish and wildlife if project operations suddenly cause detrimental effects on these species.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
ODFW-75	1	10a	Implement a Recreation Adaptive Management Plan and form a Recreation Stakeholder Group.
ODFW-76	2	10a	Develop a road management plan.
ODFW-77	3	10a	Continue, fund and enhance the Litter and Sanitation Plan.
ODFW-78	4	10a	Develop and implement an Information and Education Plan.
ODFW-79	5	10a	Consult with state and federal agencies regarding proposed changes to Hells Canyon Park.
ODFW-80	6	10a	Develop site plans for Westfall; Bob Creek Section A, B and C; and Airstrip A&B.
ODFW-81	7	10a	Develop site plans for Copperfield, Oxbow Launch, Carters/Old Carters Landing, Spring, and McCormick Park.
ODFW-82	8	10a	Develop and implement a site plan for enhancement of Hewitt and Holcomb Parks.
ODFW-83	9	10a	Develop a low-water boat launch on the Oregon side of Brownlee reservoir at or near Swedes Landing.
ODFW-84	10	10a	Improve access to the Stud Creek Trail.
ODFW-85	11	10a	Fund law enforcement officers for project lands and waterways and form a Safety Committee.
ODFW-86	12	10a	Remove or modify Project facilities and restore pre-Project conditions upon project abandonment.
ODSL-1	none	comment	Obtain a lease from ODSL to occupy the state-owned submerged and submersible land.
ODSL-2	none	comment	Obtain authorization from ODSL for project facilities or structures located on state of Oregon lands.
OPRD-1	1	10a	Apply a bank stabilization treatment to Farewell Bend State Park.
OPRD-2	2	10a	Develop and fund a maintenance plan to address sediment buildup at Farewell Bend State Park.
OPRD-3	3	10a	Implement a maintenance operation to remove sediment build-up at Farewell Bend State Park.
OPRD-4	1	10a	Form a Recreation Stakeholder Group.
OPRD-5	2	10a	Fund, develop and implement a Recreation Adaptive Management Plan.
OPRD-6	3	10a	Develop and implement a Comprehensive Recreation Plan with the Recreation Stakeholder Group.
OPRD-7	4	10a	Implement the Comprehensive Recreation Plan.
OPRD-8	5	10a	Fund construction, O&M and monitoring efforts found within the Comprehensive Recreation Plan.
OPRD-9	1	10a	Increase and improve low water access to project reservoirs.
OPRD-10	2	10a	Install moorages for recreational watercraft.
OPRD-11	3	10a	Include moorages for shore access and composting toilets in site development.
OSHPO			No measures in this letter.
OSMB-1	1	10a	Provide salaries and expenses for two full-time seasonal Baker County marine deputies.
OSMB-2	2	10a	Provide an effective marine enforcement and safety presence on the Snake River below Hells Canyon dam.
OSMB-3	3	10a	Facilitate biannual law enforcement proceedings.

Identifier Used in the EIS	Recommending Entity ID	Recommen-dation Type	Description of Measure
OSMB-4	4	10a	Implement a Recreation Adaptive Management Plan in consultation with a Recreation Stakeholders Group.
OSMB-5	5	10a	Include human waste disposal in litter and sanitation planning.
OSMB-6	6	10a	Incorporate education and outreach materials to prevent the introduction or spread of aquatic invasive species.
OWRD			No measures in this letter.
SBT-1a	1	10a	Develop and implement a water quality improvement program to improve habitat conditions for anadromous fish.
SBT-1b	1	10a	Implement anadromous fish passage; but not until protection from the ESA is secured.
SBT-2	2	10a	Arrange for the construction maintenance and operation of two hatcheries in the Yankee Fork and Panther Creek.
SBT-3	3A, 3B	10a	Develop a cultural resources center and a HPMP for all cultural sites on lands near and upstream of the project.
SBT-4	4	10a	Consult on a government-to-government basis on all issues that may affect Tribal interests.
SPT-1	A.1	10a	Conduct studies to examine project effects on the diet and health of tribal members.
SPT-2	A.2	10a	Place adult Chinook and steelhead in the Owyhee River where it flows through the Duck Valley Reservation.
SPT-3	A.3	10a	Reintroduce Chinook and steelhead into the Owyhee, Bruneau, and Snake rivers to Upper Salmon Falls.
SPT-4	A.4	10a	Convene an Aquatic Resource Task Force
SPT-5	TR.1	10a	Acquire lands to benefit the Tribes and their fish, wildlife and botanical resources.
SPT-6	TR.2	10a	Convene a Terrestrial Resource Task Force.
SPT-7	TR.3	10a	Utilize standardized Habitat Evaluation Procedures to determine suitable habitat units for mitigation.
SPT-8	TR.4	10a	Fund the development and implementation of Wildlife Management Strategies.
SPT-9	C.1	10a	Undertake a multi-year ethnographic research project with specified objectives.
SPT-10	C.2	10a	Establish and fund a Cultural Center upstream of the Hells Canyon Complex.
SPT-11	C.3	10a	Include in the APE all lands to the confluence of the Snake and Salmon Rivers upstream to Shoshone Falls.
SPT-12	C.4	10a	Fund the Tribes' participation in and establish a Cultural Resources Task Force.
SPT-13	C.5	10a	Develop procedures for draw downs and other maintenance requirements to protect cultural resources.
SPT-14	C.6	10a	Provide law enforcement to protect cultural resources.
SPT-15	D	10a	Allocate $10,000,000 to the Tribes for Native American Programs.
SPT-16	E	10a	Complete studies to examine environmental and human health risks from the project.
SPT-17	F	10a	Comply with federal laws dealing with tribal sovereignty, religious freedom, and cultural resource protection.

Note: AR/IRU – American Rivers-Idaho Rivers United
BPT – Burns Paiute Tribe
Corps – U.S. Army Corps of Engineers
CTUIR – Confederated Tribes of the Umatilla Indian Reservation
FS – Forest Service
IDPR – Idaho Department of Parks and Recreation
Interior – Department of the Interior
ISHS – Idaho State Historical Society
LVE – Lower Valley Energy
NMFS – National Marine Fisheries Service

NPPVA – Northwest Professional Passenger Vessel Association
NPT – Nez Perce Tribe
ODFW – Oregon Department of Fish and Wildlife
ODSL – Oregon Department of State Lands
OPRD – Oregon Parks and Recreation Department
OSHPO – Oregon State Historic Preservation Office
OSMB – Oregon State Marine Board
OWRD – Oregon Water Resources Department
SBT – Shoshone-Bannock Tribes
SPT – Shoshone-Paiute Tribes

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APPENDIX B

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE HELLS CANYON PROJECT PROJECT NO. 1171-079

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COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE HELLS CANYON PROJECT PROJECT NO. 1171-079

The U.S. Environmental Protection Agency's (EPA) notice of availability of the draft environmental impact statement (EIS) was issued on August 7, 2006. Comments on the draft EIS were initially due on October 3, 2006, but the Commission later amended the due date to November 3, 2006. In addition, the Commission staff conducted five public meetings in Boise, Idaho (September 7 and 8, 2006); Halfway, Oregon (September 11, 2006); Weiser, Idaho (September 12, 2006); and Lewiston, Idaho (September 13, 2006). Commission staff also held tribal consultation meetings with the Nez Perce Tribal Council and Nez Perce Tribe (Lapwai, Idaho; March 6, 2007), the Umatilla Tribes and CRITFC (Pendleton, Oregon; March 7, 2007), the Shoshone-Bannock Tribes (Fort Hall, Idaho; March 5, 2007), the Burns Paiute Tribe (Boise, Idaho; March 29, 2007), and the Shoshone-Paiute Tribes (Owyhee, Nevada; March 30, 2007). In this appendix, we summarize the written and oral comments received; provide responses to those comments; and indicate, where appropriate, how we modified the text in the final EIS. We grouped the comment summaries and responses by topic for convenience. The following entities filed comments on the draft EIS:

Commenting Entity[a]	Filing Date
Oregon Parks and Recreation Department	September 7, 2006
Brett Crow	September 8, 2006
Jason Jedry	September 13, 2006
Bill and Patty Davis	September 13, 2006
Michael Gerhard	September 13, 2006
Fred Larson	September 13, 2006
Lloyd Herbst	September 13, 2006
Bert and Janine Wollerman	September 14, 2006
John and Kerry Giardinelli, and Brian and Angie Thomas	September 19, 2006
Dale Litzenberger	September 19, 2006
Barry Dow	September 19, 2006
Paul Poorman	September 19, 2006
Nick Bradshaw	September 19, 2006
Paul Petersen	September 19, 2006
Northwest Watershed Institute	September 19, 2006
Michael Hryebewicz	September 20, 2006
State of Oregon	September 21, 2006
North Central Idaho Travel Association	September 21, 2006
Lewiston and Clarkston Chambers of Commerce	September 21, 2006
Jason Wallace	September 21, 2006

Commenting Entity[a]	Filing Date
White Bird and Riggins Chambers of Commerce	September 21, 2006
Alonzo Coby, for Shoshone-Bannock Tribes	September 21, 2006
Charles McKetta	September 21, 2006
Nancy Gover	September 21, 2006
Grangeville Chamber of Commerce	September 21, 2006
P.B. Rogers	September 26, 2006
Beverly Ferrell	September 27, 2006
Fred Mensik	September 27, 2006
Joshua Hough	September 29, 2006
Blaine R. Case	September 29, 2006
Justin Walsh	September 29, 2006
Tamra Dickinson	October 3, 2006
Western Whitewater Association	October 3, 2006 October 23, 2006
Robin Stedfeld (representing 25 others)	October 5, 2006
Richard C. Wilson	October 5, 2006
Toddy Perryman	October 5, 2006
Laura Todd	October 6, 2006
Susan K. Chaloupka	October 6, 2006
H.L. Fitchett	October 7, 2006
U.S. Department of Agriculture, Forest Service	October 10, 2006 November 2, 2006
Pioneer Irrigation District, Settlers Irrigation District, Payette River Water Users Association	October 11, 2006
Reed Burkholder	October 12, 2006
Peter Dietrich	October 13,2006
Matt Leidelker	October 13, 2006
Alan Kofoed	October 13, 2006
Sara Lee	October 13, 2006
Glen H. Petry	October 13, 2006
Rick Eichstardt	October 13, 2006
Idaho Power Company	November 3, 2006
Conservation Northwest	October 18, 2006
Karri Harpole	October 23, 2006

Commenting Entity[a]	Filing Date
David V. Vaneck	October 23, 2006
James M. Tamarelli	October 26, 2006
Ronald J. Krishnel	October 27, 2006
Jeffrey Wilhelm	October 30, 2006
Holiday Expeditions	October 31, 2006
Northwest Professional Power Vessel Association	October 31, 2006
Yvonne Prinslow	October 31, 2006
Hydropower Reform Coalition (245 comments attached from individuals)	November 1, 2006
Idaho Historical Society	November 1, 2006
W.B. Childress	November 1, 2006
Idaho Department of Fish and Game	November 2, 2006
U.S. Department of Agriculture, Forest Service, Pacific Northwest Region (Region 6)	November 2, 2006
William S. Parsons	November 2, 2006
U.S. Forest Service	November 2, 2006
Burns Paiute Tribe	November 3, 2006
ROW Inc.	November 3, 2006
Shoshone-Paiute Tribes	November 3, 2006
Idaho Rivers United and America Rivers	November 3, 2006
National Oceanic and Atmospheric Administration, National Marine Fisheries Service	November 3, 2006
U.S. Department of the Interior	November 3, 2006
American Whitewater	November 3, 2006
Idaho Water Users Association and Committee of Nine	November 3, 2006
Idaho Farm Bureau Federation	November 3, 2006
State of Idaho	November 3, 2006
Confederated Tribes of the Umatilla	November 3, 2006
Nampa and Meridian Irrigation District	November 3, 2006
State of Oregon, Water Resources Department, Hydroelectric Application Review Team	November 3, 2006
U.S. Army Corps of Engineers	November 6, 2006
Nez Perce Tribe	November 6, 2006
Shoshone-Bannock Tribes	November 6, 2006 November 24, 2006

Commenting Entity[a]	Filing Date
Northwest River Runners	November 6, 2006
U.S. Environmental Protection Agency, Region 10	November 6, 2006
J.R. Simplot Company	November 6, 2006
Bear Paw Expeditions	November 6, 2006
Citizens' Utility Board of Oregon	November 6, 2006
Sego Jackson	November 7, 2006
Patricia A. Barclay, Idaho Council on Industry and Environment	November 9, 2006
Robert Stanuers	November 9, 2006
Margaret Wright	November 13, 2006
C. Wright	November 13, 2006
Francine Redding	November 13, 2006
Daniel Cretser	November 13, 2006
Lisa and William Colsen	November 13, 2006
Carmen Dorsch	November 13, 2006
Robert Stanuers	November 13, 2006
Cynthia Graham	November 13, 2006
Jacob Judd	November 13, 2006
Juel Ruble	November 13, 2006
Mat Huray	November 13, 2006
Tanya Kutterer	November 13, 2006
J. Kirkendall	November 13, 2006
Mkan Deffries	November 13, 2006
Lisa Armstrong and Tom Boatner	November 21, 2006
Frank Jones	November 24, 2006
Harold C. Poxleitmer	November 27, 2006
John Marks	January 10, 2007
Marshallee Walters	January 18, 2007

[a] Comments without legible signatures are not listed.

B1. PROCEDURAL AND GENERAL

Comment PG-1: About 300 individuals[137] state that FERC should restore some balance to the Snake River by requiring Idaho Power to do the following under the new license:

1. Immediately provide fish passage for spring Chinook and steelhead past all dams and into previously accessible tributaries, and provide fall Chinook passage once water quality is sufficiently restored.
2. Meet all federal and state water quality standards for temperature, heavy metals, and other current or potential water quality impacts that are a result of the dams.
3. Implement tighter ramping rate restrictions to prevent drastic changes in flow, and release water to provide maximum benefit for salmon and steelhead.
4. Replenish sands and gravels to restore beaches for habitat and recreation.

Additionally, the commenters indicate that FERC should assess the economic benefits of restoring natural salmon runs, beaches, and water quality to the region, including the effect of sport and commercial fishing on communities in Idaho, Oregon, and Washington.

Response: The role of the Commission in a licensing proceeding is to decide whether to grant a license to an applicant and what conditions to impose on any license that would, in its view, "be best adapted to a comprehensive plan for improving or developing a waterway or waterways" as provided for by section 10(a)(1) of the FPA. To inform the Commission's decision, the staff evaluates all recommended measures and makes a recommendation to the Commission as to which measures should be included in any new license. The measures recommended by the commenters were all considered in the draft EIS, and the staff's rationale for its recommendations is explained in the following sections: (1) section 5.2 4.3 addresses anadromous fish restoration; (2) section 5.2 addresses water quality measures; (3) sections 5.2.4.1 and 5.2.4.2 discuss ramping rates during fall Chinook salmon spawning and incubation periods and outside those periods, respectively; and (4) section 5.2.1 addresses sand and gravel replenishment. In the final EIS, we evaluated these same concepts again, considering new information submitted since the draft EIS. In some cases, we revised our recommendation, as described in the same sections of the final EIS. With respect to doing a full economic analysis of the economic benefits of restoring natural salmon runs, this is a task beyond the scope of the Hells Canyon Project EIS.

Comment PG-2: The Umatilla Tribes state that in terms of previously identified issues, the draft EIS did not adequately address: (1) upper Snake River water pass-through; (2) drawdown; (3) socioeconomic and environmental analyses; (4) appropriate geographic scope; (5) cumulative effects analysis; and (6) cultural resources protection and mitigation. The Umatilla Tribes recommend preparation of a supplemental draft EIS to address and rectify these deficiencies.

The Shoshone-Bannock Tribes state that FERC should prepare a supplemental draft EIS to address gaps in information essential for the public and decision makers to fully understand the relative effects of alternative proposals, and to address new information developed just prior to, and following, release of the draft EIS, including the Tribe's submittal of the *Keller-Beisner* study, results of the EPAct process, results of the section 401 water quality certification process, and decisions with respect to alternative fishway prescriptions submitted by the tribes and other stakeholders.

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[137] Some of the comments are verbatim copies, while others are restated by the commenters. All address the same points, as summarized here.

Interior states that the draft EIS is inadequate and that a supplemental draft EIS must be prepared to rectify the lack of the following elements in the draft EIS: (1) an alternative that would result in the least biological, physical, cultural, and historical resource damage; (2) inclusion of outcomes from the EPAct process, including the revised terms and conditions resulting from the negotiated agreements between Idaho Power and Interior; (3) inclusion of a broader range of alternative operating scenarios, relying on the information provided by Idaho Power, Interior, and other agencies; (4) a description of methods and criteria used in analysis of financial feasibility of individual measures; (5) a description of how costs and benefits were assessed against overall economics of the project; (6) a detailed analysis of effects on additional native aquatic species, including redband trout, bull trout, white sturgeon, and mountain whitefish; and (7) inclusion and use of existing information and scientific work on operational impacts. Interior notes that if the Commission elects not to prepare a supplemental draft EIS, then the comments contained in Interior's letter of November 3, 2006, should be addressed in the final EIS.

Response: The draft EIS addresses the issues raised by the Umatilla Tribes in the following locations: (1) upper Snake River water pass-through and drawdown are addressed in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*; (2) socioeconomic and environmental analyses are addressed throughout section 3, *Environmental Analysis*; (3) the appropriate geographic scope of the project-specific analysis is defined in the relevant resource sections of section 3.0 and the geographic scope of the cumulative effects analysis is defined in section 3.2.1, *Geographic Scope*; (4) cumulative effects analysis is introduced in section 3.2, *Cumulatively Affected Resources,* and resource-specific cumulative effects are presented at the end of the appropriate resource sections in section 3.0*;* and (5) cultural resources protection and mitigation are discussed in section 3.9, *Cultural Resources*.

The other two topics raised by the Umatilla Tribes, upper Snake water pass through and drawdown, were addressed in the course of our evaluation of operational alternatives. As we describe in section 3.3.2.2 of the draft EIS, the Umatilla Tribes' operational recommendations were among about 40 such recommendations we received from resource agencies, tribes, and other interested parties in response to the Commission staff's Ready for Environmental Analysis notice. To deal effectively with these numerous recommendations, we combined various recommendations into a set of nine operational scenarios and sub-scenarios upon which we relied in assessing effects of the various operational recommendations. Our Scenario 2, Flow Augmentation, is representative of the recommendations calling for the pass-through of upper Snake releases and for drawdown. We describe the effects of this scenario in the various resource sections of EIS section 3.0, *Environmental Analysis*.

With respect to the topics raised by the Shoshone-Bannock Tribe, the final EIS includes analyses of the revised terms and conditions resulting from conclusion of the EPAct process and elements of Idaho Power's proposal that have been revised to be consistent with its January 31, 2007, application for section 401 water quality certification. We do not view any of this new information as rising to the level of requiring a supplemental draft EIS. Following its usual practice, the Commission will not issue a license order until the 401 water quality certification process is completed and after final fishway prescriptions have been issued, thus ensuring that the license will be consistent with all mandatory conditions.

With respect to the topics raised by Interior, most of these points are addressed in later sections of this appendix. For example, specific comments about the range of alternatives are addressed in section B4, *Proposed Action and Alternatives*, and specific comments about the methods and criteria used in the financial analysis are addressed in section B18, *Developmental Analysis.* We do not include in the final EIS an alternative that would "result in the least biological, physical, cultural, and historical resource damage", because such an alternative would be impossible to define. Any action with regard to relicensing the Hells Canyon Project would entail trade-offs among resources. Thus, we continue to evaluate the operational scenarios and environmental measures proposed or recommended by all parties, and craft a Staff Alternative that in our view strikes an appropriate balance among developmental objectives and environmental protections. As described throughout this appendix, we considered the comments submitted by all parties concerning the draft EIS, and we revised the text of the EIS, our analysis, and our conclusions as appropriate.

Comment PG-3: The Umatilla Tribes comment that the draft EIS does not address the impacts of observed climate change on weather or hydrologic patterns. They state that the draft EIS fails to consider the negative impacts (e.g., warming winter temperatures, less snow accumulation, and increased variability of the snowmelt patterns) from future climate change, which is expected to accelerate during the term of the new license. They also note that the University of Washington's Climate Impacts Group has documented climate change impacts. The Umatilla Tribes state that new forecast tools, which Idaho Power may not be using, are now available to improve water management, and that even changes to flood control must be considered to mitigate the regional impacts of global warming. The tribes recommend preparation of a supplemental draft EIS to address and rectify this and other deficiencies.

Response: Future climate change impacts on water resources are unknown, although some models may attempt to predict change in certain river basins. The Commission's standard re-opener article would be included in any license as the vehicle for making changes to the license should a material change in conditions occur that results in unanticipated environmental impacts.

With respect to flood control, the Corps has primary responsibility for flood control. We note that the Corps provides language in its January 26, 2006, comment letter that offers some flexibility to respond to changing conditions. Flood control at Brownlee is also tied to managing floods at locations much farther downstream on the Columbia River. Changes in Columbia River flood control management practices can be undertaken only on a regional scale and the Corps is best suited for taking the lead on such studies.

Comment PG-4: The Nez Perce Tribe notes that the draft EIS attempts to do too many things, and is poorly organized. The Tribe also states that the effects of the Staff Alternative are not analyzed as a whole, and are confusing. AR/IRU note that the draft EIS does not provide clear, easy-to-read information; is repetitive; and scatters different aspects of a single issue throughout the document. AR/IRU state that FERC should reexamine its approach, and note further that the organization by category of resource issues results in partial or incomplete discussion. AR/IRU note that a better approach would be having an initial chapter organized by action alternative, which would provide a comprehensive narrative description of how each alternative would affect resources. AR/IRU provide an example of a recommended outline.

Response: We understand that some parties do not care for the organization adopted by the Commission for its environmental documents. Nonetheless, we find this to be the best organization for presenting the staff's analysis of the myriad, and sometimes conflicting, environmental measures submitted by the many parties in a relicensing proceeding, and we find that overall, the organization is workable for all parties.

Comment PG-5: Interior states that comments received during the two NEPA scoping comment periods for the project should be incorporated into a summary table.

Response: Summarizing all of the scoping comments is not necessary for compiling the EIS or ensuring that all comments have been addressed. We refer Interior to the two documents already on the record that address scoping comments: Scoping Document 1 issued October 20, 2003 (FERC, 2003), and Scoping Document 2 issued November 24, 2004 (FERC, 2004).

Comment PG-6: Interior states that the Commission does not have the authority to alter its mandatory conditions, and that the EIS and supporting analysis should contain Interior's mandatory terms and conditions exactly as filed, without Commission revision. Interior states that including the agencies' unaltered mandatory conditions would constitute a significant new circumstance that warrants the Commission preparing a Supplemental draft EIS. The Forest Service states that the Commission staff inappropriately modified or completely omitted several Forest Service 4(e) Terms and Conditions (Conditions) from its Preferred Alternative, including Conditions 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 16, 18, 19, 20, 21, 22, 24, 25, and 26. The Forest Service comments that the Commission has no authority to modify or omit Forest Service Conditions, as recently affirmed by the United States Court of Appeals for the District of Columbia Circuit in *City of Tacoma v FERC*, No. 05-1054 (D.C. Cir. August 22, 2006). Similarly, NMFS questions the Commission's authority to alter FWS's mandatory section 18 fish passage prescriptions. The Forest Service states that the staff's modification or omission provides a reduced level of resource protection that is not adequately justified, and that is inconsistent with the Commission's broad resource protection obligations under the FPA.

Response: Although a Commission license must include valid terms and conditions submitted pursuant to sections 4(e) and 18 of the FPA, Commission staff still has the responsibility in its environmental documents to make recommendations to the Commission that in its view would "be best adapted to a comprehensive plan for improving or developing a waterway or waterways" as provided for by section 10(a)(1) of the FPA. Our recommendations reflect this consideration. All of the Interior and Forest Service preliminary terms and conditions were referenced in section 2.3.1.2, *Section 4(e) Federal Land Management Conditions*, and were fully described and analyzed in section 3 of the draft EIS. The final EIS includes an analysis of the modified terms and conditions submitted by the Forest Service and Interior in their comments on the draft EIS. As noted below in our responses to comments on specific conditions, we reconsidered our recommendations with respect to some Forest Service and Interior conditions. However, neither the modified conditions nor our revised recommendations rise to the level of new circumstances that would warrant preparation of a supplemental draft EIS. In the final EIS, we include in section 4.0, *Developmental Analysis*, the cost and net power benefits associated with an alternative that includes all of the agencies' mandatory conditions and fishway prescriptions.

Comment PG-7: The Forest Service recommends that Commission staff give deference to the mitigation measures agreed to in a settlement between Idaho Power and the Forest Service as a result of the hearing process conducted in accordance with section 241 of the Energy Policy Act of 2005 (EPAct) because the Commission has a long-standing policy to encourage settlements of licensing issues. The Forest Service notes that the Commission confirmed its support of settlement agreements in both a statement issued by the Commission's Chairman as well as in a formal settlement policy. The Forest Service further notes that, in this case, the settlement results from a procedure Congress established to resolves these types of issues. The Forest Service states that accordingly, the Commission staff should afford at least as much, if not more, deference to settlements reached in the section 241 hearing process as it does for settlements in general. Idaho Power also comments that the Forest Service-modified 4(e) conditions should be included in the Staff Alternative because they represent agreements reached between the two parties.

Response: The Commission has a policy to encourage settlements of licensing issues. However, Commission staff still has the responsibility in its environmental documents to evaluate each measure and make recommendations to the Commission concerning the environmental merits of the measure. Additionally, the staff considers the appropriateness of the measures for inclusion in a Commission license; settlement parties may reach agreements that are outside the Commission's jurisdiction or contrary to Commission policy. Our recommendations reflect these considerations. In any event, these modified conditions will be included in any license issued.

Comment PG-8: Interior states that the draft EIS lacks inclusion of outcomes of proceedings that have transpired over the past 6 months under the EPAct proceedings, including the revised terms and conditions that resulted from negotiated agreements between the applicant and Interior. Interior states that these should be incorporated into an action alternative, their effects should be analyzed, and an opportunity for public review and comment should be provided.

Response: The draft EIS reflected all of the EPAct proceeding results that were filed with the Commission through June 2006, prior to release of the draft EIS in July 2006. We revised the final EIS to incorporate subsequent filings related to the EPAct process. These are listed in EIS section 2.3.1.3, *Section 4(e) Federal Land Management Conditions*, and discussed in the appropriate resource sections of section 3, *Environmental Analysis.* However, these measures alone do not constitute a complete operational alternative for the project, and we continue to evaluate the measures individually.

Comment PG-9: Interior states that in section 5, *Staff Alternative*, the EIS should identify and explain all the similarities and overlaps between measures contained in the list. For example, Interior indicates that no. 12, concerning the acquisition of mitigation lands for wildlife habitat losses, may be redundant with no. 17, which discusses lands purchased for conservation of botanical resources.

Response: The Staff Alternative, described in section 5, *Staff Alternative*, is based on Idaho Power's license application and as such follows the numbering convention used by Idaho Power. We continue to find that this is the clearest way for parties to track Idaho Power's proposal through staff's analysis of the proposal and other recommendations to the Staff Alternative. It would defeat the purpose of this summary section to include all the details of the various measures, which are discussed in detail in the resource sections of section 3.0, *Environmental Analysis*.

Comment PG-10: The Nez Perce Tribe states that FERC should consider impacts related to the project and coordination for potential mitigation measures for the Columbia River system as a whole.

Response: Coordinating potential mitigation measures for the Columbia River basin as a whole is beyond the Commission's scope in making a licensing decision for the Hells Canyon Project. However, in section 3.2, *Cumulatively Affected Resources*, we address project effects on some resources as they relate to basin-wide concerns.

Comment PG-11: The Forest Service states that the draft EIS ignores the preliminary Wild and Scenic Rivers Act section 7(a) determination filed with the Commission on January 26, 2006. The Forest Service also states that the draft EIS provides no evidence to warrant a change in the Regional Forester's finding that relicensing the project as proposed in the Staff Alternative would result in an unreasonable diminishment of the scenic and recreational values of the Snake Wild and Scenic River from the continued loss of sandbars downstream of Hells Canyon dam. The Forest Service indicates that information from the Forest Service's section 7(a) determination should be included in the final EIS, and that unreasonable diminishment could be avoided if the staff adopted Forest Service condition no. 4 without modification or limitation in the proposed action.

Response: We revised the text in section 5.5.8, *Wild and Scenic Rivers Act*, to include some of the information provided by the Forest Service in its January 26, 2006, and November 2, 2006, filings. We also note that the final EIS reflects staff adoption of Forest Service condition no. 4 as part of the Staff Alternative.

Comment PG-12: Reed Burkholder suggests the license period for the Hells Canyon project be less than 30 years in order to allow other power generation technologies to mature and come on line.

Response: The license period will be determined by the Commission in the license order. The FPA requires that a license be issued for between 30 and 50 years.

B2. EXECUTIVE SUMMARY

Comment ES-1: With respect to table ES-1, NMFS comments that FERC's analysis in the draft EIS seems to indicate that the Staff Alternative would provide more benefit in terms of increased DO levels over a wider range of flow conditions than is indicated in the summary statement. NMFS also comments that with respect to Idaho Power's proposal, the summary does not appear to recognize that, compared to the No-action Alternative, TDG levels downstream of Hells Canyon dam should be reduced as a result of Idaho Power's proposed measures (spilling from the top gates of Brownlee spillway and constructing gas abatement structures at Hells Canyon dam).

Response: In the draft EIS, we described the effects of project operations and environmental measures separately in table ES-1. It appears that NMFS misinterpreted the table by assuming that the *Effects of Operations* included both effects of operations and environmental measures. Because Idaho Power currently implements preferential use of crest (upper spillway) gates for passing spills at Brownlee dam, its proposal to continue this action would not improve TDG levels. In bullet 2 of Idaho Power's Proposal under *Effects of Environmental Measures*, we state that the "Flow deflectors at Hells Canyon dam would reduce the frequency of TDG levels exceeding the 110 percent of saturation criterion." In bullet 1 of the Staff Alternative, we state that "Revision of the dissolved oxygen supplementation plan to address downstream effects should lead to improved dissolved oxygen levels downstream of Hells Canyon dam during the Chinook salmon spawning period."

Comment ES-2: NMFS provides the following comments on the aquatic resources section of table ES-1: (1) NMFS does not believe that the ramping rate restriction would necessarily reduce mortalities due to stranding and entrapment in entrapment pools; and (2) based on the scientific information available and NMFS's understanding of FERC's proposed flow augmentation and evaluation report, it does not believe that this report will provide any scientifically credible information regarding the efficacy of flow augmentation.

Response: We modified table ES-1 to indicate that the ramping rate would be implemented in conjunction with a stranding and entrapment management plan, which would include adaptive management provisions that would provide a higher level of assurance that mortality levels would be reduced. We also deferred the flow augmentation evaluation report from 2009 to 6 years after license issuance. We consider it likely that sufficient new information on the efficacy of flow augmentation will be developed by that time to warrant evaluation. Conducting the review would help ensure that augmentation water is released in a manner that maximizes benefits to outmigrating salmon while minimizing adverse effects on power generation and other resources, including warmwater recreational fisheries, that are affected by reservoir drawdowns.

Comment ES-3: NMFS comments that the Executive Summary should mention that the State of Oregon and environmental groups each submitted to NMFS alternatives to its reservation of fish passage authority. It notes that the summary fails to include the effects of the project on all listed anadromous fish in the Columbia and Snake River basins. It also comments that the summary table would be greatly improved by adding a very brief description of the magnitude of effect (i.e., tons of sediment, mg/L of

DO, etc.), where such metrics are important for assessing the import of effects.

Response: We evaluated the potential effects of the project on all listed ESUs of anadromous fish in draft EIS section 3.8.2, *Environmental Effects on Threatened and Endangered Species*. In that section, we conclude that the effects of the project on salmon and steelhead in the lower Columbia River are limited by the substantial distance from the project and by the relatively small proportion of total flows that are contributed by flows passing the project. We also note that the primary effect of the project on flows is attributable to flood control operations, which are under Corps jurisdiction. Because all of the most substantive project effects occur in the Snake River, we focused on these effects in the Executive Summary. However, we modified table ES-1 to note that the flow augmentation measure included in the Staff Alternative would likely benefit the migration of juvenile fall Chinook salmon in both the Snake and lower Columbia rivers. In regard to the recommendation to describe the magnitude of effect in the summary table, effects on tons of sediment, mg/L of DO, and so on are highly dependent on exactly how the project is operated and how recommended measures are implemented, so it is impractical to try to quantify effects in a way that would be meaningful in a summary table. Providing metrics to describe the magnitude of effects on aquatic resources is generally not feasible due to the many factors and interactions that affect biological or population responses.

B3. PURPOSE OF ACTION AND NEED FOR POWER

Comment NP-1: Interior states that the EIS should include an estimate of where new power generation will be needed, as well as a discussion of how Idaho Power plans to meet this increased load demand.

Response: We modified EIS section 1.2, *Need for Power,* to more clearly identify where new power and transmission facilities would be located. We also updated the *Need for Power* section to reflect Idaho Power's 2006 Integrated Resource Plan. New generation is estimated for the Idaho Power service area and does not include other utilities.

B4. PROPOSED ACTION AND ALTERNATIVES

Comment PA-1: The Forest Service comments that the draft EIS incorrectly presumes that a water quality certification will be completed in time for the final EIS filing, and notes that at the draft EIS public meeting both Oregon and Idaho commented that the 401 certification would not be issued in December due to a lack of information on some important water quality issues.

Response: We revised the text of final EIS section 2.3.1.1, *Water Quality Certification*, to outline the current status of the section 401 certification process. We also revised the description of Idaho Power's proposal to reflect measures included in Idaho Power's January 30, 2007, application for section 401 water quality certification.

Comment PA-2: Brett Crow comments that section 2.4.3 of the draft EIS informs readers of the beneficial effects that would be lost if the project were retired, but fails to similarly inform readers of harmful effects that would end upon project retirement.

Response: We modified the text in section 2.4.3, *Project Retirement*, to include information on the potential benefits that would accrue if the project were retired.

Comment PA-3: Brett Crow comments that the project's effect cannot be consistently measured without stating a project's intended disposition upon retirement. He goes on to suggest four potential future conditions that he feels could be used as baselines, each of which would cease power generation but would maintain reservoirs at current levels, full, partially full, or empty. He also comments that different sections of the draft EIS appear to use different baselines relative to reservoir levels in their assessment of project effects.

Response: As we indicated in section of 3.3 of Scoping Document 2 (SD2) and in section 2.1 of the draft EIS, we consider the No-action Alternative to represent a continuation of operations under the terms and conditions of the existing license, and this represents our baseline for environmental comparison. This ensures that the effects of alternative operations and environmental measures are evaluated against a relevant and clearly defined reference point, and not to a presumed future condition. We use this baseline consistently in our analysis of proposed measures, and could not locate any places in the draft EIS where a different baseline was used. For cumulatively affected resources, such as anadromous fish, we discuss available information on past impacts and the potential effects of reasonably foreseeable future actions in order to inform our analysis of cumulative effects, but that discussion is not meant to suggest a different baseline. The four alternatives that Mr. Crow describes would eliminate the power benefit of the project but would provide only limited environmental benefits. Because these conditions would provide little benefit at great cost, and because no party has recommended that the project be retired with the dams in place, there is no need for us to evaluate the retirement alternatives that Mr. Crow describes in his comment.

Comment PA-4: Interior states that proposed operations for Brownlee dam should be described in a way that accurately reflects expected future operations, and that the estimated costs of flow augmentation may be overstated.

Response: The description in draft EIS section 2.2.2, *Proposed Project Operations*, including the description of proposed operations for Brownlee dam, is based on Idaho Power's proposal filed with its application. For the final EIS, we reviewed the cost estimates for all operational scenarios and revised section 4.2.2, *Cost of Environmental Measures under the Applicant's Proposal and Staff Alternative*, where necessary. Idaho Power updated the costs of flow augmentation in its response to our Additional Information Request filed on March 30, 2007. We included the updated information in section 4.0, *Developmental Analysis.*

Comment PA-5: The Forest Service, Interior, AR/IRU, the Nez Perce Tribe, NMFS, and others state that Commission staff has not adequately presented the potential range of alternative options available or adequately analyzed alternatives considered, especially given the wide array of conditions, recommendations, and alternative conditions provided by the parties to this proceeding. The Forest Service requests that Commission staff develop a more representative range of project operating alternatives and use the full extent of the information provided in the record to support a Proposed Action protective of the resources.

NMFS comments that the alternatives analyzed in the draft EIS are insufficient in scope to provide meaningful analysis of how the project could be operated, or what additional actions might be contemplated, to mitigate for the project's effects on aquatic resources. NMFS states that, for example, FERC did not fully analyze the reintroduction of fall Chinook salmon, including the effect of speeding up the water quality clean up so that habitat would be suitable for anadromous fish above the project in 30 years, or the introduction of anadromous fish into Pine Creek and three tributaries of the Powder River as proposed by ODFW.
NMFS comments that in the ITF report on NEPA procedures, FERC agreed to include resource agency recommended measures in one alternative, and if not, to ensure that all effects of the measures were

disclosed. NMFS comments, however, that FERC staff did not include NMFS's recommended measures in one alternative, and did not fully disclose all of their effects. ODFW similarly objects to the lack of an agency alternative, stating that FERC staff has arbitrarily and capriciously removed ODFW recommendations from detailed consideration in the draft EIS.

Interior comments that there appear to be only two alternatives that are being analyzed in the draft EIS: Idaho Power's proposal and the Staff Alternative. It states that this narrow range of alternatives is inadequate in terms of the magnitude and duration of the effects of the project on the human environment and the long term commitments being made for another 30 to 50 years. It states that the project has had adverse effects on terrestrial and aquatic resources of the Snake River, several of which have not been addressed for the last 50 years, and that these impacts need to be fully analyzed in a NEPA document to fully understand these long-term effects and assist the Commission in the development of a full range of alternatives.

Interior comments that the Commission should demonstrate that it has analyzed and considered a licensing alternative that addresses sediment movement caused by flow alterations at the project and its effect on downstream aquatic habitat for all native fish and invertebrates.

The Umatilla Tribes state that the draft EIS should have considered several alternatives, including (1) a rigorous analysis of energy conservation and other power sources to supplement or replace project power; (2) a decommissioning alternative; and (3) an alternative that fully adopts the terms, conditions, and recommendations submitted by the tribes and state and federal fish and wildlife agencies. The Umatilla Tribes also state that an alternative with greater focus on energy conservation would allow increased fish, wildlife, and other resource benefits and make little difference in power generation and revenues. The Nez Perce Tribe states that the draft EIS provides no consideration for energy conservation and its role in any alternative, and notes that the draft EIS did not provide any specific evaluation of alternative energy sources and/or practices that could supplant some of existing power generation in the project. The Nez Perce Tribe notes several alternatives that could be analyzed and compared in additional studies, including gas-fired generation, wind generators, distributed generation, load management, efficiency improvements, strategic pricing of retail power, and truer cost pricing.

Reed Burkholder comments that the EIS should include a two-scenario analysis: (1) retention of the four federal dams (Lower Granite, Little Goose, Lower Monumental, and Ice Harbor); and (2) without the four lower Snake River dams. Mr. Burkholder states that successful anadromous fish reintroduction would then be limited only by the Hells Canyon complex.

The Shoshone-Bannock Tribes state that FERC staff should have considered three alternatives in the draft EIS: (1) an alternative that includes phased restoration of anadromous fish; (2) an alternative that includes all of the feasible environmental protection, mitigation, and enhancement conditions submitted by state, federal, and tribal entities; and (3) a decommissioning alternative.

AR/IRU state that the final EIS should include additional alternatives, including: (1) immediate implementation of fish passage for spring and summer Chinook and steelhead; (2) implementation, once upstream water quality is sufficient, of mainstem fish passage above the project for fall Chinook, including immediate studies of how to implement passage; (3) sand augmentation necessary to fully support recreational activities and fall Chinook rearing habitat; (4) gravel augmentation necessary to mitigate for lost spawning habitat; (5) an upstream nutrient removal program to restore water quality within and downstream of the project; and (6) all section 18 and section 4(e) conditions and 10(j) recommendations.

Response: In Scoping Document 2 (FERC, 2004), we described the alternatives that would be considered in the EIS, including no action, the applicant's proposal, and a range of operational and environmental measures. In licensing proceedings, the terms, conditions, and recommendations filed by agencies and other entities do not generally suggest clear alternatives to the applicant's proposal. Instead, they include a variety of environmental enhancement and protection measures that reflect the individual concerns and interests of the parties. We note that in the ITF report on NEPA procedures cited by NMFS, FERC committed to analyzing an agency alternative in cases where agencies file a consistent set of recommendations or when only one agency files recommendations and FERC determines that the recommendations form a reasonable alternative. In the absence of a consistent set of agency recommendations or another clear alternative, we compare and analyze the relative merits of all of the terms, conditions, and recommendations in section 3 of the draft EIS, and then craft the Staff Alternative based on that analysis. In effect, our recommended alternative is directly derived from Idaho Power's proposal, other parties' recommendations, and measures we may independently identify. We therefore conclude that we achieve the goal of evaluating a reasonable range of alternatives.

In the final EIS, we expanded section 1.2, *Need for Power,* to include alternative energy sources as identified in Idaho Power's 2006 Integrated Resource Plan. Alternative energy and demand management would not replace the need for power from Hells Canyon, but would address projected energy and load growth in the Idaho Power service area. In final EIS section 2.4.3, *Project Retirement,* we also expanded our discussion of the factors that we considered in determining that project decommissioning is not a reasonable alternative.

Comment PA-6: The Nez Perce Tribe states that the EIS should address the possibility of federal takeover, which would allow for better coordination with other federal Columbia River system projects, and could provide other benefits such as coordinated flow augmentation and shaping, load following operations, and fish passage

Response: As noted in Scoping Document 2 (FERC, 2004), federal takeover of the project would require Congressional approval, and no federal agency has expressed an interest in operating the Hells Canyon Project. Thus, we do not consider this a reasonable alternative for inclusion in the EIS.

Comment PA-7: The Forest Service indicates that it does not understand how the Commission Staff chose the individual Staff Alternative measures because little or no justification is provided. The Umatilla Tribes state that FERC should clarify the reasoning underlying which section 10(a) and section 4(e) recommendations were included or rejected.

Response: The information in the EIS about the environmental effects of the proposed action and action alternatives is sufficient. We recognize that the analysis of various alternative operating regimes and environmental measures (EIS section 3, *Environmental Analysis*) is separate from our conclusions concerning what we are recommending as part of the Staff Alternative (EIS section 5, *Staff's Conclusions*). This is the result of our need to provide a document that can be used by other agencies, as well as FERC, to clearly present the analysis apart from the decision. In section 5.2, *Discussion of Key Issues*, we do not repeat all elements of the analysis that led us to our conclusions, but generally refer the reader back to section 3 for the analytical details that provide justification for the measures we include in the Staff Alternative.

Comment PA-8: NPPVA states that the description of Idaho Power's Proposed Operations, draft EIS table 1, skips from the period ending 9/30 to the period beginning 10/21, providing no daily limit between minimum and maximum releases for the period 10/1 to 10/20. NPPVA notes that this should be corrected.

Response: The table is correct as it appears in the draft EIS. The spring/summer constant applies only through the end of September. The fall Chinook salmon plan load following limits starts on or before October 21, depending on observed conditions.

Comment PA-9: NPPVA states that for most of the Primary Recreation Season, 6/1 to 10/20, draft EIS table 1 shows minimum flows of 6,500 cfs, with 5,000 cfs under atypical conditions. NPPVA states that Idaho Power should not be allowed to determine atypical conditions without a regulatory definition of what constitutes "atypical."

Response: Atypical conditions (that is, conditions under which Idaho Power would be allowed to temporarily modify its operations to depart from license requirements) will be defined in the Commission's license order for the Hells Canyon Project.

Comment PA-10: NPPVA states that in the detailed list of condition changes listed on page 31 of the draft EIS, the four, not five, items listed do not include safe navigation flows. NPPVA requests clarification as to whether this omission was intended.

Response: The reference to five items in the draft EIS, including a navigation flow, was a typographical error. We intended to list only four condition changes in the draft EIS and made a correction in the final EIS. We reviewed the issue of navigation flows again for the final EIS; our conclusions, which include a seasonal 8,500-cfs minimum flow in medium-high and extremely high water years, are summarized in section 5.2.2.2, *Navigation Target Flow Levels*.

Comment PA-11: NPPVA states that draft EIS table 1 does not mention the current minimum flow limit of 13,000 cfs below the confluence of the Snake River with the Salmon River. NPPVA notes that flow can be accurately measured at the McDuff/China Garden gage.

Response: In section 3.3.2.7, *Downstream Flows Important to Navigation*, we point out that Idaho Power modeled the 13,000-cfs Lime Point flow by assuming the 6,500-cfs release from Hells Canyon dam that appears on draft EIS table 1 (FEIS table 2).

Comment PA-12: The Shoshone-Bannock Tribes note that the draft EIS uses existing conditions as the No-action Alternative, and that the EIS should use pre-project conditions as the baseline. The Nez Perce Tribe states that the No-action Alternative does not allow the establishment of an appropriate baseline for comparison of benefits and costs of other alternatives, and also states that the No-action Alternative does not balance power and non-power values or give equal consideration to environmental factors.

Response: It is Commission policy that when considering whether to grant a new license for an existing project, project operations under the existing license serve as the baseline, or No-action Alternative. As such, it simply represents the current situation as it is, regardless of whether there is a balance of power and non-power values. As appropriate, the staff addresses pre-project conditions in the context of cumulative impacts.

Comment PA-13: The Shoshone-Bannock Tribes state that FERC should consider all of the comments provided in the Tribe's letter, and revise the environmental analysis and preferred alternative accordingly.

The Nez Perce Tribe states that the draft EIS fails to adequately consider the Nez Perce recommendations, and states that the Staff Alternative does not represent an appropriate balance of environmental protection, mitigation, and enhancement measures with the production of power. The Tribe states that operational modifications included in the Staff Alternative do not incorporate the Tribe's recommendations. The Umatilla Tribes state that the EIS should provide a thorough analysis of alternatives that balance the need for power with environmental impacts of the project, particularly on tribal treaty and trust resources.

Interior states that many of its recommendations are not discussed and evaluated in the draft EIS as part of a robust alternative analysis for the project, leaving only one alternative in the draft EIS to analyze. Interior states that comments received from all parties should be reanalyzed and the EIS should display clear and distinct alternatives that give full consideration to Interior's FPA section 4(e) conditions and Section 10(a) and 10(j) recommendations

Response: As noted in a previous response, we compare and analyze the relative merits of all the terms, conditions, and recommendations in section 3 of the EIS, then craft a Staff Alternative based on that analysis. We consider all comments by all parties, although we sometimes combine our analysis of measures that are similar in intent but differ by degree.

Comment PA-14: Interior states that the list of environmental measures in the draft EIS should be amended to reflect that efforts such as litter control, staffing for law enforcement, and visitor centers are not mitigation for project effects on fish and wildlife and their habitats.

Response: The list of measures provided in draft EIS section 2.1.3, *Current Environmental Measures*, does not suggest that all the measures are mitigation for project effects on fish and wildlife and their habitats.

Comment PA-15: AR/IRU state that each alternative should be independently described, rather than providing lists of proposed edits to Idaho Power's proposal.

Response: Our approach to describing the Staff Alternative in section 2.3.3 is meant to make it easier for the reader to understand the differences and similarities between the Applicant's Proposal and the Staff Alternative; hence our approach, which we maintained in the final EIS. The presentation of the Staff Alternative in section 5.1.1.2, *Staff Alternative*, may be clearer for some readers.

Comment PA-16: AR/IRU comment that while the draft EIS discusses mitigation measures, it does not provide a comprehensive analysis of Idaho Power's mitigation obligations. AR/IRU state that FERC should clearly state goals and objectives, and where monitoring, study, and planning are appropriate, triggers and specific goals for mitigation should also be included.

Response: Our EIS discusses mitigation obligations in the context of our effects analysis, indicating first what the project effects are, and then evaluating the efficacy of Idaho Power's proposed measures and the measures recommended by others in mitigating those effects. With respect to monitoring programs and studies, we do describe the goals of these programs and define the triggers that would determine when new action is required. These requirements involve coordination with interested agencies and other parties. Where the specific goals result from the consultations, goals and triggers cannot be defined at this time, but can be defined only following the consultation.

Comment PA-17: Interior states that the draft EIS lacks inclusion and use of existing information and scientific work on operational impacts. AR/IRU state that the final EIS should include all significant "direct" or "indirect" impacts supported by credible scientific evidence. AR/IRU note that where information is inadequate, FERC should include: (1) a statement that information is incomplete or unavailable; (2) a statement of relevance to evaluation of reasonably foreseeable impacts of the missing information; (3) a summary of relevant, existing credible scientific information; and (4) FERC's evaluation of all reasonably foreseeable impacts based upon generally accepted scientific research.

Response: An EIS includes the information that staff finds most relevant to assessing project effects and evaluating measures that could be applied to mitigate those effects. We note where information is incomplete or unavailable, and clearly indicate the information on which our evaluation is based. We conclude that the draft EIS, augmented by new information provided in comments on the draft and included in the final EIS, includes the most relevant information on which the staff must base its recommendations, and this is sufficient information for the Commission to make a reasoned decision with respect to the terms of any new license issued for the project.

Comment PA-18: AR/IRU state that the draft EIS incorrectly states there would be no significant change from the current environmental setting under the No-action Alternative. AR/IRU note several examples, including continuing effects of the 12-inch-per-hour ramping rate, continuing loss of sand and gravel, blockage of fish passage, habitat loss for fish, and loss of macro-invertebrate production. AR/IRU note that FERC should further develop the effects analysis of the No-action Alternative to incorporate the continuing, cumulative, and compounding effects of the No-action Alternative.

Response: We revised the text in section 3.14, *Effects of No-action Alternative*, to recognize certain ongoing effects of project operation.

Comment PA-19: Interior comments that the draft EIS discounts both past riparian habitat values and present and future restoration potential. Interior suggests that the NEPA document analyze appropriate operational scenarios that restore and/or enhance riparian habitats, such as a "run of river" or "managed lakes" scenario. Interior suggests that the NEPA document acknowledge the lack of historical data on terrestrial habitat values and conditions and reconsider Interior, ODFW and IDFG 10(j) recommendations for terrestrial mitigation.

Response: Idaho Power's license application and technical reports (Blair et al., 2003a,b) compare a full pool run-of-river scenario with Idaho Power's proposed operations. Staff did not request that Idaho Power model a Dam Removal Scenario, for reasons discussed in section 2.4.3, *Project Retirement*, but requested modeling of 11 other operating scenarios (AIR OP-1). Scenario 1a (where Hells Canyon would be used to re-regulate outflows) and Scenario 5 (Brownlee held at minimum pool, with Oxbow and Hells Canyon held at full pool) would correspond to Interior's "run-of-river" and "managed lakes" scenarios. As discussed in section 3.3.2.2, *Operational Recommendations and Alternative Evaluation Scenarios*, we did not carry all the modeled scenarios forward for detailed analysis in the EIS; we narrowed the range of alternatives to reflect the range of operational recommendations that were received in response to the REA notice. We found that none of the three scenarios that we carried forward for detailed analysis offered a significant potential for restoring "normative" riverine and riparian conditions. For this reason, the Staff Alternative focuses on acquisition of riparian habitat, as described in section 5.2.5.4. The EIS recognizes the importance of riparian habitat throughout sections 3.7.2.1 and 5.2.5.4.

We agree there is little detailed information about habitat conditions prior to project construction.

However, review of pre-project aerial and oblique photographs, General Land Office records, and interviews with agency biologists indicated that land uses (primarily unrestricted grazing since the turn of the last century) had severely reduced range conditions and virtually eliminated riparian vegetation by the time the Hells Canyon Project was built (Blair et al., 2003b). Since that time, conditions around most of Brownlee reservoir have not improved; riparian habitat continues to be limited by reservoir fluctuations, and invasive non-native weeds are widespread. However, the extent and quality of riparian habitat around Oxbow and Hells Canyon reservoirs and along the Snake River downstream of Hells Canyon dam has improved dramatically in response to changes in land use. The Staff Alternative would provide for further improvements by emphasizing protection, management, and enhancement of lands already in Idaho Power's ownership around the project reservoirs and on adjacent lands acquired for mitigation.

Comment PA-20: ODFW states that the river fluctuation zone or the shore and bottomland wetland cover type downstream of Hells Canyon dam is significantly affected by project ramping rates and mostly void of any annual or perennial vegetation. ODFW recommends that the final EIS include an alternative directing Idaho Power to increase riparian habitat below Hells Canyon dam, through changes to project operation or through land acquisition and enhancement.

Response: Based on our review of Idaho Power's technical studies, we concluded that project operations do not significantly affect the shore and bottomland wetland cover type because stage fluctuations occur within the scour zone, where rocky substrate and annual peak flows prevent the establishment of a perennial plant community that would provide significant habitat for wildlife. Information provided by the Forest Service in its comments on the draft EIS indicates that although project effects (interrupted sediment supply and load following) do not adversely affect the establishment of netleaf hackberry within the scour zone, they may prevent the establishment of sandbar willow on about 49 acres. To address this concern, we revised the Staff Alternative in section 2.3.3 to include acquisition of an additional 49 acres of riparian habitat, as part of the larger acquisition package.

B5. CUMULATIVE EFFECTS

Comment CE-1: The Shoshone-Paiute Tribes note the loss of riverine, wetland, and riparian habitat associated with Hells Canyon and other Idaho Power projects. The Shoshone-Paiute Tribes state that the final EIS should clearly describe this loss.

The Nez Perce Tribe states that the draft EIS does not adequately analyze cumulative impacts to natural resources and anadromous fish from project operations. The Nez Perce Tribe notes that their fall Chinook supplementation program is not mentioned in the analysis.

Response: The draft EIS addresses the loss of riverine habitat in *Cumulative Impact* sections 3.6.3 (pacific lamprey, redband trout, and white sturgeon) and 3.8.3 (Snake River fall Chinook salmon, Snake River steelhead and spring/summer Chinook salmon, Snake River sockeye salmon, other Columbia River basin salmon and steelhead ESUs, and bull trout), and the loss of wetland and riparian habitats in section 3.7.3.1, *Riparian and Wetland Habitats*. We revised these sections in the final EIS to include additional information with respect to cumulative effects and to acknowledge the benefits of the Nez Perce supplementation program and other tribal fisheries and habitat restoration efforts.

Comment CE-2: The Nez Perce Tribe notes that the benefits of the project (cheap electricity) are realized largely up river, and the impacts are felt down river, outside of the four-county area analyzed. The Nez Perce Tribe notes that project-related impacts on the reservation manifest as: (1) curtailed ceremonial and subsistence fisheries, affecting tribal health, welfare and culture; (2) curtailed commercial fisheries, affecting tribal health, welfare and culture; and (3) elimination of usual and accustomed fishing areas in Treaty areas. The Nez Perce Tribe recommends the EIS discuss the cumulative effects on the Tribe of the reduced fishery.

Response: The final EIS includes two new sections, 3.13.1.5, *Native American Tribes*, and 3.13.2.4, *Effects on Native Americans*, to address the points made by the Nez Perce Tribe. Nonetheless, we continue to conclude that Idaho Power's proposed aquatic measures and the staff's recommended aquatic resource measures, taken together, would represent an improvement in aquatic resources compared to existing conditions. These measures would help restore and maintain long-term ecosystem health, and would help support the economic and social needs of Native Americans in the project region, including those related to fisheries. In the Staff Alternative (see section 3.12.2.1, *Land Use Management*), we also recommend a measure that would establish a Technical Advisory Committee (plus resource-specific subcommittees) in which the tribes and other participants would have ongoing opportunities for consultation and contribution to design and implementation of aquatic, recreational, cultural resource, and other measures over the license term.

Comment CE-3: AR/IRU state that FERC should extend the temporal scope of the analysis back as far as possible before Snake River development, as well as into the future.

Response: The temporal analysis includes sufficient pre-development information to characterize the changes that have been wrought on the Snake River basin environment. For example, section 3.8.3.1, *Snake River Fall Chinook Salmon*, notes the adverse effects of placer mining, agricultural production, timber harvest, and livestock production on habitat; the blockage of upstream passage by Swan Falls dam and Hells Canyon dam; the loss of spawning gravel recruitment, altered river flows, and adversely affected water quality caused by additional tributary dams and agricultural development; and the adverse effects of additional mainstem dams on the survival of migrating salmon. We do not see that any more detail concerning the past would provide information that would be useful to the staff in making its recommendations or to the Commission in making its decision with respect to a license order.

Comment CE-4: AR/IRU note that effects on the recreation, tourism and commercial industries were not included. AR/IRU note that FERC should consider aesthetic, historic, cultural, economic and social impacts in cumulative effects.

Response: The resources to be addressed in the cumulative effects analysis were set in Scoping Document 2 (FERC, 2004) based on input during the scoping process, and we did not change that determination in the final EIS. We note that cumulative effects on recreation are discussed in draft EIS section 3.10.3, *Cumulative Effects*.

Comment CE-5: AR/IRU state that FERC's discussion of cumulative impacts on sport-fishing and whitewater boating falls short, and that the elimination of miles of free-flowing river and suppression of the salmon, steelhead, and bull trout population are treated cursorily.

Response: We continue to find that the acknowledgement of these cumulative effects provides an adequate foundation for our analysis of project effects and evaluation of alternative mitigation measures.

Comment CE-6: NMFS comments that FERC should expand the geographic scope for anadromous fish to include the entire historically accessible Snake River basin and the Columbia River from the Snake River mouth downstream to the Columbia River plume and nearshore ocean environment. The Nez Perce Tribe recommends that the geographic scope for anadromous fish should span the North Pacific to southeast Alaska.

Response: We expanded the geographic scope of our cumulative effects analysis for anadromous fish to include the entire Snake River basin upstream from its confluence with the Columbia River, and the mainstem lower Columbia River extending from its confluence with the Snake River to downstream of Bonneville dam. We include the entire Snake River basin in order to encompass the effects of dams and water storage upstream of historical barriers to anadromous fish, and the lower Columbia River due to its importance as a migratory corridor and the effects of mainstem dams on migration survival.

Given the relatively small changes in seasonal flow caused by the project, and the fact that most of the change in seasonal flow is due to flood storage requirements imposed by the Corps, we do not agree that the relicensing action has substantive effects that extend to areas downstream of Bonneville dam, including the Columbia River plume and the nearshore ocean environment of the North Pacific and southeast Alaska. Therefore, we conclude that it is appropriate to focus our cumulative effects analysis on the riverine environment, where cumulative effects on anadromous habitat have the greatest potential to overlap. We address effects on anadromous fish production, which we acknowledge can affect the number of fish that are available for harvest in the ocean environment, as a project-specific effect.

Comment CE-7: Interior comments that flow releases from Dworshak reservoir serve different purposes than those from the project, including water temperature regulation, which project releases probably cannot provide. Interior recommends that FERC eliminate this reference to tradeoffs with Dworshak reservoir releases unless there is a specific agreement between Idaho Power and the Corps to consider in a NEPA alternative.

The Nez Perce Tribe comments that the EIS should clarify that operation of Dworshak dam is for flow augmentation and temperature control for impacts caused by the Hells Canyon Project and the lower Snake River dams. The Tribe states that the EIS should also clarify that Dworshak operations will continue regardless of the outcome of the relicensing and as such, the analysis should not look at the tradeoffs between Brownlee and Dworshak but rather how the Hells Canyon Project with and without a temperature control structure and flow augmentation operations interact and compliment or impact mitigation provided by Dworshak operations.

Response: In the final EIS, we expanded our discussion of the role that coolwater releases from Dworshak reservoir play in the current flow augmentation program. The water that is released from Dworshak dam to benefit the migration of juvenile anadromous fish is guided by biological opinions on operation of the Federal Columbia River Power System, and does not serve as mitigation for impacts caused by the Hells Canyon Project. We conclude in final EIS section 5.2.3.2, *Water Temperature Measures*, that the operation of a temperature control structure at Brownlee dam could adversely affect water temperatures during the summer and could result in reduced dissolved oxygen levels and increased concentrations of ammonia, mercury and organochlorine compounds downstream of the project, regardless of the releases from Dworshak reservoir. On the other hand, our analysis shows that implementing watershed measures (e.g., temperature trading) could meet the project's temperature responsibility in a manner that would provide a broader array of benefits without the risks identified above.

Comment CE-8: The Nez Perce Tribe comments that the draft EIS fails to analyze the cumulative effects to natural resources from project operations and blocked passage to historic spawning grounds for fall Chinook salmon. The Nez Perce Tribe also notes that the draft EIS does not mention that the numbers of returning adult fall Chinook would be substantially lower if it were not for the Nez Perce

Tribe's fall Chinook salmon supplementation program.

Response: We modified the text in sections 3.8.1.1, *Fall Chinook Salmon*, and 3.8.3.1, *Snake River Fall Chinook Salmon*, to more fully explain the project's contribution to cumulative effects on fall Chinook salmon, and the beneficial effect of the fall Chinook supplementation program undertaken by the Nez Perce Tribe.

Comment CE-9: The Nez Perce Tribe comments that the draft EIS fails to include Pacific lamprey as a resource that is affected by the Hells Canyon Project and other dams in the Snake River basin. It states that Pacific lamprey are highly important to the Nez Perce Tribe's culture and are used for subsistence and ceremonial purposes. It notes that the abundance and distribution of Pacific lamprey has been significantly reduced due to mainstem hydroelectric development in the Columbia River basin and therefore, the geographic scope for analysis should include the Columbia and Snake River including the former habitat above the Hells Canyon Project and mid-Snake dams. The Nez Perce Tribe states that this species must be analyzed in the EIS and that appropriate mitigation measures must be developed. The Umatilla Tribes and the Nez Perce Tribe recommend that Idaho Power contribute to the funding of regional evaluations of salmon and Pacific lamprey stocks.

Response: We recognize the contribution of blocked passage caused by Idaho Power's mainstem developments in our cumulative effects analysis for Pacific lamprey in section 3.6.3.1, *Pacific Lamprey*. In the final EIS, we recommend a measure that would require Idaho Power to participate in regional forums on Pacific lamprey restoration, and to file a report with the Commission every 3 years summarizing the results of research activities that may affect the potential for implementing measures at Hells Canyon to benefit Pacific lamprey.

Comment CE-10: AR/IRU question why the geographic extent of the cumulative effects analysis for anadromous fish excludes the North Fork of the Clearwater River above Dworshak dam and the mainstem Clearwater above its confluence with the North Fork, while the entire Clearwater River basin is included for resident fish.

Response: We modified the geographic scope of our cumulative effects analysis for anadromous fish to include the entire Snake River basin upstream of its confluence with the Columbia River (including tributaries), and the mainstem Columbia River extending from its confluence with the Snake River to downstream of Bonneville dam.

Comment CE-11: AR/IRU comment that the draft EIS did not address cumulative effects on several critical resources including mountain whitefish and invertebrates other than federally listed mollusks.
Response: Based on our assessment of information provided during scoping, we defined the resources to be included in our cumulative effects analysis in Scoping Document 2. For resident fish, we determined in Scoping Document 2 that our cumulative effects analysis would include bull trout, redband trout, and white sturgeon. We did not identify aquatic invertebrates (other than federally listed mollusks) as a resource that we would include in our cumulative effects analysis. Because the primary pathway for potential cumulative effects on aquatic invertebrates is through changes in water quality, we conclude that our analysis of cumulative effects on water quality is sufficient to encompass effects on aquatic invertebrates.

Comment CE-12: AR/IRU comment that the discussion of cumulative impacts on resident fish did not acknowledge the impact of blocked passage for resident fish species other than white sturgeon.

Response: We modified the text of section 3.6.3.2, *Redband Trout and White Sturgeon*, to include this point.

Comment CE-13: AR/IRU comment that the cumulative impact analysis does not provide sufficient detail, and restate their position that the cumulative effects analysis in the EIS for Idaho Power's mid-Snake projects, which the Hells Canyon EIS tiers from, was itself inadequate. AR/IRU conclude that the cumulative impacts analysis in the draft EIS falls short of meeting NEPA requirements.

Response: We consider our cumulative effects analysis for both the mid-Snake and Hells Canyon projects to be adequate to support a reasoned decision by the Commission in this relicensing. However, we expanded the analysis in several areas to address specific comments that we received on the draft EIS.

Comment CE-14: AR/IRU comment that the cumulative impacts discussion for anadromous fish does not mention the impact of the loss of upstream habitat from the lack of passage at the Hells Canyon Project and Idaho Power's other Snake River dams, sediment blockage by the project, how ramping may affect anadromous fish, and effects of projects on anadromous fish spawning.

Response: We modified the text in section 3.8.3.1, *Snake River Fall Chinook Salmon*, to include discussion of these effects.

Comment CE-15: Interior comments that the draft EIS states that the cumulative effects of watershed development on resident fish will include all tributaries of the Snake River between Hells Canyon dam and Lower Granite reservoir. It recommends that to the extent that fish stocks or populations from tributaries are known to coexist in the mainstem of the Snake River, FERC should analyze the effects of the project on these fish resources.

Response: We expanded the text in sections 3.6.3.2, *Redband Trout and White Sturgeon*, and 3.8.3.5, *Bull Trout*, to include discussion of cumulative effects on redband and bull trout that migrate from tributaries into the main stem of the Snake River.

Comment CE-16: NMFS recommends that the draft EIS briefly describe the cumulative effects on anadromous fish species of: (1) water storage projects throughout the Snake and Columbia River basin; (2) basin-wide requirements to limit flood-control to upper rule curves (as recommended by NMFS at this project) in the Columbia River basin; and (3) basin-wide flow-augmentation and temperature control efforts on flows and temperatures at key locations in the Columbia River.

Response: We expanded the text in section 3.8.3, *Cumulative Effects*, *Threatened and Endangered Species*, to include a description of these effects.

Comment CE-17: NMFS comments that the Marsing Reach was blocked by the construction of Brownlee in 1958, not by the construction of Hells Canyon dam in 1966 (which was actually completed in 1967).

Response: We modified the text in section 3.8.3.1, *Snake River Fall Chinook Salmon*, to make this correction.

Comment CE-18: AR/IRU comment that the cumulative impacts discussion of water quality does not discuss the synergistic effect of upstream pollutants entering the Hells Canyon Project or how the complex alters pollutant processing in the river.

Response: Although the synergistic effects are not specifically described, they are included in our evaluation of cumulative effects.

Comment CE-19: NMFS states that FERC needs to consider the cumulative effects of flood control and irrigation on spring flows, and the cumulative effects of all these parameters on temperature, and that this analysis should be provided in as much detail as the draft EIS currently provides for sediment entrapment.

Response: We revised draft EIS sections 3.5.3, and 3.8.3, *Cumulative Effects* (on *Water Quality* and on *Threatened and Endangered Species*, respectively) to incorporate a discussion of estimated effects of flow regulation upstream of Brownlee reservoir on water temperature and on high spring (freshet) flows.

Comment CE-20: Interior comments that because of daily and seasonal reservoir fluctuations and load following operations, the reservoir shorelines and much of the Snake River downstream of the projects is no longer capable of supporting native riparian habitats. Interior recommends that the NEPA document display a table or chart showing stream mileage and area of loss in acres, to illustrate the magnitude of this loss within the geographic scope of the cumulative effects analysis. The Shoshone-Paiute Tribes comment that the final EIS should clearly describe the loss of free-flowing riverine habitat, along with associated wetland and riparian habitats, caused by the project and cumulative effects of Idaho Power's other projects.

Response: We added text in section 3.7.3.1, *Riparian and Wetland Habitats*, to indicate that construction of the Hells Canyon Project converted almost 90 miles of free-flowing riverine habitat to reservoir, accounting for almost half of the reservoir length that now exists between the Shoshone Falls and Ice Harbor dams. Draft EIS table 2 (final EIS table 3) shows the length of each reservoir between Shoshone Falls and Bonneville dam.

Comment CE-21: ODFW comments that staff does not address the effects and ongoing impacts on terrestrial species from loss of low elevation habitat due to reservoir inundation in its cumulative effects analysis. Because no mitigation was provided for inundation and loss of crucial low elevation winter range following construction and operation of the project, ODFW considers loss of this 10,220 acres (4,071 acres permanently) to be an ongoing impact and cumulative effect of project operation. Oregon's mitigation policy states that mitigation shall be provided for continued impacts that have not been mitigated consistent with current standards. ODFW recommends that FERC include an analysis of the effects of annually inundated habitat and land acquisition and enhancement to mitigate for these effects in the reasonable alternatives of the final EIS.

Response: Although we consider existing conditions to be the environmental baseline for evaluating the effects of relicensing the project, we agree that loss of habitat resulting from original construction is an important element of cumulative effects. We added text to section 3.7.3.2, *Native Grasslands and Shrublands*, to describe the loss of low elevation habitat due to inundation.

B6. WATER QUANTITY

Comment WQN-1: The Nez Perce Tribe and the Umatilla Tribes state that key CHEOPS model assumptions are not described in the draft EIS and a standardized hydro-regulation model is not used to examine flow alternatives, operational changes, and cumulative impacts. The Nez Perce Tribe and the Umatilla Tribes state that Idaho Power should use the most updated Bonneville Power modified/adjusted streamflow record, so that the cumulative effects of upriver storage regulation changes, irrigation withdrawals, and evapotranspiration can be properly assessed.

Response: The assumptions used in the CHEOPS model to simulate flows and power benefits for the evaluation scenarios were presented in appendix C of the draft EIS (appendix D of the final EIS). The simulations were run using the actual measured inflows that occurred in 5 years representing different water year types. These water years were selected because they occurred relatively recently (during the 1990s and 2000s) and capture the effects of the recent levels of upriver storage regulation and irrigation withdrawals. We also note that BPA uses monthly flow data, whereas Idaho Power has used daily flow data that are more appropriate to the scale of the Hells Canyon Project. We did not change the text of the final EIS in response to this comment.

Comment WQN-2: The Nez Perce Tribe notes that the three scenarios developed by FERC for analysis of project impacts do not adequately capture the recommendations by the tribe and agencies and do not provide reasonable comparison of environmental effects on tribal resources.

Response: The scenarios adequately reflect the range of operational recommendations that were filed, and provide a sufficient basis to support our analysis and any Commission decision on the license application. The Nez Perce Tribe's operation-related recommendations were among 40 such recommendations we reviewed in response to the Commission staff's Ready for Environmental Analysis notice. To deal effectively with these numerous recommendations, we combined various recommendations into a set of nine operational scenarios and sub-scenarios. As explained in EIS section 3.3.2.2, *Operational Recommendations and Alternative Evaluation Scenarios*, we then relied on these nine scenarios and sub-scenarios in our assessment of environmental effects. We believe these nine scenarios and sub-scenarios represent a sufficient range of operational alternatives to provide a sound basis upon which to conduct our environmental analysis.

Comment WQN-3: Dale M. Litzenberger states that Idaho Power's management of river flows has resulted in eroded river banks, loss of sandbars, chemical and thermal pollution, and lost salmon and steelhead runs. He urged FERC to correct these problems.

Response: In the draft EIS, we evaluated a wide range of measures that were recommended by the agencies, tribes, and NGOs to address the effects of the project. We adopted many of these recommendations in the Staff Alternative. Many of these measures provide benefits to salmon and steelhead runs downstream of the project, and others may contribute to the eventual restoration of salmon and steelhead runs to areas upstream of the project. However, some project effects are unavoidable, and the costs of mitigating some types of project effects clearly outweigh their benefits.

Comment WQN-4: The Shoshone-Bannock Tribes state that ramping rates should be limited to two inches per hour in order to protect fish and aquatic resources. Paul Poorman states that FERC should establish limits for flow fluctuations so that downstream water levels do not fluctuate on a daily basis by more than a few inches. The Nez Perce Tribe recommends ramping rate restrictions designed to protect juvenile salmon from stranding, as well as for protection and restoration of existing beaches and riparian areas.

Response: The Hells Canyon Project currently serves an important role in meeting electrical generation needs during periods of peak demand, and any severe restrictions on flow fluctuations would have a substantial effect on this important project benefit. We evaluated the costs and benefits of a range of limitations on flow fluctuations in the draft EIS, and we concluded that benefits to rearing fall Chinook salmon warranted the cost of a stricter 4-inch-per-hour ramping rate from March 15 to June 15. We also note that the available information on the effects of ramping on invertebrate production and on the potential for stranding rearing fall Chinook salmon was limited, and that there was no information on the effects of ramping on bull trout. As a result, we include monitoring of fish stranding and effects on invertebrate production in the Staff Alternative, with provisions for implementing additional measures based on monitoring results if warranted. During the 10(j) meeting, Idaho Power indicated that it had prepared a draft fish stranding management plan, and intended to work with NMFS and Interior to develop a plan that would be sufficient to protect federally listed fall Chinook salmon and bull trout downstream of Hells Canyon dam.

Comment WQN-5: P. Brian Rogers states that he wishes to see Idaho Power regulate water release levels to benefit and not damage salmon and steelhead fisheries in the Snake River.

Response: Regulating water release levels is not the sole means of benefiting fish downstream of the project. We include in the Staff Alternative several operational and environmental measures that would benefit anadromous fisheries downstream of the project, including flow management to benefit fall Chinook salmon spawning and incubation, restrictive ramping rates during the fall Chinook salmon rearing period, measures to improve water quality conditions by increasing DO levels and reducing gas supersaturation downstream from Hells Canyon dam, and augmentation of river flows during the juvenile outmigration period.

Comment WQN-6: The Pioneer and Settlers Irrigation Districts and the Payette River Water Users Association state that the benefits of flow augmentation above the Hells Canyon dam complex to anadromous fish are ambiguous, and have not been firmly established. They also suggest that increased spill costs millions of dollars in lost low-cost electricity generation.

Response: We recognize that there is disagreement on the benefits of flow augmentation, and that new information relevant to this issue will likely continue to be developed. As a result, we include in the Staff Alternative a provision that would require Idaho Power to develop a report 6 years after license issuance summarizing available information on the effects of providing flow augmentation water from Brownlee reservoir and to evaluate whether any changes in the volume or timing of release of flow augmentation water from Brownlee reservoir are warranted.

Comment WQN-7: The Umatilla Tribes note that a decrease in water budget is expected to accelerate as a result of global climate change, and Idaho Power should use the best tools available for water management.

Response: We recommend that Idaho Power consult with the agencies and tribes to develop a fall Chinook spawning and incubation flow management plan, which could include periodic review of new methods for forecasting seasonal flows to improve water management.

Comment WQN-8: The Umatilla Tribes and the Nez Perce Tribe note that additional flow augmentation at Lower Granite dam is necessary to achieve target flows of 50 to 55 kcfs. The Nez Perce Tribe recommends a sliding scale flow augmentation program designed to provide appropriate flows for low, medium, and high water years.

Response: We expanded our analysis of flow augmentation measures, including the sliding scale flow augmentation program proposed by the Nez Perce Tribe, in final EIS section 3.6.2.1, *Effects of Project Operations on Aquatic Resources.* We include the flow augmentation measure recommended by NMFS in the Staff Alternative.

Comment WQN-9: The Umatilla Tribes note that maintaining a balance between maximum storage and power drawdown of Brownlee reservoir during medium and low flow years is particularly important. The Umatilla Tribes also note the tribes' concurrence with the FERC Staff Alternative that retains the current minimum flows of 6,500 cfs at Hells Canyon dam and 13,000 cfs at Lime Point.

Response: In the Staff Alternative, we address the concern that Brownlee reservoir elevations should be maintained at or near the upper range of the flood control rule curve. We adopt a measure that would require Idaho Power to fill Brownlee reservoir to a level between: (1) 1 foot of the April 15 and April 30 required flood control draft, and (2) the required flood control draft on those dates. To comply with this requirement, Idaho Power would need to restrict drawdowns for power production that would interfere with refilling to meet these target levels. This measure applies to all hydrologic conditions, including medium- and low-flow years. We note the Umatilla Tribes' concurrence with retention of the current minimum flows.

Comment WQN-10: The Nez Perce Tribe recommends spring flood control shifts between Brownlee reservoir and Grand Coulee to maximize pass through of spring flows.

Response: We discussed this issue in section 5.2.2.1 of the draft EIS, and conclude that any long-term modification of the project's flood control operation involving transfer of storage capacity from Brownlee reservoir to other storage reservoirs in the Columbia River basin would be under the purview of the Corps, and any shift would require a separate environmental evaluation conducted by the Corps.

Comment WQN-11: Interior states that the EIS should include a line on each of draft EIS figures 16 through 20 showing simulated outflows under five water year types that would show the unaltered hydrograph as measured at the Weiser gage. Interior states that inflows from the Wildhorse River and Pine Creek should be included in the hydrograph.

Response: The environmental baseline for flow conditions is current conditions and not unregulated flows at the Weiser gage. Furthermore, the Weiser gage is upstream of the project and not regulated by the Hells Canyon Project. Hydrographs for the Wildhorse River and Pine Creek for each of the five water year types can be found in the Final License Application. Please refer to Technical Report Appendix E.1.4, *Project Hydrology and Hydraulics Models Applied to the Hells Canyon Reach of the Snake River*, Chapter 2, *Development of Inflow Hydrology for Hells Canyon Complex Studies*. We did not change the figures (final EIS figures 17 through 21) in response to this comment.

Comment WQN-12: Interior states that the EIS should include a map that shows the location of Hells Canyon dam, the Hells Canyon gage, Johnson Bar, Lime Point, the confluence of the Salmon River, and the China Gardens gage to further explain the measurement of flows for navigation.

Response: We added the suggested figure to final EIS section 3.3.1.1, *Surface Water* (see figure 8).

Comment WQN-13: The Corps notes that FERC should include the language recommended in the Corps' January 26, 2006, letter regarding the spring runoff flood control draft and winter flood control operations for Brownlee reservoir.

Response: The subject language is included on final EIS table 9, *Operational Recommendations*.

Comment WQN-14: The Corps notes that any discussion in the final EIS that refers to releasing flow augmentation water between June 20 and July 1 should also note that Brownlee releases between June 20 and July 1 may be restricted as needed for total system flood control and downstream levee protection.

Response: We modified the Staff Alternative in sections 2.3.3 and 5.1.1.2 to specify that flow augmentation between June 20 and July 1may be restricted by the Corps if needed for system flood control purposes.

Comment WQN-15: The Corps states that the final EIS should note that the June 7 target elevation of 2,069 feet is subject to flood control requirements.

Response: We modified the text in section 2.1.2.1, *Brownlee Development*, to reflect this fact.

Comment WQN-16: The Corps recommends a wording change wherever the phrase "April 15 and April 30 minimum elevations necessary" occurs in the draft EIS. The Corps recommends the following language be used instead "Idaho Power would refill Brownlee reservoir between 1 foot below the April 15 and April 30 required flood control draft, up to the required flood control draft."

Response: We revised the text in sections 2.3.3, *Staff Alternative*, and 5.1.1.2, *Staff Alternative,* to reflect the Corps' recommended change.
Comment WQN-17: The Corps notes that the information for Lime Point should be included in draft EIS table 3.

Response: We added Lime Point to final EIS table 4.

Comment WQN-18: The Corps notes that the header information for "The Dalles <= 75 MAF" should be deleted from the top of table 5 of the draft EIS, since this header information and corresponding information are shown on the previous page.

Response: We deleted the header information from the table (FEIS table 6).

Comment WQN-19: The Corps recommends clarifying in "footnote a" on table 5 of the draft EIS that the April to July volume inflow forecast applies to Brownlee and that the Dalles volume inflow forecast is for the April to August period.

Response: We revised the footnote in final EIS table 6 to include this clarification.

Comment WQN-20: The Corps recommends that the first paragraph on page 69 of the draft EIS should note that the Corps will provide flood control guidance during the refill of Brownlee reservoir after April 30.

Response: We understand the Corps' clarification. However, this paragraph simply summarizes the NMFS recommendation, so no change is called for.

Comment WQN-21: Regarding the second and third sentences on page 533 of the draft EIS, the Corps notes that, during flood control refill operations that typically extend from May 1 to June 30, the Corps will specify Brownlee project releases for the purpose of system flood control as measured at the downstream flood control center at Portland-Vancouver. The Corps notes that Brownlee project releases are not specified by either Idaho Power or NMFS to control downstream flooding.

Response: The third sentence of the first bullet makes clear that the coordination with NMFS "would not in any way diminish the Corps' discretion over the project's flood control operation," so we do not believe any change is necessary.

Comment WQN-22: The Corps states that Brownlee reservoir cannot be filled to full pool (elevation 2,077 feet msl) by June 20 of each year, but may be held below elevation 2,077 for flood control. The Corp notes that any recommendations that the project be full by June 20 should include the words "subject to flood control requirements."

Response: We modified sections 2.3.3, *Staff Alternative*, and 5.1.1.2, *Staff Alternative*, to address this concern.

Comment WQN-23: The Corps recommends revising the second bullet description on page 533 of the draft EIS to include what the operation would be if the reservoir is not full June 20, and make the revision to any other statement in the final EIS similar in wording to the last sentence in bullet 2.

Response: To avoid any conflict with flood control operations directed by the Corps, we revised the description concerning the refill of Brownlee reservoir to indicate that operations could be restricted by the Corps for system flood control between June 20 and July 1.

Comment WQN-24: The Corps recommends changing wording on page 533 of the draft EIS to "From December 1 to June 30, the Corps directs flood control operations of Brownlee reservoir as part of system flood control operations of the Columbia River projects to contain winter, spring and early summer flood waters from inundating the main downstream flood damage center located in the Portland-Vancouver metropolitan area."

Response: We included the suggested language in section 5.2.2.1, *Flood Storage*.

Comment WQN-25: The Corps recommends replacing the second and third sentences on page 556 of the draft EIS with "Under the current license, Brownlee reservoir may be drawn down to elevation 2,034 feet msl by February 28 to provide a maximum storage space of 500,000 acre-feet for system flood control. By April 30, Brownlee reservoir may be drawn down further to elevation 1,976 feet msl to provide an additional storage space of 480,000 acre-feet to contain floodwaters. This maximum draft of 980,000 acre-feet of storage space pertains to the most severe combination of forecasted hydrologic conditions for the Columbia River at The Dalles and Snake River above Brownlee reservoir."

Response: We included the suggested language in section 5.2.2.1, *Flood Storage*.

Comment WQN-26: The Corps states that Idaho Power's proposed operation does not provide flows required for safe navigation from June 1 through October 20. The Corps states it has determined that a minimum flow of 8,500 cfs is required for safe navigation conditions on the Snake River above the mouth of the Salmon.

Response: We understand the Corps' position on flows required for safe navigation, but navigation must be balanced with other resource benefits and costs. Refer to final EIS section 5.2.2.2, *Navigation Target Flow Levels*, for our conclusions on this subject, which now include a seasonal 8,500-cfs minimum flow in medium-high and extremely high water years.

Comment WQN-27: The Corps states that it is unclear how much of the Idaho Power's proposal is adopted in the draft EIS Staff Alternative because the language in sections 2.2.3 and 2.3.3 is unclear.

Response: We corrected the conflicting language in sections 2.2.3, *Proposed Environmental Measures*, and 2.3.3, *Staff Alternative*.

Comment WQN-28: The Corps comments that the current license limits the maximum variation in river stage at Johnson Bar to 1 foot per hour. The Corp strongly recommends that the new license contain this important safety provision as it currently exists or at some lesser rate of variation.

Response: The 1-foot-per-hour maximum variation in river stage at Johnson Bar has been retained in the Staff Alternative. The ramping rate is further restricted to 4 inches per hour at Johnson Bar from March 15 to June 15 to protect rearing fall Chinook salmon, and may be further restricted if needed based on the results of monitoring fish entrapment and stranding.

Comment WQN-29: The Corps states that in the interest of providing flows to ensure safe navigation, it has determined the following safe navigation provisions: (1) for the reach of the Snake River above the mouth of the Salmon, minimum discharge should be 8,500 cfs; (2) for the reach of the Snake River downstream of the mouth of the Salmon River, minimum discharge should be 11,500 cfs; and (3) when the previous 3-day moving average for Brownlee reservoir inflow is less than 8,500 cfs, minimum discharge should not be below the 3-day moving average for Brownlee reservoir.

Response: We present the Corps recommendation in draft EIS table 7 (final EIS table 9) and discuss it in sections 3.3.2.7, *Downstream Flows Important to Navigation*, and 5.2.2.2, *Navigation Target Flow Levels*. However, we reach the same conclusion in the final EIS that we reached in the draft EIS; that is, maintaining the Corps-recommended minimum flows would cause excessive dependable capacity losses.

Comment WQN-30: The Corps states that the Corps minimum flow recommendations for safe navigation balances the operation of Hells Canyon dam in the interests of power and navigation because the Corps minimum flow recommendations do not require that flows from Hells Canyon dam be greater than flows that would occur without the existence of the dams, that power generation is not lost because the Corps does not require that water be taken out of storage to meet the recommended minimum flow, and that new license requirements for the next 30 to 50 years should be based on the reality of the current navigation industry, not the industry that was envisioned when the original license was given to Idaho Power.

Response: Although we understand that the Corps' recommendation does not call for use of storage water to meet the minimum navigation flow, our economic analysis of the release of the minimum flow was based on the restriction of Hells Canyon dam peaking operations and the project's dependable capacity. Our staff's analysis is also based on the realities of the current navigation industry practices on the river, which became established during a period when the predominant de facto minimum flow was 6,500 cfs.

Comment WQN-31: NPPVA makes a number of comments with respect to draft EIS section 2.2.2, *Proposed Project Operations*, and section 2.3.3, *Staff Alternative*, and recommends that the analysis consider the following points: (1) draft EIS table 1 does not provide minimum and maximum flows for the period from 10/1 to 10/20, and this should be corrected. (2) For most of the primary recreation season defined by the Forest Service for its Wild and Scenic Snake River Recreation Management Plan, Idaho Power would be allowed to maintain a minimum flow of just 5,000 cfs under atypical conditions, allowing Idaho Power to operate just as it has for the last 50 years. (3) Section 2.3.3, *Staff Alternative*, indicates that the Staff Alternative includes "navigation target flows to promote safe recreational and commercial boating conditions downstream of Hells Canyon dam" among the list of five operational changes to Idaho Power's proposal, but the detailed list of conditions lists only four of the five changes, dropping the reference to the navigation target flows. (4) The Staff Alternative gives Idaho Power authority to decide for itself when atypical conditions allow it to exceed the 10,000-cfs flow change limit or drop below the 6,500-cfs minimum flow, making the real flow variation limit 16,000 cfs and the real minimum flow 5,000 cfs. NPPVA states that this is unacceptable, and that Idaho Power's responses to atypical situations must have third-party oversight. (5) Oversight should be provided by the Corps, similar to Article 43 of the current license, and recreationists and land owners should be given as much advance notice as possible when sudden changes in flow patterns could affect their safety and property. (6) draft EIS table 1 does not mention the minimum flow needed to navigate the river below the Snake River's confluence with the Salmon River, and that minimum flow should not fall below 11,500 as measured at the McDuff/China Garden Creek gage except in emergency situations.

Response: As noted in draft EIS table 1 (final EIS table 2) footnote c, the initial date of the fall Chinook plan load following restriction varies based on circumstances. After October 1, steady flows for salmon spawning are generally above 8,500 cfs. We find the table to be clear without adding an additional line for the 10/1 to 10/20 period. Regarding the comment on Idaho Power's proposed "atypical conditions," we note that the Commission's license order for the Hells Canyon Project will define the circumstances under which Idaho Power may temporarily deviate from operational requirements of the license. We modified the text to eliminate the inconsistency between the listing in section 2.3.3 and the bullets that follow. We recognize NPPVA's strong preference for adoption of the Corps' recommended navigation flows; the basis for our decision is presented in section 5.2.2.2, *Navigation Target Flow Levels*. In the Staff Alternative, the13,000-cfs Lime Point minimum flow would be replaced by the Corps' recommended 11,500-cfs minimum flow downstream of the mouth of the Salmon River as measured at the Snake River below McDuff Rapids gaging station.

Comment WQN-32: NPPVA makes a number of comments with respect to draft EIS section 3.3.1.3, *Navigation*, and recommends that the analysis consider the following points: (1) The lower river minimum flow of 13,000 cfs at Lime Point should be retained, but the "95 percent of the time" qualifier should be dropped because the time frame for compliance is not clear. (2) The 6,500-cfs minimum flow below Hells Canyon dam was arrived at without representational input or analysis of boat sizes or loads or review of accidents. NPPVA notes that the Corps staff took a short trip with a single jet boat outfitter who did not run trips into the upper river from Rush Creek to Hells Canyon dam, and did not request input from other outfitters. (3) NPPVA notes that they became aware of the existence of Article 43 (provision addressing navigation in the Idaho Power license) during the organization of NPVVA. (4) Timed releases of 8,500 cfs were negotiated among Idaho Power, the Corps, and NPPVA, but the pulses are difficult to time and do not support flexible schedules for boaters and customers. NPPVA notes that between 2001 and 2004, timed releases were intended to support morning travel downstream from Hells Canyon and afternoon return. NPPVA states that grounding incidents, differential response times, and requirements of individual trips rendered pulses unworkable. (5) The draft EIS text fails to mention that during 2005, at the request of the Corps, minimum flows of 8,500 cfs above the Salmon River and at least 11,500 cfs at McDuff Rapids were maintained, while power needs were apparently met and Idaho Power was profitable. (6) The 8,500-cfs minimum flow was maintained until July 2006 when flows varied significantly from flows announced in the Lewiston Idaho Tribune and announcements on Idaho Power's web site, and these inaccurate forecasts and unpredictable flows caused commercial boats, passengers, and private boaters to cancel trips. NPPVA states that these inaccurate, unreliable flow predictions are unsafe and inexcusable on a navigable waterway in a natural attraction and unacceptable at any cost.

Response: The background information concerning various flow arrangements is noted, but we did not modify the text to include those details. This comment is helpful in emphasizing the need for predictability and for timely and accurate communication of flow conditions. In final EIS section 5.2.2.2, Navigation Target Flow Levels, we describe our recommended navigation plan, which Idaho Power would prepare in consultation with the Corps, NPPVA, and other interested parties. Our recommended plan includes a number of measures to improve the timeliness and accuracy of flow information to be provided by Idaho Power.

Comment WQN-33: NPPVA makes a number of comments with respect to draft EIS section 3.3.2.6, *Project Outflows*, indicating that : (1) in draft EIS figures 16 to 20, it is unclear why project outflows would go above 8,500 cfs in the extremely low and medium-low situation; (2) the extreme low water conditions outlined in draft EIS figure 16 should be considered an emergency and provisions should be made to address an emergency variance and negotiation of a best flow scenario for all users; (3) in medium low conditions shown in draft EIS figure 17, navigation requirements should not be greater than 8,500 cfs unless flows measured at McDuff/China Garden gage were to fall below 11,500 cfs; (4) provision of navigation flows poses no problem at the medium to high water conditions shown in draft EIS figures 18-20; and (5) reservoir capacity is not expected to be used for navigation, and flow augmentation should not be affected by navigation flow requirements.

Response: The CHEOPS Model simulations seek to maximize the value of power production, subject to the operational constraints that are enumerated in draft EIS appendix C (final EIS appendix D). To the extent that outflows exceed 8,500 cfs, it is a result of the combined constraints imposed on the project operation. Under the extremely low flow situation, outflows do not exceed 8,500 cfs during the navigation season. We note NPPVA's view that navigation flows should be waived under extremely low flow conditions; this would be an appropriate aspect of any 8,500-cfs navigation flow requirement. We sought and received clarification from Idaho Power that the provision of navigation flows of 8,500 cfs poses no problem related to power generation or dependable capacity impacts under medium-high and extremely high water conditions (refer to Idaho Power's letter to Kimberly D. Bose, Secretary, Commission, dated April 25, 2007). We concur with NPPVA's statement that storage water should not have to be used to meet navigation flow targets and that flow augmentation would not be affected by navigation flows.

Comment WQN-34: NPPVA states that the description of the Corps' navigation proposal omits that when inflow to Brownlee reservoir drops below 8,500 cfs, the average 3-day inflow would be passed at Hells Canyon dam.

Response: The first paragraph of the referenced section 3.3.2.7, *Downstream Flows Important to Navigation*, simply deals with the Corps' stated flow preferences. The fourth paragraph fully explains the Corps' navigation flow recommendation.

Comment WQN-35: NPPVA states that draft EIS table 1 should, but does not, show the 13,000 cfs minimum at McDuff/China Garden Rapids. NPPVA states that large boats are not a recent practice, as asserted by Idaho Power, but have been used since 1910. NPPVA states that reduction of boat size is not a workable solution for overall navigation needs. NPPVA notes that the USGS maintained, calibrated, and recorded flows at the McDuff and Johnson Bar locations more accurately than Idaho Power does, and recommends that the USGS should again resume that responsibility.

Response: In section 3.3.2.7, *Downstream Flows Important to Navigation*, we point out that Idaho Power modeled the 13,000-cfs minimum flow at Lime Point by specifying a 6,500-cfs release from Hells Canyon dam. Draft EIS table 1 (final EIS table 2) summarizes this operating constraint. We acknowledge NPPVA's preference for USGS gage maintenance. Any license issued would require Idaho Power's documented compliance with any flow requirements. We revised section 5.2.2.2, *Navigation Target Flow Levels*, to reflect new information provided by NPPVA and others in its draft EIS comments.

Comment WQN-36: Idaho Water Users (IWU) (*draft EIS, section 3.6.2.5*, p 5) notes that any minimum streamflows, or bypass flows, called for in the draft EIS (e.g., the continued 100 cfs minimum flow at Oxbow) are subordinate to upstream water rights.

Response: As we state in section 3.3.2.10, *Water Users and Water Rights*, we have no information to suggest that any operational requirements in the Staff Alternative would be inconsistent with existing water rights.

Comment WQN-37: Idaho Power notes that it could not obtain a temporary variance from the Corps if the 3-day average Brownlee inflow drops below the required minimum Hells Canyon outflow. Idaho Power states that the Corps' recommendation would require that Idaho Power automatically pass the 3-day average inflow as the minimum as part of the standard procedure.

Response: We concur that under the Corps' recommendation, the release of a flow equal to the previous 3-day moving average Brownlee reservoir inflow would be automatic when inflow drops below 8,500 cfs. To eliminate the potential for confusion, we removed the temporary variance wording in the Staff Alternative.

Comment WQN-38: Idaho Power states that annual flood control operations should be based on a mutually agreed to local or regional flow forecast trigger that indicates an imminent risk of flooding.

Idaho Power notes instances during the spring flood-control operation when Brownlee storage is used for energy demand, and because flood-control draft is controlled by the Corps, Idaho Power would have no ability to use Brownlee for energy demand during the April 15-April 30 period if the reservoir elevation were to remain within one foot of the Corps' target. Idaho Power notes that occasionally additional storage space in Brownlee is needed to protect Idaho Power facilities and areas upstream and downstream during uncontrollable local spikes in flow.

Idaho Power states that flow augmentation efforts to meet federal flow targets or to aid the migration of fish through downstream federal projects are federal responsibilities, not those of Idaho Power customers. Idaho Power notes a 2006 example during which property damage and loss of power generation would have occurred if the flood control measure described in the Staff Alternative had been in place at that time.

Response: We modified the description of the staff's flood control measure (section 5.2.2.1, *Flood Control Storage*) to clarify that it would be subject to both local and regional flood control requirements.

Comment WQN-39: Idaho Power states that although higher minimum flows below Hells Canyon dam may improve boatability, this complex issue involves other factors and public interest considerations. Idaho Power states that:

- For the Snake River from Hells Canyon dam to the confluence with the Salmon River, Idaho Power proposes measuring minimum boating flows at Johnson Bar (RM 230). This is the current point, and the same point adopted in the draft EIS for ramping rates.
- The 13,000-cfs minimum flow at Lime Point was established for now discontinued barge traffic, and no real-time gage exists at Lime Point. Idaho Power notes the real-time gage at McDuff Rapids would provide more accurate data for compliance.
- Distinction should be made between setting minimum boating flows and mitigating recreation impacts from ramping rates or the amount of daily fluctuation. Idaho Power notes that higher minimum boating flow restrictions are an inappropriate tool to address potential recreation impacts from daily fluctuations. Idaho Power notes daily flow fluctuations have been voluntarily restricted from 16,000 cfs to 10,000 cfs between June 1 and September 30. Idaho Power has proposed to continue this operation, except during emergency conditions that could require up to 16,000 cfs.
- The terms, "boatability" and "minimum boating flows" are more specific and should be used instead of "navigability" and "minimum navigation flows."

Response: Compliance monitoring for the reach above the Salmon River should occur at the Johnson Bar gage. We modified the text of the Staff Alternative to indicate that the 8,500-cfs navigation flow target recommended by the Corps would be converted to the equivalent flow at Johnson Bar and measured there. In the Staff Alternative, we eliminated the 13,000-cfs Lime Point minimum flow in favor of the Corps' recommended 11,500-cfs minimum flow measured at McDuff Rapids. We acknowledge the distinction between minimum flows, ramping rate restrictions, and daily stage fluctuation restrictions. Both minimum flows and daily stage fluctuation limitations have the potential to influence the recreational boating experience. Finally, we understand Idaho Power's preference for the term "boating," but have elected to continue with our use of the word "navigation." Our use of the term "navigation" does not affect our analysis or conclusions.

Comment WQN-40: Idaho Power comments that different choices of minimum boating flows affect how often low flows occur, which affect costs and benefits. Idaho Power provides additional information concerning flow amount, type of year (water availability), models, and flow frequency.

Response: In section 5.2.2.2, *Navigation Target Flow Levels,* we included mention of Idaho Power's additional modeling data regarding the effects of the Corps' recommended navigation flows in conjunction with 237 kaf flow augmentation scenario, and we considered the data in our analysis.

Comment WQN-41: Idaho Power notes that the loss of generating capacity at the project if Idaho Power were required to provide 237 kaf for Flow Augmentation would be a considerable cost. Idaho Power notes that a significant loss of peaking capacity at Hells Canyon dam would be associated with an 8,500-cfs minimum flow, in addition to loss of capacity at Brownlee dam due to the Staff Alternative's Flow Augmentation. Idaho Power includes greater detail of analysis and modeling to address this issue.

Response: We revised the text of section 5.2.2.2, *Navigation Target Flow Levels*, to reflect updated information on the economic impact of navigation flows as well as the 237-kaf Flow Augmentation.

Comment WQN-42: Idaho Power states that the section 4(e) authority of the Corps to approve dams and structures applies only to structures not yet constructed, not to existing structures, such as Hells Canyon dam.

Response: We revised the text of section 3.10.2.1, *Effects of Project Operations on Recreation Resources, Navigation Downstream of Hells Canyon Dam*, to clarify Corps and Commission responsibilities.

Comment WQN-43: The Nez Perce Tribe comments that the 1-foot-per-hour change in river stage measured 13 miles downstream of Hells Canyon dam is not protective of tribal cultural sites and resources in Hells Canyon, including sand beaches and terraces. The Nez Perce Tribe states additionally that this change in river stage during the growing season will not allow riparian vegetation or aquatic invertebrates to establish themselves along the riparian corridor.

Response: In final EIS section 5.2.1, *Sediment Augmentation and Monitoring*, we revised our draft EIS conclusion and added to the Staff Alternative Forest Service condition FS-4, which specifies that Idaho Power fund a sandbar maintenance and restoration program consisting of sand augmentation and monitoring. We conclude in the final EIS that sand augmentation to restore sandbars could slightly increase rearing habitat for juvenile fall Chinook salmon, and potentially reduce losses to archaeological resources from beach erosion. Wave action from barges that would be used to deliver sand to the target beaches could slightly reduce the net benefit of the sand augmentation program. The Staff Alternative also includes acquisition of 49 acres of riparian habitat to mitigate for ongoing project effects (interrupted sediment supply, flow fluctuations) on the establishment of sandbar willow within the scour zone, and 13.2 acres to mitigate for predicted effects (reduced hydrologic support as ramping rates are reduced) on riparian vegetation along the shoreline above the scour zone. Regarding effects on invertebrates, we adopt a restricted ramping rate that would reduce adverse effects during the fall Chinook salmon rearing period, as well as a monitoring plan to evaluate the extent of project effects and implementation of additional restrictions, if warranted. Regarding tribal cultural sites, the cultural resources monitoring program (in the HPMP) that Idaho Power would develop and implement in consultation with the tribes, agencies, and SHPOs would also contribute toward evaluation of project effects in Hells Canyon. The HPMP would contain procedures for determining appropriate treatments to resolve adverse effects that take the nature of a site's significance into account.

Comment WQN-44: Interior comments that the draft EIS incorrectly states that Granite Creek enters the Snake River immediately downstream of Hells Canyon dam. Interior states that Deep Creek is the first perennial tributary downstream of the dam, entering from the east (Idaho) side of the Snake River.

Response: We modified the text in section 3.3.1.1, *Surface Water*, accordingly.

Comment WQN-45: Interior expresses concern that aquatic resources, including invertebrates and fish, are not discussed in regard to water quantity issues.

Response: We evaluated the effects of project operations and measures recommended by stakeholders, including effects of the project on the flow regime downstream of Hells Canyon dam, in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*. We evaluated operational effects on aquatic resources in the Oxbow bypassed reach in section 3.6.2.5, *Oxbow Bypassed Reach Flows*.

Comment WQN-46: Interior comments that the Commission required Idaho Power to evaluate a broad range of operating alternatives for the project in its additional information request (AIR OP-1) that included 11 individual and combined operational studies. Interior recommends that FERC provide a detailed discussion of what evaluation criteria were used by the Commission to retain or reject any of these eleven operating alternatives as licensing alternatives. It recommends that the NEPA document reflect a minimum of 6 clear alternatives, each delineated by a distinct operating regime. Interior comments that the range of alternatives should include an alternative in which the instantaneous outflow from Hells Canyon dam would equal the average daily project inflow from the previous 24-hour period.

Response: As we describe in section 3.3.2.2, *Operational Recommendations and Alternative Evaluation Scenarios*, the operating scenarios that we requested Idaho Power to evaluate in our additional information request were designed to cover the range of operations that we anticipated might be recommended based on our review of scoping comments and additional study requests. In order to focus our analysis in the draft EIS, we selected a subset of six scenarios, which represent the range of recommendations that were filed in response to the REA notice. In our analysis of effects of alternative operations on fish habitat, we included figures of wetted area and WUA time series for a smaller subset of scenarios, but we included tabular data summaries for all six scenarios for each lifestage and species that was evaluated. The scenarios evaluated in the draft EIS included Scenario 1a, in which the instantaneous outflow from Hells Canyon dam equaled the average daily project inflow from the previous 24-hour period. We did not include each of these operating scenarios as a complete NEPA alternative, since matching each operating scenario with different combinations of non-operational measures would result in a very large number of alternatives, and a less focused analysis.

Comment WQN-47: Interior comments that the operating alternatives requested by the Commission in the additional information request and analyzed by Idaho Power in their response (AIR OP-1 a through f and 2) call for measurement of ramping rates to be within one mile of Hells Canyon dam. Interior states that the NEPA document should clearly discuss why this operational requirement was rejected. Interior recommends that the NEPA document include at least one alternative where compliance is measured at this location.

Response: In the draft EIS, we evaluated the effects of two alternative ramping rates (2 inches per hour and 6 inches per hour) on flow-dependant resources. These evaluations were based on hydraulic and habitat simulations performed by Idaho Power in response to AIR OP-1. The 2-inch and 6-inch ramping rates included in these scenarios were simulated assuming that compliance would be measured within 1 mile downstream from Hells Canyon dam. Our analysis compared the effects of these alternative ramping rates to Idaho Power's proposed operations, which were simulated using its proposed 12-inches-per-hour ramping rate as measured at Johnson Bar. Other information that we considered in our analysis included an evaluation of ramping rate effects on fish stranding and entrapment that occurred during the spring of 2005 (Brink and Chandler, 2006). This report included an evaluation of potential stranding rates of juvenile fall Chinook salmon that would occur at alternative ramping rates of 2, 4, 6 and 12 inches per hour as measures at Johnson Bar. Based on the results of Brink and Chandler (2006), we adopted in the Staff Alternative a seasonal ramping rate restriction of 6 inches per hour as measured at Johnson Bar, and included additional monitoring to evaluate stranding and entrapment that occurs under different hydrologic conditions and for stranding and entrapment of bull trout, which was not evaluated in Brink and Chandler (2006).

The ramp rate restriction that we included in the Staff Alternative was based on the analysis of stranding rates presented in Brink and Chandler (2006), which was based on rates measured at Johnson Bar. However, in the final EIS, we include a recommendation that Idaho Power develop a new combined flow and water quality monitoring site within 5 miles of Hells Canyon dam. We adopt this measure because it would provide better data about relationships between flow releases and water quality effects, especially for effects that do not extend as far downstream as Johnson Bar, such as the DO deficit that currently occurs in the late summer and fall months. As part of the plan, we recommend that Idaho Power determine the relationship between ramping rates observed at the new site with those that occur at Johnson Bar, and determine a new compliance ramping rate that is comparable to the ramping rate included in the new license, which may be based on rates observed at Johnson Bar.

As we discuss in section 5.2.4.2, *Flow Fluctuations Outside of the Fall Chinook Spawning and Incubation Period*, Idaho Power stated during the 10j meeting that accurately measuring flow and ramping rate compliance within 1 mile downstream of Hells Canyon dam would not be feasible because spillway flow deflectors that would be installed at Hells Canyon dam would direct more energy downstream and cause substantial variations in water level that would extend at least 1 mile downstream from the dam. Because accurate measurement of river stage is essential for monitoring compliance with ramping rates, we conclude that measurement of ramping rate compliance within 1 mile downstream from Hells Canyon dam would not be a reasonable option.

Comment WQN-48: The Umatilla Tribes and the Nez Perce Tribe comment that key CHEOPS model assumptions are not described in the draft EIS. They state that it is unclear what the period of record used is, or whether observed or modified/adjusted inflows are used. They state that the draft EIS fails to consider use of a standardized regional hydro-regulation model, such as GENESYS (NWPCC, 2006) or BPA's HYDSIM, to examine draft EIS flow alternatives, operational changes and cumulative impacts.

Response: A detailed description of the operations model may be found in the project record. Please refer to Technical Report Appendix E.1-4, *Project Hydrology and Hydraulics Models Applied to the Hells Canyon Reach of the Snake River*, Chapter 3, Hells Canyon Complex Operations Modeling in the Final License Application. Please note that in appendix C of the draft EIS (appendix D of the final EIS), we include Modeled Constraints for Idaho Power Company's Proposed Operation and Operational Alternatives. We also provided an overview of the CHEOPS model on page 58 and 59 of the draft EIS. On page 59 of the draft EIS, we noted the period of record used for operations modeling. Please refer to Technical Report Appendix E.1.4, *Project Hydrology and Hydraulics Models Applied to the Hells Canyon Reach of the Snake River*, Chapter 2, Development of Inflow Hydrology for Hells Canyon Complex Studies, for a detailed description of the inflow hydrology development. We note that historical data (i.e., USGS data) were used in developing the inflow hydrology.

We did not apply a regional hydro-regulation model, because the CHEOPS model is adequate to examine the flow alternatives, operational changes, and cumulative impacts addressed in the EIS. We did not change the text of the final EIS in response to this comment.

Comment WQN-49: The Nez Perce Tribe states that the draft EIS inaccurately describes the Nez Perce component of the SRBA settlement.

Response: We incorporated the Nez Perce Tribe's suggested changes to final EIS section 3.3.1.4, *Water Rights*.

Comment WQN-50: NMFS comments that the concept of average daily inflows to Brownlee reservoir during the five representative years is a meaningless statistic without describing the frequency of expected occurrences. Similarly, NMFS comments that any subsequent discussion regarding the effect of operations in each of these "representative years" is meaningless without the context of how often each of these cases is likely to occur in the next 30 to 50 years (the duration of the action considered in the draft EIS). NMFS states that FERC should modify its analysis to identify the relative frequency of each of the representative years.

Response: The information NMFS requests is not displayed in the draft or final EIS, but does appear in the record. We reviewed the record to respond to NMFS comment and developed an estimate of the frequency of expected occurrence for each of the five representative years. We added this information to final EIS section 3.3.1.1, *Surface Water, Brownlee Inflows*, table 5.

Comment WQN-51: Interior comments that the descriptions and simulations in the draft EIS address reservoir drawdown only for flood control and flow augmentation for fisheries. Interior states that it is also important to display anticipated reservoir drawdowns for power production. Assuming these needs are additive, Interior concludes that the negative effect on recreation resources is probably much greater than displayed in draft EIS figures 11 through 15.

Interior also notes that the Brownlee reservoir drawdown is the one significant operational outcome that affects recreation resources on BLM lands, and states that the EIS should clearly display how the FERC Staff Alternative would affect Brownlee reservoir drawdown during various water years.

Response: Power production is implicitly included in each scenario, and hence draft EIS figures 11 through 15 (final EIS figures 12 through 16) already include the effects of power production and there is no need to make further adjustments. We did request additional model runs from Idaho Power in a conference call on February 8, 2007. These new runs provide an estimate of the combined economic effects of flood control, power generation, and flow augmentation on reservoir levels, and this new information is reflected in the text of final EIS section 4.2.1, *Reduced Benefits Associated with Operational Changes*. However, we did not request additional information concerning associated effects on reservoir drawdown because earlier AIR responses adequately bracketed the range of alternatives, including the staff recommendations.

With respect to the effect on recreation, Brownlee reservoir levels are affected primarily by flow augmentation. Draft EIS section 3.3.2.5 and draft EIS figures 11 through 15 (final EIS figures 12 through 16) present simulated Brownlee reservoir levels under the 350-kaf flow augmentation scenario. These simulations provide an approximation of the effects of the 237-kaf flow augmentation scenario included in the Staff Alternative, and we did not revise this information in the final EIS.

B7. SEDIMENT SUPPLY AND TRANSPORT

Comment ST-1: Idaho Power comments that, in addition to the Swan Falls dam, tributary dams between Brownlee and Swan Falls dams also trap sediment, and that sediment transport between Brownlee and

Swan Falls dams is limited due to truncation of discharge peaks and reduction of flow volume. Idaho Power recommends that staff acknowledge sediment trapping by other tributary dams between Swan Falls and Hells Canyon dams.

Response: We revised the text of section 3.2.1.1, *Sediment Transport*, to acknowledge the many small tributary dams between Brownlee and Swan Falls dams and their contributions to sediment supply and transport in the Snake River.

Comment ST-2: Idaho Power comments that it disagrees with the characterization of downstream water and sediment inputs and that there are substantial sediment inputs between Hells Canyon dam and the Salmon River. Idaho Power further comments that sediment-size classes vary with different input areas and recommends that staff revise the text to reflect differences in loads associated with different sediment size classes and the portion cut off by the Hells Canyon Project and to avoid using total loads biased with silts and clays to represent sand and larger materials.

Response: Although there are numerous (but small) water and sediment inputs between the Hells Canyon dam and the Salmon River (total contributing area of 75 square miles), the Salmon River is clearly the largest at 13,900 square miles. We revised the text on page 81, paragraph 2, in section 3.4.1, *Affected Environment*, to cite the document in which the project study reach downstream of the Hells Canyon dam is defined.

Because the size fractions of gravel, sand, and finer sediment (silt and clay) delivered by tributaries have not been measured and therefore are unknown, we did not revise the text of section 3.4.1.1, *Sediment Budget (Sediment Leaving the Reach, S_o)*, regarding different sediment size classes delivered by the mainstem Snake River and by the tributaries.

Comment ST-3: Idaho Power comments that the effect of tributary dams on sediment movement is not mentioned and recommends that staff acknowledge other dams on the tributaries between Brownlee and Swan Falls dams because these tributary dams trap sediment from the Idaho Batholith that provided a large portion of the beach-building sediments to Hells Canyon.

Response: We revised the text of section 3.4.1, *Affected Environment,* to acknowledge the many small tributary dams between Brownlee and Swan Falls dams that trapped sediment generated by twentieth-century land disturbance, and that continue to trap sediment. Possible sources of beach-building sediment are addressed elsewhere in this document.

Comment ST-4: Idaho Power comments that the existing language does not adequately characterize relative sizes of sediment storage facilities, and recommends revisions to the text that correctly reflect the size and significance of the tributary projects upstream of the Hells Canyon Project.

Response: We revised the text of section 3.4.1.1, *Sediment Budget (Sediment Supply at Weiser, S_i)*, to emphasize that the tributary basin size (not the tributary reservoir volume) determines the relative significance of sediment trapping by tributary dams with respect to sediment trapping by mainstem dams.

Comment ST-5: Idaho Power comments that the 220,000 tons per year of unmeasured sand and gravel should be 220,000 tons per year of unmeasured total sediment bedload. Idaho Power recommends revisions to the text to accurately reflect that the 220,000 tons per year represents unmeasured total sediment bedload.

Response: We revised the text of section 3.4.1.1, *Sediment Budget (Sediment Supply at Weiser,* S_i*)*, to emphasize that the unmeasured bedload comprises sand and gravel.

Comment ST-6: Idaho Power recommends clarification of assumptions used to calculate the total sediment load, and revisions as necessary based on staff's assumptions drawn from Mussetter (2006).

Response: We revised the text of final EIS section 3.4.1.1, *Sediment Budget (Sediment Supply at Weiser,* S_i*)*; table 10; and figure 22 to reflect new information provided by Idaho Power (2006: Comments on draft EIS, November 2006), which allows us to calculate total suspended load using the assumptions reported by Mussetter (2006).

Comment ST-7: Idaho Power recommends corrections to clarify the sediment sampling methods and the sampling results used to evaluate sediment composition in the three reservoirs. Idaho Power also comments that concerns in the Wilcock (2002) reference have already been addressed, and that their comments are no longer appropriate. Idaho Power recommends staff review information to determine if the reference to Wilcock et al. (2002) is appropriate in the context of sediment sampling in Brownlee Reservoir.

Response: We revised the text of section 3.4.1.1, *Sediment Budget (Sediment Leaving the Reach,* S_o*)*, to provide additional detail regarding sediment sampling techniques and the complex depositional environment described by Wilcock et al. (2002) from which these samples were obtained. The characterization of the depositional environment at the inlet to Brownlee reservoir is still valid.

Comment ST-8: Idaho Power recommends that staff review values used to calculate area-normalized sediment yield calculated from measurements at Weiser.

Response: We revised the text of section 3.4.1.1, *Sediment Budget (Sediment Leaving the Reach,* S_o*)*, to reflect revisions to the range in area-normalized sediment yield as a result of new information.

Comment ST-9: Idaho Power comments that estimates of total sediment and sand loads should not be used to estimate spawning gravel-sized material loads. Idaho Power recommends that the estimates of sand yields at Weiser not be used in the final EIS to estimate gravel loads.

Response: We did not revise the text of section 3.4.1.1, *Sediment Budget (Sediment Supplied to Tributaries,* S_t), because sand loads were not used to estimate gravel loads. All measurements of sediment loads entering Brownlee reservoir are based on suspended-load measurements at Weiser, and Idaho Power's assumption that bedload (sand and gravel) is 15 percent of the measured suspended load. The gravel and sand portions were not differentiated based on the available information.

Comment ST-10: Idaho Power asserts that the mineralogical signature of fine sediment collected upstream of the Hells Canyon Project is distinct from the signature of fine sediment collected within the reservoirs and from the mainstem downstream of Hells Canyon dam. Idaho Power recommends that staff reexamine the mineral provenance data and discussion to evaluate the validity of the provenance evidence, paying particular attention to the component of K-spar.

Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, to clarify staff's interpretation of data presented in the most recent provenance study (CH2M HILL, 2006).

Comment ST-11: Idaho Power requests that staff confirm the decrease in number and area of sandbars reported by previous studies because these data conflict with results reported by Grams and Schmidt (1991, 1999a,b). In addition, Idaho Power comments that the terms "fluctuate," "increase," and "decrease" are used imprecisely, and misrepresent measured sandbar conditions. Idaho Power requests that staff confirm the use of the terms "fluctuate," "increase," and "decrease" in the final EIS.
Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, to properly reflect the reduction in the number and area of sandbars reported by Grams (1991), Grams and Schmidt (1999b), and Miller et al. (2003a).

Comment ST-12: Idaho Power comments that it is unable to verify a reference to percent decrease in total sandbar area in Grams and Schmidt (1999a,b). Idaho Power recommends that the reference be verified and include any caveats that modify the quote.

Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, to cite Grams (1991) and include discussions that relate sand loss to measurement precision used by the author.

Comment ST-13: Idaho Power comments that it disagrees with the bar thickness used by Wilcock et al. (2002). It also disagrees with the use of historic sandbar loss rates, concluding that current loss rates are much less. Idaho Power recommends that the most recent data be used to estimate the rate of sand loss from sandbars in the Hells Canyon reach and that the most recent data be used to predict future sandbar areas.

Response: The range in average sandbar thickness of 1 to 3 meters used by Wilcock et al. (2002) and adopted by staff is less than the maximum thickness of 2 to 4 meters measured by Idaho Power at four sandbars. Staff considers the range of 1 to 3 meters assumed by Wilcock et al. (2002) to be reasonable, given that: (1) sandbar depths have been measured at only four beaches, (2) a correlation between sandbar size and thickness has not been established, and (3) the thickness of pre-project sandbars is unknown. In addition, the range in the rate of sand loss estimated by Wilcock et al. (2002) represents historical losses of sand volume (or mass) and was not used to predict future losses of sandbar areas. Therefore, we did not revise the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, in response to this comment.

Comment ST-14: Idaho Power comments that it is Salt Creek Bar, rather than Pine Bar, that experienced only erosion. Idaho Power requests that "Pine Bar" be replaced with "Salt Creek Bar."
Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, to replace "Pine Bar" with "Salt Creek Bar."

Comment ST-15: Idaho Power comments that the language in the draft EIS should be put in context using the assumptions made in the stability analysis and field observations. It also disagrees with the statement that instability at Fish Trap Bar is expected. Idaho Power recommends that staff review the basis for statements regarding sandbar instability in light of analytical assumptions and field observations.

Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, to clarify results of the sandbar stability analysis and to indicate where model assumptions are conservative. Although Parkinson et al. (2003b, 2005b) conclude that slope failure is not expected, results of the stability analyses (which incorporated several conservative assumptions) show the contrary, as reiterated by Idaho Power in these comments. Staff defer to common engineering practice, which assumes that slopes are unstable until a more-representative (i.e., less conservative) model shows otherwise.

Comment ST-16: Idaho Power comments that both overpredicted and underpredicted sand mobility should be discussed, not just underpredictions of mobility. To counterbalance this discussion, Idaho Power recommends that staff acknowledge cases where sand mobilization did *not* occur, as predicted by modeling.

Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Beaches)*, to indicate that modeling underpredicted and overpredicted sand mobilization measured in the field.

Comment ST-17: Idaho Power comments that instability may be due to either flood flows or Idaho Power's load following operations, and that additional assumptions used in the analysis are not clarified. Idaho Power states that this language does not distinguish between instability caused by Idaho Power operations and that caused by flood conditions. Idaho Power recommends that the final EIS clarify when instability is produced under operational flows controlled by Idaho Power or under flood flows where Idaho Power has less control due to hydrologic and regulatory constraints.

Response: We revised the text of section 3.4.1.2, *Beaches and Terraces (Terraces)*, to distinguish between project-related effects and non-operational effects on terraces.

Comment ST-18: Idaho Power comments that it did not directly determine bed mobility from MIKE11 results. Idaho Power recommends that the final EIS explain the combination of analyses used to evaluate incipient motion. In addition, Idaho Power comments that processes other than river flows may contribute to gravel movement. Idaho Power recommends that the final EIS acknowledge that spawning-size gravels can be mobilized by processes other than flows, such as spawning activity and boat wakes. Finally, Idaho Power comments that it has not explicitly stated a threshold discharge for gravel mobility. It states that its threshold of motion analysis uses a range of critical dimensionless shear stress values. Idaho Power recommends deletion of references to threshold discharge based upon Idaho Power's model.

Response: We revised the text of section 3.4.1.3, *Spawning Gravel*, to explain additional methods used to estimate gravel mobility and to report the range of bed area estimated to be mobile over the assumed range of critical dimensionless shear stress. Gravel mobilization during flows at or less than 30,000 cfs, as indicated by the scour chains, supports the model results, but could also be partly due to spawning activity (as implied by the location of scour chains in spawning beds). Boat wakes are not considered a likely mechanism for bedload transport because their influence is limited to disturbance of the armor layer in the near-shore environment.

Comment ST-19: Idaho Power comments that no citations are provided to substantiate the statement that beach erosion adversely affects aquatic resources. Idaho Power recommends either removal of the statement or citation of literature.

Response: We revised the text of section 3.4.2.1, *Effects of Project Operations on Sediment Transport (Beach and Terrace Erosion)*, to emphasize that it is the loss of beaches and sandbars (not necessarily the type of erosion causing this loss) that results in a reduction in the quantity of gently sloping shoreline habitat.

Comment ST-20: Idaho Power comments that sand mobility was over- and under-predicted, and that both conditions should be presented, not just one.

Response: We revised the text of section 3.4.2.1, *Effects of Project Operations on Sediment Transport (Beach and Terrace Erosion)*, to reflect the conservative assumptions used in the sandbar stability analysis and to indicate that areas of sand mobility measured in the field were over- and under-predicted by the model.

Comment ST-21: Idaho Power comments that its stability analyses are being taken out of context because it did not analyze ramping rates, but assumed instantaneous drawdown. It also comments that the other assumptions of its analyses are not fully clarified. Idaho Power recommends that the final EIS explicitly state the analyzed failure mechanisms and assumptions, and that instantaneous drawdown is not extrapolated to ramping rates.

Response: We revised the text of section 3.4.2.1, *Effects of Project Operations on Sediment Transport (Beach and Terrace Erosion)*, to indicate that effects of ramping rates were not evaluated by Idaho Power.

Comment ST-22: Idaho Power comments that fine sediment is known to have adverse effects on spawning gravel, contradictory to language in the draft EIS. It also states that gains in spawning gravel mobility, created by increased fine sediment content of the bed, are offset by the effects of fine sediments on spawning gravels. Idaho Power recommends that staff revisit Wilcock and Kenworthy (2002) and re-interpret their results with respect to positive and negative effects on spawning gravel movement and quality.

Response: We revised the text of section 3.4.2.1, *Effects of Project Operations on Sediment Transport (Spawning Gravel)*, to distinguish between the detrimental effects to salmon redds caused by excessive sand content and insufficient sand content.

Comment ST-23: Idaho Power comments that it has not established 30,000 cfs as a threshold for sediment mobility. It states that mobility is a function of the selected critical dimensionless shear stress value. Idaho Power recommends that either the value of 30,000 cfs not be discussed in the context of a mobility threshold, or that specific locations be cited where this threshold applies. Idaho Power further comments that no basis has been provided to select 22,200 cfs as the threshold for gravel mobilization, and that mobilization has not been well-defined. Idaho Power recommends that a basis of selection be provided, and that the support of the cited references (O’Connor [2002] and Wilcock et al. [2002]) be explained as it pertains to the final license application.

Response: The threshold flow for sediment mobility was addressed in a previous response. The references to O’Connor (2002) and Wilcock et al. (2002) are no longer relevant, and they have been deleted. We revised the text of section 3.4.2.1, *Effects of Project Operations on Sediment Transport (Spawning Gravel)*, to clarify the basis for selecting 22,200 cfs for comparison of bed mobilization under the various operational scenarios.

Comment ST-24: Idaho Power comments that the draft EIS does not specify either the areas of gravel mobilized at 22,200 cfs, or their significance. Idaho Power recommends that the final EIS supply an analysis showing that a significant area of spawning-sized gravel is mobilized at 22,200 cfs. Idaho Power further comments that the occurrence of gravel mobilizing flows (22,200 cfs) would not be reduced by as much as 10 percent for extreme high water years. It also comments that boat wakes significantly contribute to sand and gravel mobilization. Idaho Power recommends that the language be modified to reflect 3 percent rather than 10 percent reduction in flow recurrence, and that the impact of boat wakes be considered.

Response: The draft EIS cites Parkinson et al. (2003a), which provides details of the gravel mobility study. We revised the text of section 3.4.2.1, *Effects of Project Operations on Sediment Transport (Spawning Gravel)*, to correctly indicate that the occurrence of 22,200-cfs flows would be reduced 4 percent rather than 10 percent for the indicated operational scenarios. The impact of boat wakes on gravel mobilization was addressed in the response to the comment on page 88, paragraph 5.

Comment ST-25: Idaho Power has proposed a gravel monitoring plan and recommends that FERC review and adopt the plan.

Response: We revised the text of section 3.4.2.2, *Sediment Augmentation and Monitoring*, to include a discussion of the proposed gravel monitoring plan.

Comment ST-26: Idaho Power comments that Swan Falls dam is not immediately upstream of Brownlee reservoir, and that multiple other tributary dams trap sediments. Idaho Power recommends that this language be rewritten to explicitly state distances and dams referred to as “these dams.”

Response: Swan Falls dam is the nearest mainstem dam upstream of Brownlee reservoir. We revised the text of section 3.4.3, *Cumulative Effects,* to clarify the areas from which Swan Falls dam and other tributary dams have historically trapped sediment.

Comment ST-27: Idaho Power comments that the values stated in section 3.4.4, *Unavoidable Adverse Effects*, are over 50 years, rather than per year. Idaho Power recommends modifying the sentence to reflect a duration of 50 years.

Response: We revised the text of section 3.4.4, *Unavoidable Adverse Effects*, to reflect a duration of 50 years, rather than annually.

Comment ST-28: Idaho Power comments that the statement that spawning-sized gravel comprises 10 percent of the sediment trapped in project reservoirs each year is unsupported. It also comments that current hydrology is unable to mobilize gravel-size particles between Swan Falls dam and the Hells Canyon Project. Idaho Power recommends that the final EIS present supporting data for this 10 percent value.

Response: We revised the text of section 3.6.2.14, *Sediment Augmentation*, to clarify that 10 percent of the combined coarse sand and gravel component (not 10 percent of the total sediment load) is likely spawning-size gravel. Assuming the coarse fraction is 15 to 25 percent of the total sediment load, spawning-size gravel would amount to 1 or 2 percent of the total load, which we consider reasonable. As noted above, we dropped the staff-proposed pilot gravel augmentation study in favor of Idaho Power's proposed fall Chinook spawning and gravel monitoring plan. If the fall Chinook spawning and gravel monitoring study indicates that the quantity or quality of spawning habitat may be limiting the production of fall Chinook at some point in the future, appropriate measures to address this impact would be developed and implemented at that time.

Comment ST-29: Idaho Power disagrees with the range of values given in draft EIS table 8 for tons of sand and gravel trapped in project reservoirs annually.

Response: We revised the text of section 3.6.2.14, *Sediment Augmentation*, to reflect the values of total sand and gravel trapped in the three project reservoirs, as shown in final EIS table 10. The estimated value of 10 percent for spawning-size gravel was addressed in a previous response.

Comment ST-30: Interior comments that the draft EIS fails to analyze the effects of the lack of gravel transport on species other than fall Chinook, or where gravels migrate to when they are mobilized downstream of Hells Canyon dam. In order to evaluate the potential changes in aquatic habitat that might occur through time, Interior states that it is important to know whether gravels and other coarse sediments move out of the project area or are merely moving to the thalweg of the Snake River channel. Interior comments that the draft EIS also fails to consider how extreme high flows (between 50,000 and 90,000 cubic feet per second) alter habitat for sturgeon, bull trout, redband trout, and other resident fishes, or the role of stochastic flow events in tributaries on the bed material in the main stem of the Snake River.

Response: Substrate monitoring included in the proposed gravel monitoring plan addresses the movement of spawning gravel from tributary sources to the thalweg. The influence of stochastic sediment inputs from tributaries on the channel morphology is addressed throughout section 3.4.1, *Affected Environment*. Since the project does not alter extreme high flow events, their effects on aquatic species has not been evaluated. Species other than fall Chinook salmon spawn primarily in tributaries to the Snake River, and are likely little affected by the reduced supply of sediments from upstream of Hells Canyon dam. Although Pacific lamprey also spawn and rear primarily in tributaries, we modified the text in section 3.6.3.1, *Pacific Lamprey*, to note that the reduced supply of fine sediments likely reduces the quantity and quality of potential habitat for Pacific lamprey in the mainstem Snake River downstream of Hells Canyon dam.

Comment ST-31: Idaho Power states that there is no evidence that spawning gravel below Hells Canyon dam is deficient or in need of augmentation, and recommends that FERC withdraw the staff-proposed pilot gravel augmentation program. Idaho Power notes that during each year of spawning surveys, new spawning areas are being used and some areas that were heavily used in past years see little or no use. In addition, Idaho Power reports that neither Idaho Power nor the FWS have noted significant superimposition of redds during their weekly aerial and ground surveys of spawning sites. As an alternative, Idaho Power filed a fall Chinook spawning and gravel monitoring plan with its draft EIS comments, which it asks FERC staff to consider as part of its license application.

The Forest Service comments that the volume of gravel that staff recommends be deposited during the pilot gravel study is not likely to be sufficient to cause an increase in the amount of spawning habitat, and the amount of increase of turbidity would be imperceptible. ODFW comments that the total flux of coarse sediment within the Snake River at its confluence with the Salmon River is currently between 3 and 7 percent of what it would be without the three dams of the Hells Canyon Project. Without augmentation of coarse-grained sediment downstream of Hells Canyon dam, ODFW states that the loss of sand and gravel bars would continue to adversely affect aquatic and riparian habitat. However, ODFW questions the probability of augmented sediment reaching targeted spawning sites due to the size of the river, the magnitude of the high flows, the distance of the augmentation site from spawning sites, and the relatively small amount of gravel proposed to be augmented in the pilot project. ODFW supports the general requirement to monitor erosion, substrate, and gravel, but states that much more detail is needed, including the actions that would be implemented should monitoring show an adverse effect or trend.

Response: We revised the text of section 3.4.2.2, *Sediment Augmentation and Monitoring*, to reflect Idaho Power's proposed fall Chinook salmon spawning and gravel monitoring plan. We adopt Idaho Power's plan as part of the Staff Alternative instead of the pilot gravel augmentation study that we had recommended in the draft EIS.

Comment ST-32: NMFS states that the annual loss of 22,700 to 90,800 tons of spawning-sized gravels to the Snake River is a serious threat to mainstem spawning areas, especially those nearest to Hells Canyon dam. NMFS comments that the threat to spawning habitat in these areas is sufficient to warrant physical and biological monitoring of the habitat to ensure that the quality and quantity of this habitat persists over time. NMFS comments that FERC should consider their recommendation to monitor spawning areas downstream of the project to be within the scope of section 10(j), since the monitoring is integral to ensuring that the conservation value of downstream spawning habitat remains adequate during the term of the license. It states that evaluating spawning habitat every 5 years is needed to determine the cause of any decline that is observed so that suitable steps can be taken.

Response: We reconsidered our position on this measure, and we concur that measure NMFS-7 is a valid 10(j) recommendation. We also adopted the fall Chinook salmon spawning and gravel monitoring plan proposed by Idaho Power, which includes incubation monitoring at 5-year intervals, consistent with the NMFS recommendation.

Comment ST-33: The Forest Service comments that the draft EIS inaccurately characterizes spawning habitat conditions downstream of Hells Canyon dam as being "of very high quality." The Forest Service notes that this statement conflicts with the statement that DO concentrations never meet spawning criteria in the fall (draft EIS pg 266).

Response: Our statement on page 208 of the draft EIS referred to metrics of spawning gravel quality reported by Groves and Chandler (2003). Their evaluation of four commonly used metrics of spawning gravel quality (percent fines, geometric mean diameter, Fredle Index, and apparent velocity) indicated that survival to emergence in the upper Hells Canyon reach (upstream of the Salmon River) likely exceeds the survival to emergence downstream of the Salmon River, and that survival to emergence at both locations likely exceeds that in the Hanford Reach in the Columbia River. More recent redd monitoring conducted by Groves et al. (2006) in the Hells Canyon reach indicated that intragravel DO exceeded 8 ppm throughout the incubation period, and the mean survival rate of eyed eggs planted in artificial redds in the Hells Canyon reach averaged 89 percent in 2003–2004 and 84 percent in 2004–2005. Regardless of these findings on the current quality of spawning and incubation habitat in the Hells Canyon reach, we adopted Idaho Power's proposed fall Chinook spawning and gravel monitoring plan. This measure would help assess whether any adverse effects that occur in the future warrant implementing measures to protect or improve the quantity or quality of spawning habitat.

Comment ST-34: The Umatilla Tribes support the pilot gravel augmentation and monitoring program adopted by FERC staff in the draft EIS, and concur with the FERC staff that unwashed gravel, as long as it is free of hydrocarbons and other contaminants, would be appropriate for supplementing gravel areas and to raise turbidity levels to increase juvenile fall Chinook survival. However, the Umatilla Tribes note that FERC staff rejected the proposal for sand augmentation for fall Chinook spawning and rearing areas and to protect tribal cultural resource sites below the project that are now affected by the project. Other than costs to Idaho Power, they state that the draft EIS does not provide justification for why sand replenishment should not be undertaken as well as gravel replenishment, stating that both are necessary to increase fall Chinook habitat quantity and quality. The Nez Perce Tribe provides cautious support for the pilot gravel augmentation and monitoring program, but states that it is imperative that this proposal be further fleshed out in consultation with the Nez Perce Tribe and state and federal resource agencies. The Nez Perce Tribe states that it conducts a fall Chinook supplementation program in the Snake River below the Hells Canyon Project, and gravel augmentation needs to be coordinated with this program. AR/IRU comment that they are pleased that FERC is proposing to require Idaho Power to undertake a gravel augmentation pilot study, but they believe that the proposed program is too limited to show any meaningful results. AR/IRU also state their position that project effects on spawning gravel must be fully mitigated.

Response: As noted previously, we abandoned the pilot gravel augmentation study that we recommended in the draft EIS and replaced it with Idaho Power's proposed fall Chinook spawning and gravel monitoring study. This program should provide sufficient information to determine whether the quantity or quality of spawning habitat is decreasing and may be limiting the productivity of the fall Chinook salmon population. If this monitoring program indicates that the quantity or quality of available spawning habitat limits spawning and incubation success of fall Chinook salmon, then appropriate measures to address that effect can be developed. As we discussed in the draft EIS, because of the relatively high gradient and confined stream channel in the upper Hells Canyon reach, we conclude that the potential for increasing rearing habitat through fine sediment augmentation in this reach is very limited.

B8. WATER QUALITY

General

Comment WQL-1: Idaho Power comments that the draft EIS does not reflect current water quality standards, and it specifically refers to changes that were approved by Oregon and Idaho since the TMDL was written but are not presented in the draft EIS. Idaho Power recommends that the final EIS describe current state water quality standards.

Response: We revised the referenced table and text of section 3.5, *Water Quality*, to incorporate Idaho and Oregon water quality criteria that were approved by EPA after the TMDL was written.

Comment WQL-2: Idaho Power agrees that water quality conditions in the Snake River basin are influenced by a wide range of natural and anthropogenic sources, but states that it is incorrect to assume that project impacts may be understood only by evaluating the entire Snake River basin. Idaho Power comments that it is possible to examine actual, discrete project impacts and tailor appropriate mitigation to address those impacts while acknowledging the effects of other water developments. Idaho Power notes that it is confident that a common understanding of project impacts on water quality and appropriate mitigation measures will result from its ongoing discussions with IDEQ and ODEQ in the water quality certification process and recommends that FERC coordinate its review with the two states to ensure consistency.

Response: We recognize that it is possible to examine discrete project impacts and tailor appropriate mitigation of those impacts. However, to properly assess benefits of the measures that have been proposed to address project impacts, they must be considered in the context of other past, present, and future actions that affect water quality and water quality-dependant resources.

Comment WQL-3: Interior comments that the draft EIS stated that ODEQ (2005) reports coliform bacteria within the range of existing criteria, and it references a report that states that coliform bacteria have been detected in very high concentrations in the Boise River near its confluence with the Snake River. Interior recommends that the EIS include Idaho's assessment of coliform bacteria in the Snake River and consider using *Escherichia coli* (*E. coli*) criteria alone since it is more strongly correlated with swimmer's gastrointestinal illnesses than is coliform bacteria.

Response: We revised the text in section 3.5.1.7, *Coliform Bacteria*, to reflect this new information for the Snake River.

Comment WQL-4: The State of Idaho comments that the draft EIS includes an analysis of water quality issues and staff's recommendations that address the impacts of the project on water quality within and downstream of the project. The State of Idaho and ODEQ comment that water quality certification will be required by both the state of Oregon and the state of Idaho prior to issuance of a new FERC license, and that any license issued for the project must incorporate any conditions accompanying these water quality certifications.

Response: We acknowledge that the Idaho and Oregon water quality certifications will include conditions that they deem necessary to address violations of water quality standards. The final EIS evaluates Idaho Power's revised proposal with respect to water quality measures, as described in its January 31, 2007, application for water quality certification.

Comment WQL-5: The Shoshone-Bannock Tribes comment that it appears doubtful that Idaho Power's proposal or the Staff Alternative would satisfy applicable water quality standards, based on the evidence discussed in the draft EIS. The Shoshone-Bannock Tribes recommend that FERC reconsider its analysis of water quality impacts and require additional mitigation that would result in compliance with state water quality standards downstream of the project and within project reservoirs.

Response: Many factors contribute to the water quality in the project area and the Snake River downstream of Hells Canyon dam, and we note that Idaho Power should not be held responsible for water quality degradation caused by other parties. Therefore, even if Idaho Power implements measures that fully compensate for the project's adverse water quality effects, some applicable water quality criteria may not be satisfied. Since the draft EIS was issued, new information has become available regarding both adverse effects caused by the project and the efficacy of potential water quality measures. We revised the draft EIS to discuss this new information and have revised our recommendation. In the final EIS, the Staff Alternative includes the following recommendations:

- Develop a DO enhancement plan designed to determine the project's DO load allocation, evaluate the effectiveness and feasibility of potential measures, and implement Commission-approved measures (see section 5.2.3.1, *Dissolved Oxygen Measures*).

- Implement Idaho Power's Temperature Adaptive Management Plan that would (1) identify the project's responsibility for elevated temperatures downstream of Hells Canyon dam, (2) include an evaluation of potential measures to satisfy this responsibility, and (3) identify any appropriate measure(s) for implementation (see section 5.2.3.2, *Water Temperature Measures*).
- Continue preferential use of the upper spillway gates at Brownlee dam; install spillway deflectors at Hells Canyon and Brownlee dams; and evaluate, select, and implement TDG-abatement measures for Oxbow dam (see section 5.2.3.3, *Total Dissolved Gas Abatement*).
- Develop and implement an operational compliance and water quality monitoring plan to document the compliance with the TMDL load allocations, appropriate pollution-trading requirements, and water quality standards (see section 5.2.3.4, *Water Quality Monitoring*).

Comment WQL-6: Interior comments that pages 144 and 147 of the draft EIS refer to measures that Idaho Power proposed in its final license application and in subsequent discussions with the respective state water quality agencies. The measures discussed with the states of Idaho and Oregon, such as adding a TDG abatement structure at Brownlee dam, are not consistently acknowledged or discussed in the draft EIS. Interior recommends that the EIS include a clear discussion of the water quality measures that were included in the preferred alternative for the project.

Response: We revised the text of the final EIS to clarify Idaho Power's proposal to FERC, which includes the measures specified in its January 31, 2007, revised application for water quality certification.

Temperature

Comment WQL-7: Interior comments that the EIS should provide all available information about naturally occurring stream temperatures in our analysis of the proposed action on water temperatures.

Response: We provided monthly average water temperatures for inflows to Brownlee reservoir, outflows from Hells Canyon dam, and pre-project temperatures measured at the site of Brownlee dam in draft EIS figure 25 (final EIS figure 26). This is sufficient data on which to base the staff's analysis. Comparing outflow to inflow temperatures provides an understanding of the change in water temperature as flow passes through the project, and of how current outflow temperatures compare to those that would exist without the project in place.

Comment WQL-8: Idaho Power comments that the statement "…although some tributaries with dams a short distance upstream of the confluence with the Snake River (e.g., the Owyhee River) are relatively cool (table 16)" on draft EIS page 105 is misleading. Idaho Power also comments that incomplete or incomparable data sets in table 16 could lead readers to erroneously conclude that the Anatone location is cooler than upstream locations. Idaho Power recommends revising table 16 and the accompanying narrative by incorporating the additional temperature data that it provides for the Owyhee and Malheur rivers and including the number of individual values and period(s) of record that were used to calculate the summary information contained in the table.

Response: Our primary objective for including table 16 in the draft EIS (table 18 in the final EIS) was to use as much of the available data as practical to provide an overview of the conditions for flow, water temperatures, and phosphorus loading for sites throughout much of the basin. We revised the footnotes to the referenced table and associated text to incorporate the maximum temperature data provided by Idaho

Power for the mouths of the Owyhee and Malheur rivers and indicate that the temperature data are not directly comparable because the data were not collected over the same period for all sites. We did not incorporate the periods of record in the table because many of the sites have different periods of record and data gaps. As a result, adding this information would be of little value for readers.

Comment WQL-9: Idaho Power comments that the statement "… in early spring of the wet year of 1997, Brownlee reservoir was drawn down to an elevation of approximately 600 feet for flood-control purposes" on page 113 of the draft EIS is incorrect. Idaho Power states that the reservoir was drawn down approximately 100 feet to elevation 1,976 feet mean sea level (msl).

Response: We revised the text of section 3.5.1.2, *Temperature*, as recommended.

Comment WQL-10: Idaho Power states there is no scientific basis for concluding that springtime temperatures are cooler than natural conditions because of project operations. Idaho Power acknowledges that springtime temperatures of water released from Brownlee reservoir are cooler than contemporary inflowing water temperatures, but comments that contemporary inflowing temperatures do not represent "natural" conditions because the natural thermal regime was significantly altered due to major upstream storage and diversion projects developed during several decades prior to construction of the project. Idaho Power recommends that FERC delete speculative statements about springtime temperature effects of the project.

Response: As noted in this comment, comparing the temperature of flows into Brownlee reservoir with concurrent downstream temperatures does not represent the change in temperature from natural conditions. However, this approach does provide a reasonable estimate of the effect of the project on downstream water temperatures given current, present day conditions. We revised the text of section 3.5.2.4, *Water Temperature*, to clarify this point, and we discuss Idaho Power's estimate of the historic temperature regime.

Comment WQL-11: Interior comments that section 3.5.2.1, *Effects of Project Operations on Water Quality*, discusses water temperature in Brownlee reservoir and outflows from Hells Canyon dam, but does not analyze their importance from a biological perspective. It further notes that restoring the river's thermal regime as close as possible to pre-impoundment conditions is important to the biota living in the Snake River downstream from the project. Interior credits the draft EIS with discussing how proposed operations would result in higher than normal winter temperatures and lower than normal summer temperatures, along with discussing the estimated amount of time that the TMDL temperature target would be exceeded. Interior comments that the draft EIS does not, however, discuss how altered temperatures would affect beneficial uses such as coldwater biota or provide a scenario for achieving temperatures that more closely mimic natural cycles. Interior requests that the EIS be revised to more completely address the impact of altered temperatures on invertebrates and fish, and provide an operational alternative that attempts to more closely mimic the natural temperature cycles.

Response: The primary focus of our discussion of water temperatures in section 3.5.2.1 of the draft EIS, *Effects of Project Operations on Water Quality*, pertains to water quality, not effects on beneficial uses. In the draft EIS, we discussed the effects of water temperatures on fish and invertebrates in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources* and section 3.6.2.4, *Temperature Control*. Our analysis indicated that delayed warming caused by the project likely reduces the growth rate of fall Chinook salmon fry during the spring months, and delayed cooling may delay fall Chinook salmon spawning and reduce gamete viability. We amended the EIS to expand on this discussion, which now includes a discussion of the potential effects of altered water temperatures on white sturgeon and bull trout. We also added a discussion of Idaho Power's proposal, filed with the Commission on April 26, 2007, to implement a Temperature Adaptive Management Plan that addresses the project's thermal load allocation. As described in section 5.2.3.2, *Water Temperature Measures*, implementing this plan could provide substantial benefits to fall Chinook salmon and other aquatic resources. We therefore conclude that Idaho Power's adaptive management program for temperature is warranted and would be worth the cost. We estimate the cost at $452,000 annually.

Regarding a temperature control structure, we conclude that installing such a structure is not warranted. It carries a substantial cost, yet could have potential adverse effects on fall Chinook salmon from: (1) increased water temperatures downstream of the project during the summer outmigration season, and (2) reduced dissolved oxygen levels and increased releases of ammonia, mercury, and organochlorine compounds from Brownlee reservoir. We revised final EIS section 5.2.3.2, *Water Temperature Measures*, to incorporate these changes.

Comment WQL-12: Interior comments that section 3.5.2.4 of the draft EIS, *Temperature Control*, provides an extensive description of the temperature of water entering, traveling through, and leaving the project, but that it does not discuss the importance of attempting to match water temperatures leaving the project with ambient temperatures in the Snake River upstream of Brownlee reservoir. Interior also states that the staff relies on analyses by Idaho Power to determine effects on species, primarily fall Chinook salmon. Interior recommends that the EIS display and analyze the effects that the altered temperature regime of the Snake River within and downstream of the project has on native aquatic fauna (bull trout, white sturgeon and other native fishes, and invertebrates) and explore potential measures to mitigate these effects in one of the alternatives chosen for detailed analysis.

Response: We conclude that it is beneficial to attempt to match water temperatures leaving the project with the water temperatures upstream of Brownlee reservoir. In section 3.6.2.4, *Water Temperature*, we discuss ways that the project alters water temperatures in some seasons that adversely affect fall Chinook salmon, including slower growth in the spring due to delayed warming and adverse effects on spawning associated with delayed cooling. However, some project effects on water temperature likely provide benefits to fall Chinook salmon and other native species, including cooler water temperatures during the smolt migration season and warmer temperatures during the incubation period. In the final EIS, we expanded our analysis to better describe effects on other aquatic species, including white sturgeon and bull trout.

Comment WQL-13: The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS failed to evaluate the benefits to adult fall Chinook migration, pre-spawning activities, gamete viability, and spawner success potential from a temperature control structure. They comment that even if there would not be sufficient cool water to provide both summer and fall "optimal" thermal conditions, as stated on pages 565-66 of the draft EIS, there would still be a benefit to either summer or fall temperatures from providing cool water, and selecting warm water in the spring would increase emergence timing and growth rates of fall Chinook, leading to earlier seaward migrations that would increase survival and lead to increased smolt-to-adult returns. The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS discounted the CRITFC analysis of the benefits of a temperature control structure, and have included a detailed response to the Idaho Power critique of CRITFC's analysis. The Umatilla Tribes and the Nez Perce Tribe recommend that the EIS be revised to address these issues.

Response: In draft EIS section 3.6.2.4, *Temperature Control*, we discussed and evaluated the potential benefits of using a temperature control structure to reduce water temperatures in the fall. Such a structure could reduce stress caused by high water temperatures and low DO levels, as well as potentially reduce pre-spawning mortality and improve gamete viability. We also discussed the potential for increasing water temperatures in the spring to enhance growing conditions for juvenile fall Chinook salmon, which could promote earlier outmigration and attainment of a larger size prior to outmigration, both of which are likely to improve outmigration survival. After reviewing the information provided by the Umatilla Tribes, the Nez Perce Tribe, and Idaho Power, we reanalyzed potential benefits of temperature control structures, and we revised section 3.6.2.4, *Water Temperature*, accordingly.

After the draft EIS was issued, Idaho Power filed a proposal to implement a Temperature Adaptive Management Plan to address the project's thermal load allocation. Based on our analysis in section 5.2.3.2, *Water Temperature Measures*, we conclude that implementing this plan could provide substantial benefits to fall Chinook salmon and other aquatic resources, and that it would be worth the estimated annualized cost of $452,000. We also conclude that installation of a temperature control structure is not warranted. Such a structure would be costly, yet potentially have adverse effects on fall Chinook salmon from: (1) increased water temperatures downstream of the project during the summer outmigration season, and (2) reduced dissolved oxygen levels and increased releases of ammonia, mercury, and organochlorine compounds from Brownlee reservoir. We revised final EIS section 5.2.3.2, *Water Temperature Measures*, to reflect this change.

Comment WQL-14: EPA comments that it is encouraged that modeling by Idaho Power indicates that temperature control structures can achieve significant improvements in the reach between Hells Canyon dam and Lower Granite dam, potentially benefiting water quality for more than 100 river miles. In particular, the modeling indicates that a temperature control structure can achieve the 13°C TMDL target for salmon spawning. EPA also notes that these results indicate that a temperature control structure could substantially improve temperature conditions for rearing and migration, consistent with Oregon's 20°C summer temperature criterion and the natural thermal regime standard.

Response: We concur that Idaho Power's modeling results indicate that a temperature control structure could satisfy the 13°C fall spawning target TMDL for Hells Canyon dam outflows and improve thermal conditions for rearing and migrating fall Chinook salmon. However, we conclude that the benefits of a temperature control structure do not warrant its substantial cost, given the associated potential to further degrade other water quality parameters (e.g., DO, ammonia, mercury, and organochlorine compounds). Instead, we include in the Staff Alternative Idaho Power's proposal to implement a Temperature Adaptive Management Plan to address the project's thermal load allocation. Measures implemented as part of this plan have the potential to enhance spawning and incubation conditions for fall Chinook salmon, and, in the case of watershed measures, could provide a broader array of environmental benefits. We revised final EIS section 5.2.3.2, *Water Temperature Measures*, to incorporate these changes.

Comment WQL-15: EPA recognizes that the Staff Alternative requires Idaho Power to develop and implement a temperature management plan in consultation with IDEQ and ODEQ. However, EPA comments that the draft EIS provides little information about how this plan would be developed and what types of measures would be evaluated and implemented. Accordingly, EPA recommends that the final EIS present more information about the basic timeline, milestones, and strategy for achieving water quality standards consistent with the existing TMDL.

AR/IRU comment that although FERC proposes to require a plan regarding temperature, it provides no specifics as to what such a plan should include and makes no statement that Idaho Power must actually do something to address temperature impacts. They also comment that FERC provides no explanation or support for its assertion that its proposed alternative would result in changes to the temperature regime in

Hells Canyon. AR/IRU further comment that FERC is employing a double standard by claiming it cannot analyze and adopt recommendations of agencies and NGOs unless such recommendations are extremely specific, but then proposes vague, open-ended measures for plans, studies and assessment, without any requirement that Idaho Power actually undertake mitigation.

Response: Idaho Power provided additional detail on its proposed temperature management plan in its January 31, 2007, application for water quality certification, and we revised section 3.5.2.4, *Water Temperature*, to include this information. In the final EIS, we adopt Idaho Power's proposed approach, which includes three steps: (1) defining the extent and nature of the project's temperature responsibility; (2) evaluating potential measures; and (3) identifying any appropriate measure(s) for implementation.

In its application for water quality certification, Idaho Power states that certain measures designed to address the project's temperature responsibility could also have adverse effects on aquatic resources. As such, Idaho Power notes that the effects on all aquatic resources should be considered before selecting measures for implementation. In the draft EIS, we concluded that the seasonal shift in water temperatures caused by the project adversely affected fall Chinook salmon by contributing to high water temperature during the spawning season and below optimal temperatures during emergence and early rearing periods. The approach proposed by Idaho Power, which we adopt as part of the Staff Alternative, would allow the comparison of benefits associated with alternative measures to address the project's temperature responsibility under the TMDL. With respect to the AR/ARU statement that this approach represents a double standard, we note that the water quality certificates issued for this project will likely require Idaho Power to meet its temperature obligation under the TMDL. The Temperature Adaptive Management Plan proposed by Idaho Power would provide a process for ensuring that the selected measures provide the greatest overall benefit to aquatic resources.

Comment WQL-16: EPA recommends that the final EIS provide additional information about the economic feasibility of temperature control structures.

Response: We added the range of annualized costs ($3.7 to $40.6 million) for the five alternatives that were evaluated to section 5.2.3.2, *Water Temperature Measures*, in the final EIS. Detailed information on cost assumptions for each of the alternative temperature control structures were provided in Idaho Power's responses to AIR WQ-2. These include: (1) detailed costs for each of the five alternative temperature control structures, as filed on February 4, 2005; (2) revised costs for the three alternatives evaluated in detail, filed on September 1, 2005; and (3) costs of DO augmentation associated with temperature control structures, filed on October 21, 2005. These filings may be obtained through FERC's eLibrary system web page (http://www.ferc.gov/docs-filing/elibrary.asp).

Comment WQL-17: EPA recommends that the final EIS provide further documentation of the temperature control structure modeling performed by Idaho Power, including detailed information about the seasonal withdrawal strategies that were evaluated.

Response: We discuss the methods and results of modeling performed by Idaho Power to assess the effects of alternative temperature control structures in section 3.5.2.4 of the final EIS. Additional details about specific simulations that were run for each of the alternative structures are provided in reports filed by Idaho Power on December 13, 2004, and May 9, September 1, September 30, and October 21, 2005, in response to AIR WQ-2. These reports can be accessed through FERC's eLibrary system web page (http://www.ferc.gov/docs-filing/elibrary.asp). As previously noted, in the final EIS we adopt Idaho Power's proposed Temperature Adaptive Management Plan.

Comment WQL-18: EPA recommends that the final EIS provide additional temperature control model runs described in enclosure 4 and analysis of potential benefits described in enclosure 1 of its letter.

Response: We revised section 3.5.2.4, *Water Temperature*, and 3.6.2.4, *Water Temperature*, in the Water Quality and Aquatic Resources sections, respectively, to include further modeling and analysis of the potential benefits that a temperature control structure could provide to spawning and rearing fall Chinook salmon.

Comment WQL-19: EPA recommends that the final EIS provide available information from the states of Idaho and Oregon regarding the status of outstanding temperature issues in the CWA Section 401 certification process. ODEQ comments that Idaho Power has been working closely with IDEQ and ODEQ to better define the project's effect on water temperatures downstream of Hells Canyon dam during the fall Chinook salmon spawning period. ODEQ also comments that the ongoing evaluation indicates that the project's warming effect downstream of the Hells Canyon dam may be less than previously estimated. ODEQ also notes that something less extensive than the earlier-evaluated temperature control structure alternative may be feasible to address the project-induced temperature effects of the fall. ODEQ further notes that upon resolution of this effort, Idaho Power would be better positioned to identify measures that are best suited to address the project's impacts on lower river temperatures.

Response: In its January 31, 2007, application for water quality certification, Idaho Power indicated that it intends to implement a Temperature Adaptive Management Plan. We discuss this plan in our analysis of water temperature effects in the final EIS, and incorporate it in the Staff Alternative.

Comment WQL-20: EPA recommends that the final EIS provide analysis of estimated project effects on Snake River temperatures at the Washington border and compare it to applicable Washington water quality standards.

Response: We revised the text of section 3.5.2.4, *Water Temperature*, to include a comparison of simulated temperatures for the Anatone gage, which is less than 10 miles downstream of the Oregon/Washington border, and Lower Granite reservoir tailwater to Washington's year-round temperature criterion of 20°C.

Comment WQL-21: Idaho Power comments that the draft EIS implies that warming springtime temperatures downstream of the project would benefit anadromous fish, but that this conclusion appears to conflict with the NMFS 2005 biological opinion for ESA Section 7 consultation for the operation and maintenance of BOR's upper Snake River projects upstream of Brownlee reservoir. Idaho Power states that NMFS's 2005 biological opinion suggests cooler springtime temperatures in the Snake River improve spring migrant conditions. Idaho Power recommends that FERC revise the EIS by incorporating NMFS's analysis that cooler springtime temperatures benefit anadromous fish.

Response: NMFS's analysis to which Idaho Power refers states that BOR's proposed operations would benefit spring-migrating yearling smolts by reducing the frequency of water temperatures exceeding 13°C downstream of Lower Granite dam between April 3 and June 20. Our evaluation indicates that water temperatures downstream of Hells Canyon dam rarely exceed 13°C before mid-May, indicating that there is considerable potential to increase water temperatures to improve the growth of rearing fall Chinook salmon from mid-March through mid-May without adversely affecting the temperature regime for yearling migrants.

Comment WQL-22: Idaho Power comments that the statement "[r]educing water temperatures in the fall also could increase the current low DO levels" on page 151 of the draft EIS is misleading. Idaho Power references modeling that it conducted for AIR WQ-2(b), which shows the potential for DO increases occurred only with a weir-type structure operated during low flow years, and that all other structures and flow years predicted lower DO conditions. Idaho Power recommends that the reference to reducing fall temperatures could increase DO levels be deleted.

Response: The intent of the statement that Idaho Power refers to is simply to describe the physical relationship between water temperature and the solubility of oxygen. Thus, we revised the text of section 3.5.2.4, *Water Temperature*, to clarify that changes in temperature have the potential to increase DO levels downstream of the project by increasing the solubility of DO. In the final EIS, we described the specific effects of alternative Brownlee temperature control structures on DO.

Comment WQL-23: AR/IRU comment that FERC fails to adequately analyze temperature problems downstream of the project and does not include sufficient measures to address these problems. They also comment that FERC does not consider whether the lack of spawning during the fall temperature shift is due to adverse water temperatures caused by the project. AR/IRU further comment that FERC's discussion of pH and ammonia does not comport with its discussion of DO, given various temperature control structure options, and that FERC does not adequately support its assertion that all options could result in greater amounts of ammonia and lower pH (on pages 154-155 of the draft EIS). AR/IRU recommend that if FERC ultimately decides to require Idaho Power to implement a temperature control structure, it should require that Idaho Power fully mitigate for any additional DO issues that may be caused by a temperature control structure.

Response: We revised the text of section 3.5.2.4, *Water Temperature*, to better support our conclusions about the effects of temperature control structures on pH and production of ammonia. We continue to conclude that installation of a temperature control structure is not warranted, given its (1) high cost, (2) potential to increase summer temperatures, which could adversely affect out-migrating fall Chinook salmon, and (3) potential to reduce dissolved oxygen levels and increased releases of ammonia, mercury, and organochlorine compounds from Brownlee reservoir. Therefore, we do not include the temperature control structure in the Staff Alternative. However, as discussed in final EIS section 5.2.3.2, *Water Temperature Measures*, of the final EIS, we revised our recommendations to include Idaho Power's proposal for implementing a Temperature Adaptive Management Plan to address the project's temperature responsibility and enhance fall Chinook salmon habitat.

Comment WQL-24: AR/IRU comment that the draft EIS mentions Idaho Power's efforts to obtain site-specific criteria for water quality, but fails to discuss how it could affect the licensing and project impacts. They recommend that the final EIS provide more discussion of Idaho Power's efforts. The Umatilla Tribes and the Nez Perce Tribe comment that adopting Idaho Power's proposal for a site-specific change of the fall Chinook salmon spawning temperature criterion would essentially mean that Idaho Power could operate the project under status quo conditions, and avoid addressing the chronic temperature problems experienced by fall Chinook salmon in the upper Hells Canyon reach. The Tribes state that it is incumbent on Idaho Power to implement measures to address the thermal problems, as well as to abide by appropriate temperature criteria.

Response: We revised our recommendations in the final EIS (see section 5.2.3.2, *Water Temperature*

Measures) to include Idaho Power's proposal for implementing a Temperature Adaptive Management Plan to address the project's temperature responsibility and benefit fall Chinook salmon. We also added a footnote to the table that summarizes water quality criteria and targets (final EIS, table 17) to indicate that EPA is concerned that Idaho Power's proposed site-specific temperature criteria would likely not protect salmon spawning and egg incubation.

Comment WQL-25: NMFS comments that it worked extensively with Idaho Power to investigate several temperature control measures at the project and various strategies for using these structures during the relicensing study period. Based on this information, NMFS concludes that these structures would not provide the substantial benefits to incubating, rearing, migrating, or spawning fall Chinook salmon that the agency had hoped would be attained with these structures.

Response: We revised the text in section 3.5.2.*4, Water Temperature Measures*, to recognize NMFS's position on the benefits of a temperature control structure.

Comment WQL-26: Interior states that there are several other fish species, including white sturgeon, bull trout and other native resident fish, that should be included in the analysis of the potential benefits of a temperature control plan at the project. Interior recommends that the EIS include a discussion of the relationship between DO and temperature and the acute and chronic effects of the diminished water quality conditions within and downstream of the project created by the combination of altered thermal regime and low DO.

Response: We focus our analysis of a temperature control structure on fall Chinook salmon because potential benefits to this species are considerably greater than for other species. In addition, most parties that recommended the evaluation of a temperature control structure indicate that the measure would be intended to primarily benefit fall Chinook salmon. Nonetheless, we added text to section 3.6.2.4, *Water Temperature,* to describe the effects of temperature alterations on white sturgeon and bull trout. Regarding DO, we recommend that Idaho Power evaluate methods to augment DO downstream of the project.

Comment WQL-27: Interior comments that the description of water quality measures, as specified in the Staff Alternative on page 534 of the draft EIS, is incomplete and should include the recommended measures that are contained in draft EIS table 96.

Response: The list of staff-recommended water use and quality measures on page 534 of the draft EIS includes only those measures also proposed by Idaho Power; staff-recommended water use and quality measures that are not proposed by Idaho Power are listed on page 542 of the draft EIS. These lists correspond to measures in draft EIS table 96 (final EIS table 105).

Comment WQL-28: The Umatilla Tribes and the Nez Perce Tribe state that it is not clear why temperature allocations for the project have not already been calculated, since a temperature TMDL has been completed, and they question why it is the purview of Idaho Power to determine its own responsibility for TMDL compliance. They note that temperature data upstream, within, and downstream of the project is spotty, making the ability to use this data for management very difficult. They state that collecting comprehensive water quality data in the Snake River encompassing the project, as recommended by CRITFC, should have been a precursor to preparing the TMDL and the draft EIS, and that it should be a significant part of future operations. The tribes also identify the need for access to data to corroborate or validate the positions taken by Idaho Power.

Response: Although Idaho Power could evaluate the project's contribution to downstream water temperatures, IDEQ and ODEQ have responsibility for setting TMDL allocations associated with the project. We revised the Staff Alternative to include an operational compliance and water quality monitoring plan, which would include provisions for Idaho Power to post water quality, flow, and reservoir level data on the Internet. We discuss this monitoring plan in section, 5.2.3.4, *Water Quality Monitoring*.

Comment WQL-29: The Umatilla Tribes and the Nez Perce Tribe comment that FERC staff appear to be content with not addressing the current thermal regime in the Hells Canyon reach, and state that the current regime does not provide suitable conditions for fall Chinook salmon. They comment that reliance on continued supplementation is not sufficient to bring about a self-sustaining population. The tribes also state that improving conditions in the reservoirs is dependent on funding upriver restoration efforts, and that reliance on production of fall Chinook salmon in the Clearwater and Salmon rivers is not a valid substitute for production in the mainstem Snake River.

Response: We revised the Staff Alternative, as discussed in section 5.2.3.2, *Water Temperature*, to include Idaho Power's proposal for implementing a Temperature Adaptive Management Plan to address the project's temperature responsibility. This measure is expected to benefit fall Chinook salmon production in the mainstem of the Snake River downstream of the project. We also adopt a number of measures that would benefit fall Chinook salmon, including continued management of flows to benefit spawning and incubation, flow augmentation to improve the survival of outmigrating smolts, and measures to address adverse effects on DO and high TDG levels. We also expanded our discussion of the potential benefits of funding TMDL implementation, in section 3.6.2.6, *Anadromous Fish Restoration*, of the final EIS. However, we conclude that adverse effects on the quality of inflows to the project are the result of other activities in the basin, and that these have little nexus with the project and project effects (primarily via increased development associated with low power costs). Therefore, we do not include TMDL funding in the Staff Alternative. Nonetheless, we do adopt measures that Idaho Power proposes in its application for water quality certification to evaluate alternative approaches before selecting and implementing measures to meet the project's temperature and nutrient responsibility under the TMDL. These alternative approaches include phosphorus trading and watershed measures, which have the potential to provide water quality benefits upstream of, within, and downstream of the project.

Comment WQL-30: The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS recommends continuation of temperature monitoring, but that it is unclear what kind of temperature monitoring is required. They state that such data are very important for evaluating the effect of the project on downriver salmon habitat, and should be readily available to the public.

Regarding staff measures 2, 3, and 4, NMFS suggests that to carry out its management plans, the water quality parameters would need to be measured within 1 mile downstream of the specified dams. NMFS encourages FERC to reconsider its decision to allow flow compliance to be measured at a separate location 16 additional miles downstream of this point so that a unified base of information will be created for future management decisions.

Response: We modified the Staff Alternative to include a measure that would require Idaho Power to develop and implement an operational compliance and water quality monitoring plan, which would include continuous temperature monitoring at one site located less than 5 miles downstream of Hells Canyon dam. Additional spot measurements of water quality would be collected at downstream locations and at frequencies to be determined during consultation on staff's recommended DO enhancement plan.

We note that during the 10j meeting held in December 2006, Idaho Power indicated that installing a combined water quality and flow measurement gage within 1 mile of Hells Canyon dam was not feasible because the proposed spillway TDG abatement structures would direct more energy downstream, resulting in turbulent conditions that are not conducive to representative measurement of water level variations.

Comment WQL-31: Interior states that the draft EIS assessed biological productivity primarily by addressing phytoplankton community composition at different times of the year, and that the draft EIS did not discuss production of invertebrates or fish, both of which can be dramatically affected by alterations to natural temperature regimes. Interior comments that altered temperatures reduce species richness downstream of the dams because warmer than average winter temperatures can reduce or remove the thermal cues needed by eggs of many species to break diapause. Interior also comments that cooler summer temperatures may preclude the completion of development in some species; change the pattern of growth and development, or cause life cycles to lose synchrony, which may affect insect emergence. Interior recommends that the EIS address the combined effect of temperature and biological productivity on invertebrate and fish communities in and below the project.

Response: The seasonal shift in the temperature regime caused by thermal inertia of the large volume of water in Brownlee reservoir is likely to cause some change in the aquatic species assemblage that occurs downstream of the project. However, we conclude that not all effects of the altered temperature regime are adverse, as implied by Interior. Many aquatic species benefit from a more stable temperature regime, which incorporates thermal characteristics more similar to the Thousand Springs section of the Snake River, which historically provided a highly productive habitat for fall Chinook salmon. However, we revised the Staff Alternative in the final EIS to include two additional measures that would help to determine, and address, project effects on aquatic invertebrates. As we describe in section 5.2.4.11, *Invertebrate Monitoring*, we recommend that Idaho Power develop and implement a plan to evaluate the effects of project operations and water quality measures on invertebrate production, and on sensitive mollusks. The plan would include provisions for annual monitoring reports, updating the monitoring plan at 5-year intervals, and evaluation of whether additional measures are warranted to address project effects, based on monitoring results. We also recommend that Idaho Power develop a plan to install continuous water quality monitoring equipment within 5 miles downstream from Hells Canyon dam and collect spot measurements of water quality at additional locations to monitor the extent of downstream effects.

Comment WQL-32: AR/IRU state that staff's implication that high phosphorous levels may derive from natural processes because of naturally high phosphorus in south-eastern Idaho is misleading, and notes that most of the phosphorus present in the Snake River derives from anthropogenic sources. They comment that the assessment of primary productivity lacks an evaluation of community production/respiration ratios. They indicate that measurements taken on a 24-hour basis would likely show more non-compliance with DO water quality standards, and that figure 28 of the draft EIS would likely look quite different had the samples been acquired at around 4 a.m.
Response: We revised the text of section 3.5.1.3, *Biological Productivity*, to emphasize the anthropogenic sources of most nutrients. We concur that diurnal measurements provide a better representation of actual conditions than mean values. However, plots of DO in outflows from Hells Canyon reservoir measured at 10-minute intervals (Myers et al., 2003c) show DO concentrations similar to those in draft EIS figure 28 (final EIS figure 31) , indicating that DO concentrations of water drafted from deep in Hells Canyon reservoir remain similar throughout the day.

Total Maximum Daily Load

Comment WQL-33: AR/IRU comment that FERC's assumption that water quality standards will be fully met within a few years of license issuance is flawed. They state that this assumption ignores the fact that TMDLs are voluntary for non-point source polluters, and that the TMDL notes some pollutants will not be fully implemented for decades. AR/IRU indicate that it is unlikely that there will be significant movement toward TMDL implementation for at least another 20 years, and it is unlikely that the TMDL will be even close to fully implemented by the time a new license for the project expires. As a result, AR/IRU state that DO is likely to be a problem for decades to come. AR/IRU also comment that the proposed structures will not prevent TDG levels from exceeding 110 percent at high flows, and that TDG problems will be exacerbated if Idaho Power undertakes the proposed air injection at Hells Canyon dam.

Response: We did not suggest in the draft EIS that water quality standards would be fully met within a few years. In the discussion of cumulative effects on water quality (section 3.5.3), we stated that implementation of TMDLs for the Snake River and its tributaries and any tributary restoration efforts conducted by Idaho Power would result in a slow, long-term decline in loadings of sediments, and that gradual improvements would be expected to continue through the license term. We revised the text of the final EIS to note that IDEQ and ODEQ anticipate that it would take up to 70 years to reduce nutrient levels to the target levels set in the TMDL.

Comment WQL-34: The Umatilla Tribes and Nez Perce Tribe comment that the actions that will be taken to correct the DO problem become very difficult to follow in the draft EIS. They also comment that the draft EIS is deficient in specifying any timetable for completing, planning, and actually doing any implementation. The Umatilla Tribes and Nez Perce Tribe recommend that the EIS's preferred alternative be revised to require the expedited implementation of plan measures to increase DO within and downstream from the project. The plan would outline a specific scope and schedule and would be developed in consultation with and approved by tribes and the state and federal resource agencies.

AR/IRU comment that FERC's proposed DO plan is much too vague and gives Idaho Power too much discretion. Specifically, AR/IRU state that FERC should specifically require Idaho Power to meet its water quality obligations upstream, downstream, and within the project.

Response: Prior to issuance of the draft EIS, Idaho Power proposed to improve DO conditions within the Hells Canyon Project by injecting an average of 1,125 tons of oxygen during the summer into the transition zone of Brownlee reservoir. Idaho Power also proposed to install and operate turbine-venting systems in Brownlee units 1 through 4 and to evaluate the feasibility of implementing turbine-venting technology at Brownlee unit 5, but subsequently withdrew this proposal. In its January 31, 2007, application for water quality certification, Idaho Power proposes to meet its TMDL DO load allocation in Brownlee reservoir either by installing an oxygen diffuser system in Brownlee reservoir or through upstream phosphorus trading. Idaho Power also proposes to aerate Hells Canyon outflows using a forced air (blower) system at the Hells Canyon powerhouse to add 1,500 tons per year of DO downstream during summer and fall, or to install a similar system or aerating runners at Brownlee dam if it can provide reasonable assurance that the DO targets below Hells Canyon dam would be met. Based on our assessment, we modified the Staff Alternative to include the evaluation of phosphorus trading or other nutrient reduction measures as a potential approach for Idaho Power to meet its DO allocation under the Snake River-Hells Canyon TMDL. We discuss our rationale for this measure in final EIS section 5.2.3.1, *Dissolved Oxygen Measures*. The plan would be developed in consultation with IDEQ, ODEQ, NMFS, Interior, IDFG, ODFW, and interested tribes; would be filed with the Commission within one year of license issuance; and measures approved by the Commission would be implemented as soon as practical.

Comment WQL-35: Interior agrees that there are many parties responsible for degraded water quality in the Snake River, but states that water flowing into Brownlee reservoir generally meets ODEQ and IDEQ standards for DO. Interior states that DO concentrations at mile 247 downstream of Hells Canyon dam would be the same or higher than those levels at mile 340 to mile 343 if not for presence of the project. With this as a basis, Interior recommends that the EIS be revised to discuss the opportunities for matching DO levels of Hells Canyon outflows with Brownlee reservoir inflows. Interior states that this would require more than one DO monitoring site, especially in the first 10 miles downstream from Hells Canyon dam.

The Umatilla Tribes and the Nez Perce Tribe disagree with FERC's claim that Idaho Power should be responsible only for the project's incremental changes to nutrients, temperature, and DO. To support this, the tribes state that slow flows and long water retention times in the reservoirs create conditions whereby nutrient and sediment loads produce poor habitat conditions in the reservoirs and reaches downstream from the project. The Nez Perce Tribe comments that the draft EIS fails to discuss mitigation for specific impacts associated with the afore-mentioned reservoir effects on water quality and the project's elimination of the anadromous fish runs.

Response: We recognize that the combination of high nutrient loads from upstream sources along with the reduction in assimilative capacity caused by converting the riverine environment into a reservoir system degrade water quality within and downstream from the project. The project also continues to block anadromous fish from historic habitat upstream of Hells Canyon dam. However, we note that without the project the high nutrient load would pass downstream and lead to greater water quality problems within and downstream of the lower Snake River impoundments.

IDEQ and ODEQ addressed the effect of the project's reservoirs on low dissolved oxygen in the Snake River-Hells Canyon TMDL, which specified a load allocation of 1,125 tons of DO per season, or the equivalent in pollutant trading, to Idaho Power for the project impoundments. As discussed above, we modified the Staff Alternative to include Idaho Power's proposal to evaluate nutrient reduction in upstream tributaries as a method for meeting the project's TMDL load allocations and other measures to enhance DO in the Oxbow bypassed reach and downstream from Hells Canyon dam. We also include in the Staff Alternative many measures that would benefit anadromous fisheries, including: (1) continuation and improvement of Idaho Power's hatchery system; (2) Idaho Power's continued participation in the existing flow augmentation program for the Snake River to improve conditions for outmigrating smolts; (3) continued management of flows to benefit spawning and incubation of fall Chinook salmon; (4) various measures to improve water quality downstream from the project; (5) a program to enhance habitat conditions in key tributaries to the project; (6) monitoring the spawning success of surplus hatchery steelhead and spring Chinook that enter Pine Creek; and (7) monitoring to determine when water quality conditions upstream of the project have improved to a point where reintroduction of anadromous fish is warranted.

Comment WQL-36: ODEQ states that implementation of upstream measures may potentially provide more extensive (spatial and temporal) water quality and natural resource benefits than Idaho Power's proposal of aerating Brownlee reservoir to address its TMDL requirement. For this reason, ODEQ recommends that any upper basin measures that could be implemented by or through Idaho Power to address the project's DO TMDL requirement be explored.

The Umatilla Tribes and Nez Perce Tribe comment that on page 653 of the draft EIS the benefits from the Staff Alternative appear distorted. The Umatilla Tribes and Nez Perce Tribe indicate that the effect of the reservoirs is to significantly alter the seasonal thermal regime, trap sediments and pesticides, and exacerbate the DO problems by acting as a collection point for nutrients that stimulate algal growth. The

Tribes comment that the measures adopted by FERC may improve DO somewhat, but more needs to be done. They indicate that greater improvement could be achieved by combining aeration with nutrient reduction.

AR/IRU comment that the general tone of the draft EIS is dismissive of the importance of water quality concerns on the assumption that the new license and the TMDL will solve all water quality problems downstream of the dam. AR/IRU comment that FERC staff's analysis and recommendations related to funding TMDL implementation ignores the synergistic impact on water quality of upstream nutrients and the operation of the project. They also comment that FERC further compounds the problem by refusing to seriously consider comprehensive, basin-wide approaches (e.g., nutrient removal) to resolving water quality concerns in the Snake River. AR/IRU comment that the proposals to inject air or oxygen into Brownlee reservoir or at Hells Canyon dam are simply a band-aid, and that a much more cohesive approach to the problem would be to order Idaho Power to work cooperatively with upstream pollutant sources on nutrient removal efforts. AR/IRU state that reducing upstream pollutants would have a lasting effect throughout the system, as opposed to reservoir supplementation, which is temporary and limited in geographic scope. Thus, AR/IRU recommend that FERC should require Idaho Power to develop a nutrient removal program, or at a minimum, include this measure in one of the action alternatives in the next version of the EIS.

Response: We recognize there could be benefits associated with funding water quality improvements upstream of the project. However, because the project has no direct nexus with upstream water quality conditions, we did not include measures to improve water quality in upstream reaches in the draft EIS. However, in the draft EIS we also concluded that the reservoir aeration system proposed by Idaho Power for Brownlee reservoir would provide a very limited, localized benefit. In its January 31, 2007, application for water quality certification, Idaho Power proposes to investigate phosphorus trading as an alternative method for meeting its load allocation under the nutrient TMDL. In the final EIS, we adopt this proposal as part of the Staff Alternative because we conclude that phosphorus trading represents an alternative approach to meeting Idaho Power's TMDL responsibility that could provide a broader array of environmental benefits. In the application for water quality certification, Idaho Power also proposed using a forced air (blower) system at Hells Canyon powerhouse to aerate Hells Canyon outflows, and installation and operation of a destratification system in the Oxbow bypassed reach. We also adopt these proposals as part of the Staff Alternative, in the final EIS, since we conclude that they would adequately compensate for adverse effects of the project in the Oxbow bypassed reach and the reach downstream of Hells Canyon dam. In addition, we revised the Staff Alternative to include the development of a DO enhancement plan, in consultation with stakeholders, that would identify and evaluate alternative approaches for meeting Idaho Power's DO TMDL allocation. This evaluation would include measures that could benefit water quality upstream of as well as within and downstream of the project. We specify that the plan should include an evaluation of the benefits of reducing nutrient and organic matter loadings from upstream tributaries. We evaluate these benefits in sections 3.5.2.2, 3.5.2.5, 3.6.2.2, *3.6.2.5*, and 5.2.3.1 of the final EIS.

Comment WQL-37: Idaho Power states that it supports the staff recommendation that Idaho Power develop a DO enhancement plan that would determine whether reservoir DO supplementation is the most beneficial method to improve DO levels within and downstream of the project, and notes that the plan would need to be consistent with the water quality certification. NMFS indicates that it does not oppose the concept of an overarching DO plan, unless it would needlessly delay mitigation for this impact beyond the period that NMFS recommended.

Interior comments that the Staff Alternative in the draft EIS includes a recommendation that Idaho Power develop a plan to determine whether reservoir DO supplementation is the preferred method for meeting Idaho Power's TMDL DO allocation while also including Idaho Power's proposal to supplement DO in the transition zone of Brownlee reservoir. Based on the results of Idaho Power's simulation models showing that oxygen injection will have no effect on DO outside of Brownlee reservoir, Interior sees no need to develop a plan, as outlined in the Staff Alternative.

The Umatilla Tribes and the Nez Perce Tribe state that FERC's recommendation for a DO plan is needlessly delaying implementation of DO remedies based on uncertainties in cost effectiveness and the need for confirming DO load allocations, even though the costs and TMDL load allocations have already been calculated.

Response: Because the water quality certification conditions would need to be incorporated into any new license for the project, Commission staff will review its recommendation for a DO enhancement plan to ensure that it is consistent with the water quality certificate. Interior may have misunderstood our recommendation. Idaho Power would be required to first develop a DO enhancement plan to address the project's adverse effects on DO levels, then to implement measures required by the Commission, and then monitor the effectiveness of the measures implemented. We revised section 5.2.3.1, *Dissolved Oxygen Measures*, to indicate that our recommended DO enhancement plan should be developed and filed with the Commission within 1 year of license issuance, and that measures approved by the Commission should be implemented within the periods specified by the Commission.

Comment WQL-38: Interior states that Idaho Power and the resource agencies recognize the seasonal DO deficit within the project as a critical problem for aquatic resources that must be addressed. Interior states that the Staff Alternative does not provide adequate measures and assurances that will increase DO downstream of Hells Canyon dam. Interior states that the following measures would help ensure DO levels are adequate to protect aquatic life:

1. Analyzing the more protective DO standard (Oregon's instead of Idaho's) of an instantaneous minimum of 6 mg/L DO as the appropriate criteria for conservation of resident and anadromous salmonids;
2. Providing a greater degree of assurance that DO supplementation will occur so as to protect listed and sensitive aquatic species downstream of Hells Canyon dam;
3. Including and more thoroughly analyzing the information provided in addenda documents addressing DO, temperature, and TDG, along with analyzing their costs and effectiveness; and
4. Including monitoring to evaluate the effectiveness of the DO measures implemented and requiring Idaho Power to take additional measures to ensure that DO is increased to reaches downstream of Brownlee dam, if needed to correct the dissolved oxygen deficit created by the project.

Response: We do not recommend that the new license require Idaho Power to achieve DO targets or criteria downstream of Hells Canyon dam, because factors not under the control of Idaho Power also contribute substantially to low DO levels both within and downstream of the project. Instead, we focus our evaluation on comparing the costs and benefits of alternative approaches for addressing project effects on water quality, and for enhancing aquatic resources within and downstream of the project. We revised the text of section 5.2.3.1, *Dissolved Oxygen Measures*, to clarify that we recommend developing and implementing a DO enhancement plan in consultation with interested stakeholders and filing the plan with the Commission for approval. The plan would include appropriate monitoring provisions to identify the need for new or modified measures, if warranted based on monitoring results.

In draft EIS section 3.5.2.2, *Dissolved Oxygen*, we discussed potential measures to address low DO levels. These included using a reservoir diffuser system and oxygen supply facility to supplement DO in the transition zone of Brownlee reservoir, reduction of nutrient and organic matter loadings from tributaries, Brownlee and Hells Canyon turbine venting systems, and forced air blowers at Brownlee. We modified this discussion in the final EIS to include additional measures discussed by Idaho Power in its January 31, 2007, application for water quality certification. Idaho Power's water quality certification application addenda documents, dated March 2006, present information on a number of potential measures to address DO and TDG. Most of this information was previously provided by Idaho Power in its responses to the Commission's AIRs, which we included in the draft EIS. Parties desiring a more detailed description of potential alternatives or their cost can refer to: (1) Idaho Power's responses to AIR WQ-1, *Dissolved Oxygen Augmentation* and AIR WQ-2, *Temperature Control*, which can be obtained from FERC's eLibrary system web page (http://www.ferc.gov/docs-filing/elibrary.asp); and/or (2) the addenda documents that were filed with the Commission on April 12, 2006, which can also be obtained from the Commission's eLibrary system.

Comment WQL-39: AR/IRU state that Idaho Power's proposed Brownlee reservoir oxygen supplementation will raise DO in only a very small geographic area, hence it will benefit only a very small number of aquatic species that enter that area. They also state that the draft EIS does not address whether the bubbler would increase the risk of mobilizing toxins, such as methylmercury, other trace metals, and ammonia. AR/IRU recommend that FERC address these issues in the final EIS.

Response: In draft EIS section 3.5.2.2, *Dissolved Oxygen, Reservoir Supplementation*, we discussed potential changes in ammonia, mercury, and organochlorine compounds that are expected to occur from the proposed reservoir aeration system. We revised this section of the final EIS to better describe the potential for the proposed reservoir aeration system to mobilize toxins associated with sediments deposited on the reservoir's bottom. In the same section, we also concluded that the proposed reservoir oxygen supplementation system would increase DO levels in a very limited portion of Brownlee reservoir, and this limited benefit was the primary reason that we recommend adopting Idaho Power's proposal to evaluate phosphorus trading as an alternative approach for meeting its obligation under the Snake River-Hells Canyon TMDL.

Comment WQL-40: Interior comments that the draft EIS states that Idaho Power's modeling indicates that injecting air into the Brownlee dam generating units would elevate TDG levels. Interior recommends that the EIS analyze and discuss the benefits and cost effectiveness of this and other options to improve DO conditions in the context of an adaptive management approach. Interior also recommends that Idaho Power and other agencies and tribes work together to implement an action to address DO issues in a way that benefits aquatic habitats affected by the project, without adversely affecting aquatic life by elevating TDG to harmful levels.

Response: In the Staff Alternative, we recommend that Idaho Power work with agencies and tribes to implement appropriate actions to address DO issues in a way that benefits aquatic habitat, but does not adversely affect aquatic life by elevating TDG to harmful levels. This would be accomplished through the development and implementation of our recommended DO enhancement plan.

Comment WQL-41: ODEQ comments that injection of 125 tons of oxygen per year into the turbine discharge of Hells Canyon dam to address project effects on DO levels in the lower river during the late summer and fall may be deemed insufficient for water quality certification. ODEQ comments that there should be additional evaluation of this proposal. AR/IRU comment that FERC accepted Idaho Power's own assessment of its mitigation obligations for air injection at Hells Canyon dam, without any corroborating information. It states that the amount of oxygen injected should be determined by the Technical Advisory Committee based on water temperature and how much DO depletion has occurred. To facilitate this, AR/IRU recommend that Idaho Power conduct real-time monitoring and use the monitoring results to determine the appropriate timing for Idaho Power to inject oxygen at Hells Canyon dam. In addition, AR/IRU state a concern about the potential for the Hells Canyon dam air blower to increase TDG problems downstream from the dam, and emphasize their preference for injecting oxygen over atmospheric air.

Response: In the draft EIS, we did not simply accept Idaho Power's own assessment of its mitigation obligation for air injection at Hells Canyon dam, but instead recommended that Idaho Power consult with IDEQ and ODEQ on the amount of oxygen that would need to be injected to meet its TMDL allocation, as discussed in draft EIS section 5.2.3.1, *Dissolved Oxygen Measures*. In its January 31, 2007, application for water quality certification, Idaho Power estimated that the project's maximum responsibility for low DO downstream of Hells Canyon dam is 637 tons of oxygen per year, and proposed to add 1,500 tons of oxygen per year downstream from Hells Canyon dam by aerating the Hells Canyon turbines or alternatively aerating the Brownlee turbines. We continue to recommend that Idaho Power consult with IDEQ and ODEQ on the amount of oxygen that would need to be injected to meet its TMDL allocation. We also recommend a monitoring plan that could be used to determine the appropriate timing for oxygen supplementation efforts. We discuss the potential for injection of atmospheric air at Hells Canyon dam to increase TDG to levels above the 110-percent TDG criterion in final EIS section 3.5.2.2, *Dissolved Oxygen*.

Comment WQL-42: Interior states that all of the project dams have bottom-releases, which result in discharges of DO levels well below standards set by IDEQ and ODEQ. The draft EIS states that "Idaho Power's evaluation of increases in DO show that baffles cannot induce additional airflow and thus would be ineffective at increasing DO levels," but it does not cite such studies.

Response: As described in the draft EIS, Idaho Power's evaluation of the potential for using baffles at Brownlee shows that the units cannot induce additional airflow and thus would be ineffective at increasing DO levels. We amended the text in section 5.2.3.1, *Dissolved Oxygen Measures*, to include the citation for Idaho Power's study.

Comment WQL-43: The Umatilla Tribes and the Nez Perce Tribe indicate that it is important that water quality monitoring stations for TDG, temperature, DO, nitrogen, ammonia, organic pollutants and metals be established above the project, as well as within and downstream from it. Interior states a concern about a time lag between issuing the license and implementing monitoring that would be agreed to through the consultation process called for in ODFW-58. Interior states that if no monitoring occurs until the consultation process is complete, as recommended by the Staff Alternative, valuable data that would aid in understanding the effectiveness of water quality improvement measures required by the license would be forgone. Interior recommends that the EIS be revised to include an alternative that incorporates provisions of its recommendation no. 41 (Interior-67 in the draft EIS) prior to beginning the monitoring called for in Oregon's recommendations (ODFW-58 in the draft EIS).

Response: We revised the Staff Alternative to include provisions for establishing a station for continuously monitoring water quality parameters within 5 miles downstream from Hells Canyon dam, as well as obtaining spot measurements of water quality upstream of Brownlee reservoir and at multiple locations downstream from Hells Canyon dam. Although additional water quality data could be collected during the development of our recommended DO enhancement plan, many years of data already exist to describe DO conditions under existing operations. Therefore, we conclude that water quality monitoring is not critical during this period. However, we encourage Idaho Power to continue consultation with stakeholders to determine appropriate monitoring measures and to initiate monitoring measures as soon as practical. If IDEQ or ODEQ require immediate monitoring of water quality as a condition of their water quality certification, the Commission would be required to include this condition in any license issued for the project.

Comment WQL-44: Interior clarifies that its recommendation, measure Interior-66, does not address the scope of measures that are needed to increase DO downstream from the project. Rather it is specific to monitoring the response of the aquatic community before, during, and after supplementation to provide useful information for adaptive management purposes. Interior recommends that the EIS be revised to reconsider adopting Interior-66 as part of the Staff Alternative.

Response: We concur with the need to monitor the effectiveness of measures to facilitate adaptive management. In the final EIS, we recommend that Idaho Power develop plans to monitor (1) water quality within and downstream of the project, (2) the effects of project operations and environmental measures on invertebrate production and populations of rare and sensitive mollusks, and (3) the effects of flow fluctuations on stranding and entrapment of fall Chinook salmon and bull trout. All of these plans include provisions for adaptive management based on monitoring results. There are two aspects of Interior-66 that we do not adopt. First, we do not adopt the establishment of specific study durations for sampling in each study phase, because we conclude that a well designed study program, with a year or more of baseline data, should be sufficient to document changes in the invertebrate community prior to DO implementation, and we expect that the schedule for implementing DO enhancement measures will be established in the section 401 certificate. Second, we do not adopt monitoring ramping rates within 1 mile of Hells Canyon dam because the installation of spillway deflectors will divert energy downstream and make this location unsuitable for compliance measurement, and because doing so without adjusting ramping rates to account for the change in measurement location would cause a substantial reduction in the ability of the project to meet changes in energy demand.

Comment WQL-45: Interior comments that the draft EIS does not acknowledge that low DO levels caused by continued operation of the project downstream from Oxbow and Hells Canyon dams cause habitat loss for aquatic species other than fall Chinook salmon. It states that all native aquatic species including bull trout, redband trout, and white sturgeon, in addition to the invertebrate fauna present in riverine sections of the Snake River, need improved DO conditions Interior recommends that the DO analysis of the EIS include other native species, and that it consider additional environmental measures to improve conditions for rare, sensitive, or declining species in the Oxbow bypassed reach, Hells Canyon reservoir, and in the Snake River downstream from the Hells Canyon dam. It states that such measures could include injecting liquid oxygen at Hells Canyon dam to improve DO immediately downstream of the dam and the use of hydraulic spillway deflectors to reduce TDG in a wider range of flow conditions.

Response: We discuss the potential effects of low DO on white sturgeon downstream from Hells Canyon dam in draft EIS section 3.6.2.2, *Dissolved Oxygen*, and we expanded this section in the final EIS to include a discussion of potential effects of low DO on bull and redband trout. In the final EIS, we include in the Staff Alternative the development of a DO enhancement plan that would evaluate alternative approaches to meeting Idaho Power's DO TMDL allocation, including measures that would benefit water quality and improve habitat conditions upstream of, within and downstream from the project. The efficacy and cost-effectiveness of hydraulic spillway deflectors could be evaluated as part of our recommended TDG abatement plan.

Comment WQL-46: Interior comments that the draft EIS does not include any discussion of the environmental effects of low DO in the project reservoirs or in the Snake River downstream of Hells Canyon dam on bull trout. It states that bull trout have been documented in Hells Canyon and Oxbow reservoirs, as well as downstream from Hells Canyon dam during periods when low DO levels associated with project operations may occur. It also states that analysis of the potential effects on this federally listed species is essential to a complete consideration of environmental effects of the project.

Response: We expanded section 3.6.2.2, *Dissolved Oxygen*, to include a discussion of the potential effects of low DO on bull trout in the Oxbow bypassed reach, in project reservoirs, and downstream from Hells Canyon dam.

Comment WQL-47: Interior expresses concern about the potential adverse effects of low DO on sturgeon, including potential effects on fecundity and exposure of juvenile sturgeon to predators or pathogens. AR/IRU state that staff's sturgeon recovery requirements should not be tied to the assumption that there would be no water quality problems for sturgeon by the time hatchery sturgeon bound for the Swan Falls reach are of reproductive age. AR/IRU state that uses staff's faulty logic for dismissing any concerns about water quality effects on hatchery sturgeon, and that the faulty logic contradicts staff's logic for rejecting passage of fall Chinook salmon.

Response: We revised section 3.6.2.2, *Dissolved Oxygen*, to include a discussion of adverse effects of low DO on white sturgeon within and downstream of the project. Our recommendation in the draft EIS to supplement the sturgeon population in the Swan Falls to Brownlee reach is based on sound logic, and it does not conflict with our conclusion that water quality conditions are not likely to support fall Chinook salmon in this reach in the near future. Even if nutrient targets in the TMDL take many decades to attain, implementing a stocking program to build sturgeon stocks in the reach could provide a substantial benefit to tribal subsistence and ceremonial fisheries and to recreational fisheries more rapidly than through the alternate path proposed by Idaho Power, which involves conducting water quality studies to be followed by the translocation of small numbers of adult sturgeon from other reaches. Because only a small proportion of sturgeon spawn in any given year, the small number of adults that would be available in early years of a translocation program would not allow for successful reproduction and recruitment to occur in all years. A supplementation program could easily seed the habitat to its capacity within a much shorter period of time and at relatively little cost, and with less adverse effect on the donor population

Comment WQL-48: Interior states that improving water quality and/or habitat conditions immediately downstream of Hells Canyon dam is a critical step in contributing to the survival and recovery of salmonids, including fall Chinook salmon and bull trout. Interior recommends that the EIS be revised to address the fact that the biotic community downstream from Hells Canyon dam lacks the vigor and diversity expected in such a stream system, and examine causative factors, in addition to water quality, such as flow and stage fluctuations from operations. Interior also recommends that if there is sufficient information to conclude that downstream impacts are due strictly to hypoxic conditions, the EIS should contain one or more alternatives that describe and analyze DO supplementation measures for the Hells Canyon reach.

Response: We modified section 5.2.3.1, *Dissolved Oxygen Measures*, by recommending that Idaho Power develop a DO enhancement plan in consultation with stakeholders that would evaluate alternative measures to meet Idaho Power's DO load allocation within and downstream of the project, and identify a preferred approach for implementation. In addition, we modified section 5.2.4.11, *Invertebrate Monitoring*, to require Idaho Power to develop and implement an invertebrate monitoring plan, in consultation with the state and federal fisheries agencies that would assess the ecological effects of water quality conditions and project operations on invertebrate production and on rare and sensitive species of mollusks. The plan would require annual reporting of the results of monitoring efforts, a description of any recommended adjustments to the monitoring effort, and a description of any measures that are proposed by Idaho Power or recommended by the resource agencies or tribes to address the effects of the project.

Comment WQL-49: The Forest Service comments that the DO aeration system proposed for Brownlee reservoir, if it is effective at all, would likely provide only limited refugia for fish to reduce the intensity of fish kills in Brownlee and would not serve to address larger, basin-wide, pollution problems or increase DO concentrations downstream of the project within the Wild and Scenic Snake River. The Forest Service recommends that the EIS either include in the Staff Alternative the upstream water quality fund recommended by NMFS or delete references to TMDL attainment within the new license term. Interior comments that supplementation of DO in Brownlee reservoir may have limited success in correcting or significantly improving periodic conditions of hypoxia both within the reservoir and downstream. Interior comments that turbine venting or forced-air injection into turbines, as proposed for Hells Canyon dam, is far more likely to provide measurable improvement in water quality to the reach downstream of Hells Canyon dam. Interior states that the Commission needs to undertake a more active effort to plan for and implement such water quality measures at Hells Canyon dam, and recommends that this be included in the EIS. Interior also recommends that the EIS include a "road map" for implementing this measure as part of one or more alternatives.

Response: We recognize that the Brownlee reservoir aeration system would provide a very limited benefit, and in the final EIS, we adopt a DO enhancement plan that would evaluate alternative measures to meet Idaho Power's load allocation under the TMDL, which would include consideration of upstream nutrient reduction measures. The plan would be filed with the Commission within 1 year of license issuance, and any measure required by the Commission would be implemented as soon as practical. We revised section 5.2.4.3, *Anadromous Fish Restoration*, to clarify that upstream water quality would improve slowly as the TMDL is implemented.

Comment WQL-50: AR/IRU comment that FERC fails to consider continuing and/or cumulative impacts of project operations over time, and that continuing effects can cause further degradation of the resource. They state that having Idaho Power restore conditions in tributaries as a pollution-trading measure could improve the quality of source water to the Oxbow bypassed reach, but that FERC does not include such a pollution-trading scheme in any of its action alternatives.

Response: Our analysis is based on a No-action Alternative baseline, which includes continuation of numerous environmental effects. Although not necessary for our comparison to the No-action Alternative, we describe cumulative effects on water quality in section 3.5.3, *Cumulative Effects*. As we discuss in our response to comment WQL-36, we modified the Staff Alternative in the final EIS to adopt

Idaho Power's proposal to evaluate the potential to pursue phosphorus trading as an alternative approach for meeting its TMDL allocation

Hazardous Materials

Comment WQL-51: AR/IRU comment that the draft EIS wrongly asserts that Idaho Power holds NPDES permits because it does not have an NPDES permit for its Brownlee powerhouse discharges. They state that Idaho Power previously held an NPDES permit for sewage discharges at Brownlee, but that permit has long since expired and it specifically prohibited any discharge of oil or grease. They hold that Idaho Power's admitted oil discharges from Brownlee, however small, are in direct violation of Idaho Power's previously held NPDES permit. AR/IRU comment that before FERC can issue a new license to the project, it must ensure that Idaho Power has complied with all applicable regulatory requirements, including the requirement that any and all pollutant discharges are covered by an NPDES permit, including oil discharges from Brownlee.

Response: In table 6.1-13 of its January 31, 2007, application for water quality certification, Idaho Power shows that it has NPDES permits for cooling water and sump water at all three project developments. NPDES permits are not required prior to issuance of any license.

Comment WQL-52: AR/IRU comment that DO, temperature, ammonia, and trace metal levels are all closely tied and changes in one parameter will cause changes in the others. They comment that the draft EIS states that in some years the augmentation flow will have some benefit for DO, but will never benefit ammonia or trace metals. AR/IRU state that there is an inverse relationship between oxygen tension and the presence of ammonia and soluble trace metals, and thus there will always be a decrease in ammonia and trace metals if there is an increase in DO.

Response: Idaho Power's modeling indicates that flow augmentation would result in the anoxic layer being at a slightly lower elevation than under the Proposed Operations. However, it would have little effect on the amount of near-bottom water that would be anoxic. Because production of ammonia and soluble metals from deposits on the reservoir's bottom is controlled by the extent of anoxic conditions at the water/substrate interface, we conclude that flow augmentation would not result in substantially different production of ammonia or soluble metals, compared to Idaho Power's proposed operations.

Comment WQL-53: ODFW states that sturgeon are particularly susceptible to exposure and bioaccumulation of contaminants due to a number of factors, including poor water quality conditions between Swan Falls and Hells Canyon dams, long-life span, late age at maturation, their use of benthic habitats, and position at the top of the food chain. ODFW states that without financial assistance, significant water quality improvements that would substantially reduce the level of legacy contaminants over the term of the new license will not occur. ODFW also recommends site-specific analysis of white sturgeon to determine potential effects of contaminant bioaccumulation on reproductive success and recruitment. Interior recommends that the EIS clarify that supplementation with hatchery sturgeon does not resolve or eliminate risks associated with degraded water quality downstream from Hells Canyon dam. Interior recommends that the issue of contaminant monitoring be reconsidered, in terms of both monitoring the overall health and threats to the sturgeon population and evaluating the likelihood of success of the hatchery program in supplementing wild populations.

Response: We re-evaluated this issue in the final EIS and conclude that implementing the TMDL would result in negligible reduction in bioaccumulation of toxic contaminants for at least 20 years. We also conclude that monitoring bioaccumulation in white sturgeon in a non-lethal manner would aid in determining the effects of contaminant bioaccumulation on reproductive success and recruitment, while minimizing adverse effects to the population. Although Idaho Power does not bear responsibility for the introduction of these contaminants into the environment, slow water in the project reservoirs causes the deposition and retention of contaminated sediments, increasing the exposure of sturgeon to contaminants. Monitoring contaminant bioaccumulation in sturgeon could aid in managing sturgeon by providing a better understanding of the effect of contaminants on the sturgeon population, including potential effects on reproductive success. Therefore, we recommend that Idaho Power, if requested by IDEQ or ODEQ, collect sturgeon tissue samples during its proposed population assessments, and provide them to the state agencies for their use in analyzing bioaccumulation of contaminants. We amended section 5.2.4.10, *Sturgeon Conservation Measures*, accordingly.

Comment WQL-54: ODFW states that even though the Staff Alternative in the draft EIS does not include habitat enhancements or support a water quality fund, Commission staff makes no recommendation for a contingency plan if water quality improvements are slow to occur or do not occur.

Response: As noted above, we revised the Staff Alternative to include development of a DO enhancement plan, in consultation with stakeholders, that would evaluate alternative approaches for meeting Idaho Power's TMDL DO allocation. The evaluation would include measures that could benefit water quality upstream of as well as within and downstream of the project. We expect that the water quality certificates to be issued by Oregon and Idaho will include appropriate provisions for monitoring and adaptive management to provide reasonable assurance that DO allocations will be fulfilled and that water quality criteria will be met within and downstream of the project in a timely fashion.

Total Dissolved Gas

Comment WQL-55: Idaho Power provides an update on it estimated 10-year, 7-day average flood flows (7Q10) for both Hells Canyon and Brownlee dams and recommends that the final EIS present the more recent estimates.

Response: We revised the text of section 3.5.2.3, *Total Dissolved Gas*, to reflect this new information.

Comment WQL-56: NMFS states that draft EIS tables 23 and 24 suggest that under Scenario 2 (flow augmentation), there would be a slight increase in the frequency of discharges at Brownlee and Hells Canyon dams in excess of powerhouse capacity, thereby increasing the risk of exceeding the TDG limit. NMFS comments that this is a modeling artifact. NMFS comments that during high flow years, when aiming for a June 20 refill, Idaho Power, NMFS, and FERC would confer and likely delay refill as appropriate to avoid unacceptable risks from involuntary spill. NMFS states that while there is the potential for runoff prediction errors to result in "fill and spill" operations, it believes that this possibility would be virtually equal in all alternatives considered. NMFS recommends that FERC staff carefully review the model results to determine if careful in-season management would avoid this adverse effect.

Response: After reconsideration, we conclude that modeled flows likely over-predict the frequency of spill events, since predicted flows would be used to guide refill operations. We augmented the text of section 3.5.2.1, *Effects of Project Operations on Water Quality, Total Dissolved Gas*, to incorporate NMFS discussion of modeled flows and the procedure that would take place under Scenario 2 in high flow years, and also added this caveat to the table footnotes (FEIS tables 26 and 27). Under the Staff Alternative, Idaho Power would monitor TDG to determine whether it exceeds the 110-percent criterion, and implement appropriate measures to meet the water quality standard.

Comment WQL-57: ODEQ comments that additional details still need to be resolved pertaining to project-related impacts on TDG concentrations. These details include: (1) taking a closer look at potential excessive TDG concentrations caused by spill at Oxbow dam and measures that may be implemented to address them; (2) developing a monitoring plan; and (3) refining a TDG adaptive management plan and implementation schedule.

Response: The issues raised by ODEQ would be addressed during development of our recommended TDG abatement plan described in section 5.2.3.3, *Total Dissolved Gas Abatement*.

Comment WQL-58: AR/IRU comment that FERC staff's TDG alternative is too vague, in that it only requires that Idaho Power develop a plan to address TDG. They state that the analysis section of the draft EIS staff discusses the installation of flow deflectors at both Hells Canyon and Brownlee dams to reduce TDG, but makes no mention of flow deflectors in the Staff Alternative. They recommend that FERC be more specific in the final EIS about what measures are being considered in the Staff Alternative, and urge FERC to specifically require Idaho Power to install flow deflectors at Hells Canyon and Brownlee dams. Interior states that the levels of TDG observed within and downstream from the project are detrimental to aquatic resources, and necessitate more stringent and enforceable environmental measures. Also, Interior comments that the draft EIS does not clearly identify the staff's recommendations

Response: In section 5.1.1.2, *Staff Alternative*, there are two lists of staff-recommended environmental measures. The first list includes measures that are proposed by Idaho Power, some of which have been modified by FERC staff, and the second list includes measures that are based on agency, tribal, and NGO recommendations and our analysis. In the draft EIS, we recommended that Idaho Power install spillway flow deflectors at both Hells Canyon and Brownlee dams and that it develop and implement a TDG Abatement Plan. In the final EIS, we revised the text in section 5.2.3.3, *Total Dissolved Gas Abatement*, to include evaluation and selection of a TDG abatement structure for Oxbow dam.

Comment WQL-59: AR/IRU emphasize the adverse effects that project-caused elevated TDG have on out-migrating smolts and resident fish in the river, such as white sturgeon and bull trout. AR/IRU comment that it is likely that the technology does not exist to completely mitigate for the TDG impacts of the project as long as the project is in place. AR/IRU comment that FERC's reasoning behind its refusal to consider their recommendation to require Idaho Power to compensate for TDG impacts that cannot be mitigated directly conflicts with many of FERC's extremely open-ended and vague mitigation plans or requirements in the draft EIS. AR/IRU comment that it is imperative that Idaho Power provide some sort of compensation for this impact, in the form of other mitigation to protect the species that are harmed by TDG impacts (e.g., off-site habitat restoration and water quality measures). They recommend that the specifics of how the compensation program would look should be overseen by a Technical Advisory Committee.

Response: We emphasized the need for satisfying the TDG standards in a timely manner by recommending TDG abatement measures for all three project dams along with a TDG abatement plan to adaptively manage total dissolved gas. Specific measures recommended include Idaho Power's proposals to continue preferential use of the upper spillgates at Brownlee dam and install spillway deflectors at Hells Canyon dam, along with its intended spillway deflectors at Brownlee dam, evaluation/implementation of an appropriate TDG abatement measure for Oxbow dam, and an evaluation of the need for additional TDG abatement measures if warranted based on monitoring results. We conclude that the staff-recommended measures would satisfy the TDG standards, and therefore we do not include AR/IRU's recommended compensation program in the Staff Alternative.

Comment WQL-60: Interior observes that the draft EIS, on page 269, states that Idaho Power has observed few effects of TDG on fish. Interior comments that this statement minimizes the scientific and historic information on the acute and chronic adverse effects of elevated TDG levels on aquatic life. Interior recommends that the EIS provide information from the record that documents the potential for major problems for fish life, including fish kills and gas bubble trauma, in the Snake River caused by spill at the project, both as part of the Affected Environment, and as a basis for evaluating the effects of imposing or not imposing license conditions that mitigate the effects on fish from elevated dissolved gas levels resulting from the project.

Response: Idaho Power filed a study reporting the results of fish sampling conducted below Brownlee and Oxbow dams during spills, which found that a wide range of fish species showed evidence of GBT, especially when TDG levels exceeded 125 percent. We revised the text of section 3.6.2.3, *Total Dissolved Gas*, to reflect this information. In the final EIS, we also adopted additional measures to address gas supersaturation.

Comment WQL-61: The Forest Service agrees that spillway deflectors are necessary at Brownlee dam, but states that other modifications downstream of Brownlee dam, such as a flow separator wall, may also be necessary if the new flow deflectors do not achieve the desired results. The Forest Service recommends that FERC require Idaho Power to work with ODEQ and IDEQ to identify an adaptive management process for TDG attainment whereby monitoring data would be used to determine the need for additional measures should those in the Staff Alternative prove inadequate.

Response: We clarified our recommendation for adaptively managing TDG abatement in section 5.2.3.3, *Total Dissolved Gas Abatement*. This adaptive management process could result in Idaho Power constructing a flow separator wall downstream of Brownlee dam, if monitoring results document that the TDG standard is not satisfied.

Comment WQL-62: The Umatilla Tribes and Nez Perce Tribe indicate that they recommended that Idaho Power install gas abatement structures at both Hells Canyon and Brownlee dams in order to meet water quality standards within 5 years. The Umatilla Tribes and Nez Perce Tribe also recommended a TDG monitoring program. Although the Staff Alternative in the draft EIS supports these measures, the Umatilla Tribes and the Nez Perce Tribe state that additional measures will need to be implemented during the term of the new license if monitoring indicates that the measures are not adequate to meet the standards.

Response: As discussed in section 5.2.3.3, *Total Dissolved Gas Abatement*, we continue to recommend a TDG monitoring program. This program would document the need for any additional TDG abatement measures that are needed to address adverse effects.

Oxbow Bypassed Reach Flows

Comment WQL-63: Interior states that FERC staff's conclusion that water quality improvements cannot be realized with more water flowing through the Oxbow bypassed reach is not consistent with Idaho Power's analysis that determined that flows of 1,350 cfs completely mixed the stratified water that accumulated at mile 271.3. In addition, a 1960 order from the Federal Power Commission required a continuous flow of 1,000 cfs around the Oxbow Bypass to the fish trap facility at Oxbow dam. Upon evaluation of the 1,000-cfs flow, it was later determined that the minimum flow to be released through the Oxbow spillway and the spillway fish trap was to range between 250 and 750 cfs. Interior recommends that the EIS be revised to include the above minimum flows in an alternative that provides a greater level of protection of the ecological integrity of the Oxbow bypassed reach than Idaho Power's current 100-cfs proposal. Interior states that these flows should be the starting point in evaluating attraction flow needs for the Oxbow dam fish trap when it is built. Interior also notes that increases in DO would benefit listed species.

Response: We amended section 3.5.2.5, *Oxbow Bypassed Reach Flows,* and section 3.6.2.5, *Oxbow Bypassed Reach Flows*, to clarify that increasing spill flows at Oxbow dam may provide some increase in DO levels within the bypassed reach during the summer months. However, we note that water temperatures would continue to be very high regardless of the flow volume that is released into the bypassed reach. In addition, Idaho Power's radio telemetry studies indicate that bull trout move out of the bypassed reach into tributaries by mid-May, and would not benefit from increased DO levels during the summer months.

Cumulative Effects

Comment WQL-64: Interior observes that the draft EIS does not discuss the influence of wastewater discharges from industries and municipalities on the overall water quality in the project area. Interior recommends that source pollutants from recreational activities be mentioned in the general description of water quality, and that the EIS discuss the potential effect of recreation on beneficial uses of the project area.

Response: We revised the text in section 3.5.3, *Cumulative Effects*, to address these points. However, this did not alter our analysis or conclusions.

Comment WQL-65: Interior comments that the geographic scope described in section 3.2.1.2 of the draft EIS was to include the entire Snake River basin for water temperature and water quality. Interior recommends that the EIS be revised to include a more thorough discussion of the need to mitigate Hells Canyon TMDL loads, and include strategies to address these concerns as part of one of the alternatives for this project.

Response: In section 5.2.3.1, *Dissolved Oxygen Measures*, and section 5.2.3.2, *Water Temperature Measures*, we discuss the need for Idaho Power to consult with IDEQ and ODEQ on the estimate of project effects and the TMDL load allocation for DO and temperature. As part of the Staff Alternative, we include individualized plans to address project effects on DO, TDG, and water temperature. We amended section 5.2.3.1, *Dissolved Oxygen Measures*, to make it clear that we recommend that Idaho Power identify appropriate upstream phosphorus trading partner(s) and evaluate the benefits of reducing nutrient and organic matter loadings from upstream tributaries, as well as other approaches for meeting TMDL load allocations and water quality standards.

Comment WQL-66: Interior comments that the draft EIS discusses the cumulative effects of the project's operation, but does not stress the importance of cumulatively affected resources downstream of the project. Interior states that the injection of oxygen in Brownlee reservoir does little for listed fish in either Oxbow or Hells Canyon reservoirs or downstream from the project dams. Interior recommends that the EIS provide more complete information regarding the cumulative effects to listed fish species and invertebrates immediately below the project dams, particularly within the first 10 to 15 miles downstream of Hells Canyon dam.

Response: We discuss the potential effects of low DO on aquatic resources in the project reservoirs and downstream from Hells Canyon dam in section 3.6.2.2, *Dissolved Oxygen*. We expanded this section, however, to include a discussion of the potential effects of low DO on sturgeon, bull trout, and redband trout. We address the potential effects of low DO in the Oxbow bypassed reach on aquatic species in section 3.6.2.5, *Oxbow Bypassed Reach Flows.* In section 5 of the final EIS, we recommend that Idaho Power evaluate alternative approaches to meeting TMDL loads and water quality standards within and downstream of the project, including measures such as nutrient reduction that would provide water quality benefits upstream of the project. We also recommend a plan to monitor the response of aquatic invertebrate production and rare and sensitive mollusks to changes in project operations and to water quality measures included in the new license.

Comment WQL-67: Idaho Power comments that it disagrees with the draft EIS assertion that springtime temperatures need to be warmed to mimic natural conditions. Idaho Power recommends that the final EIS recognize that the cooler water being released from Brownlee dam under current operations is improving water conditions for spring migrants.

Response: We revised sections 3.5.2.4, and 3.6.2.4, *Temperature Control*, to clarify that the project acts to delay seasonal warming and cooling compared to those that would occur if the project had not been constructed, which may differ from pre-project conditions. However, this did not change our analysis or conclusions.

Comment WQL-68: AR/IRU comment that the draft EIS (page 160) does not address the full scope of unavoidable adverse consequences to water quality that cannot be mitigated. They state that these effects include creation and contamination of reservoir sediments, lost riverine function, and trace metals including methylmercury and ammonia.

Response: We modified section 3.5.4, *Unavoidable Adverse Effects*, to include these effects.

B9. AQUATIC RESOURCES

Comment AR-1: Idaho Power provides clarification of Idaho Power's participation to date in the regional effort to augment river flows during the juvenile migration season.

Response: We modified section 5.2.2.3 to reflect Idaho Power's clarifications.

Comment AR-2: ODFW and AR/IRU comment that Idaho Power has indicated that with a cost cap of \$2 million, 237 kaf could be provided in a majority of water years, while in the draft EIS, staff states that providing a flow release of 237 kaf would cost an estimated \$6.6 million. ODFW requests that FERC staff include a detailed analysis and discussion of its cost estimates for flow releases of 237 to 350 kaf, and why its estimate is considerably greater than Idaho Power's. AR/IRU comment that NEPA, the FPA, and the Northwest Power Act all mandate that FERC fully explain and support any cost estimates in an EIS.

Response: We requested additional model runs from Idaho Power in a conference call on February 8, 2007. These new runs provide an estimate of the combined effects of flood control, power generation, and flow augmentation on project economics. We use Idaho Power's revised estimate for the 237-kaf augmentation scenario in final EIS table 102. Idaho Power's latest estimate shows over \$2.4 million in lost energy benefits alone. Total benefit losses including dependable capacity and ancillary benefits would potentially exceed \$9.03 million. Under the 350 kaf augmentation scenario, additional lost energy benefits of \$1.34 million would result; however, these benefits would be partially offset by lower dependable capacity losses due to higher summer flows such that the overall benefits loss would be about

$0.62 million higher or $9.65 million.

Comment AR-3: The Umatilla Tribes and the Nez Perce Tribe comment that it is important for the new license to contain provisions that allow flood control operations to be modified based on improved forecasting tools and new Corps flood control assessments.

Response: We anticipate that any new license would include provisions for adjusting flood control operations based on changed circumstances or new information.

Comment AR-4: The Umatilla Tribes and the Nez Perce Tribe comment that their recommendation to shift a minimum of 110,000 acre-feet in flood control space from Brownlee reservoir to Lake Roosevelt in the March-through-May period during low to average flow years was not adopted as part of the Staff Alternative. They state that this shift is required by the 2000 and 2004 Federal Columbia River Power System biological opinions, and is included in the state and tribal fishery agencies' comprehensive plan, *Detailed Fishery Operating Plan with 1994 Operating Criteria*. However, they note that to meet Lower Snake River target flows in past years, the Corps has approached Idaho Power to engage in the flood control shift, but Idaho Power declined. The Umatilla Tribes recommend that the preferred alternative contain a recommendation that requires Idaho Power to engage in the spring flood control shift, particularly in a low runoff year, if the Corps and the fishery agencies and tribes determine it is appropriate to assist in meeting the lower Snake River spring flow targets.

The State of Idaho comments that it would be most efficient and constructive to use a cooperative approach for determining necessary flood control elevations in Brownlee reservoir on an annual basis. The State of Idaho, Idaho Power, and other regional interests should work collaboratively each year to review the Corps proposed flood control elevations and recommend operations that take into account the annual variation in water availability and migration timing of Chinook salmon and steelhead.

Response: Any major changes in flood control on a system-wide basis would require a NEPA analysis of both the Snake River and Columbia River facilities. Because flood control is a congressionally authorized purpose that falls under the purview of the Corps, the Corps would be the responsible federal agency to lead any NEPA process related to flood control shifts. The Corps would also lead any efforts to modify the approach to inter-agency collaboration. We did not change the text of the final EIS in response to this comment.

Comment AR-5: The Umatilla Tribes concur with retaining the current minimum flows of 6,500 cfs at Hells Canyon dam and 13,000 cfs at Lime Point. Based on their hydrological analysis, higher minimum flows during the summer for commercial and recreation would jeopardize storage necessary for fall Chinook spawning requirements in October in low flow years.

Response: We note the Umatilla Tribe's concurrence with the Staff Alternative that retains current minimum releases. We also note that preservation of storage water for fall Chinook salmon spawning requirements is a reason (among others) to retain current minimum Hells Canyon release levels.

Primary Production and Aquatic Macroinvertebrates

Comment AR-6: Interior comments that the draft EIS's extrapolation of area dewatered to assess impacts to the benthos and aquatic community is overly simplistic and does not take into account habitat type and quality, which it considers to be critical factors in assessing operational impacts to the ecosystem. It states that both Bailey (1974) and Brusven et al. (1974) document the benthic habitat in the Snake River as primarily comprising two major zones: the Ash Grey Zone (approximately 3.15 to 26.8 inches in depth) and the *Cladophora* Zone (greater than 26.8 inches). It reports that the Ash Grey Zone mostly comprises periphyton and is the most relied on by benthic grazers, while the deeper, *Cladophora* Zone, which comprises the filamentous green alga *Cladophora* sp., is of relatively low nutritional value to most aquatic herbivores.

Response: We revised the subsection on *Primary Production and Aquatic Macroinvertebrates* in section 3.6.2.1 accordingly. However, our review of the references cited by Interior indicate that the deeper *Cladophora* Zone, which is less affected by daily dewatering, also supports a substantial amount of invertebrate production.

Comment AR-7: Interior and AR/IRU reiterate their recommendation, and ODFW is supportive of, long-term monitoring of the benthic community to track ecological responses to changes in basin conditions, project operations, and implementation of aquatic resource enhancement measures, as well as to document mitigation or compensation needs.

Response: We revised the Staff Alternative to include a measure that would require Idaho Power to develop and implement an invertebrate monitoring plan to evaluate trends in the abundance and distribution of rare and sensitive species of mollusks, to evaluate the effects of load following operations on the food supply available to fall Chinook salmon and bull trout, and to determine whether additional operating constraints are warranted.

Comment AR-8: Interior comments that the new species of mollusk (*Taylorconcha insperata)* that was identified in the Hells Canyon reach should be regarded as sensitive and warrants greater consideration by the Commission and more consideration for future management. It states that *Taylorconcha insperata* and all but one other native mollusk are absent from the 12-mile reach immediately downstream from Hells Canyon dam. Interior considers the species' presence in the Snake River significant to the continuing survival of the species, and it does not regard these data to show the species to be "abundant." Interior states that use of the term "abundant" in the draft EIS misrepresents the status of this species within the project area. Interior also comments that the draft EIS does not present any data on potential project-related impacts to *T. insperata* and does not discuss measures to reduce or eliminate such impacts. It notes that Richards et al. (2005) provides data indicating that *T. insperata* becomes less abundant with increasing depth, placing this species at greater threat to load following operations.

Interior states that it is inconsistent for the Commission to recognize that "project operations have the potential to disturb rare plant populations or … the habitat that supports them" (draft EIS section 5.2.5.1, page 588), and for the Staff Alternative to include the proposed preparation of a "project-wide threatened, endangered, and sensitive species management plan," but to exclude such a discussion or plan for sensitive and/or rare aquatic mollusks that will be directly affected and whose habitat will be disturbed from project operations.

Response: We revised section 3.8.1.6, *Bliss Rapids Snail*, to include more information on the abundance and distribution of this species downstream from Hells Canyon dam. We revised the Staff Alternative to include the development and implementation of an invertebrate monitoring plan, which would include the assessment of effects on rare and sensitive species of mollusks.

Comment AR-9: Interior states that the draft EIS should address the effects of the project on the

narrowly ranging *Taylorconcha insperata* and the declining *Margaritifera falcata*.
Response: Richards et al. (2005) reported that no *Margaritifera* species were found in their survey effort, which was focused on the detection of rare and sensitive mollusk species in both reservoir and riverine habitats. As noted previously, we revised the Staff Alternative to include the development and implementation of an invertebrate monitoring plan, which includes continued monitoring and assessment of project effects on rare and sensitive species of mollusks.

Comment AR-10: Interior comments that the construction, operation, and maintenance of the project has completely closed historic corridors of migration from 93 miles of the Snake River for freshwater mollusk species, precluding natural immigration and emigration to and from mollusk populations in the numerous tributaries to the Snake River between miles 340 and 247. It recommends that the Staff Alternative include measures for the conservation and enhancement of sensitive, rare, and/or declining species of freshwater mollusks in the project area.

Response: We anticipate that measures to increase DO downstream of Hells Canyon dam will benefit rare and sensitive mollusks, and may over time improve the suitability of habitat for these species in the first 12 miles downstream of the dam, where they do not currently occur. The invertebrate monitoring plan that we include in the Staff Alternative, which would be developed in consultation with Interior, could include provisions for the reintroduction of rare and sensitive mollusks if the results of water quality monitoring indicate that habitat would support their reintroduction.

Comment AR-11: AR/IRU comment that given uncertainty about the distribution of Snake River snails, FERC should not assume the absence of Idaho springsnails from the Hells Canyon reach, and Bliss Rapids snails should be discussed in the final EIS.

Response: As reported in the draft EIS, neither of these species were found downstream of Hells Canyon dam during Idaho Power's surveys, although several individual snails were misidentified as Bliss Rapids snails during Idaho Power's initial survey efforts. Both of these species were found to be relatively abundant in reaches associated with Idaho Power's upstream mid-Snake and C.J. Strike projects. Given the relative abundance of these species in upstream locations, we consider it likely that these species would have been detected during Idaho Power's survey efforts if they occurred downstream of Hells Canyon dam. Nonetheless, the DO augmentation measures that we include in the Staff Alternative would benefit these species, if present, and our recommendation to continue invertebrate monitoring should assist with verifying the presence or absence of these species downstream of Hells Canyon dam.

Anadromous Fish Species

Comment AR-12: Interior recommends that FERC include and analyze the information, conclusions, and recommendations contained in the following Northwest Power Planning Council Subbasin Plans and use them to formulate additional licensing alternatives for the project: (1) Boise, Payette, and Weiser; (2) Burnt; (3) Grande Ronde; (4) Imnaha; (5) Lower Snake; and (6) Malheur.

Response: We expanded section 5.5.7, *Pacific Northwest Electric Power Planning and Conservation Act,* to include evaluation of the consistency with the Hells Canyon, Powder River, Burnt River, Middle Snake River, Bruneau, Owyhee, Malheur, Clearwater, Imnaha, Grande Ronde, Salmon, Lower Snake, and Boise, Payette and Weiser River subbasin plans. Nearly all of the fish and wildlife measures included in the Staff Alternative would assist with meeting biological objectives identified in the Middle Snake River, Hells Canyon, Powder River, and Burnt River subbasin plans. Monitoring water quality conditions upstream of the project and efforts to evaluate hatchery steelhead and spring Chinook salmon production in Pine Creek would contribute to the biological objective identified in the Boise, Payette, and Weiser Subbasin Plan to continue investigating the feasibility of restoring anadromous fish runs above Hells Canyon dam. Consulting with the agencies and tribes to determine the best use of surplus hatchery fish may result in development of recreational and tribal harvest fisheries upstream of the project, which would be consistent with the objective of the Malheur and the Boise, Payette and Weiser Subbasin Plans to compensate for lost opportunities to user groups related to diminished fish runs and ecological function. There is considerably less connection of proposed measures with biological objectives in the Imnaha, Grande Ronde, and Lower Snake River Subbasin Plans, although some measures, such as flow augmentation and TDG abatement, may improve conditions in the downstream migratory corridor for anadromous fish species.

Regarding Interior's recommendation that the subbasin plan recommendations be used to formulate additional licensing alternatives, we did not identify in the subbasin plans a separate agency alternative that would encompass the full scope of measures recommended by the different stakeholders. We therefore adopted our standard approach of evaluating the full range of recommended measures and combining the measures that stood on their merits into a comprehensive Staff Alternative to contrast with Idaho Power's licensing proposal.

Comment AR-13: NMFS comments that in its January 24, 2006, filing, it provided an analysis indicating that the Snake River upstream of Brownlee reservoir likely produced far more than the 214,000 fall Chinook salmon estimated by Idaho Power and reported in the draft EIS.

Response: We reviewed the assessment provided by NMFS, and compared it with Idaho Power's estimate. We agree that NMFS' estimate, which takes into account the account differences in habitat suitability upstream and downstream of the project, is likely more accurate than Idaho Power's estimate, which assumed that the number of fall Chinook salmon produced in each reach was proportional to the linear miles of river contained in each reach. We revised the text in section 3.6.1.3, *Anadromous Fish Species*, to reflect this information.

Comment AR-14: NMFS comments that in its January 24, 2006, filing, it provided its best assessment of the likely number of major population groups of fall Chinook salmon, spring/summer Chinook salmon, and steelhead that were extirpated with construction of the Swan Falls and Hells Canyon projects, both of which are owned by Idaho Power.

Response: We recognize NMFS expertise in this area and appreciate being notified that we had not included this information in the draft EIS. We revised the text in sections 3.8.1.3, *Sockeye Salmon*; 3.8.2.1, *Snake River Fall Chinook Salmon*; 3.8.2.2, Snake River *Spring/Summer Chinook Salmon*; and 3.8.2.4, *Snake River Steelhead*; to include this information.

Comment AR-15: NMFS comments that while it is true that salmon and steelhead must now migrate past eight mainstem dams located along the lower Snake and Columbia rivers to reach the ocean, NMFS's Northwest Region Science Center estimates that juvenile survival is, at present, equivalent to that observed in the 1960s when only four dams were present.

Response: We incorporated this information into final EIS section 3.6.1.3, *Anadromous Fish Species.*

Comment AR-16: NMFS comments that the description of juvenile fall Chinook salmon migration timing in the draft EIS is outdated and did not include the detailed information provided by NMFS in its January 24, 2006, filing. This information indicates that the median date of juvenile migration at Lower Granite dam has shifter earlier into the summer over the past 10 to 15 years.

Response: We incorporated this information into final EIS section 3.6.1.3, *Anadromous Fish Species.*

Comment AR-17: Interior and the Shoshone-Paiute Tribes provide additional information documenting that the historic distribution of Pacific lamprey in the Snake River extended upstream to Shoshone Falls, and included many of the Snake River's tributaries.

Response: We expanded our description of the historical range of Pacific lamprey in final EIS section 3.6.1.3, *Anadromous Fish Species.*

Comment AR-18: Interior recommends that FERC revise the draft EIS to include information on water quality, flow and operational issues that were discussed in the 1965 report entitled, "Fishery Problems Associated with Brownlee, Oxbow, and Hells Canyon dams on the Middle Snake River."

Response: The cited report by Haas (1965) focuses on the construction history of the Hells Canyon Project, and of the attempts that were made to maintain anadromous fish runs to areas upstream of the project. We summarized this history in section 3.6.1.3, *Anadromous Fish Species*, of the draft EIS. We found no other information in the report to be relevant to our analysis of water quality, flow, and operational issues, and therefore did not make any changes in the final EIS.

Passage and Restoration

Comment AR-19: NMFS comments that mitigation for impacts of Idaho Power's mid-Snake projects on anadromous fish should be added to the list of 11 principal issues that the draft EIS addresses. NMFS states that the draft EIS should be revised to elaborate on the effects of these projects on anadromous fish and to identify measures to mitigate for those effects that FERC would then incorporate into the project licenses.

Response: The Commission deferred the analysis of cumulative effects on anadromous fish until the Hells Canyon proceeding because the types of measures that could be warranted to benefit anadromous fish at the mid-Snake projects depends to a large extent on what measures are implemented at the Hells Canyon Project. If and when a new license is issued for the Hells Canyon Project or subsequent actions are taken to restore anadromous fish populations upstream of Hells Canyon dam, the license amendment process would be needed to consider whether additional measures are warranted at the mid-Snake projects.

Comment AR-20: NMFS and ODFW comment that there is no requirement in the FPA for anadromous fish reintroduction to occur only if there is a comprehensive plan. NMFS states that rather than developing a comprehensive reintroduction plan, NMFS has done what it typically does in FERC relicensing proceedings, and has provided its resource management goals and objectives for this relicensing. NMFS's goals for salmon and steelhead recovery in the Columbia River basin include: (1) avoid extinction and foster long-term survival and recovery of Columbia River basin salmon and steelhead and other species; and (2) conserve the ecosystems upon which salmon and steelhead depend, including watershed health. The Forest Service questions the position of Commission staff that continuation of hatchery operations by itself is adequate mitigation for the continued loss of natural production of anadromous fish from within and upstream of the project. The Forest Service states that staff, by relying on continued hatchery production as the sole mitigation for lack of passage at the project, has missed an opportunity to address habitat and natural production issues at one of the most significant human-made blockages for migratory fish remaining in the Columbia River System. AR/IRU recommend that the Commission require Idaho Power to immediately begin implementation of a spring/summer Chinook salmon and steelhead passage program and that the Commission require a detailed adaptive management process for studying and implementing passage of fall Chinook salmon.

Response: In our view, a decision to proceed with restoring salmon and steelhead to areas upstream of Hells Canyon dam could provide large-scale benefits, but may also have a wide array of societal consequences. A comprehensive planning effort is needed to bring these wide ranging concerns and interests together. This planning effort does not need to be linked to any specific licensing proceeding, because appropriate environmental measures can be implemented through the license amendment process at any time. Many of the measures that we include as part of the Staff Alternative could help lay the groundwork for this type of planning effort by: (1) providing relevant information; (2) improving habitat conditions in potential restoration areas; (3) constructing facilities that could be used to pass anadromous fish; and (4) increasing the number of fish available for restoration efforts. Measures in the first category include establishing a water quality monitoring station at the head of Brownlee reservoir; compiling water quality data from upstream parts of the basin; monitoring tributary habitat enhancements in the Burnt, Powder, Wildhorse, Indian, and Pine basins; monitoring habitat use by surplus hatchery steelhead and spring Chinook salmon in Pine and Indian creeks; and observing behavior and habitat use, as well as reproductive success, of surplus adult salmon and steelhead released in tributaries to support tribal and recreational harvest fisheries. Measures in the second category include tributary enhancements in the five basins listed above and DO enhancement measures that are implemented upstream of Hells Canyon dam. Measures in the third category include improvement of the adult trapping facility at Hells Canyon dam; installation of a trap and weir (operable year-round) in Pine Creek; and eventual installation of additional passage facilities at Oxbow dam, Indian Creek, and Wildhorse River. Measures in the fourth category include flow augmentation, continuation of the fall Chinook spawning and incubation flow program, measures to improve DO and TDG levels, implementation of seasonal ramp rate restrictions, and construction of a new hatchery on Yankee Fork in the Salmon River basin.

Comment AR-21: The Umatilla Tribes and the Nez Perce Tribe comment that FERC should require Idaho Power to conduct specific passage studies and stock evaluations to assess the feasibility of anadromous fish restoration. Both tribes note that they, as well as other stakeholders, recommended that Idaho Power fund, develop, and implement a salmon and steelhead reintroduction plan, in consultation with interested tribes and state and federal fishery agencies. Interior and the Shoshone-Paiute Tribe recommend that the final EIS evaluate and recommend studies using radio-tagged adult fall Chinook salmon to monitor the migration, spawning, and egg-to-fry survival upstream of Brownlee reservoir. NMFS comments that waiting to conduct biological studies until water quality is sufficient to support reintroduction would unnecessarily delay fish reintroduction by many years or decades. NMFS states that fish passage investigations at other major hydroelectric projects in the Pacific Northwest have proven to take considerable time and effort. ODFW recommends initiating studies of fall Chinook passage in the near term so that passage could occur as soon as the habitat is capable of supporting fish.

Response: Our analysis in the EIS leads us to conclude that it may be several decades before much of the habitat upstream of and within the project area will be restored to a condition that is suitable for the reintroduction of anadromous fish. Our view is that it would be more appropriate to initiate passage studies and stock evaluations closer to the time when habitat and water quality conditions would support both rearing and passage. We note that fish tracking technologies will likely continue to improve in the future, and that it is uncertain which of the upstream reaches and tributaries will be the first to have habitat that is suitable for restoration. Deferring studies until water quality conditions have improved will allow studies to be directed at resolving passage issues at the appropriate reaches and to take advantage of advancements in fish tracking techniques.

Comment AR-22: The Shoshone-Bannock Tribes comment that they provided, as part of their draft EIS comments, a draft reintroduction plan that they recommend serve as the basis for a phased reintroduction plan. Also, the Shoshone-Bannock Tribes state that all parties advocating for reintroduction in this proceeding agree that planning is a logical first step in the process. The Forest Service comments that many recent FERC licenses for barrier dams in the Pacific Northwest have included requirements to develop anadromous fish reintroduction plans, including the Cowlitz, Lewis, Pelton/Round Butte, and North Umpqua projects. They state that in these other cases, the utility involved recognized the lack of passage as being a major project effect and worked with the other parties to develop a fish passage plan acceptable to all involved. The Forest Service comments that from the outset of the Hells Canyon Project relicensing, Idaho Power has resisted providing fish passage at the project and has been unwilling to participate in the development of such a cooperative plan.

Response: The draft reintroduction plan filed by the Shoshone-Bannock Tribes represents a listing of many of the recommended terms and conditions that we evaluated in the draft EIS. Because the draft plan does not provide any substantive new measures, we do not evaluate it further in this final EIS. Nonetheless, we note that compared to the comprehensive planning effort that we describe above, the Shoshone Bannock's plan is not based on a process that brings the full range of stakeholders together to balance the interests of all parties that would be affected by anadromous fish restoration. With respect to the Forest Service's reference to other projects in the Pacific Northwest, the notable difference between the Hells Canyon Project and these other proceedings is that the other proceedings all included settlements, which provide the Commission with a much higher level of assurance that the benefits and consequences of restoration have been considered and resolved in a manner that is much more likely to serve the public interest.

Comment AR-23: AR/IRU comments that it is unreasonable to require the agencies to develop a comprehensive plan for anadromous fish restoration, since the elimination of passage was caused by the Commission's decision to license construction of the project and to allow its continued operation without fish passage. They state that if the Commission finds that passage is warranted and a comprehensive plan is needed, then the Commission should take the initiative to see that such a plan is created. AR/IRU recommends that the Commission clearly identify what would trigger a fish passage decision, as well as who would have authority to trigger such a decision.

Response: We are not requiring anyone to develop a comprehensive plan. We maintain, however, that prior to restoring anadromous fish passage to areas upstream of the project, we believe that a cooperative process is needed to address the full range of concerns of the parties that would be affected by reintroduction. If such a process were to occur and the outcome supports the initiation of reintroduction and passage measures at the Hells Canyon Project are needed, the development of necessary fish passage studies and measures could be triggered by: (1) NMFS or FWS exercising their Section 18 authority to prescribe fishways; (2) re-opening the license at the request of a fish and wildlife agency; or (3) action of the Commission after opportunity for public hearing. Any of these actions could be triggered by a demonstration of substantial improvements in water quality in the Snake River upstream of the project or the filing of a comprehensive plan demonstrating that the initiation of a program to restore anadromous fish to areas upstream of the project is in the public interest.

Comment AR-24: The Shoshone-Bannock Tribes comment that the Pacific Northwest Electric Power

Planning and Conservation Act of 1980 (Northwest Power Act) constrains the use of cost-effectiveness to judge measures required to restore salmon and steelhead populations adversely affected by hydroelectric development in the Columbia River basin. The act bars "…power losses and economic costs…from precluding biologically sound restoration of anadromous fish in the Columbia River basin…so long as an adequate, efficient, economical and reliable power supply is assured." The Shoshone-Bannock Tribes also note that the cost of adding salmon and steelhead reintroduction to Idaho Power Company's proposed measures would be modest, and would constitute a small fraction of the economic benefits received by the company, its shareholders, and ratepayers. ODFW comments that the lack of safe, timely, and effective passage for anadromous and resident native fish species is a continuing impact of the project, and that Oregon law requires mitigation of all ongoing adverse impacts. AR/IRU states that if passage of anadromous fish is not implemented, Idaho Power should be required to implement in-lieu mitigation that would benefit anadromous fish species affected by the project.

Response: The FPA requires that the Commission ensure that the project to be licensed is best adapted to a comprehensive plan for developing the waterway for beneficial public purposes, and must give equal consideration to developmental and environmental values. As discussed in previous responses, the Staff Alternative includes measures that would benefit anadromous fish downstream of the project in the near term and other measures that would contribute toward the future restoration of anadromous fish to areas upstream from the project. We do not agree with the Shoshone-Bannock Tribes' comment that the cost of adding salmon and steelhead reintroduction would be modest. Restoring fall Chinook salmon would be likely to require at least one very large screening facility on the mainstem Snake River, and collecting spring Chinook salmon and steelhead produced in tributaries would require smolt traps capable of screening high flows that occur during the spring outmigration. For example, we estimate that our recommendation to expand the size of the Pine Creek facility to operate year-round would increase the capital cost of the facility from $2.5 million to $7.5 million. Regarding ODFW's comment, we acknowledge that the Staff Alternative may be inconsistent with state law. Finally, the Commission typically supports measures that address direct project impacts, when they are determined to be in the public interest, and generally does not require in-lieu mitigation. However, recognizing the substantial cumulative impact that Idaho Power's projects have had on anadromous fish in the basin, a wide range of measures have been adopted in the Staff Alternative that would benefit anadromous fish downstream of the project, improve habitat conditions within and upstream of the project, and to support tribal ceremonial and subsistence fisheries.

Comment AR-25: The Umatilla Tribes and the Nez Perce Tribe state that the draft EIS failed to evaluate how the measures in the FERC Staff Alternative would qualitatively or quantitatively assist in halting the decline of salmon and sturgeon stocks, which is the objective of the CRITFC tribes' anadromous fish restoration plan.

Response: We listed the measures that would contribute to attaining this objective in section 5.4.2 of the draft EIS, and we evaluated the effects of these measures in sections 3.5, *Water Quality*; 3.6, *Aquatic Resources*; and 5.2, *Discussion of Key Issues*.

Comment AR-26: The Shoshone-Bannock Tribes comment that meeting the goal of natural self-sustaining populations may not be possible immediately, and note that this goal is not currently being met anywhere in the Snake River basin. The Shoshone-Bannock Tribes and ODFW indicate that reintroduction efforts will likely require a long-term infusion of hatchery produced fish, but reliance on hatchery supplementation would decrease over time.

Response: These are factors that it should be considered when a comprehensive plan is developed to restore anadromous fish to areas upstream of the project.

Comment AR-27: The Shoshone-Bannock Tribes state that restoration of anadromous fish to habitat within and above the project is crucial to fulfillment of the tribes' treaty rights, and that the economic, societal, and cultural benefits associated with restoration and recovery of anadromous fish runs would outweigh the costs. They further state that while the long-term goal of reintroduction is to reestablish self-sustaining populations, there are short and near-term reintroduction objectives and opportunities that FERC ignores. These include immediately reestablishing the presence of the native assemblage of species above Hells Canyon dam, and the related objective of immediately providing opportunity to harvest adult fish of hatchery origin. The Shoshone-Bannock Tribes state that these objectives can be quickly achieved and sustained under existing conditions.

The Shoshone-Bannock Tribes discuss several considerations supporting their recommendation that Idaho Power construct additional hatcheries at Yankee Fork and Panther Creek. These considerations include: (1) Idaho Power has never achieved the spring or fall Chinook production goals that it agreed to in the 1980 Settlement Agreement; (2) the Hells Canyon Project and the smaller Idaho Power dams on the mid-Snake blocked passage to the most productive fall Chinook salmon habitat in the Snake River basin, as well as hundreds of miles of tributary habitat formerly occupied by spring/summer Chinook salmon and steelhead; (3) NMFS estimates that the blocked habitat historically produced at least 241,280 to 377,000 adult fall Chinook salmon; and (4) while the tribes strongly assert that the first priority for anadromous fish mitigation must be in-kind and in-place, the enormity of the loss warrants off-site and/or in-lieu mitigation, in addition to the in-kind and in-place measures. During tribal consultation meetings held in March 2007, the Shoshone-Bannock Tribes indicated that because of the effort they have put into habitat restoration in the Yankee Fork, the stream is ready to support fish now and implementation of a hatchery on the Yankee Fork would be of great value to them.

The Shoshone-Paiute Tribes state that Idaho Power's hatchery program does not serve to restore salmon and steelhead runs to the 50-mile-long Marsing reach, where members of the Shoshone-Paiute Tribes and other tribes once fished for salmon and steelhead. They also comment that Idaho Power's fish restoration efforts have benefited primarily downriver interests and ignored the losses of the tribes that fished the upper Snake River above the project. The Shoshone-Paiute Tribes recommend that, in the short term, adult Chinook salmon and steelhead from Idaho Power hatchery facilities should be placed throughout the portion of the Owyhee River that flows through the Duck Valley Reservation to create put and take fishing opportunities for tribal and non-tribal members.

Interior comments that unlisted adult steelhead and/or spring Chinook salmon captured at the Hells Canyon trap, which are in excess of current management needs, can and should be transported to available habitats in both Oregon and Idaho. Interior states that the EIS should discuss the benefits of this type of program, including moving anadromous fish into the Weiser, Payette, Powder, Malheur, and Owyhee rivers, as well as continuing to release fish into the Boise River.

Response: We recognize that measures directed at improving fisheries downstream of Hells Canyon dam provide no immediate benefit to tribes that historically fished in areas within and upstream of the project. Discussion of near-term measures that would be of value to these tribes occurred during the March 2007 tribal consultation meetings.[138] As a result of these meetings, we modified the Staff Alternative to

[138] The tribal consultation meetings were publicly noticed, and transcripts of the meetings are part of the

include funding for a hatchery on the Yankee Fork as requested by the Shoshone-Bannock Tribes, and to require that Idaho Power develop a plan for using surplus unlisted hatchery salmon and steelhead to create and support harvest fisheries for the Shoshone-Paiute and Burns Paiute Tribes at locations to be determined in consultation with these tribes. A secondary objective of the plan would be to allocate surplus fish for stocking in project reservoirs and tributaries within the project area as a means to restore marine derived nutrients and provide forage for bull trout in tributaries within the project area. State and federal fisheries management agencies would also be consulted during plan development to ensure that actions implemented through the plan are consistent with fisheries management objectives, bull trout recovery, and other ongoing restoration efforts.

Comment AR-28: NMFS comments that the reintroduction of fall Chinook salmon into areas upstream from Brownlee reservoir, and of spring Chinook salmon and steelhead into project reservoir tributaries, are quite different in scale and scope, and should be treated separately.

Response: We expanded the analysis and discussion in the final EIS to address issues specific to the restoration of mainstem-spawning fall Chinook salmon versus those issues specific to the restoration of tributary-spawning steelhead and spring Chinook salmon.

Comment AR-29: NMFS comments that Snake River fall Chinook salmon historically had three viable populations, but that two of the three populations were extirpated by Idaho Power's Swan Falls and Hells Canyon projects. NMFS states that the Columbia River Recovery Team has advised it that the long-term risk of extinction of a species with only one viable population is substantially higher than if there were two viable populations.

Response: We added this information to final EIS section 3.8.1.1, *Fall Chinook Salmon.*

Comment AR-30: NMFS comments that it views funding TMDL improvements as a vital step toward successfully restoring salmon and steelhead to historically important spawning and rearing habitat upstream of the project. NMFS comments that FERC staff's analysis identifies, but fails to analyze, its proposed water quality enhancement fund as part of its reintroduction strategy. NMFS states that the measure is conceptually no different than the upstream habitat work that staff adopted for bull trout. NMFS also states that funding water quality improvements would comply with the comprehensive development standard because such improvements fit within state TMDL programs, the major federal and state effort to recover salmon and steelhead in the Columbia River basin, and NMFS's goals for this project. Finally, NMFS comments that FERC should consider the effects of Idaho Power's mid-Snake projects in considering its funding recommendation since the Scoping Document 2 for those projects deferred the consideration of cumulative effects on anadromous fish to the Hells Canyon EIS.

The Forest Service comments that staff's recommendation to track and report on changes in upstream water quality is relatively meaningless. The Forest Service states that, without some seed money or other monetary incentive such as that proposed by the agencies in the upstream fund concept, there is no incentive to make substantial water quality improvements within the timeframe encompassed by the new license, and that little improvement in water quality is likely to occur. The Shoshone-Bannock Tribes comment that FERC must require Idaho Power to contribute to the restoration of Upper Basin water quality, because such restoration is a necessary prerequisite to reintroduction of fish stocks to much of

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public record for the project. The transcripts may be obtained through eLibrary at www.ferc.gov.

their historic habitat.

Response: We expanded the text in section 3.6.2.6, *Anadromous Fish Restoration*, to include evaluation of the potential benefits of providing TMDL funding as recommended by NMFS. However, we conclude that it would not be appropriate to require Idaho Power to implement measures to reduce nutrient loads attributable to upstream sources, given that Idaho Power's projects on the Snake River, taken as a whole, serve to reduce the nutrient loads that are delivered to areas downstream of the project. Although we recognize that TMDL funding is conceptually similar to the tributary habitat enhancement program that we adopt in the Staff Alternative, there are several key differences, including: (1) greater geographic proximity of tributary measures to the project; (2) direct effects of the project on habitat connectivity between tributaries and inundation of the lower portion of each tributary by project reservoirs; and (3) greater certainty that the measures would provide substantive and documentable benefits to aquatic resources in the project area within the near future.

We also adopted measures proposed by Idaho Power in its application for water quality certification to meet its responsibility under the nutrient and temperature TMDLs. These include an evaluation of alternative measures such as phosphorus trading and watershed measures that would provide broader ecological benefits than the measures that Idaho Power proposed in its license application.

As discussed in previous responses, we also include numerous measures in the Staff Alternative that would benefit anadromous fish downstream of the project in the near term, other measures that would contribute to the future restoration of anadromous fish to areas upstream from the project, and other measures that would create tribal ceremonial and subsistence fisheries. The scope of the aquatic measures that we recommend in the final EIS reflect the substantial cumulative effects that Idaho Power's mid-Snake and Hells Canyon projects have had on fisheries for resident and anadromous fish, including the blockage of anadromous fish from habitat upstream of Hells Canyon dam.

Comment AR-31: NMFS states that FERC may have mislabeled some of the components of recommendation 14, since parts 14b, 14c, and 14f are not addressed in the EIS. These parts recommended the formation of a committee to oversee and evaluate which projects would receive funds, to evaluate the effectiveness of projects funded by the water quality improvement account, and determine whether monies should be shifted to different projects.

Response: Because of the large number of individual recommendations that we evaluated in the draft EIS, we consolidated some recommendations to facilitate our analysis. We considered parts a, b, c and e of your recommendation 14 to be components of your recommendation to provide funding for TMDL implementation, and we addressed them as a single measure that we referred to as measure NMFS-14a in the draft EIS. To improve the clarity of our analysis in the final EIS, we expanded our description and discussion of measure NMFS-14, and we discuss all components of this recommendation together as a single measure to avoid any confusion that was introduced by the numbering system that we used in the draft EIS. We also revised the 10(j) table to follow the sub-element designations used in NMFS's letter.

Comment AR-32: NMFS comments that its recommendation to monitor water quality downstream of the Bliss, C.J. Strike, and Swan Falls dams is a vital part of its proposed program to restore fall Chinook salmon to habitat upstream of the project, and is necessary to determine when passage will be appropriate. NMFS states that there is a nexus with these upstream projects because FERC decided to defer addressing anadromous fish issues for these projects and consider them, instead, during the Hells Canyon relicensing.

Response: The restoration of fall Chinook salmon to areas upstream of Swan Falls or C.J. Strike dams would require that downstream passage be implemented at those dams. Accordingly, the potential for restoration of fall Chinook salmon to areas upstream of either dam would need to be addressed through the upcoming Swan Falls relicensing proceeding for the C.J. Strike reach or through re-opening the C.J. Strike license for the Bliss reach. We include monitoring of water quality conditions in the Snake River just upstream of Brownlee reservoir in the Staff Alternative, which would be useful for monitoring trends to determine when it would be appropriate to initiate fall Chinook salmon restoration studies in the Swan Falls reach. We note that provisions for monitoring water temperature and DO downstream of Idaho Power's Upper and Lower Salmon Falls, Bliss and C.J. Strike were included in the licenses, and we recognize that water quality monitoring will be an issue in the Swan Falls licensing proceeding. We conclude that the monitoring provisions included in each license are appropriate and should be sufficient for tracking water quality improvements.

Comment AR-33: NMFS, IDFG, and ODFW comment that water quality monitoring alone would not be sufficient to determine the condition of incubation habitat upstream of the project. They state that DO can vary, particulates can be different, and algae mats do not show up as water quality parameters but are important for gravel suitability. They note that monitoring egg-to-fry survival is a relatively low cost measure that provides important information for reintroduction.

Response: We expanded our discussion of this issue in the final EIS. We recognize that the amount of sediment in the substrate affects DO levels within the gravel by affecting the flow of water through the substrate and biological oxygen demand from decomposing organic material. We conclude in the final EIS that a reduction in seasonal peak flows caused by water storage at upstream reservoirs operated by BOR has likely contributed to the build-up of fine sediment in the intragravel environment and the establishment of rooted aquatic vegetation. We maintain that substantial improvements in the condition of the intragravel incubation environment will require a sustained improvement in overall water quality (i.e., reduced nutrient loading), followed by one or more substantial high flow events to dislodge rooted aquatic vegetation and to cleanse fine sediments from potential spawning areas. Accordingly, we conclude that at this time, it would be premature to require Idaho Power to initiate restoration studies, including additional monitoring of incubation survival.

Comment AR-34: The Shoshone-Bannock Tribes comment that FERC failed to consider evidence provided by the tribes, which suggests that water quality above Brownlee reservoir has not changed substantially since the 1960s (Keller Bliesner & Associates report, filed with the Shoshone-Bannock Tribes response to REA notice). The Shoshone-Bannock Tribes state that the report concludes that only slight improvements in water quality in the Upper Snake River will establish habitat necessary for successful anadromous fish passage and reintroduction.

The Shoshone-Paiute Tribes comment that, due to high quality spring discharges and flows over 5,000 cfs, both the Bliss and C.J. Strike reaches of the Snake River are suitable to justify live adult fall Chinook and egg incubation studies. They state that both reaches were primary anadromous fishing grounds for the tribes. Interior comments that it believes that water quality conditions in the Bliss and C.J. Strike reaches are sufficient to warrant egg incubation studies, and recommends that FERC staff reassess the proposed fall Chinook restoration studies and include them for early implementation in the anadromous fish passage plan.

Response: We modified sections 3.0, *Environmental Analysis*, and 5.0, *Staff's Conclusions*, in the final EIS to include information from the cited report. We recognize that the report indicates water quality conditions in the Swan Falls reach have changed little since the project was constructed. However, the intragravel monitoring studies conducted by Idaho Power demonstrate that the current condition of spawning habitat in the Swan Falls reach is not adequate to provide for successful incubation to survival. The report also indicates that conditions in the C.J. Strike reach are beginning to improve.

Comment AR-35: Interior states that the weir to be constructed on Pine Creek could serve as an evaluation tool for anadromous fish in addition to serving a key role in bull trout restoration. It also states that steelhead passed upstream of Hells Canyon dam are now successfully spawning in Pine and Indian Creeks, according to data from IDFG, ODFW, and Idaho Power, and that there is a put and take steelhead fishery in the Boise River. Thus, Interior recommends that FERC reanalyze the feasibility of reintroducing both steelhead and spring/summer Chinook salmon to tributary habitats. ODFW recommends that the monitoring weir should be designed for year round operation and for collection and handling of resident and anadromous species, and that the weir be designed to function at high spring flows when smolt migration occurs.

Response: The reported observation of steelhead spawning in Pine and Indian creeks does not alter our conclusion that it would be premature to undertake restoration of passage to habitat within or upstream of the project in the absence of a comprehensive plan. However, we modified the text in sections 3.0, *Environmental Analysis*, and 5.0, *Staff's Conclusions*, to include a discussion of the potential for the Pine Creek weir to be used to monitor the reproductive success of any surplus hatchery steelhead and spring Chinook salmon that enter Pine Creek after they have been released into Hells Canyon reservoir. To meet this objective, and to provide better information on the timing of bull trout migration, we recommend that Idaho Power design the Pine Creek weir to function year-round, encompassing at least 90 percent of the flows that occur in the stream during an average water year.

Comment AR-36: ODFW recommends immediate initiation of studies in Oregon tributaries to support spring Chinook salmon and summer steelhead reintroduction. According to ODFW fishery biologists and available water quality information, habitat is sufficient in Pine, Eagle, Goose, and Daly creeks to warrant reintroduction in the near term and certainly within this license term.

The Shoshone-Bannock Tribes comment that the resource agencies and tribes identified many tributaries as viable candidates for immediate reintroduction of spring Chinook and steelhead. They state that the Lower Middle Snake River Subbasin Plan found that existing habitat in Pine, Eagle, Goose, Daly, and Big creeks would sustain summer steelhead and spring Chinook salmon. They also comment that providing fish passage to Pine Creek, Indian Creek, the Wildhorse River and Eagle Creek would reopen 200 linear miles of suitable habitat with the potential to produce 500 adult spring Chinook salmon and 5,000 adult steelhead. The Tribes also state that production potential would increase considerably with implementation of the tributary habitat restoration efforts proposed by Idaho Power. They state that there is a vast area of existing, high-quality habitat for salmon and steelhead in the upper reaches of the Payette River basin, which IDFG estimated contains 43 percent of the spring Chinook habitat and 39 percent of the summer steelhead habitat remaining in the Snake River basin above Hells Canyon dam.

The Shoshone-Paiute Tribes comment that suitable habitat exists upstream of Hells Canyon dam, where water quality and habitat conditions are not the primary limiting factors. They state that the final EIS should analyze the benefits of, and include in the Staff Alternative, a program for transporting adult steelhead and Chinook trapped at Hells Canyon dam into a number of tributaries including, but not limited to, the Owyhee and Bruneau Rivers. They recommend that: (1) adult Chinook and steelhead from the hatchery facilities be placed throughout the portion of the Owyhee River that flows through the Duck Valley Reservation; (2) Chinook salmon and steelhead be reintroduced in the Owyhee River; (3) full-scale reintroduction be implemented in the Bruneau River, including Marty's Creek; and (4) reintroduce fall Chinook salmon to the mainstem Snake River from Brownlee reservoir to the base of Upper Salmon Falls.

Response: As stated previously, a decision to proceed with restoring anadromous fish to areas upstream of Hells Canyon dam could provide a wide range of benefits but would also have a variety of societal consequences. We conclude that development of a comprehensive plan outside of the licensing process would provide an opportunity for the concerns and interests of different users to be aired and considered. Moreover, such a comprehensive plan would allow for greater collaboration in the development of restoration approaches than is possible during a contested relicensing proceeding. When such a planning effort determines that proceeding with studies or the installation of passage facilities is warranted, measures could be implemented at the Hells Canyon Project through a variety of methods, including: (1) NMFS or FWS exercising section 18 authority to prescribe fishways; (2) amending the license at the request of a fish and wildlife agency; or (3) action of the Commission after opportunity for public hearing. Regarding the Shoshone-Paiute's recommendation that adult hatchery Chinook salmon and steelhead be placed in the Owyhee River, we modified the Staff Alternative to require Idaho Power to develop a plan for using surplus hatchery salmon and steelhead to create and support harvest fisheries for the Shoshone-Paiute and Burns Paiute tribes at locations to be determined in consultation with these tribes.

Comment AR-37: ODFW recommends that reintroduction studies in Powder River tributaries be started immediately following completion of studies in Pine Creek and the installation and testing of the Pine Creek weir. ODFW fully expects to rely on hatchery supplementation at least initially to improve the likely success of reintroduction. ODFW recommends that reintroduction proceed into additional tributaries and habitats once smolt and adult migration, survival, and trapping studies are completed, assuming sufficient hatchery adults are available, and it is determined that that reintroduction should proceed.

Response: We recognize ODFW's desire to move forward with restoration of anadromous fish to tributaries in the Powder River basin. In the final EIS we expanded the tributary enhancement program to include the Powder and Burnt River basins. However, for the reasons stated in our response to the previous comment, we believe that the costs and benefits of restoring anadromous fish to the Powder River basin can best be evaluated in a comprehensive plan developed outside of this contested licensing proceeding. Again, year-round operation of the Pine Creek weir would provide useful information on the reproductive success of surplus hatchery steelhead and spring Chinook salmon, and assist with future decisions regarding the restoration of these species to tributary habitat upstream of Hells Canyon dam.

Comment AR-38: ODFW comments that within draft EIS table 51, FERC staff indicates that ODFW recommends installation of an adult trap at Brownlee dam, a Brownlee smolt trap, and a fish screen at Hells Canyon dam. ODFW states that it has not recommended adult or smolt traps at Brownlee dam.

Response: We modified draft EIS table 51 (final EIS table 56) accordingly.

Comment AR-39: ODFW states that tributary trapping is not recommended for all tributaries with native fish nor is it expected to occur year round. ODFW also states that tributary weirs proposed by Idaho Power are not designed to be operational under all conditions or across all flows. For these reasons and because migratory species display a diversity of life-history characteristics, ODFW continues to recommend investigating the installation and operation of a downstream passage facility at Hells Canyon dam during the term of this license.

Response: We recommend that Idaho Power design the Pine Creek weir and trap to operate year-round to encompass typical high flow conditions. If the results of monitoring reproductive success of surplus hatchery steelhead and spring Chinook salmon in Pine Creek are favorable, we anticipate that the Indian Creek weir and trap would also be designed to operate year-round when it is constructed. Construction of these weirs to operate year round would allow the majority of migratory fish to be collected and transported downstream of Hells Canyon dam without risk of mortality from entrainment through the project's turbines or from passing over the project's spillway. While we acknowledge that installing a downstream passage facility at Hells Canyon dam would allow outmigrants from these creeks to rear in Hells Canyon reservoir with a reduced risk of turbine entrainment, this benefit would come at a disproportionately high cost for the construction and operation of a substantial downstream passage facility at the dam.

Comment AR-40: Based on historical estimates of fish abundance, ODFW states that it does not agree with FERC staff's estimates of the number of adult steelhead that could be produced from tributaries within the project area. ODFW also states that it expects production to increase with implementation of TMDLs and tributary enhancement measures, and through the implementation of additional measures to improve juvenile salmon survival through the Federal Columbia River Power System migratory corridor.

Response: We revised the final EIS to note that the adult return estimates in draft EIS table 55 (final EIS table 60) appear to be conservative, and we now include an alternative estimate of 2,700 adult steelhead for Pine and Indian Creeks based on returns to the Hells Canyon dam trap in its first three years of operation. We also revised our estimates using species-specific survival rates taken from table 3 of Chapman and Chandler (2003). We note that there is potential for increased returns as tributary enhancements and TMDLs are implemented, and as additional measures are implemented to increase survival rates in the lower Snake and Columbia River migration corridors.

Comment AR-41: The Umatilla Tribes and the Nez Perce Tribe recommend that Idaho Power contribute to the funding of regional evaluations of Pacific lamprey stocks.

Response: As an outcome of the 10j process, we revised the Staff Alternative to include a measure that would require Idaho Power to participate in regional forums on Pacific lamprey restoration. Also, Idaho Power would be required to file a report with the Commission every 3 years summarizing the results of research activities that may affect the potential for implementing measures at Hells Canyon to benefit Pacific lamprey.

Comment AR-42: Interior comments that Pacific lamprey are present in the Salmon and Clearwater basins, and states that the number of lamprey passing fish counting windows is often not accurately enumerated. Interior supports efforts to restore lamprey to their former abundance throughout the lamprey's accessible range in the Snake and Columbia rivers. Interior recommends that monitoring and reporting protocols be developed for this species. Interior also recommends that the Columbia River lamprey workgroup should be tasked to develop a meaningful lamprey enumeration protocol and then to explore solutions to pass lamprey around the project dams.

Response: We consider the effects of the Hells Canyon Project on the population size of Pacific lamprey to be limited, given the substantial migration challenges that are posed by downstream projects as reflected by the small number of lamprey that are counted passing Lower Granite dam. However, it is clear that the project blocks access to a substantial amount of habitat that was historically used by this species, and affects downstream habitat by interrupting sediment recruitment. Additionally, flow ramping may affect migratory movement of the lamprey in the river downstream from the project. Accordingly, we revised the Staff Alternative to require Idaho Power to participate in regional forums on Pacific lamprey restoration, and to file a report with the Commission every 3 years summarizing the results of research activities, identifying any new information that is applicable to addressing project impacts, and any new measures that are proposed to address effects on this species.

Comment AR-43: The Umatilla Tribes and the Nez Perce Tribe state that Idaho Power should be required to develop a lamprey passage plan with a goal of no net effect of the project on Pacific lamprey. They state that the presence and operation of the project, without any mitigation for the loss and cumulative and synergistic impacts to lamprey, directly contribute to the seriously depressed lamprey numbers found today in the lower Snake River and elsewhere. They state that FERC staff apparently do not adequately understand or appreciate the cultural and spiritual importance of lamprey to tribal people in the Columbia Basin. The Shoshone-Paiute Tribes comment that because lamprey occur in the Salmon and Clearwater basins, it is clear that the Hells Canyon project is blocking lamprey from using habitat upstream of Hells Canyon dam. The Shoshone-Paiute Tribes state that there is a significant benefit to considering lamprey passage at the project, and this issue needs to be analyzed in the final EIS.

Response: See our response to the previous comment. Also, we understand that efforts to improve upstream passage at downstream dams are underway. However, given the small numbers of adult lamprey that pass Lower Granite dam and the large amount of underseeded lamprey habitat that is available in tributaries to the Hells Canyon reach, we consider it premature to initiate passage studies at the Hells Canyon Project.

Comment AR-44: The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS recommends no lamprey measures for the project. Thus, the Umatilla Tribes and the Nez Perce Tribe state that the draft EIS fails to address the objective of halting the decline of Pacific lamprey stocks impacted by the project.

Response: We recognize that no measures are proposed for immediate implementation. However, as described in the preceding response, we recommend a measure that would require Idaho Power to participate in regional forums to evaluate and, if warranted, implement measures to enhance lamprey restoration efforts.

Comment AR-45: ODFW states that Idaho Power should: (1) develop, fund and implement habitat enhancement measures designed to improve mainstem and tributary habitat conditions for Pacific lamprey; (2) monitor Pacific lamprey using tributaries and the mainstem Snake River downstream of Hells Canyon dam; and (3) prepare a report on adult and juvenile counts at mainstem dams and juvenile trapping in tributaries to the Snake River. ODFW states that, in lieu of operational changes at the project (e.g., increased spring flows and reduced ramping) and absent a gravel and sand augmentation program below Hells Canyon dam to improve margin and juvenile lamprey rearing habitat, Idaho Power should contribute annually towards improvement of tributary habitat above, within, and below the project. Similarly, AR/IRU comments that an overt program to restore lamprey is likely the only solution to the problem of lamprey survival. ODFW also recommends that Idaho Power develop a detailed upstream and downstream passage plan for Pacific lamprey. Such a plan would have an extended timeframe of 10 to 20 years to allow for advances in tagging technologies, passage technologies, and increased escapement to the Snake River, as well as allow for completion of upstream and downstream passage facilities for salmonids.

Response: We recognize that the Hells Canyon Project blocks Pacific lamprey from a large area of formerly occupied habitat. However, we maintain that conditions in the downstream migratory corridor are the primary factor limiting the abundance of this species in the Snake River basin upstream of Lower Granite reservoir, and that predation may limit the potential for providing downstream passage of juvenile lamprey through the project reservoirs. However, the installation of tributary traps, as detailed in Interior's modified fishway prescription, would allow passage to and from the Pine, Indian and Wildhorse drainages to be implemented if the number of Pacific lamprey returning to the Snake River increase to levels that suggest that the species may benefit from access to additional habitat. As noted above, we revised the Staff Alternative to require Idaho Power to participate in regional forums on Pacific lamprey restoration, to report the number of Pacific lampreys that have been collected in the Hells Canyon fish trap, and to identify and implement reasonable studies and/or measures to enhance Pacific lamprey restoration efforts in the Snake River.

Spawning Habitat

Comment AR-46: NMFS expresses concern that the maintenance of steady flows between 8,000 and 13,000 cfs during the fall Chinook salmon spawning season is characterized as a voluntary operation. NMFS considers this operational measure to be necessary to prevent harm to fall Chinook salmon redds, and urges FERC to make this a mandatory license requirement.

Response: We modified the wording of the Staff Alternative to specify that flows are to be maintained between 8,500 and 13,500 cfs during the fall Chinook salmon spawning period, consistent with NMFS's 10(j) recommendation.

Comment AR-47: IDFG comments that, in addition to Idaho Power's proposed fall Chinook spawning flow program, a flow management plan should be developed, in consultation with IDFG and others, to determine appropriate monitoring methods for use in determining flow levels to be maintained downstream from the Hells Canyon dam during the fall Chinook spawning and incubation season. The Umatilla Tribes and the Nez Perce Tribe state that it is not clear how the October-December fall Chinook spawning flow is determined in real time, and whether the process takes advantage of new advances in water supply forecasts to ensure better management of Brownlee reservoir elevations.

Response: As part of the Staff Alternative, we recommend that Idaho Power develop and implement a fall Chinook spawning and incubation flow management plan. Within this plan, Idaho Power would determine appropriate monitoring methods to assist with deriving flow levels to be maintained downstream from Hells Canyon dam during the fall Chinook spawning and incubation season. We added a requirement that the plan be developed in consultation with NMFS, FWS, IDFG, ODFW, and interested tribes[139].

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[139] We use the term "interested tribes" to be inclusive of all tribes that have been active participants in the relicensing proceeding, including the Nez Perce, Umatilla, Shoshone-Bannock, Shoshone-Paiute, and Burns Paiute tribes. Several of these tribes do not have federally recognized treaty fishing rights pertaining to existing anadromous fisheries downstream of the project. However, all of these tribes historically hunted and fished in areas that have been affected by the existence and operation of the project. It is our view that all of these tribes, including those that historically used areas upstream of the project, should be offered the opportunity to participate in consultation regarding measures that could affect anadromous and resident fish (to include measures affecting habitat and water quality), as well as plants and wildlife species of value to the tribes. This view is based on the premise that even measures that would affect only downstream habitat could help increase the abundance of fish that could be used in upstream restoration efforts, and that both fish and wildlife may move among the lands that are or were used by multiple tribes.

Comment AR-48: The Umatilla Tribes and the Nez Perce Tribe comment that continued monitoring of both shallow and deepwater fall Chinook redds is the best means of tracking the effective number of spawners, as well as the success of efforts to restore the population. Based on a number of factors, the tribes indicate that continuation of complete (shallow and deepwater) redd counts would be important as confirmation of population recovery and evidence of sufficient spawning gravels

Response: As part of its proposed gravel monitoring plan filed with its comments on the draft EIS, Idaho Power committed to continuing both shallow and deepwater redd counts on an annual basis for the term of the license. Aerial helicopter surveys would be conducted from Asotin, Washington (RM145), upstream to the Hells Canyon dam (RM247.5). Video searches for deep-water spawning locations would continue to be conducted on an annual basis. In the final EIS, we adopted Idaho Power's proposed gravel monitoring plan, including shallow and deepwater surveys, in the Staff Alternative.

Rearing Habitat

Comment AR-49: AR/IRU comments that in describing current operations, FERC includes a figure showing monthly reservoir fluctuations, but does not provide a similar depiction of shorter term changes in river elevation due to ramping. AR/IRU states that ramping and ramping rates are discussed throughout the document, but that FERC staff omitted a depiction of what the extent of ramping means in terms of actual changes in discharge and effects on river stage. AR/IRU also states that, in describing how Oxbow reservoir is currently used to re-regulate discharges from Brownlee, staff failed to discuss the extent to which there is additional capacity to limit flow fluctuations downstream from Hells Canyon dam. AR/IRU also comments that there is no indication that any of the ramping rates analyzed in the draft EIS would be measured below the dam.

Response: Plots of hourly simulated flow rates at Hells Canyon dam and at Anatone (near the head of Lower Granite reservoir) are shown for three water years representing extreme low, medium, and extreme high water years for proposed operations and five evaluation scenarios in appendix D of the draft EIS (appendix E of the final EIS). Hourly changes in wetted area for the same years and scenarios are shown in draft EIS figures 37 through 46 (final EIS figures 56 through 65). While we did not include plots of reservoir elevations under scenario 1a (outflows from Hells Canyon dam equal to average preceding 24 hours of inflows) in the draft EIS, plots filed by Idaho Power with their February 3, 2005 response to AIR OP-1(f) indicate that outflows could be fully re-regulated by Hells Canyon reservoir, with a typical fluctuation of less than 5 feet in the reservoir. We outlined the operational constraints that were used in Idaho Power's modeling of the operational scenarios in appendix C of the draft EIS (appendix D of the final EIS). As specified in appendix table 7, Scenario 3 (navigation) was the only evaluation scenario where compliance was based on ramp rates measured at Johnson Bar; compliance for all other scenarios was based on measurement within 1.0 mile of Hells Canyon dam, as we specified in the additional information request.

Comment AR-50: NMFS recommends that FERC analyze the likely amount of streambed that would be dewatered by the Staff Alternative's 4-inches-per-hour ramping limit.

Response: As previously explained, we designed our requested model runs to bracket the anticipated range of recommendations that would be received after the REA notice was issued. We believe that the model runs that used 2 and 6 inches per hour provide a sufficient understanding of the effects on wetted area and fish habitat associated with the 4-inch-per-hour ramp rate that we include in the Staff Alternative. In addition, we recommend that Idaho Power develop a stranding and entrapment management plan, as well as an invertebrate monitoring plan, to assess the effects of load following on invertebrate production and on rare and sensitive mollusks. Both of these plans would be developed in consultation with NMFS, FWS, IDFG, ODFW, and interested tribes, and would include provisions for developing and implementing modified operational constraints, if warranted, based on monitoring results.

Comment AR-51: NMFS states that it updated information on growth rates of juvenile fall Chinook salmon in its January 24, 2006, filing. It states that this recent information indicates that growth rates of fish captured and tagged in the Hells Canyon Reach of the Snake River and recaptured at Lower Granite dam have decreased slightly as the number of redds and rearing juveniles has increased. NMFS believes that this is an initial indication of density-dependent effects stemming from the relatively large number of juveniles rearing in the remaining habitat between Hells Canyon and Lower Granite dams. IDFG, however, states that there is no evidence to support the conclusion that increased competition for food and space has resulted in smaller outmigrating fish. IDFG agrees that competition could lead to reduced growth, but so could temperature. IDFG also states that earlier outmigration could be a function of more naturally spawning hatchery fish, which in many instances tend to have an earlier spawn timing.

Response: We updated the information in section 3.6.1.3, *Anadromous Fish Species*, to incorporate the information on recent trends in growth and migration timing of fall Chinook provided by NMFS. We conclude that other factors that could affect fall Chinook salmon growth (e.g., water temperatures, nutrient levels, or project operations) have not changed substantially during this time period. We also conclude that it is likely that reduced growth rates are due to competition, and indicate that the number of juvenile fall Chinook salmon rearing in the Hells Canyon reach may be nearing the carrying capacity of the habitat.

Comment AR-52: The Forest Service comments that ramping on the scale present below Hells Canyon dam can negatively affect fisheries communities present in affected reaches. It states that impacts can include: (1) increasing fry mortality and reducing overall recruitment to the population; (2) dislodging and transporting eggs and fry resulting in egg desiccation, physical injury and mortality; (3) stranding and trapping fish in the varial zone; (4) relegating fish spawning areas to permanently wetted channels; (5) possible food chain effects due to chronic disturbance regime; and (6) fish expending additional energy moving laterally to the new locations that may include the varial zone where food supply is reduced by dewatering caused by peaking operations.

Response: We recognize that flow fluctuations have the potential to cause mortality by stranding fry and juvenile fish and may adversely affect fish growth by reducing the abundance of food and increasing energy expenditures. As noted above, we recommend (1) a seasonal 4-inch-per-hour ramp rate restriction to protect rearing fall Chinook salmon fry and juveniles, and (2) Idaho Power develop a stranding and entrapment management plan and an invertebrate monitoring plan to assess the effects of load following on fish and invertebrate production and on rare and sensitive mollusks. Ramping during the fall Chinook spawning and incubation seasons likely has no substantial adverse effects because flows are held at a steady rate during the spawning season, and fluctuations are curtailed during the incubation season to avoid dewatering the shallowest redd observed.

Comment AR-53: Interior is concerned that aquatic resources, including invertebrates and fish, are not discussed in regard to water quantity issues. Interior states that the timing and magnitude of flows in river systems is of extreme importance to fish and wildlife resources, and that many species depend, in part or entirely, on environmental cues (e.g., the timing or magnitude of flows) to induce migration or reproduction. Interior further states that the frequency of large pulses of flow (like those from peak loading) represents an important impact to aquatic invertebrates, and that research has demonstrated that the number of insects is positively correlated with the time since the last large rainfall event. Interior comments that frequent flushing events with little time between them may prevent the establishment of abundant insect populations, which is a detriment of other aquatic resources in the river system. Interior concludes that the timing and magnitude of flows below the project is dramatically altered from that in the river before construction of dams or other anthropogenic changes. Interior recommends that the NEPA document assess the effects of reduced or altered timing and magnitude of flows.

The Forest Service comments that the draft EIS provides no evidence that the ramping rates included in the Staff Alternative would adequately protect anadromous fish, resident fish, macroinvertebrates, mollusks, or any other aquatic or riparian-dependent resource of concern downstream of Hells Canyon dam. ODFW states that FERC's conclusion that only fall Chinook salmon are affected by project operations ignores the substantial information submitted by ODFW and other agencies, tribes, and non-governmental organizations documenting project impacts on aquatic and terrestrial habitat and species.

Response: The discussion of effects for water quantity issues (i.e., project operations) downstream of Hells Canyon dam and in the Oxbow bypassed reach is located in pages 191 to 265 and 270 to 272, respectively, of the draft EIS. We recognize that the fluctuating flow regime caused by load following operations likely causes some degree of alteration in the composition of the invertebrate community and likely has some adverse effects on invertebrate production and fish growth rates. However, the magnitude of these effects appears to be limited based on the favorable growth rates of fall Chinook salmon juveniles and the size of bull trout compared to bull trout sampled from the Salmon River, a river not exposed to load following operations. As noted above, we recommend that Idaho Power develop a stranding and entrapment management plan and an invertebrate monitoring plan, and both of these plans would include provisions for modifying operation, if warranted, based on monitoring results.

Comment AR-54: The Forest Service comments that the peer-reviewed literature indicates that a ramping rate of between 0 and 2 inches per hour or less is necessary to protect anadromous fish, that the current 1-foot-per-hour ramping rate exceeds the ramping requirements included in other licenses recently issued in the region, and it far exceeds the natural rate of stage change on a river similar to the Snake River in the project area.

Response: We recognize that a 2-inch per hour ramp rate is commonly applied at hydroelectric projects, but we also note that stranding potential is highly site-specific. There is considerably less risk of stranding in a river that flows in a confined channel with few gently-sloping shorelines such as the Hells Canyon reach, especially upstream of its confluence with the Salmon River, where stage fluctuations are the most pronounced. We do not dispute, however, that load following causes some adverse effects on aquatic resources. We recognize that reducing ramping rates during the fall Chinook salmon rearing season could improve growth rates, and we recommend that ramping rates be reduced from 12 inches to 4 inches per hour during the rearing season for fall Chinook salmon. As noted previously, we also recommend that Idaho Power develop and implement a stranding management plan to collect additional information on fish mortality caused by stranding and entrapment, including a provision to further modify operations to reduce stranding, if warranted.

Entrapment and Stranding

Comment AR-55: Idaho Power indicates that it is working with NMFS to develop operational guidelines to minimize entrapment at high-priority entrapment sites in the upper Hells Canyon reach. The approach under development would include: (1) identification of significant entrapment pool areas and their connection flows in the upper Hells Canyon reach; (2) a use assessment (including any mortalities) of entrapment areas by juvenile Chinook salmon and

steelhead that would include expanded estimates for the entire rearing period; (3) documentation of thermal characteristics of pools during the rearing period; and (4) establishment of adaptive in-season operational protocols developed to protect and minimize (to the extent practical) negative effects to juvenile Chinook rearing in entrapment pools. Idaho Power urges FERC to adopt the adaptive approach described above.
Response: We recognize the benefits of this adaptive approach, and include the development of a stranding and entrapment management plan in the Staff Alternative. However, we conclude that implementing a 4-inch-per-hour ramp rate as measured at Johnson Bar[140] from March 15 to June 15 would benefit fall Chinook salmon by increasing food production in shallow-water habitats favored by fall Chinook salmon juveniles and by reducing energetic losses and the risk of predation or stranding associated with daily changes in habitat conditions associated with load following operations.

Comment AR-56: NMFS comments that Idaho Power's assessment of entrapment and stranding sites was able to assess entrapment effects only through mid-May when temperatures are relatively cool. It was unable to assess these effects later in the year because flows increased to beyond the generation capacity of the project. Thus, NMFS concludes that Idaho Power's surveys greatly underestimate mortality in the entrapment areas between mid-May and the end of juvenile fall Chinook salmon rearing. NMFS states that FERC should not base decisions on this information alone.

Response: As noted above, we recognize that additional information on stranding and entrapment is needed. We recommend that a stranding and adaptive management plan be developed to better define ongoing project effects and to develop methods to reduce impacts on rearing juvenile fall Chinook salmon and bull trout.

Comment AR-57: NMFS comments that the 4-inch-per-hour ramping rate recommended by staff would not prevent the injury or death of juvenile salmon caught within several large, high-use entrapment areas that become disconnected from the river at flows below about 11,200 cfs (Durham Bar pools) and 9,900 cfs (Little Bar). NMFS indicates that it continues to discuss this issue with Idaho Power and plan to provide FERC with a jointly-supported recommendation in the coming months. ODFW concurs with the staff-recommended 4-inch-per-hour ramp rate and comments that FERC should analyze the amount of streambed that would be dewatered under this ramping rate restriction. ODFW recommends a minimum flow of 11,500 cfs during the fall Chinook rearing season, which it states would reduce entrapment by 72 percent. The Shoshone-Bannock Tribes comment that FERC cannot reject the more protective 2-inch-per-hour ramping rate on grounds of cost, and that past court decisions have determined that the plain intent of Congress in enacting the ESA was to halt and reverse the trend towards species extinction, whatever the cost.

The Umatilla Tribes and the Nez Perce Tribe recommend that ramping rates be limited to 2 inches per hour during the fall Chinook spawning, emergence and early rearing periods, as well as when flows reach 30 kcfs below Lower Granite dam. The Tribes also recommend that critical flow levels be established to protect juvenile fall Chinook from stranding and entrapment. They report that the daily flow fluctuations that occur between June 15 and October 15 could cause substantial juvenile fall Chinook losses, citing

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[140] We recommend that Idaho Power develop a new combined flow gage and water quality monitoring site within 5 miles of Hells Canyon dam. We also recommend that the ramp rate requirement at the new gage site be adjusted to account for any difference in the stage/discharge relationship at the new gage site compared to the Johnson Bar gage.

information from the Hanford Reach where 3.4 percent of fall Chinook are lost due to flow fluctuations from June 8 to 21. They state that juvenile size in the Hells Canyon reach is limited by cold water in the spring so that juveniles are not as large as those in the Hanford Reach by June 15. Consequently, they state that the incidence of stranding in the Hells Canyon Reach is apt to be much more severe on June 15 than it is in the Hanford Reach, and that flow fluctuation restrictions should be extended for a considerably longer period than proposed, possibly until July 15.
Response: In addition to the seasonal 4-inch-per-hour ramping rate and the stranding and entrapment management plan discussed in the previous response, we also recommend that Idaho Power develop an invertebrate monitoring plan to assess the effects of load following on invertebrate production and on rare and sensitive mollusks. Both plans would be developed in consultation with NMFS, FWS, IDFG, ODFW, and interested tribes, and would include provisions for developing and implementing additional operational restrictions, if warranted based on monitoring results. The seasonal 4-inch-per-hour ramping rate included in the Staff Alternative represents a substantial reduction from the current 12-inch-per-hour ramping rate. We conclude that it represents a reasonable and substantial first step toward minimizing impacts during the fall Chinook rearing period.

Comment AR-58: IDFG comments that because the timing of migration changes between years, operations to protect fall Chinook salmon during the rearing period should be developed on a real time basis in consultation with appropriate state and federal agencies and treaty tribes. IDFG states that Idaho Power should continue to monitor key pools, reconnect pools on a daily basis, conduct a mark/recapture study to monitor distribution, conduct survival assessments, and conduct salvage operations as necessary.

Response: In the final EIS, we assessed these recommendations and identified them as potential components of the stranding and entrapment management plan that is included in the Staff Alternative.

Comment AR-59: The Umatilla Tribes and the Nez Perce Tribe state that, while they support the implementation of a stranding and entrapment monitoring plan a more precautionary approach to protect an ESA-listed species and tribal treaty resource is to implement the 2-inch-per-hour restriction. If, through monitoring and consensus agreement of an aquatic resource committee (of tribes and resource agencies), a 4-inch-per-hour ramping rate is found to provide as much protection as the 2-inch-per-hour rate, they state that it could be implemented. Interior comments that with resumption of the proposed 12-inch-per-hour ramping rate after June 15, juvenile Chinook are more likely to be stranded or entrapped, and the macroinvertebrate food base will undergo reductions due to stranding-related mortality, increased rates and frequency of drift, and reduced food production. Interior also comments that the increased ramp rate would be implemented before outmigration has peaked, subjecting juvenile salmon to stranding, entrapment, other related disturbance, and reduced food abundance. Interior recommends that protective ramping rates be implemented throughout the period of outmigration or at least throughout the period of highest outmigration.

Response: Recent data indicate that migration of juvenile fall Chinook salmon past Lower Granite dam currently peaks in mid to late June, indicating that most juveniles would have emigrated from the Hells Canyon reach before the ramping rate restriction is relaxed on June 15. Connor et al. (1991) reported that the shoreline rearing by fall Chinook parr in the upper Hells Canyon reach (upstream of the Salmon River) was complete by June 21 in four out of 6 years studied, with end dates ranging from June 15 in 1997 to July 5 in 1998. The monitoring and adaptive management approach would allow the timing and magnitude of ramping rate restrictions to be adjusted if it is warranted based on monitoring results.

Comment AR-60: The Forest Service comments that Idaho Power's studies did not evaluate stranding on cobble bars, entrapment in seasons other than the spring, or the cumulative effect of fish being entrapped multiple times during their downstream migration. ODFW recommends that monitoring of entrapment and stranding should include evaluation of stranding on cobble bars and be expanded beyond March-June to assess stranding of other species.

Response: We include, as part of the Staff Alternative, a stranding and entrapment management plan that would be developed in consultation with the management agencies and interested tribes. The plan would include monitoring of stranding on cobble bars and of entrapment of fall Chinook salmon juveniles and bull trout, and would establish a mechanism for modifying project operations through adaptive management to address unidentified or unanticipated adverse effects.

Comment AR-61: The Forest Service states that a review of Idaho Power's instream flow study, prepared under contract to the Forest Service (Hardy, 2006), indicates that Idaho Power's analysis underestimated the potential impact of daily ramping cycles.

Response: We revised section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, to include a discussion of the review prepared by Hardy (2006).

Comment AR-62: Interior expresses concern that the draft EIS considers the potential impacts of project operations only on fall Chinook salmon. It recommends that the benefits of an adaptive approach to studying the effects of ramping rates on native aquatic species be considered.

Response: We expanded the stranding and entrapment management plan to include monitoring effects on bull trout, and we added an invertebrate monitoring plan to determine effects on invertebrate production and on rare and sensitive mollusks. Both of these plans include adaptive management provisions that would offer a means of modifying project operations to address project effects.

Comment AR-63: NMFS, Interior, and ODFW recommend that FERC require that outflows from Hells Canyon dam be measured within one mile downstream from the dam at USGS station number 1320450. NMFS states that measuring compliance 17 miles downstream at Johnson Bar masks project effects, thereby reducing the usefulness of the measurements in ensuring compliance. NMFS also recommends that the station be used to monitor DO and TDG to ensure compliance with other license conditions. The Forest Service comments that the draft EIS fails to identify specific data to support the proposal to monitor compliance at Johnson Bar. Interior states that the NEPA document should include a table that shows current ramping rates at other licensed projects, and that ramping rates at the Hells Canyon Project should conform to current standards at projects that affect important anadromous and resident fisheries.

Response: As an outcome of discussions that occurred at the 10j meeting held in December 2006, we added a requirement to the Staff Alternative that would require Idaho Power to develop and implement an operational compliance and water quality monitoring plan. The purpose of this plan is to monitor compliance with minimum flows, reservoir levels, and ramping rates specified in the license, and to monitor water quality upstream of Brownlee reservoir, within Brownlee reservoir, and downstream of Brownlee and Hells Canyon dams. The plan would include continuous monitoring of river flows and water quality at one site located within 5 miles downstream of Hells Canyon dam, as well as periodic spot measurements of water quality above, within, and downstream of Brownlee reservoir and at multiple points downstream of Hells Canyon dam. The results of the monitoring would be made available to the public on the Internet and summarized in annual reports. We recommend that the plan require a new ramping rate be developed to account for the change in location. We also recommend that adaptive management provisions be incorporated in the monitoring plans to assess fish stranding and entrapment and invertebrate production. These provisions would allow ramp rates to be adjusted in the future to address adverse effects that are identified by the results of monitoring. We see little value in preparing a table showing current ramping rates at other licensed projects, since the effects of ramping are highly dependent on site-specific factors including the species and lifestages that are present and the occurrence of gently sloping shorelines or pools and side channels that can become disconnected from the river channel.

Comment AR-64: Interior comments that the draft EIS includes the annual cost of changing Idaho Power's flow compliance point to within one mile of Hells Canyon dam, which would be between $4 and $7.5 million due to reduced ramping rates. At the same time, the draft EIS states that the potential cost of run-of-river operations for 6 years would be $5 million annually, and the cost of the Staff Alternative to reduce ramp rates to 4 inches per hour from March 15 to June 15 would be $6.8 million annually. Interior states that it is unclear how these costs were estimated, and there does not appear to be consistency among the various operational changes and associated costs.

Response: During the section 10(j) meeting, Idaho Power clarified that the annual cost of 6 years of run-of-river operation was less than changing the compliance point because the 6-year test period was considered to be a temporary measure, which would not have a permanent effect on the project's dependable capacity. Idaho Power noted that these costs were calculated in a manner determined by the Public Utilities Commission. However, we over-estimated the cost for the staff-recommended seasonal 4-inch-per-hour ramping rate in the draft EIS. The original cost estimate was based on costs estimated by Idaho Power for Scenarios 1(d) and 1(e), which was based on compliance measurement within 1 mile of Hells Canyon dam. The 4-inch-per-hour seasonal ramping rate included in the Staff Alternative would be measured at Johnson Bar, and would not affect ramping rates or dependable capacity compared to current conditions, other than in the March 15 to June 15 period when the more restrictive ramping rate would be imposed. Because this is not a high-demand period, there would be no effect on dependable capacity. As a result, our estimated annual cost for the seasonal 4-inch-per-hour ramping rate included in the Staff Alternative is reduced substantially in the final EIS, from $6.8 million to $988,000.

Comment AR-65: The Forest Service comments that the draft EIS, on page 209, inaccurately describes the maximum daily flow change (10,000 cfs) under typical operating conditions. The Forest Service states that Idaho Power proposes this limitation only for the summer recreation season (Memorial Day to Labor Day).

Response: We modified the text in final EIS section 3.6.2.1 to include this correction.

Juvenile Migration

Comment AR-66: Interior comments that the document should discuss the regional and local environmental effects of delivering flow augmentation water from upstream BOR storage facilities to Brownlee reservoir, including alternative methods that provide for the maximum benefit to aquatic resources. It states that these methods should track and account for this water and ensure its delivery in a measured and timely fashion downstream from the project.

Response: We expanded our analysis of the effects of measures recommended by stakeholders regarding Idaho Power's participation in the regional flow augmentation program in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*. In that section, we conclude that adopting the target Brownlee elevations identified by NMFS in measures

NMFS-8 and NMFS-9 would ensure that flow augmentation water is passed through the project in a timely fashion. Furthermore, we added to the Staff Alternative a measure that would require Idaho Power to develop an operational compliance and water quality monitoring plan to monitor compliance with minimum flows, reservoir levels, and ramping rates specified in the license, which would include the posting of reservoir levels and flow rates on the Internet.

Comment AR-67: NMFS comments that none of the graphics depicting the effects of flow augmentation releases at Brownlee reservoir (reservoir elevation as vertical axis) throughout the juvenile migration section of the document reflect what was recommended by NMFS or adopted by FERC staff.

Response: The figures that we used in the draft and final EISs to portray the effects of operational recommendations are from Idaho Power's response to our AIR, which was based on additional study requests submitted by the agencies, tribes and NGOs. The flow augmentation scenario was developed using the reservoir elevations and timing that was specified in the additional study request filed by NMFS. Although we understand that the 10(j) recommendation that was ultimately filed by NMFS differs from the modeled scenario in some respects (e.g., the maximum drawdown would be to elevation 2,059 feet msl instead of to 2,049 feet msl), we considered the model results to be sufficient to provide a conservative representation of the effects of flow augmentation on other resources.

Comment AR-68: NMFS states that it provided clarifications in its January 24, 2006, filing with respect to the "reservoir" or "estuary" type Chinook salmon life-history strategy that has been expressed only since the flow augmentation releases (including cool water releases from Dworshak dam) have been instituted. NMFS recognizes that these life-history strategies are providing substantial numbers of returning adults, but takes issue with Idaho Power's characterization of these fish being a small proportion of all juveniles migrating past Lower Granite dam. NMFS states that the proportion of juveniles produced in the various spawning areas that adopts each of these life history strategies is unknown, but it appears that yearling fish are predominantly from the cooler water spawning and rearing areas, not from the mainstem Snake River that is most directly affected by the Hells Canyon Project.

NMFS comments that the key to sustaining the yearling life-history strategy is to provide suitable water temperatures for rearing (less than 68° F) in the Snake River through August, and good passage conditions during the following spring, when many of these fish are actively migrating. Thus, NMFS states that measure NMFS-8, which would minimize reductions in streamflow associated with spring flood operations, should benefit fall Chinook salmon that outmigrate as yearlings.

Response: We incorporated this information into the text in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*.

Comment AR-69: IDFG comments that the statement "[y]earling fish typically migrate before flow augmentation water is released from Brownlee reservoir in late June through July" is not entirely accurate. IDFG notes that Connor et al. (2005) showed that some fall Chinook salmon juveniles in the Snake River basin spend their first winter in a reservoir and resume seaward movement the following spring at age one.

Response: We clarified the text in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*, to say that yearling fish typically outmigrate in the following spring.

Comment AR-70: NMFS comments that figure 56 in the draft EIS (figure 76 in the final EIS) indicates that flow augmentation causes an increase in water temperatures downstream of Hells Canyon dam in July and August. It comments that because the majority of fall Chinook reared in the Hells Canyon Reach begins their seaward migration by early July and are predominantly located in and below Lower Granite reservoir, this graphic is largely immaterial to the question of how 237 kaf of flow augmentation affects juveniles migrating through Lower Granite reservoir. NMFS states that Idaho Power's modeling indicates that project operations only slightly affect temperatures in Lower Granite reservoir. NMFS states that the draft EIS would be improved by including information on how flow augmentation affects conditions in Lower Granite reservoir and discussing how Dworshak dam releases are managed to optimize both flow and temperatures for actively migrating juveniles.

Response: We incorporated this information into the text in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*.

Comment AR-71: Interior comments that draft EIS figures 57 and 58 (final EIS figures 77 and 78), which depict adult escapement at Lower Granite dam and flow augmentation releases, should also show the number of hatchery fall Chinook released by year into the Snake River. NMFS states that although these figures suggest support for the hypothesis that flow augmentation increases adult returns, it notes that adult returns are driven in large part by ocean and estuarine conditions, by the number of smolts produced by both natural and artificial means, and by the rate at which they survive through the mainstem Snake and Columbia River dams.

Response: We added a new table in the final EIS (table 51) that provides annual totals of yearling and subyearling fall Chinook salmon released from acclimation sites upstream of Lower Granite dam. We also revised the text to describe other factors that have likely contributed to the recent increase in the number of adult fall Chinook passing lower Granite dam.

Comment AR-72: NMFS and ODFW recommend that FERC remove the post-licensing reevaluation of flow augmentation from the Staff Alternative. The Nez Perce Tribe expresses concern that the flow augmentation report would be used to discontinue flow releases from Brownlee reservoir. NMFS states that the mainstem Snake River produces only a few "reservoir type" juveniles in most years, and that the majority outmigrate in June and July when they would benefit from flow augmentation. NMFS and ODFW state that there are many environmental factors affecting the adult return rate of fall Chinook, and that it would be risky to ascribe variations in adult returns to flow conditions alone, particularly over such short time periods. Interior comments that uncertainties introduced by this requirement would make it impossible to address how project operations would affect listed species after 2009. ODFW recommends that a comprehensive monitoring program be conducted over the term of the new license to provide information necessary to determine the efficacy of flow augmentation. This monitoring program would include parameters identified by the Independent Scientific Advisory Board (ISAB, 2003). Idaho Power comments that development of an experimental design to assess the efficacy of flow augmentation is complex, and requires significantly more thought and analysis than the approach recommended by FERC staff.

Response: In the final EIS, we eliminated from the Staff Alternative the 2009 post-licensing reevaluation of flow augmentation that we recommended in the draft EIS. However, it is likely that additional information on the effects of flow augmentation will continue to be developed, and that this information could improve our understanding of how flow augmentation water can be managed to maximize benefits to outmigrating salmon and steelhead. Accordingly, we recommend that the manner in which Brownlee storage is used to provide flow augmentation water be reviewed in 2015 or sooner if petitioned by Idaho Power, IDFG, ODFW, NMFS, FWS, or interested tribes.

Comment AR-73: NMFS states that juvenile migration survival rates are the most appropriate evaluation tool, not adult returns. The Umatilla Tribes and the Nez Perce Tribe recommend that the metrics for evaluating the benefits of flow augmentation should be measurement of juvenile migration timing and reach survival to Lower Granite dam.

Response: We recognize that adult returns are influenced by a large number of variables, and that evaluating the survival rates of juvenile salmon passing at downstream dams is a better method to evaluate survival benefits associated with flow augmentation. Accordingly, we eliminated the recommendation that we made in the draft EIS that the effectiveness of flow augmentation be evaluated based on adult returns, and instead recommend evaluation based on juvenile salmon.

Comment AR-74: IDFG comments that flow augmentation from the upper Snake River may provide marginal travel time benefits and harm downstream migrants through increased summer water temperature. IDFG cites a number of limitations of studies conducted to date, and recommend that inferences regarding the efficacy of flow augmentation from the upper Snake River should either be qualified or eliminated from the draft EIS. IDFG states that little, if any, research has focused specifically on the efficacy of flow augmentation from the upper Snake River (which has different flow and temperature characteristics than flow augmentation from Dworshak reservoir) on fall Chinook salmon migration and survival in the lower Snake River. IDFG also states that draft EIS figures 57 and 58 (final EIS figures 77 and 78), which show fall Chinook salmon adult returns and flow augmentation volumes, are misleading because they do not take into account other factors that influence adult returns, and recommend that the figures and associated text be removed from the draft EIS.

Response: In the final EIS, we qualified our conclusions regarding the relationship between flow augmentation and adult returns. Also, we added final EIS table 51 showing the number of hatchery fall Chinook salmon that have been introduced to the reach to better portray the likely influence of supplementation on adult returns. As noted above, we recommend that the manner in which Brownlee storage is used to provide flow augmentation water be reviewed in 2015, or sooner if petitioned by Idaho Power, IDFG, ODFW, NMFS, FWS, or interested tribes.

Comment AR-75: IDFG cites a recent study showing that lower flows from Hells Canyon result in less water mixing below the confluence of the Snake and Clearwater rivers. Decreased mixing resulted in a slightly warmer epilimnion (upper stratified zone) in Lower Granite reservoir and cooler hypolimnion (lower stratified zone) temperatures (lower by more than 1°C). By inference, greater flow augmentation from the upper Snake River may increase mixing and therefore increase summer temperatures in an otherwise cooler hypolimnion, which may negate possible travel time benefits from upper Snake River flow augmentation.

Response: We incorporated this information into the text in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*.

Comment AR-76: IDFG recommends that any re-evaluation of flow augmentation be conducted in cooperation with other state and federal agencies and regional interests. IDFG comments that the evaluation should, at minimum, quantify the physical impacts of flow augmentation from Brownlee reservoir (e.g., water velocity, turbidity, temperature) and the biological impacts (e.g., migration and survival impacts).

Response: We concur that any re-evaluation of flow augmentation should be conducted in cooperation with other state and federal agencies and regional interests. We also conclude that the flow augmentation evaluation include consideration of the factors identified by IDFG.
Comment AR-77: ODFW requests that it be included in the consultation on refill rates after Brownlee reservoir has been drawn down for flood control purposes.

Response: We modified the Staff Alternative to include coordination of Brownlee refill after April 30 with the Corps, NMFS, ODFW, IDFG and interested tribes.

Comment AR-78: The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS does not examine specific flow augmentation benefits to Snake River fall Chinook salmon associated with a range of augmentation flows. They state that CRITFC and EPA collaborated on an analysis of flow augmentation volumes from 237 to 927 kaf on water temperatures at Lower Granite dam and particle travel time as a result of Hells Canyon Project outflows. Based on reduced water particle travel time, their analysis indicates that most of the fall Chinook migration would experience increases in survival with flow augmentation greater than 237 kaf in all years modeled, even without temperature control from the project. In addition to the work of Connor et al. (2003) cited in the draft EIS, the Umatilla Tribes state that some of the best available scientific information regarding the strong correlation between increased fall Chinook survival and reduced water particle travel time is offered by Williams et al. (2005).

Response: We incorporated the pertinent information from Williams et al. (2005) into our analysis in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*. As previously stated, we recommend that the manner in which Brownlee storage is used to provide flow augmentation water be reviewed in 2015, or sooner if petitioned by Idaho Power, IDFG, ODFW, NMFS, FWS, or the interested tribes.

Comment AR-79: ODFW recommends that Idaho Power pass all BOR flow augmentation water through the project, and assist with flow augmentation by shaping up to 100 kaf of BOR water releases as necessary. ODFW states that typically, Idaho Power has only needed to shape 30 to 35 kaf. AR/IRU comment that the draft EIS failed to analyze the benefits of flow shaping and providing timely pass-through of flow augmentation water provided from the upper Snake River basin. The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS does not address their recommendation to provide timely pass through of all BOR Upper Snake water through the project, in consultation with, and subject to approval of, the Umatilla Tribes and other appropriate tribes, as well as state and federal agencies. The Umatilla Tribes state that in the past, Idaho Power has held this water within the project boundaries for its own economic gain when it was needed to aid anadromous fish migration in the Lower Snake River. Interior comments that the NEPA document should discuss methods to account for, and to ensure the timely delivery of, augmentation water from BOR's storage reservoirs to the Snake River downstream of the project. IDFG comments that because system-wide coordination is essential to any flow augmentation study or program, it recommends that a more accessible water accounting system be developed collaboratively by BOR, IDWR, and Idaho Power.

Response: As previously stated, we expanded our analysis of the effects of measures recommended by stakeholders regarding Idaho Power's participation in the regional flow augmentation program in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*. We conclude that adopting the target Brownlee elevations identified by NMFS

(NMFS-8 and NMFS-9) would ensure that flow augmentation water is passed through the project in a timely fashion. During the December 2006 section 10(j) meeting, Idaho Power reported that BOR has developed approaches for managing its storage facilities that have allowed its augmentation water to be delivered to the lower Snake River in a timely fashion. We also recommend, as part of the Staff Alternative, that Idaho Power develop an operational compliance and water quality monitoring plan, which would include posting hourly water surface elevations and estimated storage volumes in each of the project reservoirs on an Internet site. This plan would provide the framework for documenting compliance with any reservoir elevations required in a new license.

Comment AR-80: The Umatilla Tribes and the Nez Perce Tribe comment that the draft EIS says "[m]odeling conducted by Idaho Power shows that 350 kaf of storage from Brownlee reservoir would increase water temperatures." However, they state there is no citation or report given to support this statement. The Umatilla Tribes go on to state that they provide a quantitative temperature modeling analysis in their comments that clearly indicates there would be a benefit to juvenile anadromous fish from flow augmentation.

Response: Our analysis of Idaho Power's temperature modeling results is in section 3.6 of the draft EIS. Also, plots of simulated water temperatures downstream of Hells Canyon dam under proposed operations and with 350 kaf of flow augmentation were shown in draft EIS figure 56 (final EIS figure 76). While there are studies to the contrary, we conclude that the preponderance of evidence indicates that flow augmentation provides a benefit to migrating juvenile anadromous fish.

Comment AR-81: The Umatilla and Nez Perce tribes comment that maintaining Brownlee reservoir at its upper curve for flood control during the late winter and early spring would assist with meeting target flows specified in the 2004 biological opinion (85 to 100 kcfs between April 10 and June 20 and between 50 to 55 kcfs between June 20 and August 31). They recommend that the preferred alternative include a provision that would require Idaho Power to maintain Brownlee reservoir at its upper flood control rule curve, and that Brownlee reservoir not be refilled during the spring target flow period (April 10 to June 20) unless target flows are being met at Lower Granite dam.

Response: We revised the text in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, in the subsection on *Anadromous Fish Juvenile Migration*, to address these recommendations. We conclude that filling Brownlee reservoir by April 15 would minimize the potential for adverse flow effects during the majority of the spring outmigration season. We note, however, that deferring refill until after June 20 would conflict with NMFS's recommendation to fill the reservoir in preparation for summer flow augmentation to benefit subyearling fall Chinook salmon.

Comment AR-82: The Umatilla and Nez Perce tribes comment that operation of Brownlee reservoir to one set of fixed elevations for anadromous fish flows, is inflexible and fails to take advantage of runoff and flow conditions that can vary significantly between years. The Umatilla Tribes recommend that Idaho Power, subject to annual tribal and fishery agency consultation and approval, should investigate and make the most efficient use of Brownlee storage to meet anadromous fish needs on an annual basis. They recommend that Brownlee operations be managed to: (1) draft Brownlee reservoir by May 15 for spring flows; (2) refill Brownlee reservoir by June 15 for summer flow storage for fish flows and pass some portion of inflows during this period; and (3) draft Brownlee for summer flow augmentation by August 1 and then refill to a level necessary to provide minimum flow of 9,000 cfs for fall Chinook spawning and incubation below the project. The Umatilla Tribes support their recommendation with an analysis of 50 years of historical flows, which indicates that all three fish flow objectives could be met and balanced by judicious use of annual flow forecasts and real-time management.

Response: We modified final EIS sections 3.6.2.1 and 5.2.2.3 to include an evaluation of these recommendations. We recognize that there may be opportunities to increase flow augmentation levels in years with high runoff forecasts that would still allow Brownlee reservoir to be refilled to meet refill requirements for summer augmentation and recreation. However, we conclude that the biological benefit of implementing flow augmentation is the greatest during low flow years, and that increasing the amount of flow augmentation water provided from Brownlee reservoir in medium and high flow years would provide little biological benefit. Nonetheless, we include in the Staff Alternative a provision that Idaho Power's participation in the flow augmentation program may be revisited via petition if substantial evidence indicates that such a review is warranted.

Comment AR-83: The Umatilla and Nez Perce tribes cite recent literature that supports the importance of flow augmentation to reduce water particle time and increase survival rates of outmigrating anadromous fish. They also comment that Federal Columbia River Power System operations have significantly changed with the advent of 24-hour spill at lower Snake dams and at McNary dam. They indicate that implementation of this spill in 2005 and 2006 has significantly reduced water particle and fish travel time and increased reach survival for Snake River fall Chinook. They note that increasing the amount of flow augmentation provided from Brownlee reservoir would increase the volume of water that can be spilled at downstream projects, and would increase the survival of juvenile fall Chinook salmon migrating past downstream dams.

Response: Our understanding is that summer spills to improve survival at downstream projects are typically limited by TDG levels during medium and high water years. Consequently, increasing flow augmentation water provided from Brownlee reservoir in high runoff years would not necessarily increase the amount of water that could be spilled at downstream projects. However, in the event that information becomes available that would support modifying the flow augmentation, as previously noted, we include a provision in the Staff Alternative that Idaho Power's participation in the flow augmentation program can be revisited via petition if substantial evidence indicates that such a review is warranted.

Comment AR-84: Idaho Power discusses four arguments that supports its position that the provision of flow augmentation water from Brownlee reservoir is not justified: (1) the 1980 Hells Canyon settlement agreement was designed to provide full and complete mitigation for all numerical losses of salmon and steelhead caused by construction and operation of the project under the original license; (2) adoption of flow augmentation in the Staff Alternative is based on a false premise that the project is having adverse effects on fall Chinook spawning and rearing downstream from Hells Canyon dam that have not been addressed; (3) impacts to migrating salmon due to delayed passage through downstream federal projects are not related to the operations or existence of the project; and (4) the efficacy of the flow augmentation program remains in considerable doubt.

Response: With regard to Idaho Power's first three arguments, we do not concur that Idaho Power's hatchery program has effectively mitigated all impacts associated with the cumulative effects of Idaho Power's hydroelectric projects on the Snake River. Idaho Power has not met its fall Chinook salmon production target in most years and, other than the release of limited numbers of surplus steelhead and spring Chinook salmon, the hatchery program does very little to mitigate for lost fisheries in the basin upstream of Hells Canyon dam. As to the fourth argument, we conclude, based on our independent review and analysis that the preponderance of evidence indicates that flow augmentation provides a substantial benefit to outmigrating anadromous fish.

Native Resident Salmonids

Comment AR-85: Interior comments that the draft EIS does not say that there is limited information currently available on bull trout movement and migration downstream of Hells Canyon dam, and that population trends and status for the species over time are not available. Interior recommends that FERC include a more thorough description of the information available for bull trout downstream of Hells Canyon dam, and of any assumptions made in the environmental analysis based on that information. Interior states that this analysis should include a description of the scope of existing studies and any potential data limitations. Interior also comments that the draft EIS does not provide information regarding what life stages of bull trout are present throughout the project and how those life stages are expected to use different habitats within the project.

Response: We summarized available information on the distribution, status and life history of bull trout within and downstream of the project area in section 3.6.1.4 of the draft EIS. We recognize that the information available on bull trout trends, status, and migration downstream of Hells Canyon dam is limited. This is part of the reason that we recommend additional monitoring to evaluate bull trout stranding and project effects on invertebrate production to assess effects on the food resources available to bull trout and other fish species. For more detailed information on the status and life history of the bull trout population within and downstream of the project, we refer Interior to sections 4.2, 4.3, 5.1 and 5.2 of technical appendix E.3.1-7 of Idaho Power's license application. Available information on population trends in the project area is limited, and this limitation forms the basis for Idaho Power's proposal to construct a monitoring weir on Pine Creek.

Comment AR-86: Interior recommends that FERC staff consider information about mortality factors from radio telemetry studies and observations of radio tagged bull trout in the main stem of the Snake River.

Response: We modified the text in section 3.6.1.4, *Native Resident Salmonids*, to include a discussion of the movements of radio tagged bull and redband trout.

Comment AR-87: Interior recommends that Commission staff review and include information contained in FWS's September 2005 paper *Hydroelectric Operations: A Summary of Studies of Effects on Aquatic Resources*, which was submitted with Interior's preliminary terms and conditions.

Response: We incorporated information into the final EIS from several of the studies that were cited in FWS's review paper. It is not our practice, however, to include an exhaustive literature review on each issue that is addressed. We include only enough information to adequately support and inform our analysis.

Comment AR-88: Interior comments that the modeling results for bull trout and redband trout in the Snake River was conducted using habitat use criteria collected in a highly altered Snake River environment, which may not be reflective of preferred habitat in an improved aquatic environment. Interior states that conclusions made based on the WUA analysis should be reconsidered in the EIS using a cooperative approach, as is intended with any instream flow habitat assessment.

Response: In our view, the suitability criteria developed by Idaho Power are sufficient for the purposes of assessing project effects and for evaluating the potential effects associated with modifying project operations. The habitat suitability criteria were developed based on telemetry data from 23 bull trout monitored over the winter and early spring months, when water quality conditions are generally good and would not be expected to alter habitat use substantially. Although information on habitat use at night was not determined, this is an understandable limitation given the safety considerations related to night operation of boats on a whitewater river. Habitat use may have also been affected to some degree by load following operations, but the extent of load following varied considerably over the monitoring period, so the data collected is representative of a wide range of operations. We recognize that the study would have benefited from a higher level of coordination with the resource agencies and tribes. However, the study approach used by Idaho Power was technically sound and yielded results that are sufficient to support our analysis of the effects of project operation on aquatic resources.

Comment AR-89: Interior comments that the draft EIS is correct in that some resident salmonids move out of the main Snake River into tributaries. However, Interior states that resident salmonids may be present in the Snake River at any time and are therefore vulnerable to effects from project operations. For example, Interior states that Idaho Power's limited data indicates that at least 2 of 7 bull trout monitored with radio telemetry were located in the mainstem Snake River in August of 2000. ODFW states that Idaho Power's studies documented usage of the mainstem Snake River by bull trout, including nearshore habitats affected by load following operations, in all seasons, and that anglers have reported catching rainbow trout in the mainstem Snake River in nearly every month of the year. The Forest Service and ODFW state that the draft EIS did not consider: (1) Muhlfeld et al. (2003) that indicates that bull trout sub-adults use margin-related foraging sites during the winter, or (2) Chandler (2006) that identifies bull trout adults using the "plumes" at coldwater tributary junctions of several streams.

Response: We modified the text in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, and 5.2.4.2, *Flow Fluctuations Outside of the Fall Chinook Spawning and Incubation Period*, to reflect this information.

Comment AR-90: The Forest Service comments that there is insufficient information to determine the effects of project operations on species other than fall Chinook salmon. The Forest Service notes that collection of 1,070 redband trout, with a catch per unit effort of 0.5 to 2.0 fish per hour, during sampling conducted by Idaho Power indicates the presence of a substantial population of redband trout in this reach.

Response: Based on new information filed with comments on the draft EIS, we modified the Staff Alternative to include additional monitoring of fish stranding and entrapment of native resident salmonids, as well as invertebrate monitoring, to determine project effects. Both monitoring efforts would include adaptive management components to refine project operations if warranted to enhance habitat conditions for aquatic species.

Comment AR-91: AR/IRU comment that the draft EIS provides little information on mountain whitefish, and recommend that the EIS include an analysis of project impacts and mitigation needs for this species.

Response: Effects on mountain whitefish were not identified as a major issue during NEPA scoping. In addition, no measures specifically designed to benefit this species were recommended by any party to the proceeding. Nonetheless, most of the measures that would benefit redband and bull trout would also provide benefits to mountain whitefish.

Comment AR-92: Interior states that the NEPA document should provide a complete analysis of the effects of project operations on bull trout prey availability.

Response: We expanded our discussion of the effects of load following on invertebrates in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, including information from several relevant studies cited by Interior. We also expanded the discussion of effects on bull trout in section 3.8.2.6, *Bull Trout*.

Comment AR-93: Interior comments that Idaho Power recently collected 1 year of data on the entrapment of juvenile salmon during the spring. Interior states that this effort did not address other Snake River native fishes of interest, including (1) younger age classes of redband and bull trout, which may be present in any month of the year, and (2) white sturgeon, which never migrate out of the mainstem of the Snake River to complete their life history. Interior recommends that the NEPA document include a complete analysis of the potential and expected effects of stranding and entrapment to bull trout and redband trout, and specify whether and under what conditions Idaho Power will continue monitoring these effects.

Response: We include, as part of the Staff Alternative, a measure that would require Idaho Power to develop a Stranding and Entrapment Management Plan, which would require expanded monitoring to assess effects on fall Chinook salmon, bull trout, and redband trout, and to determine whether additional measures are warranted to benefit these species. The expanded monitoring effort would also provide information on any other species or lifestages that are susceptible to stranding and entrapment.

Comment AR-94: Interior states that the draft EIS cites Chandler et al. (2006 that documents that bull trout found in the Snake River were similar in size and condition as those from the Salmon River. However, the draft EIS does not identify the significance or potential implications of this statement. Interior recommends that the NEPA document expand on the Chandler et al. (2006) findings and explicitly interpret those findings in the context of effects of the project on bull trout. Interior also recommends that the NEPA document include an analysis of other related information, such as the relationship between size and density in fish communities.

Response: We expanded our discussion of bull trout in section 3.6.2.1, *Effects of Project Operations on Aquatic Resources*, of the final EIS to include more information and analysis of weights and condition factors.

Comment AR-95: The Forest Service does not agree with FERC staff's modification of the Bull Trout Passage Plan included in its 10(a) recommendation and FWS's fishway prescription. Interior states that the NEPA document should include a recommendation that Idaho Power actively participate in the management and life history restoration for resident fish species over the term of the license. It also recommends that the Staff Alternative include and clearly describes the measures needed to lead to the restoration of resident fish passage at the project. The Shoshone-Paiute Tribes comment that passage of resident fish has been largely ignored and needs to be included.

Response: In the final EIS, we adopt Interior's modified fishway prescription in the Staff Alternative, which involves the phased restoration of connectivity among native resident salmonids in several key tributaries in the project area. This measure should help to restore the fluvial life form of bull trout, which has likely been greatly reduced as a result of poor passage conditions at the project.

Comment AR-96: Idaho Power, Interior, and ODFW recommend that the Pine Creek weir not be delayed pending brook trout removal efforts, as recommended by staff. All three agree that the weir is needed to establish a long-term trend and monitoring program of fluvial bull trout.

Response: In the final EIS, we adopt Interior's modified fishway prescription in the Staff Alternative, which specifies that the Pine Creek weir and trap fishway be constructed within 2 years of license issuance.

Comment AR-97: ODFW recommends that Idaho Power conduct a population viability risk analysis of genetic and demographic costs incurred by donor and recipient bull trout populations. ODFW comments that very little is known about the fluvial component of bull trout currently within the Pine Creek basin or any Snake River basin, and there is currently no means of establishing long-term trends of fluvial fish deemed to be critical to recovery of the core area. ODFW states that trend information for fluvial bull trout using the mainstem Snake River is limited and difficult to obtain, especially given the low numbers of bull trout in the system.

Response: We modified our recommendation so that the need for a population viability analysis would be determined through development of the Bull Trout Passage Plan implemented as part of Interior's modified fishway prescription.

Comment AR-98: ODFW questions the statement in the draft EIS that the results of radio telemetry studies might lead to a decision to transfer outmigrating bull trout from Pine Creek to habitat downstream of Hells Canyon dam. ODFW is concerned that transferring bull trout could mine fish from upstream populations and increase their risk of extinction. Furthermore, ODFW states that it does not want to preclude use of Hells Canyon reservoir as a rearing area for native migratory fish species. ODFW recommends that Idaho Power evaluate turbine- and spill-related mortality of native salmonids once ODFW and Idaho Power determine that sufficient numbers of fluvial fish exist to conduct an entrainment study. ODFW recognizes that given the low number of fluvial bull trout currently in the system, it is likely impossible to evaluate turbine-and spill-related mortality. However, ODFW states that this should be done in the future after passage systems and weirs are installed and fluvial fish numbers increase.

Response: We modified the text in sections 3.6.2.8, *Resident Salmonid Passage*, and 5.2.4.4, *Resident Salmonid Passage*, to reflect the fact that Idaho Power's telemetry studies conducted to date do not suggest that there is a high entrainment potential for bull trout. However, we recognize that additional telemetry studies may be conducted in the future as part of the monitoring efforts associated with Interior's modified fishway prescription.

Comment AR-99: IDFG states that if the development and implementation of a Fish Pathogen Plan requires additional agency resources and personnel, the license should allow for additional funding to support any additional state agency expenses. ODFW states that it has health expertise and efficient fish health laboratories, and that Idaho Power should consider funding a full or part-time pathologist position with ODFW for any fish health monitoring and authorization associated with the project and mitigation measures. Idaho Power states that it intends to fund the necessary pathology work associated with the proposed fish pathogen assessment. However, Idaho Power comments that it should have the option, but not be required, to fund a pathologist as part of its staff or through the fish management agencies. Idaho Power states that the primary consideration should be that the work be conducted by personnel qualified to conduct such assessments, and recommends that the final EIS provide for the option to fund a pathologist but should not require such funding.

Response: We modified the text in sections 3.6.2.9 and 5.2.4.6 of the final EIS to reflect that Idaho Power may hire or fund a full-time fish pathologist only if one is needed to perform the pathology work associated with the proposed fish pathogen assessment.

Comment AR-100: ODFW recommends expansion of pathogen surveying and monitoring to both native resident and anadromous populations upstream of, within, and downstream from the project. ODFW states that the survey area in Oregon should include the Snake River upstream of and downstream from the project, Pine Creek, Powder River (including Eagle, Daly and Goose Creeks), Burnt River, Owyhee and the Malheur River basins, and the Imnaha and Grande Ronde rivers downstream from Hells Canyon dam. If carcass outplants are to occur, ODFW indicates that there will likely be the need for annual fish health inspections to meet ODFW outplant guidelines for the use of adult salmon and steelhead carcasses. It states that the appropriate scope of the pathogen assessment should be determined in consultation with, and agreement of, ODFW and IDFG fish pathologists.

Response: We conclude that it is reasonable and appropriate to limit the scope of the pathogen survey to the range proposed by Idaho Power, which encompasses the tributaries and adjacent reservoirs where passage would be provided under Interior's modified fishway prescription. We note that Idaho Power's telemetry studies did not document any movement of bull trout to areas downstream from the Imnaha River. As a result, we do not include the Grande Ronde River.

Tributary Habitat Enhancements

Comment AR-101: Interior comments that BLM should be included in the parties invited to participate in the advisory committee that would oversee tributary habitat invited to participate in the advisory committee that would oversee tributary habitat improvements. The Shoshone-Paiute Tribes comment that the project area and the upstream habitat represent important aboriginal lands of the tribes, so the tribes should be included in the Technical Advisory Committee that oversees tributary habitat enhancements.

Response: We identify the parties that are expected to participate in the technical committee in section 5.2.4.5, *Tributary Habitat Improvements*. This would include landowners and representatives from state and federal agencies that manage lands where enhancements would be implemented, including BLM.

Comment AR-102: The Forest Service states that Idaho Power's tributary habitat mitigation fund should be expanded to include other tributaries including Eagle Creek. ODFW recommends that habitat enhancements to benefit redband trout and bull trout be expanded to include the Powder and Burnt River. ODFW comments that the Staff Alternative makes no provision for habitat enhancement if bull trout are present in Eagle Creek, or provisions to enhance redband trout within the Powder or Burnt River basins, or other tributaries that are also affected by project operations.

Response: We modified the Staff Alternative to include tributary habitat enhancements in portions of the Powder and Burnt River basins, where there is potential for rebuilding populations of redband or bull trout.

Comment AR-103: AR/IRU comment that they view Idaho Power's proposed $8.5 million funding level for tributary enhancements to be inadequate and that the draft EIS did not address the extent of Idaho

Power's financial contribution to the tributary habitat enhancement effort. They also state that the draft EIS does not address their recommendation that there be an adaptive management approach that leaves open the possibility of geographically expanding the tributary habitat improvement program.

Response: As previously stated, we modified the Staff Alternative to include tributary habitat enhancements in portions of the Powder and Burnt River basins where there is potential for rebuilding populations of redband or bull trout. To estimate the funding that would be needed to restore suitable habitat in the Powder River basin, we used the cost per square mile of drainage area in the Pine, Indian and Wildhorse basins from Idaho Power's proposal and applied it to the drainage of key tributaries in the Powder River basin (Eagle, Goose and Daly Creeks). We assumed that a comparable amount of funding would be required to improve suitable habitat in the Burnt River basin. The total funds that we recommend Idaho Power allocate to tributary enhancement measures is $18.0 million, which compares to $8.5 million proposed by Idaho Power and $22.5 million proposed by ODFW. ODFW recommended that the funding be provided in $750,000 increments in each year of the license. In order to expedite restoration efforts, we assumed that all funds would be allocated in the first ten years of the new license, which resulted in an annualized cost nearly twice that of ODFW's proposed measure. ODFW's staff has considerable knowledge of habitat conditions and enhancement opportunities in the project area. Based on the similarity of our proposed funding level, we conclude that our proposed level of funding is appropriate.

Comment AR-104: ODFW recommends that Idaho Power conduct presence/absence surveys for bull trout in all of the major tributaries associated with the Eagle Creek basin, including Eagle Creek, West Eagle Creek, and East Fork Eagle Creek. As part of these investigations, ODFW states that Idaho Power should operate a temporary picket-style weir near the mouth of Eagle Creek during the fall months to capture any fluvial fish exiting the Eagle Creek basin. If bull trout are captured, ODFW states that genetic sampling should occur to examine the extent of hybridization with brook trout.

Response: We modified the text in section 3.6.2.10 of the final EIS to clarify that all the components outlined by ODFW are included in Idaho Power's proposal, which we adopt in the Staff Alternative.

Comment AR-105: Interior recommends that the Staff Alternative include an adaptive management component as part of the tributary enhancement program to allow evaluation of the tributary habitat enhancements and associated effects on the native salmonids and their habitats. Interior also recommends that the NEPA document describe the magnitude and severity of the effect of water quality conditions in project reservoirs on connectivity among bull trout populations.

Response: We modified the text in section 5.2.4.5 to clarify that part of the funding would be used to conduct an appropriate level of monitoring to guiding future enhancement efforts. We also expanded section 3.6.1.4 to include analysis of effects of water quality conditions in project reservoirs on the seasonal habitat suitability for bull trout.

Marine-Derived Nutrients

Comment AR-106: ODFW recommends that nutrient supplementation be implemented in all tributaries to the project in coordination with ODFW and ODFW fish pathologists to improve forage opportunities for bull trout. ODFW states that if the proposed presence/absence survey documents the existence of bull trout in Eagle Creek, this tributary should be a priority area for nutrient supplementation. In addition, ODFW recommends that placement of salmon carcasses be designed to minimize benefits to brook trout and maximize benefits to bull trout and other native resident species, as opposed to making nutrient supplementation contingent upon the success of brook trout eradication efforts. ODFW concurs with staff that the transport and release of live surplus adult fish into Hells Canyon reservoir would benefit bull trout by increasing forage opportunities for bull trout from the eggs, fry, and carcasses of any fish that spawn in Pine and Indian creeks.

Response: We modified section 5.2.4.5, *Tributary Habitat Improvements*, to indicate that nutrient supplementation in Eagle Creek could be added to the tributary enhancement program if bull trout are found to occur in that stream during the proposed presence/absence survey. We also modified section 3.6.2.1, *Marine Derived Nutrients*, to reflect the suggestion that nutrient supplementation be targeted for habitat that would maximize benefits to bull trout and minimize benefits to brook trout.

Comment AR-107: Interior comments that the NEPA document should include a specific recommendation that Idaho Power develop a program to provide hatchery salmon and steelhead access to tributaries within the project area, as a means to restore marine-derived nutrients and improve forage for bull trout.

Response: In section 3.6.2.11, *Marine-Derived Nutrients*, of the final EIS we discuss the potential benefits of stocking surplus adult hatchery steelhead and spring Chinook into project reservoirs or directly into tributaries to restore marine derived nutrients and increase forage opportunities for bull trout. In final EIS section 5.2.4.8, *Hatchery Production*, of the final EIS we recommend that this use of surplus fish be considered in the development of a Surplus Hatchery Fish Plan to be developed in consultation with the Shoshone-Paiute and Burns Paiute tribes and fisheries management agencies (IDFG, ODFW, Interior, and NMFS).

Comment AR-108: The Umatilla Tribes and the Nez Perce Tribe comment that restriction of the Nutrient Supplementation Plan to Pine Creek, Indian Creek, and the Wildhorse River is inappropriate, because Idaho Power's projects have eliminated anadromous fish access to upstream tributaries as well.

Response: While we recognize that Idaho Power's Snake River projects have blocked anadromous fish access to many upstream tributaries, it is appropriate to focus fisheries restoration efforts associated with this relicensing proceeding on tributaries within the reach that is directly affected by the Brownlee, Oxbow and Hells Canyon impoundments. Focusing efforts in this manner is appropriate, because the nexus to a range of project effects is limited. Such effects include inundation of portions of the tributaries and adverse effects on connectivity from inhospitable water quality conditions during the summer and early fall. In addition, portions of these tributaries have been identified by stakeholders as areas with substantial potential for restoration and enhancement of habitat for native salmonid fisheries.

White Sturgeon

Comment AR-109: Interior recommends that the NEPA document describe precisely how the average WUA values for sturgeon were determined and expand the analysis of effects of different operating alternatives on different lifestages and sturgeon production, including comparisons to production that would occur under run-of-river conditions.

Response: As described on page 242 of the draft EIS, we used the plots of WUA to estimate the minimum, maximum and normal maximum daily percent fluctuation. All three of these statistics were estimated by visual interpretation of the plots shown in the draft EIS. As noted in footnote 48, the normal fluctuation was defined as the largest percentage change that occurred in at least 3 consecutive days. We compiled these statistics for each lifestage of sturgeon under each evaluation scenario and water year type in draft EIS table 49 (final EIS table 53). Interpretation of the biological significance of the observed level of variation in WUA relies on the analyst or the reader's scientific expertise, as there currently are no widely accepted tools or models for translating fluctuations in WUA into changes in fishery production. However, as stated in the draft EIS, we conclude that the size distribution of sturgeon (shown in draft EIS figure 76 and final EIS figure 96) indicates that the effects of current operations on the spawning success and recruitment are minimal. This finding is supported by the uniform distribution of larger size classes, which indicates that successful reproduction and recruitment occurs in most, if not all, years.

Comment AR-110: AR/IRU comments that the draft EIS analysis on effects of ramping impacts to sturgeon did not take into account effects on spawning or on the food supply available to white sturgeon. AR/IRU recommends that FERC refer to the FWS biological opinion on relicensing of the C.J. Strike and mid-Snake projects, which found that flow fluctuation can shrink the amount of deep-water habitat, degrade water quality and reduce food availability, even when such habitat is not dewatered.

Response: Habitat conditions in the Hells Canyon reach are substantially different from those that occur in the C.J. Strike reach. Habitat in the C.J. Strike reach is much shallower than the Hells Canyon reach, and contains few deep, turbulent areas that are favored by spawning sturgeon and that are abundant in the Hells Canyon reach. Further, habitat use information provided in Lepla and Chandler (2003) indicate that all lifestages of sturgeon from larvae to adult rarely use habitat that is less than 4 meters deep. We maintain that the level of food production in water this deep is unlikely to be affected by the range of flow fluctuations that are caused by project operations. As we noted on page 257 of the draft EIS, there is no indication that growth rates have declined because the sturgeon population rebounded after catch-and-release regulations were implemented, and the growth rates of sturgeon in the Hells Canyon reach compare favorably to other reaches of the Snake and Columbia rivers.

Comment AR-111: The Forest Service comments that FERC staff should adopt the adaptive management program proffered by the Forest Service and FWS as a means to identify the need for more restrictive ramping during sturgeon spawning, as well as other recommendations submitted by resource agencies designed to protect and enhance sturgeon populations in the Snake River. AR/IRU comments that the fact that there is some sturgeon recruitment does not show that project operations are not reducing the recruitment of sturgeon. AR/IRU state that FERC has dismissed Interior's expert analysis without any real justification.

Response: Given the considerable variation in load following operations between low and high flow years, we would expect to see evidence of impaired recruitment, if it were to occur, during low-flow years when load following operations are prevalent during the sturgeon spawning and incubation season. However, the size distribution of sturgeon both upstream of and downstream from the Salmon River is uniform for all size classes between 100 and 230 cm in length (shown in draft EIS figure 76 and final EIS figure 96). We find no indication of impaired recruitment. In addition, we consider it highly unlikely that the load following study proposed by the Forest Service and Interior would yield any useful insights regarding the effects of load following on sturgeon recruitment, considering the lack of effective methods for assessing the abundance of young lifestages of sturgeon before they attain a size that is susceptible to setline sampling (approximately 70 cm).

Comment AR-112: Interior states that in average flow years, the refilling process at Brownlee reservoir likely has a negative effect on white sturgeon progeny that have just hatched and are foraging in the main stem of the Snake River downstream from Hells Canyon dam. Interior states that this appears to be an unmitigated effect that occurs every year and should be analyzed more fully in the EIS.

Response: If reduced flows during the refilling process at Brownlee reservoir were adversely affecting recruitment, we would expect to see reduced recruitment during high flow years when flood control drafts are more substantial. Based on the information in draft EIS figure 76 (final EIS figure 96), we see no indication that substantial variation in recruitment occurs between years.

Comment AR-113: Interior states that the NEPA document should fully analyze the potential permanent loss of sturgeon production in the Brownlee reservoir reach as a result of project caused temperature and water quality problems.

Response: Based on the evidence in the record, there appears to have been no permanent loss of sturgeon production in Brownlee reservoir. There has not been a kill of adult sturgeon observed in Brownlee reservoir since 1990, and water quality conditions in the Swan Falls reach and in Brownlee reservoir are expected to gradually improve with implementation of the phosphorus TMDL. Idaho Power proposes measures, which we adopt in the Staff Alternative, to assess whether recruitment in this reach is limited by water quality conditions, followed by translocation or stocking efforts to rebuild the sturgeon population in the Swan Falls to Brownlee reach.

Comment AR-114: Interior comments that because setlines are not efficient at collecting smaller sturgeon, there is a lack of information on survival and recruitment of younger age classes of white sturgeon. Interior states that the NEPA document should include an analysis of other measures that could be implemented at the project to boost sturgeon survival from vitellogenesis and spawning through incubation, early rearing, juvenile, and adult life stages.

Response: We maintain that the uniform size distribution of sturgeon between 100 and 230 cm observed both upstream of and downstream from the Salmon River, despite substantial differences in flow levels and load following operations between years, provides substantial evidence that recruitment is occurring consistently and is not being substantially affected by project operations.

Comment AR-115: The Shoshone-Paiute Tribes recommend that conservation and restoration of white sturgeon be made a high priority issue for the project, and that effects on sturgeon be included in the list of principal issues in section 1.1, Purpose of Action.

Response: We modified final EIS section 1.1, *Purpose of Action*, of the final EIS, accordingly.

Comment AR-116: Interior and the Shoshone-Paiute Tribes state that the goal of the hatchery sturgeon program should be amended to reflect the goal of Idaho Power's White Sturgeon Conservation Plan, which is to have harvestable (catch and keep) fisheries for sturgeon in the Snake River.

Response: We modified the text in section 3.6.2.13, *Sturgeon Conservation Measures*, accordingly.

Comment AR-117: The Umatilla Tribes and the Nez Perce Tribe express support for the development of a Sturgeon Aquaculture Plan, but indicate that the plan needs more details regarding: (1) a plan for siting and operation a conservation hatchery; (2) broodstock collection, holding, and catalogue procedures; (3) collection and monitoring schedule for regular (1–3 year intervals) stock assessment/broodstock collection surveys; (4) genetic catalogue of adult spawners and released family groups; (5) breeding plan; and (6) research and development using radio/sonic tags to evaluate movement of hatchery sturgeon prior to implementation of management-level stocking.

Response: We include, in the Staff Alternative, a measure that would require Idaho Power to conduct a feasibility assessment that would assess the risks and benefits of the translocation and conservation aquaculture approaches for restoring white sturgeon populations in the reaches between Swan Falls and Hells Canyon dams. We note, however, that implementing a conservation aquaculture program would require approval from IDFG and ODFW, and approval by these agencies is uncertain. If approval to proceed with a conservation aquaculture program is obtained, the development of a detailed Aquaculture Plan, in consultation with the agencies and tribes, would be appropriate. We discuss our recommendation in section 5.2.4.10, *Sturgeon Conservation Measures*.

Comment AR-118: AR/IRU comment that the draft EIS does not address the Conservation Groups recommendation that a Technical Advisory Committee have authority to determine whether the conservation aquaculture program should be expanded beyond the Swan Falls reach.

Response: Expansion of a sturgeon aquaculture program to include stocking of additional reaches could be accommodated at minimal additional cost. However, any decision to stock sturgeon in reaches upstream of Swan Falls dam would need to be implemented through the licenses of those projects associated with the reach under consideration. In the case of the Mid-Snake and C.J. Strike projects, this would be accomplished through the license re-opener process. For the Swan Falls Project, this could be addressed in the upcoming licensing proceeding.

Comment AR-119: The Umatilla Tribes and the Nez Perce Tribe concur that attempts to implement upstream passage for sturgeon or replacing trashracks would likely involve a substantial expenditure of resources while providing little benefit. They note that downstream movement of white sturgeon will provide continued genetic variability, provided that the Conservation Plan includes a breeding program that maximizes genetic diversity in the affected section of the Snake River. Similarly, they agree that reducing trash rack spacing and entrainment concerns might create more mortality than turbine passage, particularly for young fish, and note that this issue has not been a significant concern on the lower Snake and the Columbia rivers.

Response: We note the Umatilla and Nez Perce's concurrence with our analysis on this matter. We did not modify our recommendations pertaining to sturgeon passage.

Comment AR-120: Interior recommends that the NEPA document include cost estimates for providing effective trash rack upgrades to prevent juvenile sturgeon entrainment. ODFW supports ongoing consultation to determine whether providing upstream and downstream passage is feasible and desirable. AR/IRU comment that the draft EIS does not address whether, in the absence of entrainment, the sturgeon populations would be in better shape.

Response: We expand our analysis in final EIS section 3.6.2.13, *Sturgeon Conservation Measures*, to evaluate whether reducing the trash rack spacing is a viable option to minimize the risk of entrainment. Based on our analysis, we conclude that the potential for sturgeon impingement on the racks would increase. Expanding the size of the intake and trash rack structure could reduce approach velocities and the potential for impingement, but would involve substantial capital costs given the engineering challenges of constructing a large structure in a deepwater forebay environment. We modified our recommended White Sturgeon Plan to include annual meetings with agencies and tribes to discuss monitoring and study results, and to consider whether additional measures or refinement of existing measures may be warranted to further enhance populations of white sturgeon.

Comment AR-121: The Forest Service comments that FERC staff appears to be relying on outdated paradigms by asserting that aquaculture and hatcheries can resolve problems related to white sturgeon habitat and population recovery in the Snake River. ODFW comments that sturgeon populations cannot be rebuilt relying on hatchery production alone. ODFW states that, as seen throughout the Columbia River basin with salmon and steelhead, suitable habitat conditions, including water quality and quantity, throughout the sturgeon's life history are necessary to support natural reproduction.

IDFG expresses concern regarding adoption of a conservation aquaculture approach to rebuilding sturgeon populations in the project area. The primary concerns that IDFG identifies are the risk of genetic swamping of wild populations with offspring from a small number of parent fish and artificial selectivity associated with aquaculture practices and the hatchery environment. In addition, IDFG notes that in Idaho, only the director of IDFG is authorized to establish and maintain fish hatcheries, and has supervision over all matters pertaining to the inspection, cultivation, propagation and distribution of wildlife. IDFG states that implementation of a hatchery conservation program, as the primary mitigation measure for white sturgeon protection and enhancement, is inconsistent with IDFG's Fisheries Management Plan and Draft White Sturgeon Management Plan.

ODFW (73-81) expresses many of the same genetic concerns as IDFG. ODFW states that it does not currently support a conservation aquaculture program due to the inherent risks and uncertainties associated with such a program. ODFW comments that the genetic implications of hatchery supplementation on wild stocks of white sturgeon, especially those downstream from Hells Canyon dam, must be thoroughly investigated first. ODFW continues to support genetic monitoring to detect the potential loss of genetic variation by inbreeding and genetic drift.

Idaho Power opposes stocking of sturgeon in the project reservoirs because: (1) stocking is not supported by the state resource management agencies, and (2) such programs are experimental and have not demonstrated long-term effectiveness in preserving sturgeon populations. Idaho Power also notes that some degree of continued supplementation would probably be required to maintain some desired level of population abundance, making the long-term benefit of this action questionable.

Response: We maintain that implementing a conservation aquaculture program is the only feasible means, other than a large-scale translocation program, to rebuild sturgeon populations in many of the interdam segments that do not include appropriate habitat to support the spawning, incubation, and larval lifestages of white sturgeon. Due to low population sizes and the fact that only about 10 percent of adult female sturgeon spawn in each year, only a small number of reproductive broodstock would need to be collected in any given year to match or exceed the level of genetic diversity that would result from natural reproduction in these reaches, especially if the broodstock were collected from a large, genetically diverse population such as in the lower Columbia River. In addition, because few adult fish would be needed in any year, new broodstock could be collected from the wild each year. This would help avoid the selective pressures that can occur when multiple generations of fish are spawned and reared in the hatchery environment.

We recognize that white sturgeon could not be stocked without approval from the state management agencies. Thus, we modified the Staff Alternative to include a feasibility assessment that is intended to assist IDFG and ODFW with weighing the risks and benefits of implementing a conservation aquaculture program.

We maintain that genetic risks can be reduced to negligible levels through appropriate selection of broodstock, and that regular stocking could succeed in developing harvestable populations of sturgeon in river segments that do not provide suitable habitat for spawning, incubation and larval lifestages of sturgeon. Also, marking of hatchery sturgeon via fin clips would allow selective harvest of any hatchery-origin sturgeon that move downstream into the Hells Canyon reach, further reducing the level of genetic risk to that population of sturgeon. Nonetheless, we modified the Staff Alternative to include monitoring of genetic variation, recognizing that this would provide useful information for guiding a conservation aquaculture or translocation program for rebuilding sturgeon populations.

Comment AR-122: Idaho Power maintains that the measures and strategies proposed for white sturgeon, as outlined in the final license application, provide a reasonable and logical progression for adaptive implementation of actions as the White Sturgeon Conservation Plan unfolds. Idaho Power, therefore, urges that the proposed alternative in the final EIS include each of the aspects of the proposed White Sturgeon Conservation Plan.

Response: We modified the Staff Alternative to include each of the measures recommended by Idaho Power in the White Sturgeon Conservation Plan. However, we added a feasibility assessment for implementing a conservation aquaculture approach to rebuilding white sturgeon populations in each inter-dam segment between Swan Falls and Hells Canyon dams.

Comment AR-123: ODFW (78-79) states that FERC staff should place increased emphasis on habitat improvement, and that sturgeon mitigation efforts should be focused on improving degraded water quality via a concerted and cooperative effort led by the Idaho and Oregon Departments of Environmental Quality. ODFW notes that white sturgeon collected from Brownlee reservoir had significantly lower condition factors than white sturgeon captured in Bliss, Oxbow, and Lower Granite reservoirs, and that Idaho Power attributes these lower condition factors to poor water quality in the reach of the Snake River below Walters Ferry to Brownlee reservoir. Interior and AR/IRU recommend that the discussion of future water quality improvements be revised to reflect the fact that changes may be quite slow since the nutrient portion of the TMDL has a 70- to 75-year compliance time frame, and is voluntary with respect to nonpoint source polluters.

Response: Efforts to improve water quality conditions in the project reservoirs (such as funding efforts to reduce phosphorus inputs) would benefit white sturgeon, as would water quality improvements in the Swan Falls reach. However, this type of measure lacks sufficient nexus to the effects of Idaho Power's Snake River projects for the Commission to require that the measures be funded by Idaho Power. To address the temporal issues, we qualified our references to water quality improvements to indicate that they would be gradual in nature and would extend beyond the term of the next license.

Comment AR-124: The Umatilla Tribes and the Nez Perce Tribe comment that it is inappropriate for FERC staff to reject measures to improve water quality for sturgeon in upstream areas since reservoirs act to exacerbate nutrient problems, resulting in large DO-related fish kills. They note that anoxic conditions near the reservoir bottoms tend to increase the concentration of methylmercury, the most toxic and bioaccumulative form of mercury. They also comment that increasing the concentration of DO in the reservoir beyond what is simply required in TMDL calculations is important in the interest of reducing the exposure to mercury.

Response: See previous response. Our understanding of the conditions that led to the major fish kill in 1990 included anoxic conditions within the riverine reach upstream of, as well as within, the reservoir. This indicates that the fish kill may have extended upstream into the free-flowing river, and was not necessarily exacerbated by reservoir processes. In addition, we note that no major fish kills have been reported in project reservoirs since 1990.

Comment AR-125: The Umatilla Tribes and the Nez Perce Tribe comment that it will be necessary for Idaho Power to maintain close involvement with other resource managers dealing with white sturgeon for guidance and assistance as they begin the task of restoring the species to the capacity of the habitat. They recommend that the NEPA document contain a recommendation for this issue to be addressed by the aquatic resource committee.

Response: Idaho Power continues to convene the interagency white sturgeon Technical Advisory Committee on an annual basis to review the results of the past year's efforts and to guide ongoing study efforts. We modified the Staff Alternative to include annual meetings of the white sturgeon Technical Advisory Committee for the purpose of reviewing the results of monitoring efforts and managing ongoing monitoring programs, as well as managing the implementation of enhancement measures.

Comment AR-126: The Umatilla Tribes and the Nez Perce Tribe comment that monitoring the bioaccumulation of toxic materials in sturgeon may provide useful information. They note that sturgeon have been a key fish species in environmental monitoring below Hanford for years because of their mode of feeding on bottom sediments and also their ability to ingest organisms from higher trophic levels. Because contaminated sediments can be scoured and exposed to the surface intermittently, the tribes state that a long-lived species such as sturgeon can be said to better integrate conditions over a greater time period. ODFW recommends site-specific analysis of the potential effects of bioaccumulation of contaminants on reproductive success and recruitment of white sturgeon.

Response: Although Idaho Power is not responsible for introducing these legacy contaminants into the environment, the accumulation of contaminant-laden sediments in the project reservoirs does increase the exposure of sturgeon and other fish species to these contaminants. As discussed in final EIS section 5.2.4.10, *Sturgeon Conservation Measures,* we modified the Staff Alternative to require that Idaho Power collect tissue samples during their proposed population monitoring efforts, and provide the samples to IDEQ or ODEQ for analysis, if it is requested to do so by either of these agencies.

Reservoir Fisheries

Comment AR-127: Interior comments that in draft EIS table 29, tadpole madtom (*Noturus gyrinus*) is not native to the Snake River and should be listed as an exotic species.

Response: We modified final EIS table 32 accordingly.

Comment AR-128: AR/ARU questions why the draft EIS discusses the risk of dewatering bass nests in Brownlee reservoir, when water levels typically rise during the bass spawning season. AR/IRU also claims that the draft EIS says that reduced ramping during the fall Chinook rearing will "significantly" reduce erosion downstream from the project.

Response: Water levels typically rise during the smallmouth bass spawning season. However, figure 23 in Richter and Chandler (2001) indicates that some smallmouth bass nests were exposed to receding water levels during the 1991 to 1998 study period. As for the effects of ramping, we were not able to locate any statements in the draft EIS where we indicated that the seasonal ramp rate would significantly reduce erosion. However, we revised the final EIS text to clearly indicated that the reduction in erosion associated with the seasonal ramp rate would be minor.

Comment AR-129: Interior recommends that the Commission include implementation of an adaptive management program for warmwater fisheries, as well as a mitigation plan for any impacts to warmwater fisheries that are caused by project operations. Interior also recommends that BLM be consulted regarding the Warmwater Fisheries Plan.

Response: We modified the Staff Alternative to include annual consultation with ODFW, IDFG and BLM on the results of warmwater fisheries monitoring and assessing effects of project operations on the fishery, as well as to identify any feasible measures to minimize adverse effects.

Comment AR-130: The Umatilla and Nez Perce tribes comment that FERC staff recommends measures such as spawning protection to promote warmwater fish population productivity within the project. The tribes state that they do not support these measures because exotic warmwater fish prey on, and cause ecological problems for, native resident fish, anadromous salmonids, and other native species. They state that the draft EIS does not examine active measures to control and reduce inappropriate warmwater fish populations and the implications of these measures on restoration of native fish. The tribes recommend that these measures be addressed in the NEPA document.

Response: We recognize the cultural importance of native fish species to the tribes. Many of the measures that we adopt in the Staff Alternative are intended to benefit these species. However, the warmwater fishery in Brownlee reservoir is a popular recreational resource and provides substantial economic benefits to local communities. Although the presence of warmwater fish species could result in predation on salmon and steelhead smolts if anadromous fish species are reintroduced upstream of the project, this potential adverse effect would be limited if downstream migrating smolts were collected upstream of and transported around the project reservoirs. Also, the potential benefits of controlling warmwater fish populations to reduce predation on anadromous fish can be addressed as part of any future anadromous fish restoration planning efforts.

Comment AR-131: ODFW states that it supports the operating constraints recommended by FERC staff to protect warmwater fish spawning, including the provision that warmwater fish spawning protection would be secondary to any conflicting operational requirements. ODFW also supports staff's proposal to conduct annual warmwater fish population monitoring at established electrofishing sites in each reservoir, and every fifth year between Swan Falls dam and Brownlee reservoir. ODFW comments that sampling should be coordinated annually with ODFW and expanded to assess the status of catfish, which was identified as the primary target species in angler surveys conducted by Idaho Power.

Response: We modified Idaho Power's proposed Warmwater Fish Monitoring Plan to include methods suitable for monitoring channel catfish; to file annual reports of monitoring results; and to consult with ODFW, IDFG, and BLM to identify feasible measures to reduce adverse effects on warmwater fisheries.

Hatchery Production

Comment AR-132: Interior comments that draft EIS table 36 should be moved to section 3.6.1.8

Response: The referenced table (final EIS table 39), which is cited in the first paragraph on page 191 of the draft EIS, is already part of section 3.6.1.8. It remains in the same section in the final EIS

Comment AR-133: NMFS comments that it views HGMPs as a necessary component of the management of any hatchery, and that it is unclear from the language on page 303 whether FERC agrees that the HGMPs are essential. NMFS notes that FERC staff appears to misconstrue its intent for monitoring various aspects of hatchery fish performance, including smolt-to-adult return rates and straying rates. Such monitoring is not intended by NMFS to supplant specified hatchery production levels. Rather, monitoring is designed to identify the likelihood of return and straying rates to identify any problems with fish qualities in keeping with the HGMP.

Response: We understand that the development of and implementation of HGMPs are essential to ensuring that hatchery operations are in compliance with NMFS's 4(d) rules for take of listed species. Furthermore, we recognize that HGMPs may contain elements to evaluate, minimize, and account for the propagation program's genetic and ecological effects on natural populations, including disease transfer, competition, predation, and genetic introgression caused by straying of hatchery fish. In the Staff Alternative, we recommend that Idaho Power fund IDFG, as the operator of Idaho Power's hatchery system, to work with NMFS to develop HGMPs for each of the project's hatcheries.

Comment AR-134: Interior states that it agrees that the current level of hatchery production as proposed in the final license application is appropriate, at least in the interim. Interior's recommendation for a new license is for the Commission to include a plan to reduce dependence on artificial fish production by restoring natural fishery production for fall Chinook salmon, spring Chinook salmon, and summer steelhead. Interior states that the Staff Alternative should require a Habitat Improvement Plan that facilitates increased fishery production by addressing present and ongoing project effects caused by degraded water quality and operations of the project. Interior recommends that the NEPA document assess the long-term role of hatchery production for the project, and evaluate whether it is possible to fully mitigate anadromous and resident fish losses by improving habitat, access, and connectivity downstream, within, and upstream of the project.

Response: We evaluate a wide range of environmental measures in the draft EIS that are directed toward improving habitat conditions, addressing fish passage and habitat connectivity. We adopt many measures in the Staff Alternative that would benefit the natural production of resident and anadromous fish. Such measures include: (1) enhancing DO and reducing TDG levels within and downstream from the project; (2) implementing tributary habitat enhancements in the Burnt, Powder, Wildhorse, Indian, and Pine basins; (3) improving the fish trap at Hells Canyon dam and installing tributary traps at Pine Creek, Indian Creek, and the Wildhorse River and a second adult trap at Oxbow dam; (4) continuing the flow augmentation and fall Chinook salmon spawning and incubation flow programs; (5) implementing seasonal ramp rate restrictions; and (6) constructing a new hatchery on Yankee Fork in the Salmon River basin

Comment AR-135: The Nez Perce Tribe comments that all hatchery management plans regarding the production of Chinook salmon and release locations are developed through the *United States v Oregon* process, which the Nez Perce Tribe is an active participant in. The tribe comments that FERC has no say in this process and cannot approve or disapprove of measures developed in this ongoing court-overseen process. The Nez Perce Tribe rejects staff's conclusion that hatchery management plans be developed with "tribes," because this assumes that all tribes in this proceeding have an equal say in hatchery production by Idaho Power. The Nez Perce Tribe benefits from Idaho Power hatcheries in its treaty area, including the Rapid River and Oxbow facilities, through harvest in the Rapid River and with spring Chinook salmon restoration efforts in the Clearwater River basin. By lumping all tribes together, including those without treaty fishing rights in this recommendation, the Nez Perce Tribe states that FERC unwittingly has created a situation for serious fisheries management conflicts between the Nez Perce and other tribes in this proceeding. The tribe states that Nez Perce treaty rights and fisheries must not be negatively affected by this measure.

Response: During the section 10j meetings, NMFS clarified that it works with the operators of each hatchery to develop HGMPs, and that its recommendation was directed at ensuring that Idaho Power fund measures that are required under the HGMP. As a result, we modified the final EIS to clarify that our Staff Alternative includes funding of hatchery measures required for the hatcheries to be operated in compliance with their HGMPs. We no longer recommend that Idaho Power develop the plan or identify who would be consulted in its development.

Comment AR-136: ODFW comments that hatchery management plans should comply with revised *United States v Oregon* production plans and balance available fish needed for fish passage and reintroduction with production needed for fisheries. ODFW states that the management plans should include provisions to identify and develop suitable spring Chinook and fall Chinook broodstock for reintroduction, as well as ensure that suitable numbers of spring Chinook, summer steelhead, and fall Chinook are available to conduct passage studies and implement reintroduction. ODFW requests that within the final EIS, FERC staff provide specific information on what is included in the hatchery management plans, and provide assurances that 10(j) recommendations such as alternative fisheries in Oregon and development of a fall Chinook salmon broodstock at Oxbow Hatchery are included. ODFW recommends that a component of the monitoring and evaluation program should be to monitor hatchery fish straying to natural spawning grounds.

Response: See our response to the previous comment. As we discuss in final EIS section 5.2.4.3, *Anadromous Fish Restoration*, we conclude that it is premature for the Commission to require Idaho Power to proceed with a program to reintroduce anadromous fish upstream of the project, so we do not include a requirement that Idaho Power develop broodstock for reintroduction at this time. However, we do include in the Staff Alternative a provision that would require Idaho Power to consult with the Burns Paiute Tribe, the Shoshone-Paiute Tribe, potentially the Shoshone-Bannock Tribes, the Nez Perce Tribe, ODFW, IDFG, Interior and NMFS to develop a surplus hatchery fish distribution plan. The goals of the plan would be to (1) stock surplus hatchery fish in the project reservoirs and/or select tributaries within the project area to restore marine derived nutrients to these streams and provide forage for bull trout; (2) provide an opportunity to evaluate spawning success, egg viability and survival, as well as smolt out-migration and survival in Pine Creek; and (3) identify and support ceremonial, subsistence, and recreational fisheries in the project area and Snake River basin. We expect that this plan would outline the specific priorities for how the surplus hatchery fish are to be used.

Comment AR-137: AR/IRU comment that the quality of Idaho Power's hatchery stock is not comparable to those of state and federal hatcheries. AR/IRU state that FERC should mandate that Idaho Power hatcheries operate according to best management practices, and, at a minimum, under the same standards as federal and state hatcheries and in compliance with the Lower Snake Compensation Plan.

Response: The Staff Alternative recommends that Idaho Power implement HGMPs that are under development for its hatcheries. This requirement would likely result in identification of best management practices and policies necessary to meet its obligation for hatchery production.

Comment AR-138: Idaho Power comments that the current hatchery program targets 1 million fall Chinook salmon, 3 million spring Chinook salmon, 1 million summer Chinook salmon, and 400,000 pounds of steelhead smolts. Idaho Power states that the switch from 4 million spring Chinook salmon to 3 million spring Chinook and 1 million summer Chinook was made by IDFG in 1985 to focus Idaho Power's hatchery program on propagation of indigenous Pahsimeroi River summer Chinook salmon, rather than the Rapid River spring Chinook stock, which was not native to this drainage. The 1980 Settlement Agreement allows for this type of deviation from the defined production goals, as long as the total production remains within the prescribed 4 million Chinook smolts annually.

Response: We modified the text of final EIS section 3.6, *Aquatic Resources*, to show the current hatchery program targets, as modified in 1985 by IDFG.

Comment AR-139: Idaho Power comments that the locations of the Upper Pahsimeroi Fish Hatchery and Lower Pahsimeroi Fish Hatchery shown in draft EIS figure 36 are reversed, and that the word "Niagara" is misspelled in figure 36.

Response: We corrected draft EIS figure 36 (final EIS figure 55) accordingly.

Comment AR-140: Idaho Power states that it is proposing to acquire a fish-marking unit, as part of the new operating license, to make the current marking programs more efficient, not to increase current marking capacity. Idaho Power also states that the final EIS should clarify that all smolts currently produced and released as part of the Idaho Power's mitigation program are marked with an adipose fin clip. Also, some smolts are marked with coded wire tags and/or passive integrated transponders for evaluation purposes.

Response: We revised the text in the final EIS accordingly.

Comment AR-141: Idaho Power states that it does not believe that its involvement in a hatchery technical oversight committee would resolve conflicts among state and federal resource agencies, Native American tribes, and conservation groups, as stated in the draft EIS. Idaho Power notes that conflicts generally involve broader fish management issues such as use of hatchery-bred fish in listed species recovery planning, sport and tribal harvest management, and equitable distribution of surplus hatchery-bred fish, and other issues that Idaho Power has no authority to resolve.

Response: We revised the final EIS to eliminate reference to formation of a Hatchery Oversight Committee. However, we recommend that Idaho Power consult with the state and federal fisheries management agencies and interested tribes to outline the goals and objectives for each hatchery. Such consultation would help ensure that: (1) goals and objectives are accurately reflected in the HGMPs that will govern future hatchery operations, and (2) the HGMPs are consistent with *United States v Oregon* production plans and Idaho Power's responsibilities under a new license. We also recommend that Idaho Power consult with these same parties to develop a plan for the use of surplus hatchery fish. Although we recognize that Idaho Power does not have authority over agency and tribal resource management decisions, it would be beneficial for Idaho Power to participate in the development of these plans to ensure that they are consistent with any requirements that are included in a new license.

Comment AR-142: Idaho Power states that the NOAA Fisheries-sponsored HGMP is the appropriate mechanism to achieve the goals expressed by AR/IRU, ODFW, and IDFG of adaptively managing the Idaho Power hatchery program and measuring its long-term performance. Idaho Power does not agree that ongoing review should allow for increases in hatchery smolt production beyond that established in the 1980 Settlement Agreement. Nor does Idaho Power support a forum to discuss increases in current smolt production to satisfy a continually increasing competition for fish between resource agencies, Native American tribes, and conservation groups to fulfill their individual fisheries objectives (i.e., adult escapement goals). Further, Idaho Power states that, since it has no authority to determine the appropriate distribution of surplus adult fish from its hatchery program, its involvement in drafting a hatchery management plan will not resolve ongoing conflicts among state agencies and Native American tribes for equitable distribution of surplus adult hatchery fish. Assuming that agencies and tribes can reach consensus on the appropriate use of hatchery-origin fish, Idaho Power states that it remains prepared to make such fish available to them without delay.

Response: Our Staff Alternative recommends that the smolt production targets, as specified in the current license, should continue under any new license issued for the project. Developing HGMPs for Idaho Power mitigation hatcheries and a distribution plan for surplus hatchery fish collected at the hatcheries and the Hells Canyon trap, in consultation with fisheries management agencies and the tribes would create a process for determining how surplus hatchery fish would be used and an evaluation of the impacts of hatchery production on listed stocks.

Comment AR-143: Idaho Power states that in 1984 it entered into an agreement with the Corps that guaranteed it sufficient eggs from the Lyons Ferry Hatchery to support the entire fall Chinook salmon program at Oxbow Hatchery. While development of a fall Chinook broodstock at Oxbow Hatchery remains an option, Idaho Power states it should not be considered mandatory, because the existing agreement fully meets Idaho Power's obligation regarding fall Chinook hatchery production.

Response: In the draft and final EIS, we recommend maintenance of current hatchery production as appropriate for the new license. Steps that are needed to operate Idaho Power's hatchery system in compliance with the ESA 4(d) rules, which may require development of a fall Chinook salmon broodstock at Oxbow Hatchery, will be identified in the HGMP for Oxbow Hatchery.

Comment AR-144: Idaho Power comments that available production space in their hatchery system should not be used to assist with restoration of fisheries such as those in Panther Creek and the Yankee Fork, as recommended by the Shoshone-Bannock Tribes. Idaho Power states that there has been no showing of Shoshone-Bannock tribal entitlement to the restoration of such fisheries, and if such a showing could be made, the duty to restore the fisheries would be with the United States, the trustee of the tribes, not with Idaho Power. Idaho Power states that passing on the cost of a hatchery program not related to operation of the project would be unfair to Idaho Power ratepayers. Also, Idaho Power states that no evidence exists to suggest that Idaho Power's hatchery stocks are appropriate for fisheries restoration in the Yankee Fork or Panther Creek. Given that ESA-listed Chinook salmon and steelhead may be present in these Salmon River tributaries, Idaho Power states that decisions on the appropriate use of hatchery-origin fish in species recovery lies solely with NOAA Fisheries. Idaho Power comments that it is prepared to make all surplus adult fish from its hatchery program available to state and federal resource agencies and Native American tribes for their use, as they deem most appropriate.

Idaho Power states that upgrades to its anadromous fish hatchery facilities should focus on: (1) operational efficiencies (e.g., improved waste management, employee safety, etc.); (2) technological advances to improve the quality of smolts produced (e.g., increased survival, reduced pathogens, reduced handling stress, increased egg quality, etc.); and (3) monitoring and evaluation requirements (e.g., improved fish marking). Idaho Power states that modification of hatchery production goals and distribution of surplus fish should not drive the need for facility improvements.

Response: As noted in our response to previous comments, we include in the Staff Alternative a recommendation that Idaho Power provide funding to the Shoshone-Bannock Tribes to develop a program to spawn and incubate salmon and steelhead eggs on the Yankee Fork of the Salmon River. Also, the project dams continue to block fish passage, which, in turn, continues to affect the opportunity for the Shoshone-Bannock Tribes, Shoshone-Paiute Tribes, and Burns Paiute Tribe to catch fish for ceremonial and other purposes. These upstream tribes do not receive any benefit from Idaho Power's hatchery system. To provide these tribes with fisheries benefits in the near term, we include in the Staff Alternative a measure that would require Idaho Power to consult with these tribes, the Nez Perce Tribe, and state and federal fisheries management agencies to develop a plan to use surplus hatchery salmon and steelhead. Among the plan's goals would be using surplus fish to create and support harvest fisheries at locations that would provide the maximum benefit to the tribes. The plan would also provide for releasing surplus fish into the project reservoirs and tributaries within the project reach to add marine-derived nutrients to the system, increase forage opportunities for bull trout, and support recreational fisheries, as well as facilitate establishing a program to evaluate production of spring Chinook salmon and steelhead in Pine Creek.

Comment AR-145: Idaho Power comments that FERC statements in the draft EIS regarding the appropriate level of hatchery production are contradictory.

Response: We modified section 5.2.4.8, *Hatchery Production*, to clarify that we recommend the current smolt production targets be retained, but that Idaho Power would be required to fund operations that comply with HGMP to be developed by IDFG and NMFS for each hatchery. We understand, based on discussions at the section 10(j) meeting, that the HGMPs could include goals for societal use that would be used to assess whether changes in production strategy are warranted. These goals would not be used to leverage increases in levels of smolt production, which will be specified in an appropriate license article.

B10. TERRESTRIAL RESOURCES

Terrestrial Habitat Conditions

Comment TR-1: Brett Crow suggests some reorganization of the NEPA document so that the Affected Environment section for terrestrial resources more directly informs the Commission and the public about the dry land acreage given up to current power generation practices.

Response: The acreage of land inundated by project construction has been added to the discussion of cumulative effects in section 3.7.3, *Cumulative Effects*. Draft EIS table 65 (final EIS table 70) shows the acreage of land currently affected by the project.

Comment TR-2: ODFW comments that draft EIS table 65 fails to include the ongoing and unmitigated impacts of reservoir and river inundation and does not include estimates of wetland habitat affected or acreage of impacts by habitat or cover type.

Response: Draft EIS table 65 (final EIS table 70) is intended to summarize the acreage of riparian (including wetland) and upland habitat types affected by ongoing project operation. We did not revise the table in the final EIS.

Key Wildlife Species

Comment TR-3: Interior requests that the NEPA document include a discussion of the Deer Flat National Wildlife Refuge and Fort Boise WMA, which are regionally important nesting and resting areas for migratory birds in western Idaho.

Response: We added text to section 3.7.1.4, *Key Wildlife Species*, to describe these two areas.

Comment TR-4: Idaho Power comments that the mew gull does not nest in Hells Canyon.
Response: The text that identifies the mew gull as one of several colonially nesting species that may be present in the project area in spring or summer is based on appendix 3 of Turley and Holthuijzen (2003c). The EIS does not identify this species as nesting in Hells Canyon.

Special Status Plants and Wildlife

Comment TR-5: IDFG agrees that a project-wide Threatened, Endangered, and Sensitive Species Management Plan (TESSMP) should be developed in consultation with IDFG and other agencies and interests. ODFW also supports development of a TESSMP, recommending that Idaho Power provide a forum for cooperative strategy updates once every 5 years with participation by interested stakeholders.

Response*:* We added a recommendation that the TESSMP include a mechanism for coordination and cooperation with adjacent landowners and land managers, as well as regular consultation with agencies, tribes, and other stakeholders.

Comment TR-6: Interior comments that the Staff Alternative is unclear regarding the specifics of the TESSMP (including monitoring and adaptive management) and how it would accomplish the needed mitigation for the list of species identified in Interior, ODFW, and IDFG 10(j) and 10(a) recommendations.

Response: We added an outline of the staff-recommended TESSMP to section 5.2.5.1, *Special Status Plant and Wildlife Protection*. The plan would include monitoring, with changes in management based on the results of monitoring, as needed. We also added text to explain how we address the species lists provided by Interior and ODFW.

Comment TR-7: Interior recommends the NEPA document include a list of agency-recommended threatened, endangered, and sensitive species that would be included in the TESSMP, and a better analysis of species (e.g., peregrine falcon) that would be excluded.

Response: We added text to section 5.2.5.1 explaining which agency or tribe-recommended species we include in the Staff Alternative's TESSMP, and why we excluded some species.

Comment TR-8: Interior notes that the TESSMP described in the draft EIS does not appear to provide for trend monitoring. Interior indicates that trend monitoring is important to demonstrate compliance with achieving recovery goals and reintroduction goals and to demonstrate non disturbance compliance as well.

Response: The staff-recommended TESSMP would not provide for trend monitoring, except in the case of the bald eagle, because the intent is to focus on the implementation and effectiveness of specific environmental measures. However, the results of Idaho Power's monitoring program should be useful to the resource management agencies in evaluating progress toward species recovery and/or reintroduction goals.

Comment TR-9: The Shoshone-Paiute Tribes comment that the scope of staff's recommended project-wide TESSMP is unclear and that the tribes should be included as parties that will be consulted in development and implementation of the plan.
Response: As described above, we added text to section 5.2.5.1, *Special Status Plant and Wildlife Protection*, to clarify the scope of the TESSMP and identify parties that should be consulted.

Comment TR-10: The Shoshone-Paiute Tribes reiterate terrestrial conditions submitted by the tribes in response to the REA Notice, including measures for funding and development of wildlife management strategies for appropriate species (e.g., bald eagle and mountain quail) on acquired lands.

Response: As discussed in sections 5.2.5.1, *Special Status Plant and Wildlife Protection*, and 5.2.5.5, *Cooperative Wildlife Management Projects*, the Staff Alternative calls for Idaho Power to develop and implement measures to protect bald eagles and to participate in projects designed to benefit mountain quail habitat and species recovery.

Comment TR-11: The Forest Service recommends that staff include condition no. 8 (*Terrestrial Threatened and Endangered Species Management*) and condition no. 9 (*Sensitive Species Management*) without modification or limitation in the Proposed Action in the final EIS. The Forest Service provides additional detail about the purpose and content of the conditions, and comments that the Staff Alternative, which combines these plans, is not clear and does not adequately define requirements for species to be included, updating species lists, conducting surveys, monitoring, and protecting or restoring sites to address project impacts.

Response: We added text to section 5.2.5.1, *Special Status Plant and Wildlife Protection*, to clarify our recommendations regarding the TESSMP. We note that the Forest Service modified conditions will be included in any new license that is issued for the project.

Comment TR-12: Interior suggests that the NEPA document discuss and analyze the fact that very little trend information about special status wildlife species exists as a result of relicensing studies, making it difficult to determine project effects. Interior comments that the NEPA document should discuss long-term effects on native wildlife species and the loss of riverine and associated habitats that occurred when the project was constructed.

Response: Trend information would provide an overview of increases or decreases in wildlife populations in the vicinity of the Hells Canyon Project, but would be difficult to use to identify project operation as a cause of population change. In our view, surveys of particular species and/or groups of species, considered in relationship to project reservoirs, project facilities, and project-related activities, provides a more accurate basis for assessing project effects. We added text to the discussion of cumulative effects (section 3.7.3.2) to describe the loss of riverine and associated habitats as a result of project construction.

Comment TR-13: Interior recommends that the TESSMP include a multi-party advisory board, similar to the rare plant advisory board.
Response: We agree an advisory board would be helpful in providing a mechanism for coordination and implementation of cooperative measures. We revised section 5.2.5.1, *Special Status Plant and Wildlife Protection*, to incorporate this conclusion.

Comment TR-14: Interior recommends the NEPA document give additional emphasis to endemic plants to determine a range of potential measures that could be implemented during the term of a new license to preserve them and prevent them from becoming listed as threatened or endangered.

Response: The TESSMP would provide a means of protecting and managing endemic species that agencies recommended for inclusion in the plan or that Idaho Power's studies identified as being affected by project operations or project-related activities.

Comment TR-15: Interior comments that the NEPA document should include Interior's recommendations regarding the southern Idaho ground squirrel, amphibians, and reptiles, as well as appropriate analysis of project impacts.

Response: Section 3.7.2.8, *Special Status Wildlife*, discusses project effects on these species and the benefits of recommended measures. We added text to the TESSMP discussion in section 5.2.5.1, *Special Status Plant and Wildlife Protection*, to clarify Interior's recommendations and how the Staff Alternative addresses them. Draft EIS table 97 (final EIS table 108) shows which measures were adopted or adopted with exceptions.

Noxious Weeds and Invasive Exotic Plants

Comment TR-16: The Forest Service recommends that staff include condition no. 7 (*Exotic and Invasive Vegetation Management*) without modification or limitation in the Proposed Action in the final EIS. The Forest Service explains that a Cooperative Weed Management Area (CWMA) would serve as a mechanism for building cooperative relationships among agencies, landowners, land managers and other individuals and organizations involved in managing weeds, while a Noxious Weed Advisory Board (which could include members who are also involved in the CWMA) would develop and implement the Integrated Weed Management Plan specified in condition no. 7. The Forest Service also comments that a 60-day review and comment period prior to Idaho Power's filing of an Integrated Weed Management Plan with the Commission for approval is needed to ensure adequate time for Forest Service review of activities that would occur on National Forest System lands.

Response: We modified the text of section 5.2.5.2, *Noxious Weed and Exotic Invasive Plant Management*, to show that the Staff Alternative includes establishment of a CWMA, as well as a 60-day review and comment period prior to filing.

Comment TR-17: IDPR states that it concurs with the staff recommendation that the Integrated Weed Management Plan should include an agency consultation requirement, and recommends that IDPR be included because noxious and invasive weeds have adverse effects on aesthetics and recreation sites. IDPR recommends that the plan address the potential spread of noxious weeds by recreational users.

Response: We modified section 5.2.5.2, *Noxious Weed and Exotic Invasive Plant Management,* to specify that IDPR should be one of the consulting agencies. Section 3.7.2.3 recognizes the potential for human activity, including recreation, to serve as a vector for weed spread.

Comment TR-18: ODFW supports the development of an Integrated Weed Management Plan and a Noxious Weed Advisory Board, and recommends it be updated every 5 years. ODFW recommends that the plan include inventory, prevention and early detection, treatment and restoration, and monitoring and evaluation, and that the plan be coordinated with surrounding counties and their weed programs.
Response: We added text to section 5.2.5.2 to clarify the staff's recommendations regarding the Integrated Weed Management Plan and Noxious Weed Advisory Board. We agree the plan should be formally updated at 5-year intervals, but recognize that more frequent adjustments may be needed based on the results of monitoring.

Comment TR-19: Interior recommends the NEPA document discuss a specific role for Idaho Power to play in the management of project lands to promote long-term control and elimination of invasive and noxious plant species, and address the potential future need to expand the list of weedy plant species as new invasives populate the area around and within the project boundary.

Response: We added text to section 5.2.5.2, *Noxious Weed and Exotic Invasive Plant Management*, to clarify the Staff Alternative regarding weed management, including Idaho Power's role and the need to update the list as conditions change.

Comment TR-20: Interior recommends that the NEPA document include a plan to monitor and manage weeds as specified in Interior's 10(a) and 10(j) recommendations and describe the membership to be included on the [noxious weed] advisory board. Interior recommends that the plan include an agency review of all pesticide application procedures.

Response: The Staff Alternative incorporates Interior's recommendations, with the exception of a project-wide inventory within 3 years after issuance of any new project license. The Staff Alternative supports the weed board membership as proposed by Idaho Power, i.e., including agencies, landowners, land managers, and other interested individuals and organizations, as well as Idaho Power representatives. Idaho Power's HCRMP (Johnson, 2003) specifies pesticide application procedures consistent with federal and state law.

Roads, Transmission Lines, and ROWs

Comment TR-21: IDFG comments that an O&M plan for transmission line 945 should include monitoring of electrocution and collision mortality and that O&M activities should be scheduled to minimize disturbance to wintering mule deer.

Response: As discussed in section 5.2.3.3, the Staff Alternative includes monitoring of electrocution and collision mortality and recommends scheduling O&M to minimize disturbance to wintering mule deer, as proposed by Idaho Power.

Comment TR-22: ODFW supports development and implementation of a Transmission Line Operation and Maintenance Plan, and recommends that it be incorporated into the IWHP and WMMP.

Response: Staff has elected to leave the transmission line operation and maintenance plan as a stand-alone plan, because management would focus on a specific set of concerns, within a specific area, within a specific ownership.

Mule Deer

Comment TR-23: In discussing mule deer winter range, ODFW comments that Brownlee reservoir does not increase mortality on 86,408 acres of crucial winter range; rather it is responsible for 10 to 30 percent of mule deer mortality.
Response: Idaho Power's studies indicate that Brownlee reservoir reduces habitat capability on crucial winter range and that it contributes directly and indirectly to winter mortality (Edelmann, 2003; Edelmann et al., 2003b). Idaho Power estimated that direct and indirect effects comprised 10 percent of annual winter mortality, and an additional 9 percent during harsh winters, based on historic data provided by ODFW.

Comment TR-24: Idaho Power notes agreement with the conclusion that the risk of mule deer mortality due to reservoir icing is small, but comments that the discussion of mule deer migration and reservoir icing is out of context with study results. Idaho Power clarifies that Ryel et al. (2003) found that ice is most likely to form in the pool associated with the Powder River arm, not in the arm itself, where mule deer cross, and that the timing of migrations only marginally overlaps with the period when ice most likely occurs.

Response: We continue to conclude that the risk of mule deer mortality due to icing is small, and have revised text that indicated otherwise. However, we note that Ryel et al.'s analysis (which does not distinguish between the Powder River arm and the Powder River pool) predicted that ice formation is most likely to occur in late December, with break-up and thawing from late February through early April. Edelmann et al.'s study of mule deer movements (2003a) found that 25 percent of the crossings occurred during the winter (January and February) and 25 percent occurred during green-up (late March–April). For this reason, many deer could encounter ice while attempting to cross the Powder River arm.

Comment TR-25: In discussing mule deer mortalities related to wintertime reservoir crossings, ODFW comments that annual mortality attributable to project reservoirs in harsh winters has not been quantified. However, ODFW biologists estimate that 30 percent mortality could occur in the severest winters. ODFW requests clarification on the specific reason for not including a study of the effects of a harsh winter on mule deer in the Staff Alternative. ODFW reiterates that FERC staff needs to evaluate the effect of two or more hard winters in a row on the ability of deer populations to recover.

Response: Edelmann et al. (2003a) used survey data provided by ODFW to evaluate the likely effects of harsh winters on mule deer populations in the project vicinity. We did not include an empirical study in the Staff Alternative because we concluded that modeling provided an adequate estimate of harsh-winter mortality.

Comment TR-26: ODFW states that it strongly disagrees with staff's assumption that ODFW identified an area of project effects on mule deer that conflicts with the results of mule deer studies, and with staff's conclusion that the studies showed that habitat capability is reduced only within a very narrow band above full pool at Brownlee reservoir. ODFW comments that staff erroneously assumed that mule deer studies were designed to identify a zone of effect; the studies were conducted to describe components of the winter ecology of mule deer and how various factors, including project reservoirs, might influence these components. The studies identified direct and indirect mortality caused by the project. The studies did not identify a zone of effect or acreage necessary to mitigate for reduced habitat capability.

Response: We understand the objectives of the mule deer winter ecology study, and agree the purpose was not to identify a zone of effect or the acreage needed for mitigation. We maintain, however, that the results of the study are important in showing how and where deer interact with the project during the winter. The winter ecology study, together with other technical reports (Edelmann et al., 2003a; Christensen, 2003; Dumas et al., 2003; Edelmann et al., 2003), provided the basis for staff's conclusions regarding project effects on mule deer, mule deer winter range, and an appropriate acreage of mitigation.
Comment TR-27: ODFW states that it does not identify elevation 3,200 feet as the zone of effect, rather as the upper extent of crucial mule deer winter range in the project area, based on concentration and distribution of deer, similar to Idaho Power.

Response: We revised the text of section 5.2.5.4, *Upland and Riparian Habitat Acquisition*, to reflect that ODFW considers elevation 3,200 feet as the upper extent of crucial mule deer winter range.

Comment TR-28: ODFW comments that FERC staff ignored crucial winter range delineated by wildlife experts (334,665 acres) and ODFW biologists (121,337 acres). ODFW estimates that 23,054 acres (0.19 x 121,337 acres of crucial winter range) is necessary to mitigate for direct and indirect mortality caused by project operations and reservoirs. ODFW recommends the Staff Alternative include acquisition and enhancement of 1,452 acres of riparian habitat and 21,602 acres of uplands to mitigate for mule deer mortality associated with project operations.

Response: Staff did not ignore crucial winter range delineations, but as described above, relied on the results of the surveys that evaluated how deer used winter range, and where they concentrated. We note that Idaho Power's proposed land acquisitions are all located within or adjacent to areas mapped as crucial deer winter range (Christenson, 2003) or a major migration route, and that the total acreage is about the same as ODFW recommends. Although it contains less riparian habitat, Edelmann (2003) found that wintering mule deer numbers were concentrated in areas with high-quality forbs, low grasses, bitterbrush, and sagebrush on south and southwest-facing slopes. This finding suggests that grasslands and shrublands serve as important habitat during the winter.

Game Species and Plants of Cultural Importance

Comment TR-29: Interior recommends that the discussion of plants of importance to Native Americans be moved to a more appropriate or separate section of the NEPA document (rather than appearing in section 3.7.1.1, *Transmission Line Right-of-Way*).

Response: We added a heading (3.7.1.3, *Plants of Cultural Importance*) to separate the discussion of ethnobotanical resources from the transmission line right-of-way discussion.

Comment TR-30: The Shoshone-Bannock Tribes comment that the description of the transmission right-of-way section briefly describes native plant use by tribes, but provides no additional analysis. The Shoshone-Bannock Tribes comment that adding more specific Tribal ethnographic information would be useful in determining what management practices should occur. The Shoshone-Bannock Tribes recommend that staff describe wildlife species and plants of cultural importance in more detail in the affected environment section, and continue with the discussion in the environmental effects section. The Shoshone-Bannock Tribes note that the discussion of wildlife species of cultural importance refers to the "Big Game Winter Range and Migration Routes" discussion, but the referenced section includes no discussion of cultural importance.

Response: We added a heading (3.7.1.3, *Plants of Cultural Importance*) to separate the description of plants of cultural importance from the transmission line right-of-way discussion, and added a section (3.7.1.6, *Special Status Wildlife Species*) describing game species of cultural importance. We also revised the headings in section 3.7.2.1, *Effects of Project Operations on Terrestrial Resources*, to discuss project effects on plants and game animals of cultural importance. We agree that adding more specific ethnographic information could improve the analysis, but the record contains very limited information.

Comment TR-31: The Shoshone-Bannock Tribes comment that the draft EIS provides no rationale or justification to explain why some plants and animals were identified as having cultural importance, or if these species adequately represent resources of importance to the Shoshone-Bannock Tribes. The Shoshone-Bannock Tribes disagree with analyses provided by Reed-Jerofke (1999) and Whipple (2001), which reflect oral history studies conducted with the Warm Springs, Burns Paiute, and Umatilla tribes, not the Shoshone-Bannock Tribes.

Response: As mentioned above, there is little information in the record regarding important cultural plant and animal species. We used the available information.

Land Acquisition

Comment TR-32: Idaho Power clarifies that it purchased 10,212 acres associated with the Daly Creek Ranch, not 10,695 acres. Idaho Power notes that since release of the draft EIS, it has reached an agreement to purchase 6,115 acres associated with the Sturgill Creek property.

Response: We revised the text of sections 3.7.2.5, *Upland and Riparian Habitat Acquisition*, and 5.2.5.4, *Upland and Riparian Habitat Acquisition*, to show this information.

Comment TR-33: ODFW comments that staff should clarify how the purchase of Daly Creek Ranch (10,695 acres) and the Cottonwood Creek property (1,971 acres) total 24,884 acres (1,004 acres riparian and 23,564 acres upland). Interior comments that acreages of upland and riparian habitat acquisition discussed in the draft EIS may be in error. Interior states that Interior and the states agreed to the general amount of mitigation land potentially available in four ranch properties, totaling a minimum of 23,500 acres.

Response: The total acreage refers to all the parcels described in the paragraph, including those targeted for purchase and those already purchased. The acreage of each parcel, and the total, has been updated in the final EIS to reflect information provided by Idaho Power in its comments on the draft EIS.

Comment TR-34: Idaho Power comments that enhancement of 13 acres of riparian habitat downstream of Hells Canyon dam would have marginal benefits, because habitat in this reach is at or near its full potential. Idaho Power states that incorporating the 13 acres into the larger habitat acquisition plan would match priorities to purchase and manage large habitat blocks associated with key wildlife species and habitats, including mountain quail.

Response: We modified the Staff Alternative to include acquisition of this acreage as part of the broader acquisition "package."

Comment TR-35: Idaho Power comments that FERC contemplates the use of grazing allotments as mitigation, but provides no details on how this might be done. If grazing allotments are to be used as mitigation, Idaho Power recommends that appropriate credit for management and improvement be granted through a reduction in the amount of acquisition acres required, and that such allotments not be included within the project boundary.

Response: We added text to section 3.7.2.7, *Wildlife Management on Idaho Power Lands*, to clarify our conclusions regarding cooperative management of grazing allotments.

Comment TR-36: IDFG comments that 1:1 habitat replacement is sufficient if on-site, in-kind mitigation parcels (i.e., those with habitat values similar to uplands and riparian areas affected by project operation) can be purchased and managed, but a 2:1 ratio should be applied if such lands are not available. At a minimum, IDFG recommends that the license allow for development of alternative replacement ratios.

Response: We added text to section 5.2.5.4, *Upland and Riparian Habitat Acquisition*, discussing a contingency for additional acquisitions that may be needed to meet the acreage target if the "first tier" parcels cannot be acquired within 5 years of license issuance.

Comment TR-37: ODFW comments that the Staff Alternative for land acquisition is not acceptable because it assumes sufficient habitat value is provided because parcels targeted for acquisition are near project reservoirs, and that a 1:1 ratio is sufficient mitigation for riparian and wetland habitat. ODFW reiterates that the Staff Alternative is not in compliance with ODFW's Fish and Wildlife Habitat Mitigation Policy or ODSL rules for wetland mitigation. ODFW states that it would consider other measures such as operational changes to decrease mule deer mortality, but no other measures have been proposed by FERC or Idaho Power.

Response: The Staff Alternative includes Idaho Power's proposed land acquisitions not only because the parcels are located near project reservoirs, but also because they meet each of the other criteria identified by the TRWG. The Staff Alternative calls not only for land acquisition, but also for implementation of measures to improve habitat values. To further address concerns about adequate mitigation, we added a contingency plan to the Staff Alternative, recommending mitigation ratios higher than 1:1 if targeted parcels cannot be acquired within a reasonable amount of time following issuance of any new license.

In preparing the draft EIS, we considered one operational scenario (Brownlee reservoir held at minimum pool, Oxbow and Hells Canyon reservoirs held at full pool) that could benefit mule deer by allowing establishment, over time, of about 5,000 acres of low-elevation winter range around Brownlee reservoir. It could provide some benefits to fish, as well, by allowing more rapid cooling in the fall for adult fall Chinook salmon, reducing stress and leading to earlier spawning, emergence and outmigration, and more rapid warming in the spring that could enhance growth of juvenile fall Chinook salmon. However, this scenario would prevent Idaho Power from controlling flows during fall Chinook salmon spawning and incubation and providing flow augmentation to improve survival of out-migrating juveniles, and would result in warmer water temperatures during the summer, with adverse effects on rearing juvenile fall

Chinook salmon. Implementation of this scenario also would have substantial adverse effects on the warmwater fishery and recreational access to Brownlee reservoir, eliminate flood control capability, and increase the risk of downstream transport of noxious weeds. Overall, staff concluded that the potential negative effects would outweigh the benefits. No agencies recommended implementation of such a flow scenario, and for this reason, we did not carry it forward for analysis in the draft or final EIS.

We recognize that the Staff Alternative may not be consistent with state policies regarding the acreage of mitigation lands. However, the FPA does not require mitigation for all project effects. We conclude that the combination of measures included in the Staff Alternative will provide an appropriate level of mitigation for mule deer and other terrestrial resources.

Comment TR-38: ODFW comments that draft EIS table 64 mischaracterizes the minimum acreage proposed or recommended by ODFW for acquisition. ODFW proposes acquisition and enhancement of 1,110 acres (275 acres riparian and 835 acres upland) to mitigate for decreased habitat capability in the fluctuation zone of all three reservoirs. ODFW proposes acquisition and enhancement of 23,054 acres to mitigate for mule deer mortality caused by presence and operation of the project. Minimum acreage assumes that acquisition and enhancement will occur in-kind and in-proximity, or within the 2,100-foot elevation contour.

Response: We revised draft EIS table 64 (final EIS table 69) to reflect our understanding of the basis for ODFW's recommendations.

Comment TR-39: ODFW comments that it disagrees with staff's recommended land acquisition proposal. ODFW recommends acquisition and enhancement of 35,739 acres (30,784 acres upland and 4,955 acres riparian), and comments that additional mitigation will be needed to provide for impacts to wetland habitat once these are identified by Idaho Power and FERC. If enhancement occurs outside the 2,100-foot elevation contour, ODFW recommends mitigation at a minimum ratio of 1:1 for upland and 3:1 for riparian habitat. If enhancement or creation of habitat occurs out-of-kind and off-proximity, ODFW recommends that upland and riparian habitat be mitigated at a 3:1 and 5:1 ratio, respectively. To mitigate for impacts to wetland habitat, once quantified, ODFW recommends a 3:1 ratio for enhancement.

Response: ODFW's recommended acquisition of 35,739 acres includes 11,157 acres to mitigate for inundation, an effect of original project construction, while 24,582 acres would address current project effects. The Staff Alternative recommends acquisition and management of 23,582 acres to mitigate for current project effects. In section 5.2.5.4, *Upland and Riparian Habitat Acquisition*, we discuss the need for acquisition of additional (i.e., beyond the acreage included in Idaho Power's proposal in response to AIR TR-1) riparian habitat to mitigate for ongoing project effects on shore and bottomland wetland, predicted effects on scrub-shrub wetland as a result of a new flow regime, and erosion likely to occur during any new license period. In this section, we added text describing the staff's recommendation for including a contingency plan in the Staff Alternative. The contingency plan would call for mitigation ratios higher than 1:1, if there should be a delay of more than 5 years in acquiring the remaining target parcels, or if "first tier" parcels cannot be acquired.

As discussed in sections 3.7.2.5, *Upland and Riparian Habitat Acquisition*, and 5.2.5.4, *Upland and Riparian Habitat Acquisition*, we are not otherwise recommending higher mitigation ratios, because parcels to be acquired are located as close as possible to the project; adjoin Idaho Power's existing ownership and/or large blocks of wildlife habitat on public lands; provide substantial acreage, rather than small fragments; and support existing and potential high-priority habitats and species. All four parcels provide mule deer winter range, with most of the acreage located within crucial winter range.

Comment TR-40: ODFW estimates that 615 acres (58 acres of riparian habitat and 576 acres of upland) would be required to mitigate for impacts to low-elevation winter range that is unavailable in the reservoir fluctuation zone of all three reservoirs. ODFW estimates that an additional 217 acres of riparian habitat and 259 acres of upland habitat is necessary to mitigate for decreased habitat capability in the annually inundated reservoir zones.

Response: The Staff Alternative includes mitigation for low-elevation habitat that is precluded from establishing in all three reservoirs. This acreage includes 388 acres of riparian habitat and 5,761 acres of upland habitat. The Staff Alternative does not apply a habitat coefficient reflecting reduced habitat capability to Oxbow or Hells Canyon reservoirs, because most mule deer interactions with the project occur at Brownlee reservoir. In keeping with the Commission's policy that sets continuing operations under the current license as the baseline, the Staff Alternative does not address the effects of original project construction.

Comment TR-41: ODFW states that it disagrees with staff's conclusions that expected improvements in habitat quality over time, together with the physical location of the parcels and the fact that they are contiguous to other lands that are being or will be managed for wildlife, should result in net benefits, because there are no guarantees that improvements will occur to completely mitigate for lost habitat values.

Response: Staff recommends that Idaho Power implement the IWHP and WMMP, as described in Idaho Power's response to AIR TR-1. The WMMP would identify overall goals and objectives, best management practices, protection and enhancement priorities, and mechanisms for adaptive management, reporting, consultation, and program review and updating. For each WMA and SMA, Idaho Power would evaluate baseline conditions, identify desired future conditions, implement habitat treatments and monitor their effectiveness, and report progress to an interdisciplinary group (similar to the TRWG) and to FERC. We do not know of any way to guarantee that improvements would completely mitigate for lost habitat values, but conclude that Idaho Power's approach provides a reasonable assurance of success. If monitoring shows that goals are not being met, additional measures or lands may be required. We presume ODFW would participate in development of the site-specific plans, and would have opportunities for input throughout any new license period.

Comment TR-42: ODFW describes the key components of the TRWG discussions that occurred in 2001 as placing a priority on in-kind replacement to recreate similar structure and function. ODFW states that replacement of habitat values should be strictly tied to losses and impacts to habitat types, versus a simple acre for acre approach as recommended by FERC staff. ODFW states that the mitigation site should replace or create the same habitat type as the one affected by the project or activity.

Response: Staff does not recommend a simple acre-for-acre approach to mitigation, without regard for habitat types or values. The Staff Alternative is based on our understanding of the ranking process that Idaho Power and the TRWG used to identify suitable target parcels for acquisition. Idaho Power and the TRWG assigned the highest priorities for acquisition to large, contiguous blocks of land near the project that would provide habitat for high-value species, including threatened, endangered, and sensitive species; waterfowl; big game; upland game birds; aquatic furbearers,; amphibians; and neotropical migrants. The target parcels ranked highest, and staff concludes that their acquisition and management would maximize the potential for mitigation lands to meet the resource needs identified by the TRWG.

Comment TR-43: ODFW recommends that the final EIS should address alternatives that the Licensee will need to implement if identified parcels are not available, parcels providing out-of-kind or out-of-proximity mitigation are acquired, or mitigation measures are not successful at recreating lost habitat types. Interior also recommends that the NEPA document include a relicensing alternative that describes how this terrestrial habitat mitigation will be achieved, what the funding needs will be, and what the course of action will be in meeting agency resource goals if all of the land acquisition parcels identified by the TRWG cannot be purchased within 10 years (at the most) from license issuance.

Response: We revised text in section 5.2.5.4, *Upland and Riparian Habitat Acquisition*, to clarify the Staff Alternative with respect to these issues.

Comment TR-44: ODFW recommends the use of HEP to establish baseline conditions prior to initiation of habitat enhancement projects, and in long-term monitoring. The Shoshone-Bannock Tribes comment that FERC failed to use proper procedures and methods for determining suitable habitat for mitigation, and also recommends that FERC use HEP to determine suitable habitat. The Shoshone-Paiute Tribes reiterate their earlier recommendation (TR-3) for use of HEP to determine suitable habitat units for mitigation.

Response: We acknowledge that a systematic monitoring program will be needed, both to establish baseline conditions and evaluate progress toward desired future conditions that will be identified for each parcel. The Staff Alternative includes Idaho Power's proposal, as described in its response to AIR TR-1, which outlines such a monitoring plan and identifies specific elements that would be included. Idaho Power would develop the monitoring plan in consultation with a TRWG. The group could elect to use HEP, but we do not recommend this approach because focused monitoring techniques would be needed to measure the effects of various habitat treatments. HEP is often valuable in describing large-scale changes in habitat quantity and quality, but is less useful in providing site-specific information for on-the-ground adaptive management.

Comment TR-45: Interior states that the draft EIS does not adequately describe project effects on terrestrial resources, due to the lack of a quantifiable habitat evaluation. Interior had earlier suggested that HEP be used to develop a terrestrial mitigation plan and establish the environmental baseline for Idaho Power lands and could be used to monitor progress in restoring these lands to their full potential. Interior states that if Idaho Power has collected data on present habitat status for lands it has or is intending to acquire, the data should be displayed in the NEPA document.

Response: We concluded that a HEP was not necessary to describe project effects on terrestrial resources because the information contained in the technical study reports was adequate to both quantify project effects on upland and riparian habitat and identify the species most affected by project operation. We also concluded that the study reports, together with the parcel ranking and selection process described in Idaho Power's response to AIR TR-1, provide a strong foundation for focusing mitigation efforts on acquiring and managing land that would help to offset project effects. Data regarding habitat conditions, wildlife use, and special status species occurrences is provided in the license application, technical study reports, and response to AIR TR-1 for all of the land in Idaho Power's ownership and three of the four parcels proposed for acquisition, although part of the fourth parcel (Daly Creek) is outside the rim-to-rim study area.

Comment TR-46: ODFW comments that it will consider lands currently owned by Idaho Power as mitigation properties based on the demonstrated benefits of these properties to mitigate for terrestrial resources affected by the project. This includes projected increases in habitat units and function expected with active management.

Response: The value of these parcels as mitigation properties is described in Idaho Power's response to AIR TR-1.

Comment TR-47: ODFW states that management planning should establish desired future conditions and include protocols, performance expectations, methods, and a reporting schedule for monitoring effectiveness through the new license period. ODFW recommends that Idaho Power evaluate effectiveness of habitat acquisition and management by funding assessments of habitat quantity and quality using HEP or another appropriate methodology.

Response: We included in the Staff Alternative the approach Idaho Power outlined in its response to AIR TR-1 regarding development and implementation of the IWHP, WMMP, site-specific management plans for WMAs and SMAs, and a long-term monitoring plan.

Comment TR-48: The Shoshone-Bannock Tribes state it is unacceptable that any lands set aside for wildlife be held in fee title by Idaho Power. They also state that the draft EIS should have considered alternative methods of land ownership to properly protect the tribes' treaty rights and traditional use rights, including transferring title of lands acquired for mitigation to the United States to hold in trust on behalf of the tribes, or transferring title of the acquired lands to the tribes.

Response: If the Commission determines that the parcels proposed for acquisition are necessary to the operation of the project (i.e., necessary to mitigate for project effects), the Commission would likely require that the lands remain under Idaho Power's control so that the Commission retains authority over Idaho Power's management to achieve expected benefits.

Comment TR-49: The Shoshone-Paiute Tribes reiterate terrestrial conditions submitted in response to the REA Notice, including measures for acquisition of 10,000 acres adjacent to or near the Duck Valley Indian Reservation to be held in fee title by the Shoshone-Paiute Tribes (TR-1).

Response: Project operations do not affect terrestrial resources in the vicinity of the Duck Valley Indian Reservation. For this reason, acquisition and management of lands near the reservation would not mitigate project effects on wildlife or wildlife habitat.

Comment TR-50: Interior comments that the parcels targeted for acquisition are not directly adjacent to the project, lie at higher elevations, and have lower habitat values than lands inundated by the project. Interior states that the NEPA document should address this issue by recognizing replacement ratios appropriate to habitat type and condition to provide reasonable mitigation acreages. Interior reiterates the recommendation that Idaho Power acquire a total of 41,747 acres.

Response: The proposed parcels are not intended to mitigate for the habitat inundated by the project; they are intended to mitigate for ongoing effects.

Comment TR-51: The Forest Service recommends that staff include condition no. 6 (*Land Acquisition and Management Plan*), without modification or limitation, in the Proposed Action in the final EIS. The Forest Service comments that the Staff Alternative excludes several elements of condition no. 6 (e.g., mitigation for the loss of 56.3 acres of riparian habitat in the scour zone along the Snake River downstream of Hells Canyon dam; a range of alternatives to assessing and controlling shoreline erosion) that are needed to provide mitigation for project effects. The Forest Service comments further that a 60-day review and comment period prior to Idaho Power's filing of a Land Acquisition and Management Plan with the Commission for approval is needed to ensure adequate time for Forest Service review of activities that would occur on National Forest System lands.

Response: We revised the text in section 5.2.5.4, *Upland and Riparian Habitat Acquisition*, to explain that the Staff Alternative now includes a recommendation for Idaho Power to add 49 acres of riparian habitat to its mitigation package to address project effects on sandbar willow in shore and bottomland wetland along the Snake River downstream of Hells Canyon dam. It is our understanding that the Forest Service recommendation for mitigation of 7.3 acres of riparian habitat is based on the assumption that Idaho Power's proposed flow regime would be implemented. The Staff Alternative assumes the staff-recommended flow regime would be implemented, which would reduce riparian habitat by about 13.2 acres. For this reason, the Staff Alternative recommends Idaho Power acquire, protect, and enhance a total of 62.2 acres, rather than 56.3 acres, to address project effects along the Snake River downstream of Hells Canyon dam. The Staff Alternative expands on FS-6 in terms of recommendations for assessing and controlling shoreline erosion through any new license period.

Cooperative Wildlife Projects

Comment TR-52: IDFG comments that with adequate funding, Gold Island can provide an opportunity to mitigate for waterfowl habitat lost through project construction and operation. IDFG further comments that funding would be consistent with FERC's policy on off-site mitigation.

ODFW comments that inclusion of Patch and Gold islands within the Staff Alternative would provide suitable in-kind, off-site mitigation for impacts to an estimated 275 acres (based on a recent GIS analysis by BLM) of island habitat that is affected by reservoir fluctuations and inundation. ODFW concurs with staff's recommended level of annual funding, but also recommends purchase of equipment and machinery at an estimated cost of $298,800. ODFW comments further that the islands should be included within the project boundary, because they were purchased as mitigation for original project impacts. ODFW suggests that an alternative would be to hold Brownlee reservoir at a lower elevation and enhance island habitat that would be exposed within the reservoir fluctuation zone.

Response: We revised the Staff Alternative to include Patch and Gold islands as two of the four islands where Idaho Power would implement cooperative management measures.

Comment TR-53: Idaho Power comments that its participation in habitat enhancement on Porter and Hoffman islands should be limited to provision of funding. Idaho Power notes that part of the annual funding it is proposing could be provided as a lump-sum payment early in the license term for the purchase of equipment, with a corresponding reduction in the annual contribution for the balance of the license term.

Response: We revised the Staff Alternative to include Patch and Gold islands, as well as Porter and Hoffman islands, as sites where Idaho Power would implement cooperative management measures. We also revised the Staff Alternative to recommend that Idaho Power provide the initial funding for equipment that will be needed to initiate and maintain enhancement projects, as well as $26,000 annually for implementation.

Comment TR-54: IDFG agrees that a consultation requirement should be included in the measure regarding enhancement of habitat and reintroduction of mountain quail.

Response: We note IDFG's support for this aspect of the Staff Alternative.

Comment TR-55: ODFW states that it supports Idaho Power's contribution of $100,000 for the cooperative reintroduction of mountain quail and enhancement of low elevation riparian habitat, but believes funding should primarily be used for capture and translocation efforts. ODFW recommends acquiring birds from Douglas County, Oregon and putting them in Hells Canyon in the best habitat available, and monitoring movements, habitat use, and incidence and factors of mortality. Furthermore, ODFW recommends that identification of suitable parcels for enhancement and reintroduction should be tied to the Land Acquisition and Management Program.

Response: We revised the Staff Alternative to recommend that Idaho Power cooperate with the resource management agencies to implement specific projects or specific elements of projects, rather than contributing funding to state programs. We agree it would be reasonable to link enhancement and/or reintroduction projects to lands Idaho Power owns or would acquire for wildlife mitigation, or to other resource enhancement measures (e.g., tributary enhancement for resident salmonids).

Comment TR-56: Idaho Power comments that mountain quail reintroduction objectives are the responsibility of the states, and that Idaho Power's participation in any reintroduction efforts should be limited to provision of funding.

Response: As mentioned above, we revised the Staff Alternative to recommend that Idaho Power cooperate with the resource management agencies to implement specific projects or specific elements of projects. This approach is consistent with Idaho Power's initial proposal to provide funding, equipment, personnel, logistical support, and expertise to projects that are initiated by the resource management agencies.

Comment TR-57: The Forest Service recommends that staff include condition no. 10 (Mountain Quail Habitat Enhancement) without modification or limitation in the Proposed Action in the final EIS. The condition specifies that Idaho Power should implement the enhancement program as proposed.

Response: As described above, we revised our recommendations concerning mountain quail to more clearly define how Idaho Power should participate. We anticipate that this approach would meet the intent of the Forest Service modified 4(e) condition. We also revised the Staff Alternative to recommend that Idaho Power acquire 13.2 acres of riparian habitat as part of its larger wildlife mitigation package, rather than enhancing habitat along the Snake River downstream of Hells Canyon dam.

Wildlife Management on Idaho Power Lands

Comment TR-58: The Forest Service recommends that staff include condition no. 5 (*Wildlife Mitigation and Management Plan*) without modification or limitation in the Proposed Action in the final EIS. The Forest Service comments that project impacts extend beyond the project boundary, and that restricting the condition to apply only to project lands is inconsistent with other staff recommendations. The Forest Service comments further that a 60-day review and comment period prior to Idaho Power's filing of the IWMP and WMMP with the Commission for approval is needed to ensure adequate time for Forest Service review of actions that would be implemented on National Forest System lands.

Response: We revised section 5.2.5.4, *Upland and Riparian Habitat Acquisition*, to reflect that the Staff

Alternative accepts FS-5.
Comment TR-59: IDFG agrees that the WMMP should include an Information and Education Program to minimize the risk of wildlife disturbance and O&M should be scheduled to minimize disturbance on deer winter range. IDFG comments that Idaho Power should consult with IDFG in development of the plans.

Response: We note ODFW's support for this aspect of the Staff Alternative.

Comment TR-60: ODFW supports establishment of a terrestrial resource work group to assist in developing, finalizing, and implementing the IWHP, WMMP, and management plans.

Response: In the Staff Alternative, we recommend establishment of an IWHP group similar to the TRWG.
Comment TR-61: The Shoshone-Paiute Tribes reiterate terrestrial conditions submitted in response to the REA Notice, including establishment of a Terrestrial Resource Task Force, with Idaho Power to fund participation of the Shoshone-Paiute Tribes (TR-2)

Response: The Staff Alternative includes establishment of an IWHP Work Group, with roles and responsibilities similar to the TRWG. As described in section 5.2.6.5, *Tribal Participation, Education, and Training*, the Staff Alternative also includes funding for tribal participation in the IWHP Work Group.

Comment TR-62: ODFW notes that management plans would need to be consistent with agency policies, rules, regulations, goals and objectives, and must identify habitat enhancement and public access for fishing and hunting as important objectives.

Response: Idaho Power would be subject to the same federal, state, and county laws and regulations under which it currently operates. Habitat protection and enhancement are the primary purpose of the Wildlife Mitigation Plan, and we anticipate that ODFW would participate with the TRWG to evaluate fishing and hunting access on a site-by-site basis.

Comment TR-63: The Shoshone-Bannock Tribes recommend that all interested tribes be appointed to serve on the terrestrial work group to ensure protective management for native plant resources.

Response: The Staff Alternative includes establishment of an IWHP Work Group, with roles and responsibilities similar to the TRWG. As described in section 5.2.6.5, the Staff Alternative also includes funding for tribal participation in the IWHP Work Group.

B11. THREATENED AND ENDANGERED SPECIES

Comment TES-1: NMFS agrees that the magnitude of flow and water quality changes resulting from operation of the project and other Idaho Power Snake River basin projects is small. However, NMFS states that the information provided in this section is not adequate to initiate consultation on the Columbia River basin species. NMFS notes that increased flows of a few thousand cfs may be characterized as a "relatively small proportion" of overall flows at a specific location. However, NMFS states that FERC must consider in its analysis of cumulative effects that similar measures to those being recommended at Brownlee reservoir have been implemented at federal hydroelectric and water storage projects for many years. Together, these measures have had substantial effects on flows and temperatures in the Snake and

Columbia rivers.

Response: To illustrate the effects of proposed operations on flows downstream from the project, we added three figures (112, 113, and 114) in final EIS section 3.8.2.5, *Other Columbia River Basin Salmon and Steelhead ESUs*. The figures show, for 3 years that represent a range of hydrologic conditions, outflows from the project under Idaho Power's proposed operations and flows that would occur under run-of-river operations with Brownlee reservoir held at minimum operating pool. We also describe the additional effect that providing 237 kaf of flow augmentation water, which is part of the Staff Alternative, would have on outflows from Hells Canyon dam. Our understanding is that the most accurate method for determining the effects of these changes in outflows and water temperatures on migration survival through the lower Snake and Columbia rivers would be for NMFS to use the SIMPAS model that they used in preparing the upper Snake Biological Opinion. We expect that NMFS would conduct this analysis to assess the effects of flow changes caused by the project on the survival rates of listed ESUs during their migration through the Lower Columbia River.

Comment TES-2: NMFS states that it disagrees with FERC's determination that the project is unlikely to adversely affect nine species of salmon and steelhead migrating in the lower Columbia River, estuary, and nearshore ocean environment. NMFS states that the biological opinion on BOR's Snake River basin projects is a good source of information for staff's analysis. NMFS notes that in its September 7, 2006, letter responding to FERC's request for formal ESA consultation, it indicated that because the project has a substantial effect on streamflows in the Snake and Columbia rivers that the species list for consultation would include all listed species that use the Snake and Columbia River migratory corridors. NMFS comments that the draft EIS should discuss the effects of project operations on every ESA-listed anadromous fish species in the Columbia and Snake River basins. NMFS states that this information will be necessary for ESA consultation.

Response: As noted above, we added figures 112, 113, and 114 in final EIS section 3.8.2.5, *Other Columbia River Basin Salmon and Steelhead ESUs*, to illustrate the effects of Idaho Power's proposed operations on flows downstream of the project and in the lower Columbia River. These data indicate that flood control operations at Brownlee dam may reduce stream flows by about 10,000 to 15,000 cfs during the spring freshet in May and June when flows at McNary dam average between 250,000 and 300,000 cfs. When outflows from Brownlee are managed to hold flows steady during the fall Chinook spawning season (generally in November and December), outflows may be reduced by about 7,000 to 8,000 cfs when flows at McNary dam average between 120,000 and 150,000 cfs. While we maintain that these changes in flow are minor, flood control operations at Brownlee act in concert with flood control operations at other reservoirs in the basin that contribute to a substantive cumulative reduction in the spring flow freshet. As a result, we revised our determination for the nine Columbia River and Willamette River ESUs from not likely to adversely affect to likely to adversely affect. We also added text discussing how these changes in flow may affect the nine Columbia and Willamette River ESUs.

Comment TES-3: NMFS states that in its scoping comments, it recommended that FERC model inflow = outflow at minimum pool (Brownlee reservoir) to better assess the continuing effects of the project on important water quality parameters and flows. NMFS states that this analysis would facilitate identifying the proposed project's effects on the critical habitat of ESA-listed salmon and steelhead. NMFS further states that the draft EIS does not adequately portray the environmental baseline (nor, by extension, the continuing effects of the project) for the purpose of ESA consultation. NMFS recommends that FERC reevaluate the environmental baseline as requested by NMFS to comply with ESA.

Response: Scenario 5, which we required Idaho Power to model in AIR OP-1, matches the scenario that NMFS describes. We did not specifically evaluate NMFS's recommended alternative in the draft EIS because we concluded that other scenarios presented the most meaningful range of alternatives. We note that the full modeling results for Scenario 5 are available in Idaho Power's February 3, 2005, filing, which is available through the Commission's website. The three figures (112, 113, and 114) we added to final EIS section 3.8.2.5, *Other Columbia River Basin Salmon and Steelhead ESUs*, illustrate the effects of Idaho Power's proposed operations on flows downstream of the project and in the lower Columbia River. We evaluate the effects of the project on water quality parameters in sections 3.5, *Water Quality*, and 3.6, *Aquatic Resources*, and we maintain that any direct effects of the project on TDG, temperature, or DO likely equilibrate over the 247.6 river miles between Hells Canyon dam and the Snake River's confluence with the Columbia River.

Comment TES-4: AR/IRU comment that many of the more significant project effects on fall Chinook salmon are omitted from the threatened and endangered species section summary of effects on fall Chinook, including: (1) low DO impacts on rearing fish; (2) ramping; (3) loss of spawning gravels and rearing beaches; (4) altered temperature regime; (5) TDG and ammonia exceedances; and (6) trace metals on spawning, incubation, emerging and rearing fall Chinook. AR/IRU state that this discussion also omits the adverse effect of using air blowers on TDG.

Response: We modified the text of final EIS section 3.8.2, *Environmental Effects*, *Threatened and Endangered Species*, to address the effects identified by AR/IRU.

Comment TES-5: NMFS states that the title of subsections of section 3.8.1 that pertain to salmon and steelhead, should start with the words "Current Status and Critical Habitat of." NMFS recommends that the EIS clearly identify which hatchery programs are included as part of the listed species ESU or DPS. NMFS also states that it will update much of the status information in the draft recovery plan, which is expected to be released early in 2007 and will be filed with FERC so that it can be incorporated into the NEPA process.

Response: We modified the introductory paragraph of final EIS section 3.8.1, *Affected Environment* under *Threatened and Endangered Species*, to clarify that this section of the EIS describes the current status and critical habitat for salmon and steelhead species. We also modified the text to specify which hatchery programs are included as part of each listed ESU or DPS.

Comment TES-6: The Umatilla Tribes and the Nez Perce Tribe state that heavy supplementation of Snake River fall Chinook from the Lyon's Ferry hatchery, as well as the release of large numbers of unmarked fall Chinook at acclimation sites upstream of Lower Granite dam, contributes to the increasing trend in total returns and in the number of unmarked spawners passing Lower Granite dam.

Response: We modified the text of final EIS section 3.8.1.1, *Fall Chinook Salmon*, to clarify the likely influence of releases of unmarked fall Chinook salmon from acclimation sites on the returns of unmarked adult fall Chinook salmon.

Comment TES-7: The Umatilla Tribes and the Nez Perce Tribe state that the draft EIS failed to offer a comprehensive and updated status of fall Chinook salmon or other anadromous fish stocks affected by the project, which is critical to the consideration of anadromous fish restoration.

Response: In the draft EIS, we summarized available information on population trends of wild and hatchery fish, as well as on stocking levels by species, in section 3.8.1, *Affected Environment*. We describe the factors that have contributed to the current status of the species in section 3.8.3, *Cumulative Effects*.

Comment TES-8: IDFG comments that the number of spring/summer Chinook migrating past Lower Granite dam has fluctuated wildly over the last several years, and that the draft EIS incorrectly states that returns have been increasing since 2001. IDFG clarifies that returns have been decreasing since 2001 and naturally produced steelhead numbers also show a similar trend.

Response: We modified the text of final EIS section 3.8.1, *Affected Environment*, *Threatened and Endangered Species*, accordingly.

Comment TES-9: NMFS states that sockeye salmon occurred in the Payette River system. However, NMFS indicates that there is no information that documents whether these fish were part of the Snake River sockeye salmon ESU or whether they were a separate, now extinct, ESU.

Response: We modified the text of final EIS section 3.8.1, *Affected Environment*, *Threatened and Endangered Species*, accordingly.

Comment TES-10: Interior comments that the NEPA document should reflect the current run size of steelhead; according to Fish Passage Center data it is not quite two times as large as the average adult count at Lower Granite dam during the 1990s. Interior suggests that the NEPA document also display hatchery releases for summer steelhead over the last 20 years in the Snake River basin due to the full implementation of the Corps' Lower Snake River Compensation Plan. Interior states that the Lower Snake River Compensation Plan hatcheries produce and release salmon, steelhead, and resident rainbow trout as part of the program's mitigation responsibility. The mitigation goals for the program include adult returns of 55,100 steelhead, 58,700 spring/summer Chinook salmon, and 18,300 fall Chinook salmon to the Snake River. Interior also states that to mitigate lost angler days for resident species, the Lower Snake River Compensation Plan program stocks about 86,000 pounds of rainbow trout into inland lakes and ponds close to the project area.

Response: We revised the text of final EIS section 3.8.1, *Affected Environment*, *Threatened and Endangered Species*, to describe the potential effects of increased hatchery production on run sizes of steelhead, spring/Chinook salmon and fall Chinook salmon.

Comment TES-11: Interior recommends that the NEPA document should include a complete discussion of the effects of turbine mortality on bull trout, as well as an assessment of likely population impacts. Interior also recommends that the NEPA document specifically evaluate the potential effects of flow fluctuations downstream of Hells Canyon dam, and of low DO and elevated water temperatures on bull trout habitat in the project area.

Response: We added an assessment of the effects of low DO and elevated water temperatures on bull trout, and of the potential effects of entrainment mortality on bull trout, in final EIS section 3.6.1.4, *Native Resident Salmonids*. We evaluate the effects of flow fluctuations on bull trout in final EIS section 3.6.2.1, *Effects of Project Operations on Aquatic Resource*s.

Comment TES-12: NMFS observes that the draft EIS recognizes that the project alters the Snake

River's thermal regime, interacts with nutrient rich inflows, reduces DO in project outflows, and blocks upstream and downstream passage of salmon and steelhead. NMFS states that all these effects will continue to some degree and should be identified as unavoidable adverse effects.

Response: We modified the text of final EIS section 3.8.4, *Unavoidable Adverse Effects*, accordingly.

Comment TES-13: Interior recommends that the Commission provide more information about bald eagles, including information about nesting, winter feeding and roosting areas, potential adverse and beneficial project effects, and conservation and impact minimization measures. Interior also recommends that the NEPA document contain specific requirements regarding recreation management to minimize disturbance and protection of mature trees that could be used for nesting, roosting or perching.

Response: We added more information to final EIS section 3.8.2.12, *Bald Eagle*, to describe bald eagle nesting and potential adverse and beneficial project effects. Idaho Power indicates that no additional information about winter feeding or roosting areas is available (Idaho Power, 2007). In the Staff Alternative, we recommend that Idaho Power consult with Interior and other stakeholders to identify and implement measures to prevent or minimize the risk of disturbance to nesting birds that could result from recreation. We note that Idaho Power's HCRMP does identify a number of specific measures that are intended to protect bald eagles and other sensitive species and habitats within Special Management Areas, Resource Protection Areas, and Resource Conservation areas, as well as common policies that protect important natural resources wherever they occur on Idaho Power lands.

Comment TES-14: As part of the TESSMP, ODFW recommends Idaho Power fund habitat enhancements for bald eagles, because ODFW biologists believe that perching, nesting, and roosting habitat is probably limiting to bald eagles in Hells Canyon.

Response: We have seen no evidence in the record to indicate that perching, nesting or roosting habitat is limiting to bald eagles in Hells Canyon. The HCRMP contains BMPs and land use designations that would protect riparian habitat. The record indicates that bald eagle use of the project area is increasing, consistent with population trends in the region and throughout the country.

Comment TES-15: Idaho Power comments that the final EIS should discuss the entire period of record for which bald eagle productivity information was collected.

Response: We added this information to section 3.8.1.14, *Bald Eagle*.

Comment TES-16: Interior comments that there are discrepancies in survey methods between Idaho Power's vegetation mapping and rare plant surveys and recommendations in the Silene Conservation Strategy. For this reason, Interior recommends the Commission assess potential project impacts on *Silene spaldingii* with the assumption that habitat exists in the project area, until adequate and timely surveys have been conducted.

Response: We assume that Spalding's catchfly could occur in the project area, as noted in the draft EIS. We do not know of any discrepancies between Idaho Power's survey methodology and recommendations in the conservation strategy, although there may be some trade-offs in sightability of this species if surveys are conducted in September rather than in July or August. As noted in the Conservation Strategy, Spalding's catchfly remains green late into the season (which makes it easier to see in surrounding strawcolored vegetation), while its stickiness allows wind-blown dust, plant fragments, and spider webs to adhere to it (which makes it harder to see). In any case, staff assumes this species could be present in project-area grasslands, and recommends surveys at sites where project-related construction or disturbance could cause adverse effects. If surveys confirm the species is present, the Staff Alternative recommends that Idaho Power consult with FWS and the other stakeholders to identify and implement any protective measures that may be needed.

Comment TES-17: Interior comments that the Commission should assess the potential presence of *Mirabilis macfarlanei* and potential impacts to the species with the acknowledgement that the timing of the surveys conducted to date and the sufficiency of 7-year-old data are questionable.

Response: The timing of surveys between April and June 1999 should have been appropriate to identify MacFarlane's four-o'clock, if present in surveyed areas, and we consider 7-year-old data to be reliable in providing an indication of the prevalence of this and other plant species in the project area. However, to ensure that the most relevant data are available, the Staff Alternative recommends surveys at sites where project-related construction or disturbance could cause adverse effects. If surveys confirm the species is present, the Staff Alternative recommends that Idaho Power consult with FWS and the other stakeholders to identify and implement any protective measures that may be needed.

Comment TES-18: Interior comments that the NEPA document should discuss which aspects (e.g., geographic scope) of Interior's 10(j) recommendation regarding MacFarlane's four-o'clock and Spalding's catchfly would be incorporated into the staff's recommended TESSMP.

Response: The Staff Alternative would be consistent with items 1, 2, 4, 6, 7, and 8 of Interior's 10(j) recommendation. Item 3 calls for additional surveys when evidence indicates that potential habitat exists and original surveys did not include these sites/habitats. Rather than recommending that Idaho Power conduct inventory-level surveys of all potential habitat, the Staff Alternative would focus surveys at sites where project-related construction or other activities could adversely affect sensitive plant species; i.e., surveys would be conducted in potential habitat if project-related effects could occur.

Item 5 calls for an annual monitoring and evaluation plan for selected sites for the first 5 years, then once every 2 years for the terms of the license. We are recommending that the monitoring frequency should be based on site-specific conditions; i.e., more frequent monitoring at sites with a high risk of disturbance, and less frequent monitoring at remote sites.

Comment TES-19: Interior comments that the draft EIS does not adequately describe baseline conditions or potential project effects on northern Idaho ground squirrel habitat. Specifically, Interior comments that Idaho Power's management of Barber Flats has the potential to affect this species through habitat alteration, and suggests that the NEPA document call for Idaho Power to retain ownership and manage Barber Flats as a conservation reserve.

Response: As described in draft EIS section 3.8.2.11, *Northern Idaho Ground Squirrel*, we concluded that the project does not affect the northern Idaho ground squirrel, because this subspecies occurs at higher elevations than those occupied by project features or affected by project operations. We updated the text of the final EIS to clarify that Idaho Power no longer owns the Barber Flats parcel, but we continue to recommend that Idaho Power consult with the agencies, tribes and other stakeholders to address management of this subspecies if Idaho Power acquires lands that provide potential or occupied habitat, and we include this species in the TESSMP.

Comment TES-20: Interior comments that additional cumulative effects analysis is needed if the EIS is to serve as a biological assessment under section 7 of the ESA.

Response: We added text to final EIS section 3.8.3.7, *Bald Eagle,* to address cumulative effects on bald eagles.

Comment TES-21: Interior comments that the NEPA document should specify the geographic scope of the project-wide threatened and endangered species management plan, and the parties that will be involved with its development.

Response: We added text to section 5.2.5.1, *Special Status Plant and Wildlife Protection*, to define the geographic scope and the parties to be involved.

Comment TES-22: Interior comments that text regarding unavoidable adverse effects on threatened and endangered plants and wildlife species is confusing and should be clarified.

Response: We clarified the text in section 3.8.4, *Unavoidable Adverse Effects*, to show that we identified unavoidable adverse effects on listed fish species.

B12. CULTURAL RESOURCES

Comment CR-1: The Nez Perce Tribe states that the draft EIS fails to recognize the Nez Perce Tribe's unique cultural and treaty-based relationship to Hells Canyon and the project area.

Response: We revised the text in section 3.9.1.2, *Cultural History Overview*, to acknowledge the Nez Perce Tribe's relationship to Hells Canyon and the project area.

Comment CR-2: Idaho Power comments that it anticipates a rotating monitoring schedule ensuring that all sites are monitored during the first 3-year monitoring cycle, consistent with Forest Service revised preliminary condition no. 25; it has not proposed annual monitoring of all historic properties.

Response: We revised the text in section 3.9.2.2, under *Monitoring*, and in section 5.2.6.2, *Cultural Resources Monitoring*, to indicate that Idaho Power has proposed a rotating monitoring schedule ensuring that all sites are monitored over the course of the first 3-year monitoring cycle.

Comment CR-3: Idaho Power comments that the $7,600 annualized cost estimate for development of oral histories for the Shoshone-Bannock and Shoshone-Paiute tribes would be in excess of the efforts put into the other oral histories that were submitted as part of the final license application and that the estimate should be revised to be comparable to the support Idaho Power offered the other tribes.

The Shoshone-Bannock Tribes comment that the funding for ethnographic studies should be increased to $150,000 per year through the term of the license to secure a contractor to produce the tribal cultural geography for the Hells Canyon area.

Response: We revised the text in section 5.2.6.4, *Ethnographic and Oral History Studies*, to indicate that the funding for oral histories for the Shoshone-Bannock and Shoshone-Paiute tribes should be consistent with that allocated by Idaho Power for the oral histories of the other tribes.

Comment CR-4: Oregon SHPO reiterates its recommendation that Idaho Power update the National Register nomination for the Hells Canyon Historic District to permit new analysis of contributing sites and to assist in prioritizing the protection/stabilization of such sites. The Shoshone-Bannock Tribes comment that revising the Hells Canyon Archaeological District nomination may afford greater protection and offer the tribes recourse if sites in the district are affected. It may also provide an opportunity for public education about the importance and use of the area prior to European contact. Idaho Power comments that section 106 does not require Idaho Power to update of the National Register nomination for the Hells Canyon Archaeological District and that the cost of doing so using only existing data would range from $50,000 to $60,000.

Response: We reconsidered our position on this measure and acknowledge that the Advisory Council's regulations implementing section 106 of NHPA do not require federal agencies to nominate properties to the National Register. Section 106 only requires federal agencies to determine whether properties are eligible for inclusion in the National Register, and to assess a proposed project's potential effects on the properties. Thus, in the Staff Alternative in the final EIS, we do not require Idaho Power to update the National Register nomination for the Hells Canyon Archaeological District. However, we do find that Idaho Power would need to resolve any project-related adverse effect to any National Register-eligible property that exists within that portion of the Hells Canyon Archaeological District that lies within the project's APE, as well as any National Register-eligible property within any other part of the project's APE. As stated in draft HPMP section 3.1.1.4.2, Idaho Power acknowledges that all but a handful of the more than 800 archeological sites recorded between Hells Canyon dam and the confluence of the Snake and Salmon rivers—the majority of which fall within the Hells Canyon Archaeological District—are considered eligible for the National Register. Regardless of whether contributing elements to the Hells Canyon Archaeological District are nominated to the National Register, Idaho Power must still manage these elements as historic properties. Thus, revising the Hells Canyon Archaeological District nomination would not afford sites within the district any greater protection.

Comment CR-5: The Forest Service comments that staff should clarify whether it recommends adoption of all of the components of FS-25, and recommends that the final EIS should include the following items as requirements of the HPMP:

1. Review process and time frame for preparing HPMP in coordination with the Forest Service
2. Adaptive management strategy to accommodate unforeseen challenges and changes to conditions affecting historic properties:
3. How consultation requirements of 36 CFR 800 will be satisfied.
4. Discussion of how future project-related developments will be evaluated and potential revisions to the APE undertaken.
5. Identification of conditions under which new surveys may be required.
6. Identification of when additional surveys resulting from increased shoreline erosion or reservoir drawdown on Forest Service lands will be completed.
7. Development of a detailed monitoring plan.
8. Development of site specific treatment plans and implementation schedule for any sites requiring mitigation or treatment as a result of adverse effects of the project.

9. A provision for sharing all cultural resources data collected by Idaho Power with the Payette and Wallowa-Whitman National Forests.
10. Development of a Cultural Resources Advisory Group.
11. Provision that all artifacts recovered as a result of Idaho Power-sponsored cultural resource investigations be curated in accordance with 36 CFR 79.
12. Inclusion of all provisions of the draft HPMP submitted with the final license application unless replaced or modified by provisions of Forest Service condition no. 25.

Response: Staff does recommend adoption of FS-25 in its entirety; we revised the text in section 5.2.6.1, *Finalization of HPMP*, to clarify this issue.

Comment CR-6: The Forest Service requests clarification regarding how the Commission has decided to move forward with a Programmatic Agreement to prepare and implement the HPMP.

Response: The Commission drafted and circulated to agencies, SHPOs, and tribes for comment a Programmatic Agreement stipulating the finalizing and implementation of the HPMP. Prior to any license issuance, the Commission would execute the final Programmatic Agreement with the SHPOs and Advisory Council, if the latter decides to participate. The Forest Service, BLM, Idaho Power, and the tribes would be concurring parties.

Comment CR-7: The Forest Service comments that the final EIS should discuss factors, such as erosion, resulting from reservoir impoundment of sediment and subsequent lack of sediment in flows downstream of Hells Canyon dam, in addition to the effects of water fluctuation.

Response: Section 3.4, *Sediment Supply and Transport*, discusses these factors.

Comment CR-8: The Forest Service comments that prior to finalizing the HPMP, Idaho Power should develop criteria to measure project-related impacts that the Commission, SHPOs, concerned tribes, and agencies can all agree on. The Forest Service comments that this is necessary to develop a successful monitoring program.

Response: We revised the text in section 3.9.2.2, *Site Treatment*, *Stabilization* to clarify the need for development of criteria to measure project-related impacts as an integral element of the monitoring plan.

Comment CR-9: The Forest Service comments that the Commission should clarify whether it is following the subpart B section 106 process or the subpart C program alternative process, and if the latter, provide Federal Register volume, number and date of the Commission's notice.

Response: The Commission follows the subpart B section 106 process in relicensing.

Comment CR-10: Interior comments that archaeologists reported three sites on Oxbow reservoir and two sites on Hells Canyon reservoir as being affected by pool fluctuations and/or cutbank erosion.

Response: We revised the text in section 3.9.2.1, *Effects of Project Operations on Cultural Resources*, *Prehistoric and Historic Archaeological Resources*, to state the correct numbers of sites affected by fluctuations and/or cutbank erosion at Oxbow and Hells Canyon reservoirs.

Comment CR-11: Interior comments that a sentence on page 416 of the draft EIS should be corrected to read "The tribes and Idaho State Historical Society recommend, and the BLM (Interior-5) and Forest Service specify, that Idaho Power revise, finalize and implement the HPMP."

Response: We revised the text in section 3.9.2.5, *Management of Cultural Resources*, *Revise and Finalize the HPMP*, accordingly.

Comment CR-12: Interior comments that BLM should be a principal signatory to the Programmatic Agreement.

Response: It has been the Commission's practice to use the traditional 2-party Programmatic Agreement format (when the Advisory Council chooses not to participate), allowing the SHPO (in this instance, SHPOs) to be the only other signatory beside ourselves in executing a PA for a new hydroelectric license. All other parties to the Programmatic Agreement are designated as concurring parties, including the licensee, who also has major responsibilities in managing lands under its new license. Being a concurring party does not diminish the responsibilities of BLM as a land manager. Irrespective of being a signatory or concurring party, all parties to the Programmatic Agreement have equal status in consultation and have the ability to recommend the Programmatic Agreement be amended at any time during the term of the new license. As a result, BLM remains as a concurring party to the Programmatic Agreement.

Comment CR-13: Interior comments that the NEPA document should describe the potential effects of flow augmentation or flood control measures on cultural resources and that the Staff Alternative should specify that the deferred cultural resource monitoring study on effects of reservoir water level fluctuations should include effects of flow augmentation or flood control measures.

Response: Idaho Power's plan for studying effects of reservoir water level fluctuations on cultural resources calls for characterizing daily, monthly and annual fluctuations and identifying those fluctuations attributable to project operations and those attributable to other purposes or requirements, such as flood control.

Comment CR-14: Interior comments that the NEPA document should clearly state that evaluation and protection of important inadvertent paleontological discoveries would be retained in the final HPMP.

Response: We clarified the text in section 5.2.6.7, *Other Cultural Resource Management Measures*, regarding treatment of paleontological resources in the HPMP.

Comment CR-15: The Oregon SHPO comments that it needs a complete list of all sites and Idaho Power's determinations for each section of the study area to determine which sites have not been adequately addressed. The Oregon SHPO also comments that a monitoring program cannot be developed until all eligibility determinations have been made. The Nez Perce Tribe comments that the tribe considers many of the archaeological sites in Hells Canyon to be eligible for the National Register under criteria other than D, and that all the National Register criteria should be applied to archaeological sites to properly assess site significance and adverse effects.

The Umatilla Tribes comment that staff should clarify that the Commission will require all unevaluated cultural resource sites to be treated as eligible for inclusion in the National Register.

Response: Lists of sites in the APE are contained in the final license application and supporting technical reports. On June 26, 2003, Idaho Power filed its National Register eligibility determinations with the Commission. In section 3.1.1 of its draft HPMP, Idaho Power summarizes information about listed and eligible resources, including those identified below Hells Canyon dam. The resources and their evaluations are itemized in appendix 3.1-a of that document. In the final EIS, we clarified the text in section 3.9.2.2, *Site Treatment*, *Monitoring,* to specify that the reasons a site is considered significant should be taken into account in assessing effects of project operation on the site and that the possibility that a site is considered significant under criteria other than D should also be taken into account.

Additionally, in section 4.2.4 of its draft HPMP, Idaho Power specifies that Idaho Power would record and evaluate the National Register eligibility of any previously-identified resources prior to any actions that could affect such resources.

Comment CR-16: The Oregon SHPO comments that the EIS needs to recognize that the Oregon SHPO disagrees with Idaho Power regarding effects on cultural resources downstream of the Salmon River confluence.

Response: We revised the text in section 3.9.2.1, *Effects of Project Operations on Cultural Resources*, *Prehistoric and Historic Archaeological Resources*, and in section 3.9.2.5, *Management of Cultural Resources*, *Expansion of Area of Potential Effect*, to indicate that the Oregon SHPO disagrees with Idaho Power regarding effects on cultural resources downstream of the Salmon River confluence.

Comment CR-17: Oregon SHPO comments that site treatment and monitoring cannot be discussed without first having completed adequate documentation of current site status.

Response: We clarified the text in section 3.9.2.2, *Site Treatment*, *Monitoring*, regarding the updating of site condition information as an integral element in the initial 3-year phase of the monitoring program.

Comment CR-18: The Oregon SHPO reiterates its recommendation that Idaho Power provide future funding to support analysis of previously recorded archaeological materials. The Oregon SHPO states that knowledge gained from such studies would help in future site evaluations and interpretations and could assist in making proper management recommendations.

Response: In section 3.9.2.3, *Cultural Resources Interpretation*, we acknowledge that analysis of previously recovered archaeological materials could potentially contribute to the state of knowledge concerning the cultural history of the Hells Canyon area. However, we conclude that its potential contribution toward management and protection of resources extant in the project would not be sufficient to support a recommendation that Idaho Power fund such analysis. Nevertheless, this conclusion does not preclude Idaho Power from acting on its own to collaborate with local educational institutions and interested tribes to provide access to, and the opportunity to conduct research on, those archeological collections in Idaho Power's possession.

Comment CR-19: The Oregon SHPO comments that general recreational enhancements do not always adequately address tribal concerns regarding access to tribal fishing sites in the APE.

Response: In section 4.3.4.2 of its draft HPMP, Idaho Power states that it will endeavor to provide access to TCPs identified within the APE where it is practical and safe to do so. Providing tribes with access to sacred sites and TCPs (which may include tribal fishing sites and locations of culturally significant plants, as well as other locations), is also specified as an action to be undertaken under Standard Procedure 1 of the draft HPMP. The SHPOs are among the consulting parties listed under SP 1. We revised final EIS section 3.9.2.4, *Support for Native American Programs*, to include this information.

Comment CR-20: The Oregon SHPO and the Nez Perce Tribe comment that at least a portion of the area downstream of the confluence of the Snake and Salmon rivers should be part of the APE.
Response: As stated in section 5.2.6.7, *Other Cultural Resource Management Issues*, we conclude that neither information filed with the Commission nor the recommendations to expand the APE downstream of the confluence of the Snake and Salmon rivers provide an empirical basis for attributing erosional impacts on cultural resources downstream of the Salmon River to operation of the Hells Canyon Project.

Comment CR-21: The Oregon SHPO and the Shoshone-Bannock Tribes comment that discrepancies among Idaho Power's archaeological consultants' investigations should be addressed and that areas within the APE for which site information is inaccurate or inconsistent should be resurveyed to address these shortcomings.

Response: The technical archaeological report that Idaho Power submitted with its license application about surveys downstream of Hells Canyon dam acknowledges discrepancies in the ways the archaeological consultants interpreted effects. These discrepancies would be rectified (and information on effects updated) through the monitoring program undertaken under the HPMP.

Comment CR-22: The Oregon SHPO comments that sites cannot be selected for stabilization until all sites have been fully documented and evaluated and that discussions regarding stabilization should take place among Idaho Power, the federal land managing agencies, and the SHPOs. The Umatilla Tribes comment that staff should clarify: (1) how the numbers of sites identified for stabilization were arrived at; (2) that effects on all affected sites, regardless of the number of sites, should be resolved; and (3) the threshold for implementing treatment on sites identified during monitoring as being adversely affected by the project and also whether the Commission or Idaho Power is responsible for making sure site treatment is appropriately implemented. The Nez Perce Tribe also requests clarification about how the sites were selected for stabilization and states that there is no consensus among the consulting parties as to which sites are being adversely affected by project operations.

Response In section 3.9.2.2, *Site Treatment*, *Stabilization*, we note that neither Idaho Power's application nor its draft HPMP describes the criteria it used to select sites for stabilization. We then state that "[d]ecisions regarding stabilization need to be based on clearly articulated, measurable criteria" set forth in the final HPMP. Section 3.9.2.2 also notes that Idaho Power proposes to coordinate with the appropriate SHPO, land-managing agency, and tribes to develop stabilization or other measures appropriate to historic properties (site, rock image, or other such property) affected by the project. Additionally, the Commission would require implementation of the HPMP (including approaches and measures for site treatment) as a condition of any new license.

Comment CR-23: The Oregon SHPO reiterates its recommendation that there be an Advisory Committee or working group specifically concerned with implementation of the HPMP.

Response: The Staff Alternative includes this measure; see section 5.2.8.1, *Land Use Management*.

Comment CR-24: The Umatilla Tribes comment that consultation with Native American tribes can contribute to identification of historic properties, and that historic properties can be of any ethnic origin.

Response: In its draft HPMP, Idaho Power proposes to identify and evaluate historic properties in consultation with the SHPOs, tribes, and, as appropriate, land-managing agencies. As noted in section 3.9.1.4 of the EIS, studies have identified a variety of historic properties in the Hells Canyon area associated with Euro-American and Euro-Asian presence in the region, as well as the numerous properties of Native American origin.

Comment CR-25: The Umatilla Tribes comment that changes to the Pine Creek-Hells Canyon 69-kV line could visually affect historic properties outside the 50-foot APE.

Response: Idaho Power proposes no changes to the Pine Creek-Hells Canyon 69-kV line. However, in the event that Idaho Power planned to make any changes to the 69-kV line in the future, the draft HPMP outlines the process (figure 4.3-c) by which work would be reviewed to determine its potential to affect historic properties and the steps necessary to ensure that any adverse effects are properly resolved. This process would be finalized in the final HPMP.

Comment CR-26: The Umatilla Tribes comment that while 0.1-mile upslope from high-pool level is an appropriate APE in some areas, it is inappropriate for places where recreation sites provided by Idaho Power are affecting an area more than 0.1 mile from the reservoir.

Response: Over the term of a license, it is possible that the APE, as well as other elements of the HPMP, may require adjustment in response to changing circumstances or new information regarding historic properties and project effects. We included in the Staff Alternative a recommendation for periodic review and, as necessary revision, of the HPMP.

Comment CR-27: The Umatilla Tribes comment that the APE should be extended to Anatone because the Commission has determined that the project has measurable impacts at that location.

Response: As indicated in section 5.2.6.7, *Other Cultural Resource Management Issues*, we conclude that neither information filed with the Commission nor the recommendations to expand the APE downstream of the confluence of the Snake and Salmon rivers provide an empirical basis for attributing erosional impacts on cultural resources downstream of the Salmon River to operation of the Hells Canyon Project.

Comment CR-28: The Umatilla Tribes comment that the APE should be extended upstream because the project blocks salmon from traditional fishing areas along the Snake River. The inability of salmon to reach traditional fishing areas compromises the integrity of the TCPs.

Response: In final EIS section 3.8.3, we note that settlement and development of the Snake and Columbia River basins have had substantial cumulative adverse effects on the habitat and population size of Snake River fall Chinook salmon. We also note that Snake River steelhead and spring/summer Chinook salmon have been subject to these same cumulative effects, although those species have been more directly affected by tributary development, particularly development associated with irrigation diversions. We acknowledge that blockage of salmon from TCPs that are the locations of traditional fishing areas constitutes an adverse effect on such TCPs. However, given the very large number and variety of factors other than the presence and operation of the Hells Canyon Project that contribute to the loss and degradation of salmon and steelhead habitat and to reduction in population sizes, we conclude that expansion of the project's APE as recommended by the Umatilla Tribes is not warranted. We do note, however, that measures proposed by Idaho Power and also those recommended in the Staff Alternative regarding protection and enhancement of aquatic resources would contribute to enhanced integrity of traditionally used tribal fishing sites both within and outside the project's APE.

Comment CR-29: The Umatilla Tribes comment that the EIS should include a statement about the Burns Paiute, Warm Springs, and Umatilla reservations similar to the statement about the reservations of other tribes.

Response: We revised the text in section 3.9.1.2, *Cultural History Overview*, to include discussion of the Burns Paiute, Warm Springs, and Umatilla reservations.

Comment CR-30: The Umatilla Tribes comment that the continued existence of the dams means the continued existence of the reservoirs and continued damage to shoreline sites from boat wakes.

The Nez Perce Tribe comments that while state and federal land-managing agencies built boat ramps on the reservoirs, Idaho Power has some responsibility for boat wakes damaging sites.

Response: In section 3.9.2.1, under *Prehistoric Archaeological Resources*, we acknowledge that requiring Idaho Power to provide boat access to the reservoirs creates a nexus between the project and erosion resulting from boat wakes.

Comment CR-31: The Umatilla Tribes comment that if a site has been determined to be adversely affected and in need of treatment, monitoring is unnecessary, and that what is necessary is to resolve the adverse effects immediately. They state that monitoring may be necessary after treatment.

Response: As discussed in section 3.9.2.2, *Site Treatment*, Idaho Power has proposed measures for stabilization and mitigation based on information from the cultural resources surveys conducted for Idaho Power's application. The monitoring program implemented as part of the HPMP would determine if other sites are being affected by project operations.

Comment CR-32: The Umatilla Tribes comment that staff should clarify how one monitoring program ensures consistency of approach and analysis. They also comment that the approach to monitoring an archaeological site is different from the approach to monitoring a rock image site.

Response: In section 3.9.2.2, *Site Treatment*, *Monitoring*, we state that employing monitoring methods that take key characteristics of a resource type and its significance into account would enhance assessment of the resource's condition. Because rock images frequently occur in association with Native American archaeological sites, we conclude that a single monitoring program, designed to address a range of feature characteristics, would ensure consistency of approach and analysis.

Comment CR-33: The Umatilla Tribes comment that analysis of archaeological materials removed from the project during previous investigations would provide a better context for sites and thus assist in evaluation of unevaluated sites in the APE.

Response: In section 3.9.2.3, *Cultural Resources Interpretation*, we acknowledge that analysis of previously recovered archaeological materials could potentially contribute to the state of knowledge concerning the cultural history of the Hells Canyon area. However, we conclude that its potential contribution toward management and protection of resources extant in the project would not be sufficient to support a recommendation that Idaho Power fund such analysis. Nevertheless, as we stated above, this would not preclude Idaho Power from collaborating with local educational institutions and interested tribes to provide access to and opportunity to conduct research on archeological collections in Idaho Power's possession.

Comment CR-34: The Umatilla Tribes comment that access to traditionally used tribal fishing sites, many of which are TCPs, involves the presence of traditionally harvested fish. They state that the lack of traditionally harvested fish compromises the integrity of these TCPs.

Response: Measures proposed by Idaho Power and also those recommended in the Staff Alternative regarding protection and enhancement of aquatic resources would potentially contribute to enhanced integrity of traditionally used tribal fishing sites. We did not revise our conclusion in that regard.

Comment CR-35: The Umatilla Tribes comment that Idaho Power should assist county, state, and federal law enforcement organizations by providing funding for individuals to focus law enforcement energy (to protect cultural resources) within the Hells Canyon Complex, as Idaho Power has been doing with Adams County, Idaho.

Response: In draft EIS section 5.2.8.2, *Law Enforcement and Fire Protection*, we note that the responsibility of funding law enforcement activities on private, state, and federal lands lies with the county, state, and federal agencies having jurisdiction over those areas. We did not revise our conclusion in the final EIS.

Comment CR-36: The Umatilla Tribes reiterate their recommendation that the APE be resurveyed every 10 years, noting that field conditions, methodologies, technology, and interpretations change over time, and that many sites will become historic over the next 30 years.

Response: We acknowledge that field conditions, methodologies, technologies, and interpretations change over time, and may change over the term of a license. We include FS-25 in the Staff Alternative. FS-25 specifies, among other measures, that Idaho Power's final HPMP include provisions for an adaptive management strategy to accommodate unforeseen challenges and conditions and also provisions for determining when and under what circumstances new survey, or resurvey of previously examined areas, may be required.

Comment CR-37: The Umatilla Tribes comment that a TCP assessment would need to be conducted prior to the proposed hatchery improvements because only an archaeological assessment has been done to date. The tribes also comment that staff should clarify that lands acquired for terrestrial resource mitigation would need to be surveyed for all types of historic properties prior to beginning any work that could affect historic properties on those lands.

Response: Section 4.2.4 of Idaho Power's draft HPMP specifies that it will evaluate all new construction projects for the presence of significant cultural resources in accordance with the Secretary of the Interior's Standards and Guidelines for Identification. This provision in a finalized HPMP would extend to the proposed hatchery improvements and any lands acquired under the terms of the license for terrestrial resource mitigation.

Comment CR-38: The Umatilla Tribes comment that staff should clarify what the Commission is requiring in terms of minimizing and avoiding effects on historic properties from recreational use in the Hells Canyon Complex.

Response: In section 5.5 of its draft HPMP, Idaho Power specifies actions it will take to resolve any adverse effects on historic properties resulting from implementation of specific recreational environmental measures. Resolution of other recreational effects on historic properties would be carried out under monitoring and treatment provisions of the final HPMP.

Comment CR-39: The Umatilla Tribes comment that staff should clarify that continued project operation would have adverse effects, how the Commission plans to have Idaho Power mitigate the effects, and that Idaho Power is responsible for carrying out all cultural resource activities in the HPMP regardless of cost.

Response: Draft EIS section 3.9.2, *Environmental Effects*, describes known and potential adverse effects on cultural resources from continued project operation. To ensure that adverse effects are appropriately resolved over the license term, the Commission has drafted and circulated a Programmatic Agreement that it proposes to execute with the SHPOs, tribes, agencies, and Advisory Council. In the Programmatic Agreement, the Commission agrees to ensure that, upon license issuance for the Hells Canyon Project, Idaho Power would finalize and implement its HPMP. The requirement to finalize and implement its HPMP would also be a condition of any new license issued by the Commission.

Comment CR-40: The Umatilla Tribes comment that staff should clarify how an annualized reduction of $70,200 per year for scholarships was determined.

Response: Because neither Idaho Power nor the tribes provided a breakdown of each of the three elements of Idaho Power's proposal with respect to tribal funding, staff estimated that 30 percent of the funds would support Native American Programs to obtain funding for participating in and/or administering cultural resources environmental measures; 35 percent would support scholarship/training funds; and 35 percent would be devoted to facilitating several cultural enhancement programs. This would amount to about $11,700 per tribe for scholarship/training funds, which would equal an annual reduction of $70,200 for all six tribes. We corrected the incorrectly labeled support measures in appendix I of the final EIS.

Comment CR-41: The Nez Perce Tribe comments that as camping locations are lost due to erosion, campers move farther inland, and begin to use cultural features such as housepits for camping. The Nez Perce Tribe also comments that this recreational effect on cultural resources is a direct result of project-related sediment trapping.

Response: Section 3.4, *Sediment Supply and Transport*, discusses the influence of beach loss on recreationists' choices for camping locations. Section 3.9.2.6, under *Recreational Measures*, also acknowledges that recreational activities are perhaps the greatest threat to cultural resources. In the final EIS, the Staff Alternative includes FS-4, *Sandbar Restoration*, which would help restore some shoreline areas used by campers.

Comment CR-42: The Nez Perce Tribe comments that the Modoc and Klamath are part of the Klamath Language Isolate, not part of the Sahaptian language family.

Response: We corrected the text of section 3.9.1.2, *Cultural History Overview*, regarding the association of specific Native American communities with particular language groups.

Comment CR-43: The Nez Perce Tribe comments that the EIS should include the information that much of Hells Canyon was originally located within the Nez Perce Indian Reservation and that the Nez Perce-ceded territory includes all of Hells Canyon and the project north of the confluence of the Powder and Snake rivers.

Response: We revised the text of section 3.9.1.2, *Cultural History Overview*, to indicate that much of the area of the Hells Canyon Project was contained within the boundaries of the Nez Perce Tribe reservation established under the 1855 treaty.

Comment CR-44: The Nez Perce Tribe comments that section 3.9.1.5, *Traditional Cultural Properties, Sacred Sites and Rock Art*, should be renumbered as 3.9.1.6.

Response: We revised the final EIS section number accordingly.

Comment CR-45: The Nez Perce Tribe comments that its oral history study was submitted to Idaho Power approximately 2 years ago.

Response: The Commission thanks the Nez Perce Tribe for this information. We revised section 3.9.2.4, under *Participation, Education, and Training*, to indicate that the Nez Perce Tribe's oral history study was filed with the Commission in February 2007.

Comment CR-46: The Nez Perce Tribe comments that to properly determine the best course of site treatment, the criteria under which the site is eligible must be determined.

Response: We clarified the text in section 3.9.2.2, *Site Treatment*, *Stabilization*, to specify that the reasons a site is considered significant should be taken into account in determining appropriate site treatment.

Comment CR-47: The Nez Perce Tribe comments that its $10 million estimate for monitoring was based on a field crew operating nearly year-round at $333,000 for 30 years. It also comments that Idaho Power did not indicate how its initial estimate of monitoring costs was determined.

Response: We revised the text in section 3.9.2.2, *Site Treatment*, *Monitoring*, to include the Nez Perce Tribe's basis for its $10 million estimate for monitoring.

Comment CR-48: The Nez Perce Tribe comments that if the oral histories completed for the project so far did not discuss TCPs in terms of National Register criteria, and are therefore insufficient to determine whether sites are eligible for the National Register, then additional work should be done. The Shoshone-

Paiute Tribes comment that existing ethnographic studies of the Hells Canyon area are inadequate and have not properly identified or described the cultural and natural resources or their tribal meaning and uses. The Shoshone-Paiute Tribes comment that the staff recommendation regarding an oral history for the Shoshone-Paiute Tribes should be expanded to include ethnographic studies conducted by a qualified ethnographer approved by the tribes and involving tribal elders and religious leaders.

Response: Each of the four oral history studies filed in association with Idaho Power's application for new license was conducted by a qualified tribal member or qualified individual associated with the respective tribe. Although all are titled "Oral History Study," each study reflects the particular interests and concerns of the tribe and tribal members with whom it was developed and conducted. The Staff Alternative includes a measure for funding an oral history for the Shoshone-Paiute Tribes and Shoshone-Bannock Tribes to afford these tribes another opportunity to contribute information and insight into the ethnography of the Hells Canyon area. The licensing process offered all the tribes the opportunity to contribute such information as they chose toward identification of cultural resources important to them. Information necessary for determining National Register eligibility in a public forum may be considered confidential by tribes. Tribal participation in consultations with Idaho Power during implementation of the final HPMP, and in the cultural resources technical subcommittee, will provide further opportunities for the tribes to indicate concerns regarding project operations that could affect specific resources of interest to the tribes. We also note that under NEPA, the "cultural environment" may include not only National Register-eligible resources but also other culturally valued property and cultural use of the biophysical environment.

Comment CR-49: The Nez Perce Tribe comments that the draft EIS recommendation against sand augmentation (because it could interfere with recreational boating and disturb wildlife) conflicts with one of the main purposes of the act creating NHNRA, which was to preserve historical and archaeological values of the Hells Canyon Area.

Response: In the final EIS, the Staff Alternative includes FS-4, *Sandbar Maintenance and Restoration*.

Comment CR-50: The Nez Perce Tribe comments that there are discrepancies and lack of information in the HPMP and that requiring Idaho Power to complete the HPMP within 1 year of license issuance is out of compliance with section 106.

Response: As indicated in section 5.2.6.1, *Finalization of the HPMP*, we included in the Staff Alternative a measure explicitly requiring Idaho Power to finalize the HPMP in consultation with the SHPOs, tribes, agencies, and Commission. Such consultation would afford all concerned parties the opportunity to identify discrepancies and make recommendations regarding information in the HPMP. Through execution of a Programmatic Agreement, the section 106 process would be completed for this particular relicensing. The Programmatic Agreement would be made part of any new license issued for this project. Prior to Commission approval of the HPMP, the licensee will be required to follow the interim process, as stipulated in the Programmatic Agreement, which essentially follows the section 106 process.

Comment CR-51: The Nez Perce Tribe comments that the annualized cost of monitoring all historic properties, as provided in the draft EIS, is extremely low.

Response: Monitoring costs provided in the NEPA document are estimates. As the monitoring program is implemented over time, these estimates may be refined based on actual expenditures and monitoring results.

Comment CR-52: The Nez Perce Tribe comments that Idaho Power and the Commission should consult with each tribe regarding how the funding proposed by Idaho Power should be prioritized and used, and that the Nez Perce Tribe should be able to use its share of the funding for its own priorities.

Response: In its license application and in its draft HPMP, Idaho Power states that it proposes to consult with each tribe in developing the funding program for that tribe; this proposal would be carried into the final HPMP.

Comment CR-53: The Nez Perce Tribe comments that the discussion on Native American interpretive sites does not differentiate among the tribes and that the Nez Perce Tribe is the tribe that should be consulted regarding development of such interpretive displays. The Nez Perce Tribe indicates that the project area should be acknowledged as being within the Nez Perce Tribe's former 1855 reservation and Indian Claims Commission-defined boundaries of the tribe's aboriginal territory.

Response: In its license application, Idaho Power stated that its proposals for Native American interpretive sites arose from consultation with Native Americans who expressed strong interest in educating the public about Native American presence and land use in the project area. Any future planned development involving Native American interpretive sites can be further elaborated upon in the final HPMP. We do not recommend that such consultation be limited to only one tribe. Information to be included at interpretive sites could appropriately include discussion of the conflicts between Native peoples and Euro-Americans in the nineteenth century, including forced relocations, establishment of reservations (including the reservation established for the Nez Perce in 1855), and other pertinent events.

Comment CR-54: The Nez Perce Tribe comments that scholarships provide the means by which members of Native American tribes can obtain the education and training necessary to perform work in natural and cultural resource management. The Shoshone-Bannock Tribes make a similar comment.

Response: We acknowledge the importance of education in the cultural well-being of the tribes. However, as indicated in draft EIS section 5.2.6.5, *Tribal Participation, Education, and Training*, there does not appear to be a nexus between the funding of scholarships and the Hells Canyon Project and effects. This does not preclude Idaho Power from promoting such scholarships; however, this kind of initiative would have to take place outside any new license for the project.

Comment CR-55: The Shoshone-Paiute Tribes reiterate their Cultural Resource conditions 1 through 6.

Response: We analyze the Shoshone-Paiute Tribes' Cultural Resource Conditions in the appropriate topical subsections of draft EIS section 3.9.2, *Environmental Effects*. We did not revise that analysis in the final EIS.

Comment CR-56: The Shoshone-Paiute Tribes comment that Idaho Power's offer of $1 million to each tribe to support tribal programs is not adequate to enable the programs to be successful and comment that the amount should be increased to $10 million.

Response: As indicated in draft EIS section 5.2.6.5, *Tribal Participation, Education, and Training*, we do not include in the Staff Alternative recommendations to increase the funding to $10 million per tribe because the record provides no information to tie such an increase to project effects, and therefore the measure lacks nexus to the project.

Comment CR-57: The Shoshone-Bannock Tribes comment that the draft EIS did not address Tribal Treaty or cultural resources in the affected environment, discuss cumulative effects on Treaty or cultural resources, or develop mitigation for Treaty and cultural resources.

Response: Implementation of the HPMP and measures and plans for aquatic and terrestrial resources would ensure that treaty and trust rights of the tribes for the protection of valued cultural resources are respected through the term of the new license. Implementation of the HPMP would include continued consultation among the tribes, Idaho Power, the Forest Service, BLM, and the SHPOs, as well as oversight from Commission staff.

Comment CR-58: The Shoshone-Bannock Tribes comment that staff should include discussion of site impacts resulting from the Brownlee service road. They also comment that this service road runs directly through sites 10-WN-157 and 10-WN-158, and sites 10-WN 159 and 10-WN-160 are adjacent to the service road and therefore affected by the project.

Response: None of these sites is listed in the final license application or any of the technical reports regarding archaeological resources in the project. However, if the Shoshone-Bannock Tribes provided information about these sites, this information could be incorporated into Idaho Power's final HPMP, and the sites could be managed in accordance with the processes and procedures contained in the final HPMP.

Comment CR-59: The Shoshone-Bannock Tribes comment that 10-WN-61 is a burial site located near the Brownlee dam road from which human remains were removed and reposited at the Idaho State University Museum of Natural History, and that the Shoshone-Bannock Tribes are investigating the status of these human remains and compliance with NAGPRA.

Response: We note this new information.

Comment CR-60: The Shoshone-Bannock Tribes comment that the EIS should contain a comprehensive regional summary of the culture history of the area and describe which tribes have been identified as an interested or affected tribe.

Response: The technical reports submitted as part of Idaho Power's license application provide detailed information regarding the culture history of the area; it is not necessary to repeat this information in the EIS. We note that section 3.9.1.5, *Traditional Cultural Properties, Sacred Sties, and Rock Art*, identifies by name the tribes that have an interest in the area.

Comment CR-61: The Shoshone-Bannock Tribes comment that they disagree with use of the chronology of the Columbia River when the project lies between the Northwest Plateau and the Great Basin, and that staff should include the Great Basin culture chronology to ensure that all interested tribes are represented.

Response: We revised the text in section 3.9.1.2, *Cultural History Overview*, to include discussion of the Great Basin culture chronology.

Comment CR-62: The Shoshone-Bannock Tribes comment that the draft EIS failed to adequately address protection of petroglyphs and pictographs due to lack of ethnographic information from Shoshone-Bannock Tribes about rock writing. The Shoshone-Bannock Tribes comment that additional funding needs to be provided to the tribes to gather information to develop appropriate mitigation. The Shoshone-Bannock Tribes also comment that Idaho Power is not providing effective preservation measures for sites located on reservoir shorelines.

Response: As indicated in section 3.9.2.2, *Site Treatment*, *Stabilization*, Idaho Power's draft HPMP provides for the design of plans for stabilization or other measures for each historic property (site, rock art image, or other such property) adversely affected by the project. Such plans would be designed in consultation with the appropriate SHPO, land-managing agency, and tribes.

Comment CR-63: The Shoshone-Bannock Tribes comment that there should be adequate mitigation to the Shoshone-Bannock Tribes for loss of sites inundated by the project and continuing effects of project operations.

Response: As stated in section 2.1, *No-action Alternative*, our baseline for analysis of Idaho Power's proposals and other alternatives is existing conditions, not pre-project conditions. Finalization and implementation of the HPMP would ensure that effects from continued project operation would be appropriately addressed.

Comment CR-64: The Shoshone-Bannock Tribes reiterate their recommendation that Idaho Power build and operate a Cultural Center within an Idaho Power project area, and a satellite office for Upper Snake River tribes, to assist in natural and cultural resource management in the region.

Response: In draft EIS section 3.9.2.3, *Cultural Resources Interpretation*, we conclude that other measures proposed by Idaho Power or included in the Staff Alternative would have a closer nexus to the project and project resources than would a cultural center. We did not revise this conclusion in the final EIS. Our decision to not include this measure in the Staff Alternative would not preclude Idaho Power from establishing or assisting with a cultural center outside the framework of a new license.

Comment CR-65: The Shoshone-Bannock Tribes comment that artifacts recovered from county, state, and federal lands should preferably be reburied as close to the original site as possible, or curated at one federally recognized facility.

Response: In section 3.9.2.5, *Management of Cultural Resources*, *Curation of Archaeological Materials*, we note that disposition of archaeological materials recovered on federal land is the responsibility of the land-managing agency. However, we revised our recommendation in the Staff Alternative regarding disposition of archaeological materials recovered on non-federal land has been modified to indicate that this policy should include consultation with the tribes and appropriate SHPO.

Comment CR-66: The Shoshone-Bannock Tribes comment that the tribes should be consulted in the selection of natural resource mitigation sites, in order to minimize or avoid damage to archaeological sites.

Response: In section 3.9.2.6, under *Terrestrial Resource Measures*, we note that any lands acquired by Idaho Power under a new license would automatically come under the provisions of the final HPMP regarding treatment of any historic properties that may exist on those lands.

Comment CR-67: The Shoshone-Bannock Tribes comment that they should be included in the Task Force/Advisory Committee/Cultural Resources Work Group.

Response: We revised the text in section 3.9.2.5, *Management of Cultural Resources*, to make clear that representatives from all the tribes would be members of this working group or technical subcommittee.

Comment CR-68: The Shoshone-Bannock Tribes comment that the tribes were not provided with site forms or other sensitive archaeological information necessary for the tribes to provide meaningful comments in the consultation process.

Response: In section 5.2.6.7, *Other Cultural Resources Management Issues*, we include in the Staff Alternative a measure for establishment of Technical Advisory Committees (including a cultural resources subcommittee whose membership would include representatives from all the tribes) to participate in implementation of the HPMP. Participation on this technical subcommittee would afford the tribes access to the information necessary for them to provide meaningful contributions to the management of cultural resources in the project.

B13. RECREATION RESOURCES

Comment RR-1: NPPVA states that the navigation history described in section 3.10.1.1, *Regional Recreation Setting*, does not agree with historic facts and should be rewritten with reference to Enclosure I of NPPVA's comment letter.

Response: Section 3.10.1.1 of the draft EIS describes the regional recreational resources in the area at a high level of generalization to establish a baseline from which to consider project-specific recreational resources. The EIS does not need to include detailed descriptions the history of boating in the Hells Canyon area or of other recreational resources in the region. Although short, the description is consistent with NPPVA's description of boating use along the entire Hells Canyon reach. Therefore, we did not change the text in the final EIS.

Comment RR-2: NPPVA states that use estimates described in section 3.10.1.1, *Regional Recreation Setting*, are different than those reported by the Forest Service permit system. It also states that use estimates north of the HCNRA were not approximated; and during steelhead fishing season, 15 to 25 commercial craft use the lower river each day.

Response: The differences between the numbers cited in the draft EIS (Brown 2003c) and Forest Service numbers provided by NPPVA are small. The recreational-use data provides sufficient detail to understand the general boating trends in Hells Canyon. Therefore, we did not change the text in the final EIS.

Comment RR-3: NPPVA notes that use figures for private and commercial use in table 68 of the draft EIS are reversed and that more recent data than 1992 to 1999 should have been used.

Response: We chose to show recreational-use data from common years across all recreational activities. The most thorough and accurate recreational use study of the project was conducted by Idaho Power and reported for these years in its license application. We corrected the private and commercial headings in draft EIS table 68 (final EIS table 76) and modified the text of final EIS section 3.10.1.1, *Regional Recreational Setting*, accordingly.

Comment RR-4: NPPVA states that the bar chart in figure 91 of the draft EIS appears to show no powerboat use for 1996 to 1999. NPPVA states that the larger commercial power vessels are certified to carry 50 to 60 passengers, not 40. NPPVA also notes that private power boaters do not concentrate at the portals.

Response: Draft EIS figure 91 (final EIS figure 118) shows commercial and private power boating in all years. In the final EIS, we clarified section 3.10.1.6, *Boating Use Downstream of the Project*, concerning the number of passengers on the larger vessels and deleted the reference to boater concentrations at portals.

Comment RR-5: Idaho Power comments that the study by Shelby, Whittaker & Brown, 2003, Technical Report appendix E.57, provided substantial information about the effect of flows on floating and power boating use on the Snake River below the project. Idaho Power notes that study methods, relevant study issues, and findings are summarized on pages 10–12 of the study's appendix. Based on the study, Idaho Power makes the following points:

- Different flows are needed for different users varying from inexperienced floaters to experienced powerboats, and overall, minimum boating flows established for powerboats are likely to meet minimum boating needs for floaters. Idaho Power states that power boats can travel upstream of the Salmon River at flows of about 6,000 to 7,000 cfs, but the "margin for error" improves up to about 9,000 to 10,000 cfs, and that this "margin for error" is probably more important for larger boats, less skilled drivers, and more challenging rapids. Idaho Power notes that given the effects of these variables, a "criterion" craft, skill level, and type of power boating opportunity must be specified before a "minimum boating flow" can be established.
- The Corps analysis on powerboat boatability should be combined with information from other sources to understand how flows affect boatability and safety, or what criteria should be considered to establish minimum boating flows. Idaho Power notes that all studies agree that preventing powerboat collision with rocks depends on three main variables: (1) boat characteristics; (2) operator skill and experience in Hells Canyon; and (3) flow. Idaho Power notes that additional variables include: (4) channel marking, and (5) channel modifications, both of which have been used to improve boatability in Hells Canyon. Idaho Power briefly summarizes the history of channel modifications and marking.
- Comments by the Corps on accidents at minimum boating flows provide an incomplete assessment of accident rates. Idaho Power notes additional information and data which it believes would be more useful for comparison.
- Shelby et al. (2003, pages 23–25) found the effects of low flows on number of boaters to be small.
- Based on results from Shelby et al. (2003), the Corps-recommended 8,500-cfs minimum is more accurately characterized as a flow in the middle of the "technical boating opportunity," well above a "minimum safe flow." Idaho Power notes that a 1974 PNRBC study concluded "a minimum flow conducive to relatively non-hazardous powerboat navigation between the mouth of the Salmon and Granite Creek Rapids is between 7,700 cfs and 5,000 cfs." Idaho

> Power notes that this study also concluded, "from the standpoint of riding comfort, speed of travel, and relative safety from hazards, the optimum flow appears to be in the range of 8,000 to 9,000 cfs." Idaho Power provides charts, tables, and discussion to support their comments on Navigation Target Flow Levels.

NPPVA states that the discussion on flows in draft EIS section 3.10.1.6, *Boating Use Downstream of the Project*, could use input from professional boaters who are on the river daily. NPPVA notes that the margin of safety is low at flows lower than 6,500 cfs, and is adequate for all craft only at 8,500 cfs.

The Chambers of Commerce from Clarkston, Washington, and Lewiston, Riggins, White Bird, and Grangeville, Idaho, as well as the North Central Idaho Travel Association, cite data from the Forest Service indicating more than 250,000 people took a variety of boats into the HCNRA during the period 2001 to 2006. That total includes 33,137 power-boat passengers and 12,207 in privately owned power-craft per year. These entities also note that thousands more boat on the river between Asotin, Washington, to the HCNRA boundary.

The Corps notes that the draft EIS did not take into account comments from the Corps and proposes flow conditions that are potentially hazardous to those navigating the river. The Corps states that the FERC staff recommendation needs to be revised to incorporate minimum flows that assure safe navigation. The Corps also states that Idaho Power substantially followed the Corps' recommended 8,500-cfs minimum flow from August 2004 until July 2006, and that there was a boating mishap when a boat ran aground after Idaho Power returned to flows below 8,500 cfs.

The Clarkston, Washington, and Lewiston, Riggins, White Bird, and Grangeville, Idaho Chambers of Commerce; the North Central Idaho Travel Association; John and Kerry Giardinelli; Brian and Angie Thomas, Michael Bell, and more than 12 individual members of the Western Whitewater Association (WWA) wrote to support the Corps' minimum flow recommendation of 8,500 cfs for the Snake River, as stated in the Corps' letter to the Commission filed January 26, 2006, to FERC. The same commenters express concern about public safety related to both commercial and private navigation on the Snake and Salmon rivers, while WWA states that the Corps' recommended flow rates are necessary to support public safety for private boaters. John and Kerry Giardinelli and Brian and Angie Thomas also note that some private landowners can access their property only by boat and access during normal low flows or under special conditions (e.g., fires) could be limited.

Response: In the final EIS, we include in the Staff Alternative a recommendation that the minimum flow be set at 8,500 cfs from the start of Memorial Day weekend to September 30 in medium-high and extremely high water years. We also recommend that, if the 3-day moving average inflow to Brownlee reservoir is less than 8,500 cfs during that period, the instantaneous minimum release required from Hells Canyon dam for the current day would be equal to the previous 3-day moving average. In other years, we continue to recommend Idaho Power's proposed instantaneous minimum flow of 6,500 cfs at the Hells Canyon dam. The current license requires Idaho Power to meet 5,000 cfs, but, since 1980, Idaho Power has generally operated the project to meet a 6,500-cfs instantaneous minimum flow at Hells Canyon dam. Our analysis shows that flows were below 6,500 cfs only about 1 percent of the time between 1980 and 2006.

Recreational and commercial boating downstream of the project has evolved over many years under existing project operations, when minimum flows of 6,500 cfs prevailed. As described in section 3.10.1.6, *Boating Use Downstream of the Project*, commercial power boaters are by far the largest recreational use group in Hells Canyon. Under existing conditions, annual recreational use does not appear to be significantly affected by low flows. For example, between 1992 and 1999, the years with the least use are associated with the highest flows, not the lowest flows. The current state of commercial boating reflects that the industry is strong and that Idaho Power's proposal would continue to support levels of use similar to those seen since 1980.

In section 3.10.2.1, *Effects of Project Operations on Recreation Resources*, we recognize that during low and extremely low water years at flows below 8,500 cfs, boating becomes more difficult and safety concerns increase for some boats, including the larger commercial boats. However, this is not the case for all recreational visitors to the HCNRA. There is ample information on the record that indicates flows of 6,500 cfs are sufficient for smaller powerboats and float boats (Shelby et al., 2002). In fact, more skilled and experienced power boaters are also known to navigate large boats through the entire Snake River, from Hells Canyon dam to Lewiston, when Hells Canyon dam is releasing 6,500 cfs.

As recommended in the Staff Alternative, including 237 kaf flow augmentation, there would be 40 days with flows below 8,500 cfs in medium water years, 120 days in medium-low water years, and 116 days in extremely low water years. At those times, it is incumbent on recreational boaters to take on a certain level of responsibility to evaluate their skill set, equipment, and accident potential as they decide where and how to use the recreational resource. It is not clear to us from any comment on the record why ensuring access to all types of boats at all times is a project responsibility, especially when the benefits accrue to a small number of boaters and the incremental cost of such an assurance is high (see section 5.2.2.2, *Navigation Target Flow Levels*).

Comment RR-6: NPPVA states that a significant need exists for accurate, reliable, and timely flow information as well as adequate minimum flow. NPPVA agrees with statements by the Corps concerning the Navigation Scenario and predictability of flows.

Response: In section 3.10.2.8, *Flow Information Downstream of Hells Canyon Dam*, we discuss Idaho Power's proposal for an Internet site and flow phone that would provide flow information sufficient to plan a trip in the canyon up to 4 days in advance of launching. We note, however, the discrepancies between the actual flows and the flows posted on Idaho Power's Internet site. Idaho Power is not currently under any license obligation to maintain accuracy on the Internet site, as illustrated in NPPVA's letter. If the Commission adopts this recommendation, Idaho Power would be required to maintain the site in a timely and accurate manner. We revised the text of the final EIS to make this point.

Comment RR-7: Paul Poorman states that the 250,000 current visitors to the project pale in comparison to the number that would come if a viable salmon and steelhead fishery was restored. He states that the money spent on recreation facilities at the reservoirs benefits only power boaters and that the money would be better spent on restoring a natural river that could be enjoyed by float boaters and fishermen.

Response: Given the important role that the project currently serves in meeting regional peak load demand, we determined during scoping that dam removal in order to restore the natural river was not a reasonable alternative. Our analysis of anadromous fish restoration measures led us to conclude that proceeding directly to anadromous fish upstream of the project is not viable at this time regardless of how many people might benefit. We note, however, that the Staff Alternative includes several measures that would benefit anadromous fish (and hence, fishermen) downstream of the project, including continued management of flows during the fall Chinook spawning and incubation season, restricting flow fluctuations during the fall Chinook rearing season, participation in the flow augmentation program to improve conditions for outmigrating smolts, and measures to improve water quality downstream of the project. Other measures that would improve the condition of fisheries for resident fish species and may foster a future decision to proceed with anadromous fish restoration include a program to enhance habitat conditions in key tributaries to the project, monitoring the spawning success of any surplus hatchery steelhead and spring Chinook that enter Pine Creek, and monitoring to determine when water quality conditions upstream of the project have improved to a point that may warrant reintroduction of anadromous fish.

Comment RR-8: Idaho Power states that the only portion of Idaho Power ownership at Hibbards Landing is up to elevation 2,085 feet msl. Idaho Power states that the Airstrip A site belongs to the federal government, managed by BLM.

Response: Some of the facilities that make up Hibbards Landing are within the project boundary, thus we did not change the reference to Hibbard's Landing in the final EIS. We deleted the reference to Airstrip A from the *Executive Summary* and revised draft EIS table 69 (final EIS table 77) to reflect that BLM owns and manages Airstrip A.

Comment RR-9: Idaho Power states that FERC identifies boater numbers from Brown (2003) as estimates. Idaho Power notes that neither the Forest Service nor Idaho Power found reason to believe that boaters use the HCNRA without registering, and that this is a census of boaters rather than an estimate.

Response: Based on the letters on the record, including the NPPVA's comments on the draft EIS, recreational use numbers for the HCNRA vary. As such, we continue to refer to the boater numbers as an estimate rather than a census. We made no changes to the text of the final EIS.

Comment RR-10: Idaho Power notes that the existing project boundary (as shown in exhibit G of the final license application) does not include all portions of recreation areas described in table 78 of the draft EIS. Idaho Power states that the final EIS should reflect actual locations in relation to the project boundary.

Response: Draft EIS table 78 (final EIS table 86) summarizes proposed and recommended measures regardless of whether they are within or outside of the current project boundary. In section 5.2.8.3, *Boundary Modification*, we conclude that any enhancement to a site that is currently outside of the project boundary should be included in a new boundary for the project. We did not change the in the final EIS.

Comment RR-11: Idaho Power notes that in table 78 of the draft EIS, it appears that agency conditions and recommendations for Copper Creek were mistakenly placed beside the Copperfield boat launch label.

Response: In the final EIS, we revised draft EIS table 78 (final EIS table 86) to correct this error.

Comment RR-12: Idaho Power notes that the Forest Service has recently revised preliminary conditions regarding a Settlement Agreement that addresses the Deep Creek Stairway measure listed in table 78 of the draft EIS. Idaho Power states the final EIS should reflect the measure as written in the Forest Service revised preliminary conditions.

Response: In the final EIS, we recommend that the Commission include Idaho Power's new proposal and the Forest Service's revised preliminary 4(e) condition with respect to the Deep Creek Stairway as part of any license issued for the project. Draft EIS table 78 (final EIS table 86) now includes the revised condition recommended by the Forest Service and supported by Idaho Power. .

Comment RR-13: Idaho Power notes that Farewell Bend State Park is on the same side of the reservoir as the Oasis site (Oregon), not on the opposite side as stated in the draft EIS.

Response: We revised the description in final EIS section 3.10.2.3, *Recreation Site Improvements*, in the final EIS to clarify that Farewell Bend State Park is on the same side of Brownlee reservoir as Oasis.

Comment RR-14: Idaho Power comments that Steck Park is located on the Idaho side of Brownlee reservoir.

Response: We revised the text in section 3.10.2.3, *Recreation Site Improvements*, *Steck Recreation Site*, to clarify that Steck Park is not located on the Oregon side of Brownlee reservoir.

Comment RR-15: Idaho Power comments that it is unaware of any dispersed site designated by any entity as "INFISH." Idaho Power requests that FERC clarify the location of the site "INFISH."

Response: We removed the reference to INFISH from the text in section 3.10.2.3, *Recreation Site Improvements*, *Dispersed Site Plan*.

Comment RR-16: Idaho Power comments that on page 471 of the draft EIS, paragraph 2, the section reference should be to 3.10.2.4 instead of 3.10.2.6.

Response: We corrected the reference in the final EIS.

Comment RR-17: Idaho Power comments that the trail registration card information referenced on page 471 of the draft EIS was collected from 1998 to 2002.

Response: We corrected the referenced collection period in section 3.10.2.6, *Trails*.

Comment RR-18: Idaho Power comments that in reference to Idaho Power's proposal related to the Carters Landing and Old Carters Landing sites, no modification is necessary in the Staff Alternative because site operation and maintenance was specified in the relevant portion of the final license application.

Response: We corrected the text of section 5.1.1.2, *Staff Alternative* to eliminate the duplication.

Comment RR-19: Idaho Power notes that in the adaptive management proposal in the final license application, the wording "recreation sites" was intended to include all recreation sites (developed or otherwise) and that no wording in the proposal eliminates the consideration of dispersed sites from the plan.

Response: In the final license application, Idaho Power distinguished between the types of recreational sites, and it typically made specific reference to dispersed sites when they were discussed. The staff recommendation to include dispersed sites is consistent with Idaho Power's comments and clarifies the scope and intent of Idaho Power's proposal. We did not change the text of the final EIS.

Comment RR-20: The Forest Service recommends that staff include condition no. 18, Operations and Maintenance, without modification or limitation in the Proposed Action in the final EIS, and that the staff include additional information provided by the Forest Service in its comments. The condition would require Idaho Power to perform necessary operations and maintenance as described in the condition for Eagle Bar, Eckels, Big Bar, and Black Point Viewpoint parking areas, as well as dispersed areas on National Forest System lands within the project boundary. The Forest Service also notes that FERC staff indicates that O&M standards and Meaningful Measures are not defined by the Forest Service. The Forest Service states that the Meaningful Measures Guide has been filed, as described in the condition and recommends that information provided in Enclosure V and condition no. 18 be included without modification or limitation in the final EIS.

Response: Based on new information filed by the Forest Service, and Idaho Power's withdrawal of its alternative 4(e) condition, we now recommend adopting FS-18 in its entirety. In final EIS section 3.10.2.7, *Operation and Maintenance at Forest Service and BLM sites*, we deleted reference to the alternative 4(e) condition. We deleted the exception noted in draft EIS table 98 (final EIS table 109), item no. 36.

Comment RR-21: The Forest Service recommends that staff include condition no. 19, *Hells Canyon Reservoir Drawdown*, without modification or limitation in the Proposed Action in the final EIS, and that the staff include additional information provided by the Forest Service in its comments. The condition would require Idaho Power to manage reservoir levels to minimize effects on recreation resources during the summer. The Forest Service notes that maximum drawdown during the recreation season is currently limited to 5 feet from full pool elevation. The Forest Service recommends that, if, for protracted periods, the reservoir is drawn down below 5 feet from full pool elevation, Idaho Power reconstruct or modify boat launching facilities to provide access to the reservoir.

Response: With this filing, the Forest Service clarifies that the purpose of the condition is not to manage Hells Canyon reservoir levels, which depend on lake levels in Brownlee reservoir, but to extend boat ramps. Therefore, we changed our recommendation in draft EIS table 98 (final EIS table 109), item 37 and added Boat Ramps on Hells Canyon Reservoir to final EIS section 3.10.2.3, *Recreation Site Improvements*. We find that the condition, as clarified by the Forest Service, is appropriate for developed recreational sites on Forest Service lands with existing or proposed boat ramps included in the Staff Alternative. We also recommend that Idaho Power extend boat ramps at its developed recreation site, if warranted and feasible.

Comment RR-22: In reference to Forest Service condition no. 12, *Recreation Management*, the Forest Service notes that specific condition no. 12 requirements are not discussed in the draft EIS, and the Forest Service is unclear as to which are included in the FERC Staff Alternative measures. The Forest Service states that FERC staff should include each requirement and, in the final EIS, identify it as such, including items recommended in the condition. The Forest Service recommends that information provided in Enclosure V and condition no. 12 be included without modification or limitation in the final EIS.

Response: Forest Service 4(e) condition no. 12 is very broad, concerning the planning and implementation of recreation, aesthetic, transportation, land use, and vegetation plans. Consequently, these components are handled in different sections of the EIS: section 3.10.2.2, *Recreation Plan*; section 3.10.2.9, *Adaptive Management*; section 3.12.2.6, *Road Management Plan*; and section 5.3.2, *Interior and Forest Service 4(e) Conditions*. In these sections, and as summarized in section 5.0, *Staff Conclusions*, we do recommend inclusion of condition no. 12 in its entirety. We did not change the text of the final EIS.

Comment RR-23: In reference to Forest Service condition no. 13, *Big Bar Development*, the Forest Service comments that specific condition no. 13 requirements are not discussed in the draft EIS, and the Forest Service is unclear as to which are included in the FERC Staff Alternative measures. The Forest Service states that the major difference is that Forest Service approval of the site development plan is not required. The Forest Service recommends that the final EIS provide additional details about the review and comment process, including a Big Bar Development as described in condition no. 13. The Forest Service recommends that information provided in Enclosure V and condition no. 13 be included without modification or limitation in the final EIS.

Response: We revised draft EIS table 78 (final EIS table 86) to reflect the new agreement between Idaho Power and the Forest Service. In the final EIS, we continue to recommend adopting FS-13 as part of any license issued. However, we note that the purpose of the EIS is to consider the environmental effects of a proposal. The consultation requirements of any license article would be developed as part of a license order for the project.

Comment RR-24: In reference to Forest Service condition no. 16, *Deep Creek Stairway*, the Forest Service comments that recreation use at Deep Creek is a direct result of the project and that it is in the public interest to maintain a cooperative effort among Idaho Power, IDFG, and the Forest Service. The Forest Service states that it supports the inclusion of the Deep Creek stairway and trail in the project boundary. The Forest Service recommends that information provided in Enclosure V and condition no. 16 be included without modification or limitation in the final EIS.

Response: We concur and have revised draft EIS table 78 (final EIS table 86) to reflect the new agreement between Idaho Power and the Forest Service. In the final EIS, we continue to recommend adopting FS-16 as part of any license issued.

Comment RR-25: In reference to Forest Service condition no. 20, *Reservoir Trail Maintenance*, the Forest Service comments that FERC staff did not include condition no. 20 in the Staff Alternative because staff could not find a clear nexus between the project and recreational use of Forest Service trails outside of the project boundary. The Forest Service states that Idaho Power, in a February 27, 2006, filing, provides its new analysis of trailhead surveys collected in 2006 and offers additional information about the portion of trails that are categorized as primarily upland hiking trails available with or without the project. The Forest Service notes that the agency requested a copy of the new analysis from Idaho Power, but that Idaho Power responded that a new analysis had not been conducted. The Forest Service notes that this information is not in the record. The Forest Service recommends that FERC staff analyze Forest Service comments indicated in condition no. 20 and that the information and condition no. 20 be included without modification or limitation in the final EIS.

Response: In section 3.10.2.6, *Trails*, page 470 of the draft EIS, we simply repeat Idaho Power's statement regarding new analysis of trailhead surveys. This sentence, which reports statements on the record, is not used exclusively in our analysis, which continues in the remainder of the section. On page 472 of the draft EIS, we analyze the Forest Service's statement that 22 percent of visitors use Forest Service-managed trails. This information suggests to us that a much smaller percentage of visitors to the project hikes along trails, while a larger percentage may walk along the reservoir or on lands within or immediately adjacent to the project.

As discussed in draft EIS section 3.10.2.6, *Trails*, the Forest Service relies on the data from the mail survey that shows 28 percent of visitors to the project engage in walking. In fundamental contrast to the Forest Service's conclusions from this data, Whitaker and Shelby (2003) find that"[o]ver one-quarter of all visitors reported walking, while 7 percent reported hiking. This suggests that most reservoir users do not travel along the reservoirs by foot, but if they do so, it is to explore the immediate vicinity rather than travel long distances." We continue to recommend excluding Forest Service condition no. 20 from any new license issued. However, we note that any license issued for the project will include all 4(e) conditions specified by the Forest Service.

Comment RR-26: In reference to Forest Service condition no. 21, *Hells Canyon Creek Launch Site and Visitor Center Facilities*, the Forest Service notes a general inconsistency between FERC staff recommendations and items provided in condition no. 21. However, the Forest Service comments that the FERC staff recommendation requires potable water and a portable waste disposal system to be developed at the Hells Canyon Creek launch site. In contrast, condition no. 21 requires that a potable water/gray water disposal system be developed at Hells Canyon Creek launch site if these facilities were not developed at Eagle Bar, but that development of such a system at both sites is not necessary at this time.

Response: It was not our intent to require potable water or a gray water disposal system at Hells Canyon Creek Launch site. We do not indicate in draft EIS section 3.10, *Recreational Resources*, that these facilities should be located specifically at the launch, although we recommend that Idaho Power install these facilities primarily because of the unique type of recreational use that occurs at the launch. We agree that potable water and gray water facilities are not needed at both Eagle Bar and Hells Canyon Creek launch site. In the draft EIS, we refer to these measures as being implemented in the Hells Canyon Creek area, which includes Eagle Bar, because the recreation sites are close together and a visitor must pass Eagle Bar to launch or take out at Hells Canyon Creek launch site. On page 640 of the draft EIS, we note that staff recommends adopting FS-21 as written. In the final EIS, we deleted the discussion about Idaho Power's alternative 4(e) condition from section 3.10.2.3, but made no other change in this regard.

Comment RR-27: Interior (p 53) states that the draft EIS does not illustrate the effects of the Staff Alternative on reservoir levels and that this information is needed to assess the effects of the Staff Alternative on recreation and aesthetics.

Response: As described in section 2.1.2, *Current Project Operations*, section 3.3.2.2 *Operational Recommendations and Alternative Evaluation Scenarios*, and elsewhere in the draft EIS, Idaho Power proposes no changes to project operations that would affect lake levels in the project. The Staff Alternative includes flow augmentation, the release of 237 kaf of water that would result in an earlier and more rapid drafting of Brownlee reservoir. In draft EIS section 3.10.2.1, *Effects of Project Operations on Recreation Resources*, we discuss the effects of this measure on recreational resources. We find that flow augmentation would have substantial benefits to boating downstream of the project, but that it would adversely affect flat water boating and crappie fishing on Brownlee reservoir compared to existing conditions. We also disclose this adverse effect in draft EIS table 96 (final EIS table 105). In the final EIS, we revised section 5.2.2.3, *Flow Augmentation for Anadromous Fish Juvenile Migration*, to acknowledge this effect.

Comment RR-28: Interior states that it supports the development and implementation of a recreation work group because it would be important in implementing recreation mitigation measures. Interior indicates that the recreation work group should be addressed in the EIS.

Response: In the final EIS, consistent with our discussion on page 451 of the draft EIS, we continue to recommend including the work group as part of any license issued for the project.

Comment RR-29: Interior states that the draft EIS does not include a discussion of Interior's 10(a) recommendation no. 8, *Weiser Dunes*. Interior states that Weiser Dunes provides the only access road to Brownlee reservoir on the Idaho side and that it experiences a high level of project-related use. Interior states that this recommendation should be addressed in the final EIS.

Response: We added a section titled Weiser Dunes to 3.10.2.3, *Recreation Site Improvements*. Based on the record, including recreational use information in Brown (2002d), we do not find a nexus to the project. In the final EIS, we do not recommend including development and implementation of a recreation plan for the site as part of any license issued for the project.

Comment RR-30: Interior states that the draft EIS does not include a discussion of Interior's 10(a) recommendation no. 9, *Heller Bar*, noting that Heller Bar receives 15,000 to 20,000 visits annually and serves as a center for commercial enterprises offering jet boat trips up the Snake River to the Hells Canyon dam. Interior indicates that this recommendation should be addressed in the final EIS.

Response: We discuss Interior's recommended measures at Heller Bar in draft EIS section 3.10.2.3, *Recreation Site Improvements*, and section 5.2.7.2, *Recreation Site Improvements*. We do not find a nexus between the project and Heller Bar, pointing out that the site is more than 100 miles downstream of the project and that there is nothing substantiated on the record that indicates recreational use of Heller Bar is project related or that project operations adversely affect the site. We did not change the text in the final EIS.

Comment RR-31: Interior states that the agency disagrees with the draft EIS conclusion that the acquisition of additional recreation lands is not justified and notes that privately owned lands currently being used for public recreation may become unavailable over the term of a new license. Interior states that it is reasonable to request that Idaho Power seek to acquire these recreation use sites from private land owners as they become available. Interior indicates that this recommendation (Interior 10(a) recommendation no. 10) should be addressed in the final EIS.

Response: As stated in the draft EIS, Idaho Power owns important recreational and project-related lands within the project boundary that provide reasonable public access to project waters and have substantial opportunities for expansion. We expect that anticipated future recreational use of the project would be easily absorbed by existing facilities on project lands and point out that there are many opportunities through the proposed Recreation Adaptive Management Plan to formalize dispersed sites or expand existing sites. These facilities appear to be sufficient to provide reasonable public access to the project for the term of any new license. We did not change the text in the final EIS.

Comment RR-32: Interior states that the EIS should address the potential conflict between recreation use, land acquisition, and special management of lands within the project boundary to benefit wildlife habitat and other special natural resources such as special status plants. Interior states that the EIS should include an analysis of the potential conflict and should include specific measures to be implemented to manage recreation use on special status wildlife habitat areas within the project boundary.

Response: The Staff Alternative includes recommendations for Idaho Power to develop and implement plans to prevent or minimize adverse effects of project-related activities on sensitive species and habitats. These include the Threatened and Endangered Species Management Plan and cooperative bald eagle nest and roost site management plans. Protective measures would also be incorporated into the IWHP/WMMP, as new lands are acquired for wildlife mitigation. Idaho Power has already mapped the locations of many sensitive species occurrences and habitats, transferred the data into a project GIS, used the information to identify sites where project facilities or activities could cause disturbance, and developed preliminary recommendations for managing the sites. The HCRMP incorporates this information as the basis for several land use designations and BMPs regarding recreation. Plans developed under any new license that may be issued would also build upon this existing information, and upon consultation with the resource management agencies and tribes.

B14. AESTHETICS

Comment AS-1: Idaho Power states that while no study has been done on the white band along the river banks, it does not appear to result from project operations and is visible in 1940s photos prior to project construction. Idaho Power states that FERC staff should either delete the statement or clarify that changes in river stages that cause the white line are not necessarily due to project operations.

Response: In the final EIS, section *3.11.2.1, Effects of Project Operations on Aesthetics, Riverbanks Downstream of Hells Canyon Dam,* we expanded the discussion of the white band along the river banks downstream of Hells Canyon dam to clarify that the degree to which the project contributes to its formation is unknown.

Comment AS-2: Idaho Power states that the draft EIS presents no valid information to support the statement that ".. stage changes in the river as a result of project operations can affect the establishment of sandy beaches and alter their composition...." Analyses contained in the final license application (Parkinson et al., 2003) and responses to AIRs (Parkinson et al., 2005) show that sandbar slopes are not likely to fail under load-following operations. Idaho Power also states that it is unclear what the draft EIS means by "...their composition...."

Response: The reference to the effects of stage change on sandy beaches was generalized and used to frame aesthetic issues downstream of hydroelectric projects. Analysis of whether stage change has effects on aesthetic resources of the Snake River downstream of the project is considered in subsequent pages of draft EIS section 3.11.2.1, *Effects of Project Operations on Aesthetics, Riverbanks Downstream of Hells Canyon Dam*, under *Our Analysis*. We made no changes to the final EIS text.

Comment AS-3: Idaho Power notes that appendix H of Technical Report E. 1-1 (Parkinson et al., 2003) concludes that slope failure at Fish Trap Bar due to load-following operations is *not* expected. Two transects do show instability, but the report notes that the substrate along these transects is not sand and would thus have a higher strength (due to interlocking) than the rest of the transects. The analysis shows instability under flood recession; however, the discussion notes that the analysis involves very conservative drainage assumptions (instantaneous drawdown), and it is likely that the slopes would be more stable than the analysis shows if information was available to more accurately characterize drainage of the sandbar.

Response: In section 3.11.2.1, *Effects of Project Operations on Aesthetics, Riverbanks Downstream of Hells Canyon Dam*, we are not primarily concerned with slope failure at Fish Trap Bar. Rather, we are more concerned with the ongoing aesthetic effects of project operations on beaches and riverbanks downstream of the project. In the final EIS, we modified the language to make this clear.

Comment AS-4: In reference to Forest Service condition no. 22, *Aesthetic Improvements to Hells Canyon Dam Site and Recreation Portal*, the Forest Service comments that FERC staff recognizes that

visual enhancements must be consistent with the approved security plan. The Forest Service states that an implementation schedule is necessary as described in the condition no. 22. The Forest Service recommends that information provided in Enclosure V and condition no. 22 be included without modification or limitation in the final EIS.
Response: The revised FS-22 was filed in October 2006, based on a Settlement Agreement with Idaho Power. The final EIS includes an analysis of the updated version of FS-22. In section 5, *Staff Conclusions*, we recommend including the proposed measure as part of any license issued for the project.

Comment AS-5: In reference to Forest Service condition no. 24, *Aesthetics Resource Management*, the Forest Service states that on October 10, 2006, it filed condition no. 24 with the Commission and recommends that staff include condition no. 24 in the Proposed

Response: Revised FS-24, which included deletion of FS-23, was filed in October 2006, based on a Settlement Agreement with Idaho Power. The final EIS includes analysis of the updated version of FS-24. In section 5, *Staff Conclusions*, we recommend including the proposed measure as part of any license issued for the project.

Comment AS-6: In reference to Forest Service condition no. 24, *Aesthetics Resource Management*, the Forest Service states that it disagrees with FERC staff's conclusion in regard to E.6.4.3.1 and 2 (*Design Standards and Guidelines for Physical Structures and Landscaping)*. The Forest Service states that the adopted measures were only broad general objectives that the Design Standards and Guidelines would be developed to meet. The Forest Service also states that the scope of the FERC staff recommendation is unclear as "certain project facilities" does not specify what facilities are to be addressed. Condition no. 24 requires that all facilities viewed from key observation points be improved to meet a *high* scenic integrity objective to enhance the recreational experience. Further, Forest Service states that the Scenery Management Plan should include the seven measures found in condition no. 24 as well as the Aesthetic Improvement Plan, and an implementation schedule for any and all improvements as required by condition no. 22. The Forest Service states that this is necessary to meet the high scenic integrity objective in the area that is required by the Hells Canyon Comprehensive Management Plan.

Response: The referenced discussion in draft EIS section 3.11.2.2, *Aesthetic Improvements and Resource Management,* was based on Idaho Power's original proposal and the Forest Service's original 4(e) conditions. Based on the settlement between Idaho Power and the Forest Service, we updated section 3.11.2.2 and now recommend including FS-24 and FS-22 as part of any license issued for the project. We continue to recommend that a scenery management plan be prepared for the entire project.

Comment AS-7: Interior states that the negative effect of reservoir drawdown for flood control and flow augmentation on recreation users is probably much greater than described in the draft EIS, and that the analysis should include the effects of all the operational drawdowns and their impacts on Brownlee reservoir during various water years.

Response: Idaho Power conducted a comprehensive recreation study for the project that considered effects of project operations on recreational use. Idaho Power assessed how Brownlee reservoir levels affect the amount, type, and location of recreation and compared the recreational use at Brownlee reservoir with other reservoirs that have less daily or seasonal level changes. The results show that under existing conditions 2/3 to ¾ of visitors to Brownlee reservoir find levels to be acceptable and the concerns of the remaining group are closely linked to the larger drawdowns.

In the draft EIS, we recommended Proposed Operations as part of the Staff Alternative. Based on new information, we now recommend the Flow Augmentation scenario. In draft EIS section 3.10.2.1, *Effects of Project Operations on Recreation Resources*, we state that Flow Augmentation would have the most substantial adverse effects on flat-water boating opportunities. In all hydrologic year types, the Flow Augmentation Scenario would result in an earlier and more rapid drafting of Brownlee reservoir and in some water years, full pool would not be reached at all during summer months.

Under the Flow Augmentation scenario, Brownlee reservoir would be drawn down about 25 feet during low and medium water years. These drawdowns would typically occur in August and September. Although 25 feet represents a substantial drawdown, access does not appear to be substantially limited, as shown on draft EIS table 77 (final EIS table 85). Flow augmentation would have less of an effect (approximately 10 feet) during above-average water years.

Based on the information and discussion in the draft EIS, we did not revise our analysis in the final EIS.

Comment AS-8: Interior states that the draft EIS fully recognizes the negative visual effects of reservoir drawdown, but that it only marginally recognizes the negative effects to all the other aspects of recreation experiences. Interior comments that the draft EIS does state that implementation of aesthetic improvements should not be left open ended but does little to set a limit on time frames for implementation. Interior states that aesthetic improvements should be implemented as soon as possible to improve the visual experience of the project area and that Interior's 10(a) Recommendation 6, Visual Resource Management, should be included in the EIS and analyzed.

Response: In draft EIS section 5.2.8.5, *Aesthetic Resource Management*, we conclude that a detailed aesthetic improvement schedule tied to Idaho Power's scheduled maintenance program would improve aesthetic resources and recommend including the measure in any license issued for the project. Our recommendation remains the same in the final EIS.

B15. LAND MANAGEMENT AND USE

Comment LU-1: The Forest Service recommends that staff include condition no. 26, Project Boundary Modification, without modification or limitation in the Proposed Action in the final EIS, and that the staff include additional information provided by the Forest Service in its comments. The condition would require Idaho Power to provide the Forest Service with a map and aerial photos depicting the approximate location of the project boundary and Geographic Information System (GIS) information as described in the condition. The Forest Service states that including the Forest Service terms and conditions without limitation would eliminate the need for expensive surveying and monumenting of the project boundary.

Response: In the final EIS, the Staff Alternative and section 5.2.8.3, *Boundary Modifications*, recommend adopting the revised FS-26 as proposed by Idaho Power and specified by the Forest Service. In section 3.12.2, Boundary Modifications, we deleted reference to Idaho Power's Alternative condition FS-26.

Comment LU-2: Idaho Power states that the Baker County Settlement Agreement (2003) modified Idaho Power's responsibilities for Homestead Road to include the entire road.

Response: We revised the paragraph in section 5.2.8.4, *Road Management Plan*, to be consistent with the Baker County Settlement Agreement.

Comment LU-3: Idaho Power comments that the draft EIS reviewed preliminary and certain revised preliminary section 4(e) conditions filed by Interior and the Forest Service, as well as proposed alternative conditions filed by Idaho Power. Idaho Power states that subsequent to issuance of the draft EIS, Idaho Power entered into settlement agreement with the Forest Service that resulted in the filing of additional revised preliminary conditions and resolution of all remaining 4(e) issues with the Forest Service. Idaho Power states that it expects to accomplish the same objective with Interior. In view of the mandatory nature of such conditions and the fact that the Forest Service and Interior consider such revised conditions adequate for the protection and utilization of reservations that are under their respective supervision, Idaho Power recommends that FERC adopt the revised preliminary conditions as filed by Interior and the Forest Service in the final EIS.

Response: We recommend adopting all of the Recreation, Land Use and Aesthetic measures on which Idaho Power and the Forest Service reached settlement following the filing of the draft EIS. These changes are made throughout the final EIS. We also recommend adopting most of Interior's revised conditions with the exception of conditions 3 and 4. We did not recommend including these measures in any license issued in the draft EIS or final EIS. Interior did not file additional information that would justify inclusion of these measures within any license issued for the project. Therefore, we did not revise the text except to include the new modified language for each condition and to delete Idaho Power's alternative 4(e) conditions.

Comment LU-4: Idaho Power comments that the road running the length of Oxbow reservoir on the Oregon side is the Brownlee-Oxbow Road, owned and maintained by Idaho Power, not Idaho State Highway 71.

Response: We made this change in the final EIS.

Comment LU-5: Idaho Power comments that Kirkwood Ranch is not a project facility, but is owned and maintained by the Forest Service.

Response: The sentence considers project-related facilities, not just facilities owned by the licensee. We made no change to the text of the final EIS.

Comment LU-6: Idaho Power notes that the Hells Canyon Visitor Information Center is not a project facility. It is owned and managed by the Forest Service.

Response: The sentence considers project-related facilities, including facilities owned by the licensee and the Forest Service. However, to clarify that the site is currently not part of the project, we changed the sentence in the final EIS to make this clear:

Comment LU-7: Idaho Power comments that the implementation section on page 503 of the draft EIS regarding specific management plans should be modified, and offers alternative wording.

Response: Based on the new information in the comment, we changed the subject paragraph in final EIS section, 3.12.2.1, *Land Management*, as suggested.

Comment LU-8: Idaho Power notes that what FERC describes as a proposal for fire suppression and cooperation on page 507 of the draft EIS is what Idaho Power already practices. Idaho Power recommends that the statement be modified, and offers alternative wording.

Response: We adopted the alternative wording in final EIS section 3.12.2.4, *Fire Protection*.

Comment LU-9: With respect to a sentence on page 511 of the draft EIS, Idaho Power states that it does not intend to provide information about the location of cultural resources to the public, only about presence and value to make people aware their actions could cause damage. Idaho Power recommends alternative wording to this effect.

Response: We adopted the alternative wording in final EIS section, 3.12.2.6, *Road Management Plan*.

Comment LU-10: With respect to a statement on page 511 of the draft EIS, Idaho Power notes that the HCRMP applies only to Idaho Power-owned lands within and adjacent to the project, and that most of the company's hatcheries are located outside the project area and would not be affected by the plan. Idaho Power recommends alternative wording to clarify this point.

Response: We adopted Idaho Power's language in final EIS section 3.12.2.7, *Effects of Other Measures on Land Management, Aquatic Resource Measures*.

Comment LU-11: Idaho Power notes that the resource management plans to be developed under Idaho Power's proposal are those specifically proposed in exhibit E of the final license application and in the HCRMP. Idaho Power states that supplementation of the Staff Alternative should be modified to delete item (2), which is already defined in the HCRMP, and item (3), which is already included in the HCRMP.

Response: This filing by Idaho Power clarifies the specific resource plans that would be developed as part of the HCRMP. In the final EIS, section 5.1.1.2, *Staff Alternative, Land Management and Aesthetics*, we deleted item 2 from the Staff Alternative based on Idaho Power's November 3, 2006, filing that clarifies which plans would be covered by the HCRMP. However, the GIS proposal is not specific enough to include roads, as discussed in the final EIS. Therefore, we include item 3 for the purposes of clarifying the condition and helping to ensure that the proposed GIS system includes a layer on road maintenance. We changed recommendation #72 in the final EIS accordingly.

Comment LU-12: Idaho Power states that the meaning of supplemented measure #73 in the Staff Alternative (draft EIS page 541) is vague and unclear. Idaho Power states that this measure should be modified, and offers alternative wording to this effect.

Response: We changed recommendation #73 in the final EIS to reflect Idaho Power's suggested wording.

Comment LU-13: Idaho Power comments that parts of Staff Alternative measure #22 (draft EIS page 544) are unclear and likely to cause difficulty in interpretation and implementation. Idaho Power states that the measure should be modified as noted in its comment.

Response: We adopted Idaho Power's language and changed the recommendation in the final EIS.

Comment LU-14: Idaho Power states that Staff Alternative measure #26 (draft EIS page 544) is already included in activities covered by Idaho Power measure #78 (draft EIS page 542). Idaho Power states that this measure should be deleted since it may cause confusion implementing a license article.

Response: We deleted the recommendation from the final EIS.

Comment LU-15: Idaho Power states that while Idaho Power did not propose the measures described in paragraph 2, page 611 of the draft EIS, they are generally compatible with implementation commitments of the HCRMP. Idaho Power states that the description should be modified as noted in its recommendation.

Response: We adopted Idaho Power's language and changed the subject sentence in final EIS section 5.2.8.1, *Land Use Management*.

Comment LU-16: Idaho Power refers to policy 6.3.8.4 of the HCRMP and notes that the addition of the biannual timeframe with respect to law enforcement and fire protection, as recommended by FERC Staff on page 611 of the draft EIS, is reasonable. Idaho Power states that the final sentence should be modified as noted in its comments.

Response: We adopted Idaho Power's language and changed the last sentence in the subject paragraph in section 5.2.8.2, *Law Enforcement and Fire Protection*.

Comment LU-17: Idaho Power comments that the Forest Service and Idaho Power have reached agreement on Forest Service condition no. 3 regarding fire prevention. Idaho Power states that FERC should adopt the language agreed upon by Idaho Power and the Forest Service, as noted in its comment.

Response: We revised section 3.12.2.4, *Fire Protection*, to reflect Idaho Power's proposed and the Forest Service specified fire protection measures.

Comment LU-18: Idaho Power states that Idaho Power does not own Homestead Road, but maintains the referenced section. Idaho Power states that the statements should be modified to correct errors and incorporate the language of the Idaho Power/BLM agreement as noted in the comment.

Response: Based on the recent settlement between Idaho Power and Interior, as well as Idaho Power's recommended language, we changed the subject paragraph in final EIS section 5.2.8.4, *Road Management Plan*, as suggested.

Comment LU-19: Idaho Power notes that in the implementation section of the HCRMP, Idaho Power proposes to develop a GIS atlas of critical and sensitive resources intended for the same purposes as the FERC Staff Alternative. Idaho Power states that the discussion should be modified as noted in its comment.

Response: Idaho Power's comments clarify the original intent of the road management measures and how these measures fit with the proposed GIS system to protect natural resources. To improve clarity of the staff recommendation and to provide continuity between Idaho Power's comments and any new license, we changed the subject paragraph in final EIS section 5.2.8.4, *Road Management Plan*, to reflect Idaho Power's suggested wording.

Comment LU-20: With reference to Forest Service condition no. 1, Implementation of Activities on National Forest System lands, and condition no. 2, *Resource Coordination*, the Forest Service states that FERC staff appear to concur with these measures; however, FERC staff limit the scope of activities to National Forest System lands within the project boundary. The Forest Service states that the limitation of the scope of these conditions is inappropriate, and recommends that the final EIS incorporate this information and condition no. 1 without modification or limitation in the Proposed Action in the final EIS.

Response: We consider our recommended limitation of Forest Service condition nos. 1 and 2 to lands within the project boundary to be appropriate because Idaho Power activities covered by a new license would take place within the project boundary, as defined by the new license. Although we did not change our recommendation in the final EIS, we note that any license issued by the Commission must include the mandatory conditions as submitted pursuant to FPA section 4(e).

Comment LU-21: With reference to Forest Service condition no. 3, Fire Prevention Plan, the Forest Service states that FERC staff direct Idaho Power to develop a Fire Prevention Plan for all lands within the project boundary, not just National Forest System lands, and that FERC staff exclude National Forest System lands adjacent to the boundary for inclusion within the Fire Prevention Plan. The Forest Service recommends that the final EIS incorporate condition no. 3 without modification or limitation.

Response: In the final EIS, we continue to recommend including FS-3 as part of any license issued for the project. We also continue to recommend developing a Fire Prevention Plan for all lands within the project boundary. The plan would include measures for coordinating with other management agencies in the project area. However, there are many thousands of acres adjacent to the project, managed by private residents as well as local state and federal agencies. These lands are managed by others for purposes that are not project related. Therefore, we do not recommend including oversight of adjacent lands within any project-related fire management plan.

B16. SOCIOECONOMICS

Comment SO-1: NPPVA states that Enclosure II of its comment letter, the report by Forest Economics, has a detailed discussion of the socioeconomic effects of the project, and notes that the report highlights a number of problems with the analysis included in the draft EIS, including: (1) the number and size of boats used by each outfitter is inaccurate; (2) boats are gasoline powered as well as diesel; (3) boat trips and fishing outfitter business outside of the HCNRA are not included; (4) a number of contract and charter trips, including trips for cruise ships coming to the Port of Clarkston, were not included; (5) employee wages are different than indicated; (6) local boat manufacturing should be noted; (7) values accrued to businesses in communities north of the project are inaccurate; (8) the private boating sector is not included; and 9) public safety and the public interest is not given a value. NPPVA notes that the final EIS should contain other data sources besides Idaho Power about these subjects.

The Chambers of Commerce from Clarkston, Washington; Lewiston, Riggins, White Bird, and Grangeville, Idaho; and the North Central Idaho Travel Association all note the economic dependence of the local area upon business and industry related to boating, especially manufacturing and tourism. They state that boating and related industries, as well as tourism, rely on navigable access to the Snake and Columbia Rivers and the Hells Canyon National Recreation Area. They also note that Lewiston and Clarkston are accessible as ports to sea-going craft. Each of the letters recommends that any alternative addressed in the final EIS include an economic impact analysis assessing project effects on boating and tourism for this region. All of the organizations state their support for the 8,500-cfs minimum flow recommendation outlined in the Corps' January 26, 2006, letter to FERC.

Response: As defined in Scoping Documents 1 and 2, the focus of the socioeconomic assessment was narrowly defined. Specifically, we agreed to focus the socioeconomic section on the effects of changes in current project operations on local governments, power users, and commercial enterprises. We note that Idaho Power's proposed 6,500-cfs minimum flow is the same minimum flow that Idaho Power adhered to in practice since 1980, with the exception of following the Corps' recommended 8,500-cfs minimum flow from August 2004 through July 2006. Thus, the proposed 6,500-cfs minimum flow is the same as the flow that prevailed since 1980 and would not be expected to have a major effect on commercial boating. We also note that many of the commenter's statements are actually related to Idaho Power's response to the Corps-recommended minimum flow, where Idaho Power relies on economic analysis from CRA International. The comments are not related to the EIS, which does not use the CRA International study.

Comment SO-2: Charles McKetta and Dan Green of Forest Economics, Inc, under contract to NPPVA, evaluated economic analyses and reasoning by Idaho Power for reduction of minimum summer flow rates below the 8,000 to 9,000 cfs minimum recommended by the Corp of Engineers. As part of their broader critique of Idaho Power's comments, they cite two broad areas of critique for the analysis included in the draft EIS:

1. Environmental and Recreation Values—McKetta and Green state that lower summer flows coupled with increased ramping rate fluctuation produces several negative downstream effects, including higher water temperatures, beach erosion, concentration of pollutants, variable DO concentration, shifts of aquatic habitat, unpalatable smells, reduced aesthetics, poor fishing, dangerous conditions for swimming, reduced access to upstream terrestrial recreation, and hazards or difficulties for boat and raft navigation. They state that some of these were discussed in terms of the technical issues, but they were not translated into economic values associated with changes in wilderness, environmental, or recreation quality.
2. Economic Effects of Navigation Safety—McKetta and Green state that public safety is a prime consideration and that the economic effects on navigation caused by flow rate reduction are inadequately treated in the draft EIS. They also note that accident data in the draft EIS are focused on commercial vessels, which they state may be less than 5 percent of total incidents. They state that the economic cost of reduced safety should include higher insurance fees, higher maintenance and repair costs, reduced recreation opportunity, lower quality of experience, the value of loss of human life and time, and the increased liability litigation costs to both users and flow regulators associated with low flows.

Response: McKetta and Green make a number of arguments against our approach to the developmental analysis and the socioeconomic analysis in the draft EIS. As noted in their comments, the EIS considers and describes numerous environmental effects associated with licensing the project. These environmental effects are discussed throughout the document and provide a basis for balancing competing environmental resource needs in the context of the need for reliable and safe electricity generation. However, we do not conduct comprehensive cost-benefit analysis using contingent valuation or other means to assign dollar values to all of the direct and indirect environmental measures. Such an analysis tends to create controversy and muddy the environmental review rather than improve the basis of the staff recommendation to the Commission.

We also note that all of McKetta and Green's arguments are based on a faulty assumption about the environmental and economic baseline for our environmental review; their report assumes that the proposed minimum flow differs dramatically from existing conditions and would, therefore, lead to a marginal and measurable change in recreational use of the Snake River downstream of the project. As stated on page 19 and elsewhere in their analysis: "The limited relicensing issue that we address is focused only on the economics of allowing lower summer minimum flows" (page 19). However, with the specific exceptions noted below, Idaho Power has essentially operated the project to meet a minimum flow of 6,500 cfs since 1980. Thus, current navigational use of the river developed largely during a period when the de facto minimum flow was 6,500 cfs.

As described in draft EIS section 3.3.1.3 *Navigation,* in September 1988, the Corps and Idaho Power agreed to maintain a minimum flow of 6,500 cfs downstream of Hells Canyon dam (compared to the 5,000 cfs in the current license). Inflow is passed when flows are below 6,500 cfs. In 2001 and 2002, Idaho Power, in conjunction with the Corps and the Northwest Professional Power Vessel Association (NPPVA), began providing timed releases of 8,500 cfs below Hells Canyon dam, while still maintaining a floor of 6,500 cfs. Because of flow attenuation and lag times between locations below Hells Canyon dam, these timed release flows had limited utility and were discontinued. Later from August 2004 through July 2006, Idaho Power provided a minimum flow of 8,500 cfs. Currently, Idaho Power continues to use the 6,500 cfs minimum flow as it has in most past years, and its proposal does not differ from conditions that prevailed in most years since 1980. NPPVA's comment letter on the draft EIS includes flow data from Hells Canyon dam that demonstrates this point.

As noted above, the commercial power boating industry on the Snake River has developed, in part, as a result of prevailing project operations. To the degree that prevailing conditions would continue in the future, there is no reason to assume that Idaho Power's minimum flow recommendation would adversely affect the existing commercial industry.

With regard to McKetta and Green's discussion on navigational safety, we agree that a higher minimum flow would improve boating safety. In final EIS section 3.3.2.7, *Downstream Flows Important to Navigation*, as well as section 5.2.2.2, *Navigation Target Flow Levels*, we find that the Corps-recommended navigation flow scenario would decrease the number of days when flows drop below 6,500 cfs. However, as discussed further in our response to NPPVA, the commercial boating industry has developed around existing conditions and it is not the responsibility of the licensee to eliminate this risk for all types of boats at all times of the year.

Comment SO-3: The Nez Perce Tribe states that the socioeconomic analysis is critically flawed because: (1) it does not consider how project-created impacts to treaty-reserved resources affect the social, cultural, and economic welfare of the Nez Perce Tribe; and (2) it is limited to the four counties of the project area, although the impacts extend both farther downstream and upstream. The Nez Perce Tribe states that the final EIS should expand the socioeconomic analysis to include the Zone 6 fishery in the Columbia River.

The Shoshone-Paiute Tribes state that only reservoir-based recreation was addressed in the draft EIS, and that the economic impact of restored subsistence, commercial and recreational fishing was not.

Interior states that the significance of the reservoir fishery is demonstrated through the data provided regarding angler hours. The draft EIS on page 177 shows the combined angler hours for the reservoir use at 610,000 above the Hells Canyon dam (459,654 at Brownlee, 71,145 at Oxbow, 85,907 at Hells Canyon) and 183,000 below the Hells Canyon dam. Interior states that the EIS should include an analysis of the social and economic impacts related to recreational fishing and that information presented by Interior should be used to estimate the local and regional values for recreation fishing directed at the Hells Canyon reservoirs in the EIS. Interior recommends that estimates for the net benefit of improved or maintained fisheries to the local economy be developed and included in the EIS for all of the alternatives

and displayed for comparison of their relative contribution to the overall benefits of the Project. Interior comments that the contributions and economic value of recreational fishing produced in the Hells Canyon reservoirs under present and future conditions should be included as part of the comparison of alternatives in the EIS.
Interior recommends that estimates of the net benefit of improved or restored fisheries to the local economy be developed and included in the EIS for all of the alternatives and displayed for comparison of their relative contribution to the overall benefits of the project. Interior recommends that the commercial, tribal, and sport fisheries including salmon, steelhead and lamprey be included, extending to the lower Columbia River and Pacific Ocean fisheries from Oregon northward to Washington, British Columbia and Alaska. Interior comments that the contributions and economic value of anadromous fish produced in the Snake River basin under present and restored conditions should be included as part of the comparison of alternatives in the EIS.

Similarly, the Shoshone-Paiute Tribes state that the economic value and other values of anadromous fishes produced in the Snake River basin and its tributaries under present and restored conditions needs to be analyzed and included as part of the comparison of alternatives in the final EIS. Further, the tribes state that the benefits of restored anadromous fish runs to the tribes must be included in this analysis.

The Nez Perce Tribe comments that the geographic scope should include the Lower Columbia River where the Nez Perce and other CRITFC tribes harvest fall Chinook salmon affected by the Hells Canyon Project and steelhead and should span the North Pacific coast to southeast Alaska. The Nez Perce comment that the socioeconomic impacts on harvest should be analyzed for each of the draft EIS alternatives.

Interior states that the EIS should discuss and display a reasonable economic analysis of the value of restored anadromous fisheries to commercial fishing interests in the Columbia River and Pacific Ocean. These include both Indian and non-Indian commercial fisheries for white sturgeon as well. Interior also states that the EIS should include an analysis for the net local and regional economic value of restored fish and wildlife resources in comparison to the net local and regional economic value of the power produced by the project.

Response: As defined in Scoping Documents 1 and 2, the focus of the socioeconomic assessment was narrowly defined. Specifically, we agreed to focus the socioeconomic section on the effects of changes in current project operations on local governments, power users, and commercial enterprises. The restoration of subsistence, commercial, and recreational fishing was not part of any of the alternatives considered and is not recommended by staff. Therefore, we did not include an assessment of this issue in the socioeconomic analysis. Because effects on commercial fishing interests and fall Chinook salmon and steelhead in the lower Columbia River and as far away as southeast Alaska are influenced by many factors unrelated to the Hells Canyon Project, an economic analysis of those factors would be far beyond the scope of this relicensing process.

Comment SO-4: P. Brian Rogers states that the Idaho Power dams on the Snake River have destroyed anadromous fish runs, and requests that FERC generate a formal assessment of the economic benefits of restoring sport fishing in the Hells Canyon area and the effects of the relative timing of water flow rates and water quality on fisheries.

Beverly Ferrell states that there has been a diminution of local revenue caused by decreased salmon fisheries in Washington and Adams counties, Idaho, and requests that Idaho Power counterbalance this related loss of local economic base. She states that Washington and Adams counties are paying a hidden cost for supporting production of cheap electricity for other areas.

The Shoshone-Paiute Tribes note that the economic and social needs of tribes are adversely affected by the Hells Canyon project, and that fish passage has to be provided for the tribes to access anadromous fishing resources.

Response: We use existing conditions as our baseline for comparison with Idaho Power's Proposal and the Staff Alternative, and to judge the benefits and costs of any measures that might be required under a new license. The removal of anadromous fish upstream of the Hells Canyon dam represents pre-project conditions and, therefore, we did not include it as part of our environmental review.

Comment SO-5: The Pioneer and Settlers Irrigation Districts and the Payette River Water Users Association, Inc., comment that existing water rights for flow and storage related to irrigation could be affected by mitigation required of Idaho Power. They state that irrigators and ratepayers have already paid for hatcheries built and operated by Idaho Power and consider further payment for reintroduction of anadromous fish species above Brownlee dam to be redundant.

Response: As discussed in draft EIS section 3.13, *Socioeconomic Resources*, we recognize that the cost of the staff-recommended measures is large, although the impact on rates appears to be very small. In final EIS section 5.0, *Staff's Conclusion*, we continue to find that the Staff Alternative appropriately balances power production with environmental resource protection and enhancement.

Comment SO-6: The Shoshone-Paiute Tribes state that FERC analyzed socioeconomic impacts of the project on Adams, Washington, Baker, and Wallowa counties and did not address economic impacts outside of those four counties, thereby excluding the tribes from the economic analysis.

Response: In draft EIS section 3.13.2.5, *Effects on Minority and Low-income Communities and Indian Tribes,* we discuss the effects of the Staff Alternative on Native American communities, consistent with the scope outlined in the Scoping Document. In the final EIS, we include two new sections specifically addressing project effects on the tribes: 3.13.1.5, *Native American Tribes*, and 3.13.2.4, *Effects on Native Americans*. Nonetheless, in the final EIS, we continue to find that, given existing conditions, licensing the project with the staff-recommended measures would represent an improvement in aquatic resources, with the goal of improving returns of salmonids to and above the Hells Canyon project.

Comment SO-7: The Shoshone-Bannock Tribes state that by examining only the cost to Idaho Power associated with environmental restoration measures, FERC staff does not quantify or take into account economic benefits to others.

Response: The purpose of section 3.13, *Socioeconomic Resources,* is primarily to qualitatively describe the effects of licensing the project. In that section we discuss some of the positive and negative effects of the proposed and recommended measures on socioeconomic resources in the region.

Comment SO-8: Interior points out that the draft EIS states that certain market and non-market values would accrue to the project from completion of aquatic mitigation measures. Interior states that terrestrial mitigation measures would have similar positive and measurable effects on regional and local economies. Interior recommends that the EIS contain a full economic analysis that includes completion of Interior's 10(j) and section 18 recommendations, including non-power costs and benefits for the term of the new license issued for the project.

Response: The information on the record is not detailed enough to conduct a full economic analysis of all proposed and recommended measures. As such, any quantitative economic analysis, as Interior recommends, would be speculative at best. Nonetheless, we acknowledge that some environmental measures would contribute positively to socioeconomic resources in the region even while reducing the project's net power benefits. As it relates to the Staff Alternative's benefits to wildlife and the socioeconomic values that would accrue from improved wildlife, we recognize and discuss those benefits in draft EIS section 3.13.2.3, *Effects on Commercial Enterprises*. We note that draft EIS table 90 (final EIS table 99) shows that the socioeconomic benefits of hunting and wildlife viewing are very small compared to other recreational uses. We made no changes to the final EIS in this regard.

B17. OVERSIGHT AND ADAPTIVE MANAGEMENT

Comment AM-1: The Umatilla Tribes comment that the NEPA document should examine the benefits of establishing an aquatic resources committee, comprised of interested tribes, resource agencies, and Idaho Power, to undertake adaptive management studies and actions during the full term of the new license.

Interior recommends that the Staff Alternative include the establishment of a Technical Advisory Committee to oversee implementation activities for mitigation measures. Interior also recommends that the NEPA document include a more detailed description of the adaptive management program, including: (1) objectives; (2) coordination; (3) process; (4) dispute resolution; (5) organization and responsibility; (6) timeline for actions; (7) triggers for alternative action if results are not met (i.e., ESA, CWA, new listings, etc.); (8) funding and budget.

Response: The Staff Alternative includes establishment of a technical advisory committee and various resource-specific subcommittees. Our analysis of this concept appears in draft EIS section 3.12.2.1, *Land Use Management*, and our recommendation for the Staff Alternative appears in section 5.2.8.1, *Land Use Management*. Our recommendation has not changed in the final EIS.

B18. DEVELOPMENTAL ANALYSIS

Comment DA-1: AR/IRU state that FERC does not explain how cost estimates were arrived at for implementing recommended measures or provide documentation to support estimates and that FERC's cost estimate is greater than that of Idaho Power. AR/IRU recommend that FERC provide justification for how costs and benefits of mitigation were determined.

Response: Staff developed cost estimates based on the applicant's cost estimates, similar mitigation measures at other Commission licensed projects, and our professional experience. Based on our independent review and on comments by other parties, we sometimes recommend additional mitigation beyond that proposed by the applicant. In that case, staff cost estimates are generally higher than costs estimated by Idaho Power. We note that extensive appendices were provided for the draft EIS to document our estimated costs, and they also appear in the final EIS as well. Information about capital costs and annual operations and maintenance costs were provided in appendices E and F of the draft EIS. Because the level of detail we provided in the draft EIS is appropriate for its intended use, we did not change our basic approach in the *Developmental Analysis* section of the final EIS.

Comment DA-2: Idaho Power comments that the value for dependable capacity of $114 (*sic*) per MW per year is a FERC staff number provided in the mid-Snake River project final EIS and used by Idaho

Power in its analysis. The Corps states that the dollar value of dependable capacity used in the draft EIS appears to be high, resulting in overstated power impacts for the navigation measure.

The Corps comments that the draft EIS provides no explanation of why the power impacts analysis was based on a capacity replacement cost of $114,000/MW per year rather than on the simple-cycle combustion turbine (CT) value of $73,700/MW per year provided by Idaho Power. The Corps recommends that the power impacts analysis for all proposed future operating scenarios be recalculated based on the $73,700/MW per year cost.

Response: Our use of the $114,000 per MW value of dependable capacity is based on both capital and fixed and operations and maintenance costs associated with a combined cycle combustion turbine. We note that Idaho Power did use this figure in its additional information response, and did not propose any different estimate at that time. Our reason for using this value is that the plant factors for the Brownlee, Oxbow, and Hells Canyon developments are 53.3 percent, 66.7 percent, and 67.6 percent, respectively, which are more consistent with combined cycle combustion turbines than with simple cycle combustion turbines that operate at much lower plant factors. For comparison purposes, we include in the final EIS a sensitivity analysis of the potentially lower effects on benefits associated with simple cycle combustion turbines ($73,700/MW) for staff-recommended measures.

Comment DA-3: Idaho Power states that AIR DR-4 is incorrectly referenced as Bowling and Whittaker (2005) and, instead, should be referenced as Idaho Power (2005).

Response: We corrected the reference as suggested by Idaho Power and added the complete citation to the *Literature Cited* section of the final EIS.

Comment DA-4: NPPVA states that for replacement of load following capacity lost to navigation, there are less costly alternatives to a 100-MW gas-fired plant. NPPVA also states that the costs shown in table 93 of the draft EIS are apparently based on modeling for July 1994 and that instead should be based on real world operations that would indicate a much lower cost of navigation flows.

Response: We do not recommend a 100 MW replacement plant, but rather the percentage of such a plant corresponding to the lost dependable capacity. NPPVA does not suggest what other alternatives might be cheaper yet equivalent to combined cycle combustion turbines. Gas-fired generation is generally the most economical replacement power available under current economic conditions. Combined cycle combustion turbines are consistent with load factors cited by Idaho Power for the project. Our values are based on Commission data derived from actual capital and fixed operations and maintenance costs associated with combustion turbines.

In its November 2006 comments on the draft EIS, Idaho Power reiterates that 1994 dry year conditions correspond to the criteria used in its least-cost planning efforts and that hydro capacity lost under that approach must be replaced by other sources to meet capacity and reliability objectives. It is appropriate to base dependable capacity on below-normal hydrologic conditions and to do so in a manner consistent with the utility's least cost plan. With respect to using July 1994 modeled conditions rather than actual operations data in draft EIS table 93 (final EIS table 102), we note that actual historical releases during 1994 do not necessarily correspond to present day or future effects on dependable capacity under similar conditions. Because Idaho Power loads have increased over time, it is likely that the project would be operated more aggressively to maximize on-peak generation during the most critical hour of the day. Thus, we conclude that modeled conditions provide an acceptable basis for our evaluation of capacity impacts.

Comment DA-5: The Corps comments that conclusions in the draft EIS concerning impacts on power generation are not supported by the data presented for the navigation scenario. The Corps notes that no specific data or methods are provided to show how the MW reduction in dependable capacity is calculated for each alternative, if the overall impact is reasonable, or if it is calculated consistently among alternatives. The Corps states that it is unclear how FERC estimated the values stated in scenario 2, or if it is appropriate to use a simple scaling approach. The Corps states that it is also unclear how FERC determined impacts for the flow augmentation measure in table 93 of the draft EIS. The Corps notes that costs of the combined ramping rate flow augmentation measures indicated in the Staff Alternative may be inconsistent and result in an underestimation of cost and an overstatement of the impact on navigation. The Corps recommends FERC explain in more detail how the dependable capacity estimates and corresponding power costs were developed.

Response: In the *Developmental Analysis* section of the draft EIS, we used the modeling and economic evaluation results for each power generation scenario that were provided by Idaho Power in various filings with the Commission. For a complete description of Idaho Power's methods, we refer the Corps to several specific filings, including Idaho Power's February 2005 response to the Commission's AIR DR-3, Parts (a) and (b) (*Power Economics*) and AIR OP-1 (*Operational Scenarios*), as well as a correction filed on June 22, 2005. A description of the dependable capacity methodology is provided on pages 3 and 4 of the DR-3 response. On pages 12-16 of the DR-3 response, Idaho Power provided a series of answers to staff questions about the economic analysis; this additional information may further clarify the methodology for the Corps.

The dependable capacity estimates presented in the draft EIS are based on the fixed replacement costs using combustion turbines. The higher figure of $114,000 is based on combined cycle combustion turbines, while the lower figure of $73,700 is based on simple cycle combustion turbines. Fixed costs include both the fixed operations and maintenance costs as well as amortized capital costs. We continue to conclude that the cost associated with combined cycle combustion turbines is the appropriate cost to use in our analysis and allows us to assess economic impacts in a consistent manner. For informational purposes, we added an estimate of impacts based on the lower-cost single cycle combustion turbines in footnotes to draft EIS tables 93 and 94 (final EIS tables 102 and 103).

Based on information related to additional scenarios provided by Idaho Power in its comments on the draft EIS and in response to our Additional Information Request, our computations of economic impacts associated with operational measures are more consistent in the final EIS than the analysis we presented in the draft EIS. Given the results of additional model runs by Idaho Power, we were able to drop the scaling approach and use actual modeled results to assess the effects of ramping rate changes, flow augmentation, and both in combination. That information is reflected in final EIS section 4.0, *Developmental Analysis*. As shown in final EIS table 102, we continue to conclude that providing a minimum flow of 8,500 cfs for navigation is a very expensive measure, and we do not include the navigation flow in the Staff Alternative except in medium-high and extremely high water years, which would not negatively affect dependable capacity.

Comment DA-6: Interior states that the draft EIS lacks a description of methods and criteria used to analyze the financial feasibility of individual measures and of how costs and benefits were assessed against overall economics of the project.

Response: We do not evaluate individual measures for their financial feasibility or on an individual cost-benefit basis. Instead, we estimate costs for each measure based on estimates from Idaho Power, other parties, and our own experience. Additionally, if a measure affects operations, we assess the effect on project power benefits based on alternative power costs. As shown in draft EIS table 95 (final EIS table 104), the overall economics of the project alternatives are summarized in terms of annual costs, power benefits, and net benefits. We explain our procedures in section 4.3, *Comparison of Alternatives*. We did not change our methods or description in the final EIS.

Comment DA-7: Paul Poorman states that the EIS provides no balance between low cost energy and environmental protection. He comments that Idaho Power rates are among the lowest in the country, and that higher power rates would encourage conservation, justify the use of more renewable energy resources such as solar and wind, and lead to more widespread use of energy efficient bulbs and appliances. He further states that increased electricity costs would not devastate the economy, but that much economic activity would result from efforts to reduce consumption.

Response: We acknowledge that Idaho Power's rates are low compared to other regions of the country. Nonetheless, this does not mean that the Commission should alter its approach to balancing the need for power and environmental protection. For the final EIS, we revised some of our conclusions based on new information provided by commenters on the draft EIS. The Staff Alternative presented in the final EIS includes several environmental measures in addition to those included in the draft EIS, and we conclude that it provides an appropriate balance between low cost power and environmental protection.

Comment DA-8: Idaho Power notes that comments were provided with respect to the tables in section 4, *Developmental Analysis*, to FERC staff via conference call on September 25, 2006, and that this communication is included on the FERC record.

Response: We incorporated Idaho Power's comments and made appropriate changes in our final EIS.

Comment DA-9: Interior states that the cost of the terrestrial mitigation package does not appear to include land acquisition costs that were previously estimated by Idaho Power, and that those costs should be included in the EIS.

Response: Idaho Power updated its terrestrial costs in its March 13, 2007, submittal to FERC in response to our additional information request. Further clarification was provided in its March 20, 2007, filing. These updated costs are included in final EIS appendix H.

Comment DA-10: Interior states that the EIS needs to clarify whether new CHEOPS runs were done by the Commission and Idaho Power to show new results for AIR OP-1 alternatives with the flow compliance point downstream at Johnson Bar rather than 1 mile downstream of Hells Canyon dam, as specified in AIR OP-1. Interior also states that the EIS should contain an analysis of all the AIR OP-1 alternatives receiving equal consideration using consistent evaluation criteria so that comparisons are not skewed by flow and economic data that use variable or poorly described constraints.

Response: The CHEOPS Model is a proprietary model, as described on page 527 of the draft EIS, so only Idaho Power can make new runs. Idaho Power conducted new runs combining flow augmentation and navigation for normal, dry, and very dry years and summarized the results on page 22 of its November 2006 comments on the draft EIS.

We conclude that project operating constraints are adequately addressed in appendix C of the draft EIS. Tables 6 and 7 of appendix C of the draft EIS show that compliance for the runs of concern was measured at Hells Canyon rather than at Johnson Bar. We did not modify the format of our tables in the final EIS. We do note, however, that we made a typographic error in draft EIS table 93 (final EIS table 102). The estimated decrease in benefits for the 4-inch-per-hour ramping rate is based on compliance downstream of Hells Canyon dam rather than at Johnson Bar. We corrected this in the final EIS and modified the costs in accordance with Idaho Power's March 30, 2007, response to our additional information request.

Comment DA-11: EPA notes that the draft EIS concludes that "the potential benefits of installing a temperature control structure at Brownlee dam would not be worth the cost" (page 566). EPA is concerned that, other than a footnote that presents a wide range of potential costs ($3.9 million to $28 million annually) for construction and operation of a temperature control structure, there is no further analysis in the draft EIS to support the conclusion that a temperature control structure is not economically feasible. Given the potential benefits of a temperature control structure, EPA recommends that this issue be examined more fully in the final EIS.

Response: As indicated in the referenced footnote, which provides the cost for each of the three alternative temperature control structures evaluated in detail, the estimated costs of the temperature control structures evaluated vary widely.

In comments on the draft EIS, EPA, the Umatilla Tribes, and Nez Perce Tribe indicated that there may be benefits to foregoing releases of cool water in the summer to reserve cool water for release in the fall. Idaho Power conducted studies to evaluate potential summer/fall cooling and spring warming from a temperature control structure. The extent of cooling in the fall depends on the amount of coolwater reserves used in the summer. To better understand potential benefits from a temperature control structure, we amended our recommendation for a Temperature Management Plan to include additional evaluation of the potential benefits to fall Chinook salmon that could result from a temperature control structure operated to cool Hells Canyon dam releases during the first month of spawning and warm releases in early to mid-spring. We revised final EIS section 5.2.3.2, *Water Temperature Measures*, to incorporate this change.

Comment DA-12: Interior recommends that the Commission assess the economics of an alternative that includes installing a small generator at Oxbow dam to provide sufficient flows for bull trout habitat.

Response: In the final EIS, we include in the Staff Alternative a recommendation that Idaho Power investigate energy recovery associated with providing instream flows in the Oxbow bypass reach. Because instream flows are yet to be finalized, it is premature to conduct such an analysis at this time.

Comment DA-13: Idaho Power comments that although FERC's annualized cost estimate for various PM&E measures exceeds preliminary numbers provided in the final license application, Idaho Power believes they are too low. Idaho Power provides a table showing re-calculated costs and explains the basis for these changes.

Response: We revised the cost estimate in section 4.0, *Developmental Analysis*, based on information provided by Idaho Power in its comments on the draft EIS, as well as information provided in its April 19, 2007, and April 30, 2007, filings with the Commission.

B19. CONSISTENCY WITH COMPREHENSIVE PLANS

Comment CP-1: Interior lists four comprehensive plans accepted by the Commission that were omitted from the list of comprehensive plans applicable to the project, and states that the EIS should include those four plans.

Response: We revised the text in section 5.4.1, *Section 10(a)(2) Comprehensive Plans*, to include the four plans mentioned by Interior.

B20. RELATIONSHIP OF LICENSE PROCESS TO LAWS AND POLICIES

Comment LP-1: NMFS states that it remains committed to working with FERC or its designated non-federal representative to develop a proposed action that would avoid jeopardy and adverse modification of critical habitat. NMFS also states that if FERC chooses to rely on the draft EIS as its biological assessment, then a supplemental draft EIS is appropriate because there would be substantive changes to the proposed action and analysis of effects.

Response: We revised our analysis and incorporated a number of changes in the Staff Alternative that will further contribute to the protection of listed species, as well as the protection and restoration of habitat for the listed species.

Comment LP-2: NMFS comments that the Staff Alternative is indefinite because there are a number of possible significant changes to the proposed action. These include changes in the state 401 water quality certification, changes due to the outcome of the 10(j) meeting, and changes due to the inclusion of modified mandatory conditions. NMFS states that each of these has the potential to change the proposed action significantly relative to NMFS's analysis of jeopardy and adverse modification of critical habitat. Furthermore, NMFS expresses concern that the provision to re-evaluate the benefits of flow augmentation in 2009 introduces uncertainty about whether this measure would be continued after 2009. In summary, NMFS states that it does not consider the draft EIS to be adequate for use as a biological assessment because it does not provide: (1) a sufficiently defined proposed action; (2) an adequate analysis of the effects of the action on listed species, including cumulative effects; or (3) an adequate analysis of alternative actions considered by the action agency.

Response: Several events have helped us to clarify and define the proposed action in the final EIS. First, we deferred the re-evaluation of flow augmentation from 2009 to 2015 and specified that we would consult with NMFS and Interior on the need to reinitiate consultation if a change to the flow augmentation program is proposed. Second, we completed the process of considering information that was exchanged during the 10(j) process, and as a result of that process have revised some elements of the Staff Alternative to be more consistent with the agency 10(j) recommendations. Finally, we reviewed the measures that Idaho Power included in its revised application for Section 401 water quality certification, and incorporated these measures in the Staff Alternative. Together, these changes substantially reduce the uncertainties about which NMFS expresses concern.

We find our analysis to be adequate with respect to effects on listed species. We evaluated the full scope of the recommended terms and conditions that were received and provided a sufficient description of past, present and future cumulative effects. In cases where draft EIS comments identified information or analysis that would improve the document, we incorporated this information or analysis into the final EIS. We were not able to identify a separate agency alternative that would encompass the full scope of measures recommended by the different stakeholders, so we adopted our standard approach of evaluating the full range of recommended measures and combining the measures that stood on their merits into a comprehensive Staff Alternative to contrast with Idaho Power's licensing proposal.

Comment LP-3: The Shoshone-Bannock Tribes comment that the draft EIS analysis of effects pertaining to blocked access for fall Chinook and steelhead are identical, and should provide more detail.

Response: We expanded the text in final EIS section 3.8.2, *Environmental Effects on Threatened and Endangered Species*, to provide greater detail on the effects of blocked access to habitat on anadromous fish species.

Comment LP-4: The Shoshone-Bannock Tribes comment that: (1) the Staff Alternative would continue to adversely modify critical habitat for fall Chinook, due to its adoption of unreasonably high ramping rates; and (2) FERC's reliance on cost-benefit analyses to reject measures designed to benefit ESA-listed species does not comply with its obligation to take necessary measures to protect ESA-listed fish stocks. The tribes also state that the draft EIS contains inadequate analysis of the cumulative effects associated with other Columbia River basin hydropower projects, the cumulative impacts that will result from relicensing the Hells Canyon Project, and of ways to mitigate for cumulative impacts.

Response: The Staff Alternative includes sufficient measures to prevent the adverse modification of fall Chinook critical habitat downstream from Hells Canyon dam. These measures include: (1) implementation of a 4-inch ramping rate during the fall Chinook rearing period; (2) development and implementation of adaptive management plans to monitor and address any adverse effects from stranding and entrapment or on invertebrate production; (3) continued management of flows to benefit spawning and incubation of fall Chinook salmon; (4) continued monitoring of the quantity and condition of spawning habitat and the implementation of gravel augmentation if warranted; (5) measures to augment DO and reduce gas supersaturation; and (6) water releases from Brownlee reservoir to benefit the migration of juvenile fall Chinook salmon. In addition, measures directed toward providing immediate benefits to bull trout would contribute to the long-term goal of restoring steelhead and spring Chinook salmon to areas upstream of the project. These include tributary habitat improvements in five tributary basins and the implementation of fish passage measures, starting in Pine Creek. Many of these measures would not be supported by a strict cost-benefit analysis, but were adopted as part of the Staff Alternative based on their benefits to ESA-listed species or to address the cumulative effects of Idaho Power's Snake River projects on anadromous fish species and on other aquatic species that are of cultural importance to the tribes.

Comment LP-5: NMFS states that FERC staff relied on Idaho Power's model results to assess the effects of different project operations on water quality, flow, and the aquatic resources downstream of Hells Canyon Project. However, NMFS states that the draft EIS does not include an analysis of the effects of the Staff Alternative on downstream aquatic resources.

Response: At the time that we developed additional information requests for the project, we were in the position of having to forecast what operational alternatives would eventually emerge from the relicensing. We used our best judgment and requested modeling runs for 6 scenarios and 6 sub-scenarios in AIR OP-1. After recommended terms and conditions were filed, we found that the scenarios that we requested, while they did not precisely match all of the terms and conditions that were recommended by the stakeholders, effectively bracketed these terms and conditions. This allowed us to assess the relative benefits and costs of the individual operational recommendations, which we then combined into a Staff Alternative. In our view, the modeling results that we provide in the final EIS are sufficient to support the development of appropriate license conditions, particularly given that the Staff Alternative provides for adaptive management based on monitoring results.

Comment LP-6: NMFS comments that the draft EIS failed to provide any assessment of the impacts of habitat loss for the remaining portions of the ESUs. NMFS comments that it provided summaries of key Technical Recovery Team products in its January 24, 2006, filing, yet FERC ignored this information. NMFS states that these summaries are especially pertinent for Snake River fall Chinook salmon, which now comprise a single remaining population (the other two populations were extirpated by the project and Idaho Power's Swan Falls dam). NMFS notes that this information, along with a detailed list of citations, should assist FERC in its assessment of any impact of habitat loss.

Response: We expanded the text in final EIS section 3.8.2, *Environmental Effects on Threatened and Endangered Species*, to include this information.

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APPENDIX C

MANDATORY CONDITIONS

FOREST SERVICE SECTION 4(E) CONDITIONS

TERMS AND CONDITIONS

License articles contained in the Federal Energy Regulatory Commission's (Commission) Standard Form L-1 issued by Order No. 540, dated October 31, 1975, cover those general requirements that the Secretary of Agriculture, acting by and through the USDA Forest Service, considers necessary for adequate protection and utilization of the land and related resources of the Payette and Wallowa-Whitman National Forests. Under authority of section 4(e) of the Federal Power Act (16 U.S.C. 797(e)), the following terms and conditions are deemed necessary for adequate protection and utilization of National Forest System (NFS) lands and resources. These terms and conditions are based on those resources enumerated in the Organic Administration Act of 1897 (30 Stat. 11), the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215), the National Forest Management Act of 1976 (90 Stat. 2949), and any other law specifically establishing a unit of the National Forest System or prescribing the management thereof, including the Hells Canyon National Recreation Area Act and the Wild and Scenic Rivers Act, as such laws may be amended from time to time, and as implemented by regulations and approved Land and Resources Management Plans prepared in accordance with the National Forest Management Act. Therefore, pursuant to section 4(e) of the Federal Power Act, the following conditions covering specific requirements for protection and utilization of the NFS lands shall also be included in any license issued for the Hells Canyon Complex Hydroelectric Project (Project).

Condition No. 1—Implementation of Activities on National Forest System Lands

The Licensee shall not commence implementation of habitat or ground-disturbing activities on National Forest System (NFS) lands until the USDA Forest Service has approved site-specific project designs and issued a notice to proceed.

Additional NFS Lands

If additional NFS lands are included within the Project boundary, the Licensee shall obtain a special-use authorization for occupancy and use of NFS lands added to the Project area boundary from the USDA Forest Service. Within six months of License issuance and before any habitat or ground-disturbing activities, the Licensee shall obtain from the USDA Forest Service and file with the Commission a special-use authorization for occupancy and use of NFS lands added to the Project area boundary in the License.

Additional lands authorized for use by the Licensee in a new special-use authorization shall be subject to laws, rules, and regulations applicable to the NFS. The terms and conditions of the USDA Forest Service special-use authorization are enforceable by the USDA Forest Service under the laws, rules, and regulations applicable to the NFS. The special-use authorization shall also be subject to applicable sanctions and enforcement procedures of the Commission at the request of the USDA Forest Service. Should additional NFS lands be needed for this Project over the License term, the special-use authorization shall be amended to include any additional NFS lands.

Approval of Changes on NFS Lands after License Issuance

Notwithstanding any License authorization to make changes to the Project, the Licensee shall receive written approval from the USDA Forest Service prior to making changes in the location of any constructed Project features or facilities on NFS lands, or in the uses of Project land and waters on NFS lands, or any departure from the requirements of any approved exhibits for Project facilities located on NFS lands filed by the Licensee with the Commission. Following receipt of such approval from the USDA Forest Service, and at least 60 days prior to initiating any such changes or departure, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of the USDA Forest Service for such changes. The Licensee shall file an exact copy of the report with the USDA Forest Service at the time it is filed with the Commission.

Coordination with Other Authorized Uses on NFS Lands

In the event that portions of the Project area are under federal authorization for other activities and permitted uses, the Licensee shall consult with the USDA Forest Service to coordinate such activity with authorized uses before starting any activity on NFS land that the USDA Forest Service determines may affect another authorized activity.

Site-Specific Plans

The Licensee shall prepare site-specific plans subject to review and approval by the USDA Forest Service for habitat and ground-disturbing activities on NFS lands required by the License, including activities contained within resource management plans required by the License prepared subsequent to License issuance. The Licensee shall prepare site-specific plans for activities one year in advance of implementation dates required by the License.

Site-specific plans shall include:

1. A map depicting the location of the proposed activity and GPS coordinates.
2. A description of the USDA Forest Service land management area designation for the location of the proposed activity and applicable standards and guidelines.
3. A description of alternative locations, designs and mitigation measures considered including erosion control and implementation and effectiveness monitoring designed to meet applicable standards and guidelines.
4. Draft biological evaluations or assessments including survey data as required by regulations applicable to habitat or ground-disturbing activities on NFS lands in existence at the time the plan is prepared.
5. An environmental analysis of the proposed action consistent with USDA Forest Service National Environmental Policy Act (NEPA) policy in existence at the time the plan is prepared for FERC licensed projects on NFS lands.

Cost Reimbursement

The Licensee shall provide funding to the USDA Forest Service for all costs associated with the analysis, review, inspection, and monitoring required for implementing habitat and ground-disturbing activities on NFS lands required by the License, including activities contained within resource management plans required by the License prepared subsequent to License issuance. Funding for the analysis, review, inspection, and monitoring of site-specific projects on NFS lands required by the License shall be through the use of a Collection Agreement or other instrument consistent with USDA Forest Service regulations in effect at the time the project is proposed and shall be executed by the Licensee and the Payette National Forest and/or the Wallowa-Whitman National Forest, as appropriate.

Condition No. 2—Resource Coordination

Within one year of License issuance, the Licensee shall, in consultation with and approval by the USDA Forest Service, prepare a Resource Coordination Plan (RCP) and file the plan with the Commission for approval. The RCP shall establish a process for information exchange and coordinate efforts for implementation of License conditions and ongoing Project operations and maintenance (O&M) activities impacting NFS lands. The RCP shall provide for coordination of the implementation of the various management plans required under the License to the extent they impact NFS lands, such as but not limited to: visual resource management, cultural resource management, integrated weed management, aquatic plant management, fish and wildlife management, sensitive species management, recreation resource management, monitoring, erosion control and other resource protection plans. The RCP plan shall require the Licensee to:

1. Consult with the USDA Forest Service each year during the 60 days preceding the anniversary of the License, or as agreed to by USDA Forest Service, to evaluate the past year's activities and develop a proposed implementation schedule for the upcoming year's activities and measures required by the License for NFS lands. Within 60 days following such consultation, the Licensee shall file with the Commission evidence of the consultation with any recommendations made by the USDA Forest Service.
2. Document the requirements, tasks and methods and reports related to monitoring the effects of Project operations and facilities on natural and/or social resources and effectiveness of protection, mitigation, and enhancement measures where the monitoring is required by USDA Forest Service terms and conditions.
3. Provide a mechanism for revising implementation strategies and methods to reflect improvement in sampling procedures and/or changes in regulations or environmental conditions.
4. Identify practices for record keeping and annual reporting.
5. Include provisions for the routine updating of the RCP, including incorporation of monitoring measures identified in site-specific plans prepared under the requirements of USDA Forest Service Condition No. 1 (Implementation of Activities on NFS lands).
6. Develop a field manual identifying standard operating procedures, including cultural resource identification and reporting procedures that the Licensee and its contractors shall follow while conducting activities on NFS lands.
7. Develop a process to resolve disagreements regarding the implementation of the RCP.
8. Designate an Environmental Coordinator to coordinate the implementation of the RCP and Licensee activities with the USDA Forest Service.

Condition No. 3 – Fire Prevention Plan

Within one year of License issuance, the Licensee shall, in consultation with and approval by the USDA Forest Service and in consultation with appropriate State and local fire agencies, prepare a Fire Prevention Plan for NFS lands within the Project boundary and NFS lands adjacent to the Project boundary that are impacted by the Project and file the plan with the Commission for approval. The Fire Prevention Plan shall require the Licensee to:

1. Analyze fire prevention needs to ensure that prevention equipment and personnel are available.
2. Identify fire hazard reduction measures (e.g., eliminating ladder fuels, reducing fuel loading).
3. Provide the USDA Forest Service a list of the location of available fire prevention equipment and the location and availability of fire prevention personnel.

Condition No. 4—Sandbar Maintenance and Restoration

For the purposes of restoring and maintaining 14 acres of sandbars on or adjacent to NFS lands between Hells Canyon Dam and the confluence of the Snake and Salmon Rivers that may be affected by the existence and/or operation of the HCC over the term of the new license (including any annual licenses issued thereafter), the Licensee shall establish a Mitigation Fund for use by USDA Forest Service to fund restoration and maintenance activities, which may include:

1. Development of a list of sites to be maintained, and a list of sites to be restored through managed sand supply based on the inventory of existing sandbars and potential restoration sites (Term and Condition Exhibit 1 attached hereto).
2. Restoration efforts by supplying sand to establish sufficient depth over designated areas between appropriate flow elevations. Maintenance will be implemented when average sand depths on treated sandbars fall below established criteria.
3. Distribution of sand on National Forest System lands above appropriate flow elevation contours to minimize annual sand loss attributable to ordinary high water.
4. Monitoring of existing sandbars and restoration areas on a five-year interval to evaluate whether maintenance and restoration objectives are being met.

Fund Administration

The Licensee shall, in a fiduciary capacity with the USDA Forest Service as the beneficiary, establish and maintain an independent interest-bearing account for the purpose of funding mitigation and enhancement projects undertaken pursuant to this Condition. The financial institution where the interest-bearing account shall be established must be insured by the Federal Deposit Insurance Corporation (FDIC) and the terms of the escrow agreement shall be approved in advance by the USDA Forest Service, Chief Financial Officer. The Fund's principal shall be invested in interest-bearing securities of the U.S. Treasury. The Licensee shall bear the cost of all reasonable administrative, legal, and overhead costs associated with the management of the account and shall not assess any such costs against the account or against the USDA Forest Service. The USDA Forest Service will designate an official with the authority to direct payment to the USDA Forest Service for specific project work in furtherance of the purposes of the Fund. The account shall be administered at the sole discretion of the USDA Forest Service. The Licensee and the USDA Forest Service will collaborate on development of public information to communicate the benefits of the projects being completed under this Fund.

Quarterly Reports

The financial institution shall provide quarterly reports, at a minimum, to the USDA Forest Service Chief Financial Officer, showing account activity during the period, the amounts of principal and interest income.

Annual Reports

The Licensee shall submit to FERC and the USDA Forest Service, Chief Financial Officer written annual reports that reflect the amounts of payments deposited into and disbursed from the Fund. On each anniversary of the Mitigation Fund's establishment, and every year thereafter, the Licensee shall provide an annual independent audit of the Fund and submit the results of the audit to the USDA Forest Service, Chief Financial Officer. The USDA Forest Service will provide information to the Licensee annually concerning how funds have been expended in furtherance of the purposes of the Fund.

Timing and Schedule of the Licensee's Contributions to the Fund

Within one year of the order issuing the new license, the Licensee shall establish the Mitigation Fund and shall contribute $937,000.00 annually (in 2006 dollars adjusted for inflation in accordance with Exhibit 2 attached hereto) to the Fund for the first 10 years of the license. The USDA Forest Service may begin to draw from the Fund on the date of the first anniversary of the new license. The Licensee shall be responsible for no further contributions to the Fund. The contributions shall be nonrefundable, except that any balance resulting from the Licensee's contributions, including any accrued interest, remaining in the Fund on the date that the next license order for the Project is issued shall be returned to the Licensee. A final independent audit of the Fund shall be made by the Licensee to determine the final principal and interest remaining in the Fund to be returned to the Licensee. Based on the results of the audit, USDA Forest Service shall make the final disbursement to the Licensee.

Condition No. 5—Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan

Within one year of License issuance, the Licensee shall, in coordination with the USDA Forest Service, prepare an Integrated Wildlife Habitat Program (IWHP) and Wildlife Mitigation and Management Plan (WMMP) as defined in FERC AIR TR-1, for lands within the Project boundary and NFS lands adjacent to the Project boundary that are impacted by the Project, and file the plan with the Commission for approval. The goal of the IWHP and WMMP is to specify programmatic and stewardship goals and measurable objectives, policies, guidelines and administrative procedures, including monitoring and adaptive management that provide terrestrial and botanical resource protection, mitigation and enhancement measures to lands as described above. The Licensee shall be responsible to implement the IWMP and WMMP. In addition to incorporating all USDA Forest Service terrestrial and botanical conditions approved by FERC, the IWMP and WMMP shall require the Licensee to:

1. Develop and implement a monitoring program to estimate the status and trends of the terrestrial habitats being managed and determine whether management practices support those resources goals or should be changed. The monitoring program shall include a process to establish baseline biological conditions for the resources that will be managed and monitored.
2. Develop and implement an adaptive management process, including protocols and schedules to monitor implementation and effectiveness of the terrestrial and botanical resource protection, mitigation and enhancement measures, and adapt implementation measures as needed to meet resource-specific goals and objectives. Adaptive management shall be based on periodic monitoring cycles tailored to each resource objective related to a specific mitigation or management action.
3. The IWHP and WMMP shall be prepared in coordination with the USDA Forest Service. The Licensee shall include with the plans documentation of coordination, copies of comments and recommendations on the completed plans after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the plans. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the plans with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

Condition No. 6—Land Acquisition and Management Plan

Within one year of License issuance, the Licensee shall in coordination with the USDA Forest Service prepare a Land Acquisition and Management Plan (LAMP) that shall be incorporated into the Licensee's Integrated Wildlife Habitat Program (IWMP) and Wildlife Mitigation and Management Plan (WMMP) and file the LAMP with the Commission for approval.

1. The purpose of the LAMP is to describe the Licensee's land acquisition and management of habitat mitigation parcels as described in the FLA, FERC's AIR TR-1 and other License

conditions. The LAMP shall include but not be limited to the following elements: Program goals and objectives (TR-1 Sections 1.2: #1)

a. Parcel and conservation easement acquisition criteria (TR-1 Appendix 1) and/or new criteria developed by the IWMP Work Group (TR-1)

b. Implementation schedule for land (habitat) acquisition and improvement (TR-1 Sections 1.2: #4)

c. Desired habitat conditions (TR-1 Sections 1.2: #2)

d. Comprehensive best management practices and programs (TR-1 Sections 1.2: #6)

e. Priorities and procedures for habitat restoration of parcels in degraded condition (TR-1 Sections 1.2: #4)

f. Priorities and procedures for maintaining functioning habitat on the acquired parcels (TR-1 Sections 1.2: #4)

g. Procedures for effectiveness monitoring in determining whether the desired habitat conditions and trends are being achieved (TR-1 Sections 1.2: #7)

h. Apply adaptive management practices when objectives and trends are not achieved (TR-1 Sections 1.2: #9)

i. Provision for the program's periodic review and revision, as necessary (TR-1 Sections 1.2: #11)

2. The LAMP shall be prepared in coordination with the USDA Forest Service. The Licensee shall include with the LAMP documentation of coordination, copies of comments and recommendations on the completed LAMP after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the plan. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the LAMP with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

3. The Licensee shall acquire 56.3 acres of riparian habitat to mitigate continuing Project impacts to riparian vegetation on the Snake River below Hells Canyon dam. The Licensee shall include the above riparian habitat mitigation into its land acquisition program.

4. Within two years of License issuance, the Licensee shall, in coordination with the USDA Forest Service, assess the shoreline erosion sites identified in the FLA, Technical Report E.3.2-42 and, where warranted and feasible, design and install control measures to correct active shoreline erosion problems at its source, including planting the sites with native riparian vegetation, maintaining the control measures in a functioning condition and monitor control measure effectiveness. For those sites were control measures are deemed infeasible, the acreage of these sites shall be added to the Licensee's riparian acquisition program. In addition, the Licensee shall survey for new shoreline erosion sites every 5 years, and implement control measures when deemed warranted and feasible.

Condition No. 7—Exotic and Invasive Vegetative Management

Within one year of License issuance, the Licensee shall prepare and implement a cooperative Integrated Weed Management Plan (IWMP) for the prevention, suppression, containment, endeavor to eradication and control of invasive non-native plant species, including noxious weeds in and adjacent to the Project area. The intent of this plan is to enhance and promote the coordinated management of noxious weeds with entities responsible for weed management in Hells Canyon. The plan includes the following:

1. The IWMP shall be developed cooperatively with a Licensee established Noxious Weed Advisory Board. The Board shall be comprised of entities responsible for weed management, including the USDA Forest Service. The Licensee shall include provisions to update the plan in 5 year intervals to keep the plan contemporary with new weed management science and practices.

2. The IWMP shall require the Licensee to (FLA E.3.3.3.2.1.2 pages E.3-690 & E.3-691):

a. Develop communication and coordination protocols for the Licensee and the Noxious Weed Advisory Board members, including:

1) Defining participants roles and responsibilities

2) Schedules for annual reports and work plan, meeting, review and updates

b. Define the geographic scope of the plan's implementation efforts

c. Identify noxious weed management goals and objectives

d. Develop weed species and habitat overview/descriptions

1) Location description/mapping of populations using Geographic Information Systems

2) Current site (habitat) condition

3) Data gap; identify and implement needed site-specific surveys and methodology, as appropriate

e. Create the Hells Canyon Cooperative Weed Management Area (CWMA)

f. Describe the desired conditions

g. Make recommendations for site-specific management consistent with federal state and county laws and regulations

h. Schedule for periodic inventory using common inventory and mapping protocols

i. Develop Best Management Practices (BMP) that pertain to all ground disturbing projects and proactive prevention measures to stop new infestations, consistent with Federal and State initiatives

j. Develop and implement an effectiveness monitoring program

k. Modify practices when objectives and trends are not achieved

3. The IWMP shall be prepared in coordination with the USDA Forest Service. The Licensee shall include with the plan documentation of coordination, copies of comments and recommendations on the completed IWMP after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the IWMP. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the IWMP with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

Condition No. 8—Terrestrial Threatened and Endangered Species

Within one year of License issuance, the Licensee shall, in coordination with the USDA Forest Service, and USFWS, if appropriate, prepare a Threatened and Endangered Species Management and Monitoring Strategy for the long-term protection, management and enhancement of Threatened and Endangered species and their habitats on NFS lands affected by the Project. The strategy shall be incorporated into the WMMP and filed with Commission for approval. The strategy shall address those measures required by the USFWS as a result of consultation under the Endangered Species Act (ESA) for the protection, management, enhancement, and monitoring of Threatened and Endangered species and their habitats.

The USDA Forest Service shall be provided the opportunity to participate in the ESA consultation process. To the extent that any such measures shall be implemented on NFS lands, the Licensee shall coordinate with the USDA Forest Service on such implementation.

Condition No. 9—Sensitive Species Management

Within one year of License issuance, the Licensee shall, in coordination with the USDA Forest Service prepare a Sensitive Species Management Plan (SSMP) that shall be incorporated into the WMMP and filed with the Commission for approval. The goal of the WMMP is to provide for the protection, management, enhancement and monitoring of currently identified and any new (per paragraph 1 below) Sensitive species and their habitat on NFS lands affected by the Project. The SSMP shall require the Licensee to:

1. In consultation with USDA Forest Service, conduct additional Sensitive species surveys when new species are listed on the Regional Forester Sensitive Species list that are known to exist in the Hells Canyon Project area. When there are Project-related activities that may have an impact on the newly listed species or their habitat, surveys will be conducted. The Licensee shall prepare a draft biological evaluation for Regional Forester Sensitive Species as per USDA Forest Service Condition No. 1 Implementation of Activities on National Forest System lands.
2. Conduct monitoring every two years for all Sensitive confirmed sites for the first six years of the License term and at three-year intervals thereafter to determine habitat condition and trend. The need for continued monitoring will be evaluated after year six of the new License term.
3. Protect and/or restore Sensitive sites/habitats that are declining in condition, as a result of Project-related impacts, as determined through monitoring as set out in paragraph 2 above.
4. Update the Sensitive Species Management Plan to address revisions to the Regional Forester sensitive species list over the License term.

Condition No.10—Mountain Quail Habitat Enhancement

The Licensee shall implement the Mountain Quail Habitat Enhancement program proposed in the Final License Application (FLA, 2003). Measures proposed for NFS lands shall be subject to Condition No. 1 Implementation of Activities on National Forest System lands.

Condition No. 11—Transmission Line Management

Within one year of License issuance, the Licensee shall, in consultation with and approval by the USDA Forest Service, develop a transmission line operation and maintenance plan which shall be incorporated into the WHMMP and filed with the Commission for approval. The goal of the plan is to provide communication and coordination between the Licensee and the USDA Forest Service in implementing, monitoring, and adapting all resource specific restoration, protection, and management actions associated with the transmission line occupying NFS lands.

Condition No. 12—Recreation Management

Within one year of License issuance, the Licensee shall finalize the Hells Canyon Complex Comprehensive Recreation Management Plan (Recreation Plan) and file the Recreation Plan with the Commission for approval. The Recreation Plan shall be inclusive of appropriate License requirements and also address Project-related recreation resources located on NFS lands within the existing Project boundary or as otherwise ordered by the Commission. The Recreation Plan shall include provisions for adaptive management to address changing recreation needs and preferences and shall be updated as appropriate every six years in conjunction with filing the Commission Form 80. The Licensee shall implement the Recreation Plan.

The Recreation Plan shall be prepared in coordination with the USDA Forest Service and other appropriate entities. The Licensee shall include with the Recreation Plan documentation of coordination, copies of comments and recommendations on the completed Recreation Plan after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the Recreation Plan. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the Recreation Plan with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

The Recreation Plan shall include an annual implementation schedule, consultation, and approval procedures and include:

1. Measures to adequately address USDA Forest Service resource concerns and standards of quality (e.g. Meaningful Measures) throughout the License term.
2. The following measures proposed by the Licensee in the Draft Recreation Plan (FLA, 2003):
    a. Litter and Sanitation Plan (E.5.4.3.1, E.5.4.4.1.2)
    b. Public Safety Program (E.5.4.3.1.2)
    c. Local Law Enforcement (E.5.4.3.1.3, E.5.4.4.1.4)
    d. Road Maintenance (E.5.4.3.1.4, E.5.4.4.1.6)
    e. Boat Moorage on HCC Reservoirs (E.5.4.4.1.1)
    f. Information and Education (I&E) Plan (E.5.4.4.1.3)
    g. Recreation Adaptive Management Plan (E.5.4.4.1.5)
    h. Performance of Operation and Maintenance at Applicant-Enhanced BLM and USFS Reservoir-Related Recreation Sites (E.5.4.4.1.7)
    i. Enhancement of Eagle Bar Dispersed Recreation Site (E.5.4.4.2.1)
    j. Development of Site Plan for Big Bar Recreation Site (E.5.4.4.2.1)
    k Enhancement of Boat Ramp and Associated Facilities at Big Bar Recreation Site (E.5.4.4.2.2)
    l. Development of Site Plan and Enhancement of Eckels Creek Dispersed Recreation Site (E.5.4.4.2.4)

3 The Licensee shall implement the Comprehensive Road Management Plan proposed in the FLA as it pertains to NFS lands to meet the existing standards, designs and operations and maintenance plan guidelines established in the Hells Canyon Scenic Byway Management Plan (USFS, 1993). The Licensee shall maintain Hells Canyon Dam (HCD) Road for safe and reasonable use by the public including access to Hells Canyon Creek Visitor Center, parking lot, and boat launch and also including dispersed parking between the HCD and the visitor center.

4 To address adaptive management the Licensee shall:

   a. Develop a comprehensive recreation monitoring plan that includes evaluation of recreation use, preferences and trends

   b. Report recreation use information to the USDA Forest Service and other interested entities as it becomes available, including annual reporting of use occurring at Licensee fee parks

   c. Coordinate with the USDA Forest Service to establish trigger points that indicate a need for additional development or improvements at USDA FS sites identified in the Recreation Plan

   d. Provide for appropriate expansion of existing recreation facilities or development of new Project related recreation facilities and for other recreational opportunities on NFS lands commensurately with Project-related use pursuant to the Recreation Plan

5. The Licensee shall develop and implement a Vegetation Management Plan for all developed sites on NFS lands identified in the Recreation Plan. The Vegetation Management Plan shall include a schedule and procedures for maintenance, including planting, fertilizing, mulching, watering, thinning, staking, mowing, trimming, spraying and/or weeding, etc., for each developed site.

6. The Licensee shall every six years in conjunction with FERC Form 80 requirements conduct visitor satisfaction surveys in the HCC. Details of the survey content and implementation will be coordinated with the USDA Forest Service and other applicable entities to ensure that the level of detail and applicability of information is consistent with previous surveys and analysis. When practicable these surveys should endeavor to duplicate the survey protocols developed by Whittaker and Shelby, 2002, and presented in the Licensee’s Technical Report E.5-4, FLA 2003) during the first survey periods.

Condition No. 13—Big Bar

Within three years of License issuance the Licensee shall, in coordination with the USDA Forest Service, develop a site development plan for the Big Bar Recreation Area (Big Bar Development Plan, BBDP) and file the plan with the Commission for approval. The BBDP shall address specific facility elements needed at Big Bar Section C as well as possible future expansion opportunities on other sections of Big Bar that shall be addressed as part of the adaptive management component of the Comprehensive Recreation Management Plan. The BBDP shall include a site plan, design drawings; detailed erosion and sediment control measures, and a schedule for implementation and maintenance.

The Licensee shall include with the BBDP documentation of coordination, copies of comments and recommendations on the completed site plan after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the site plan. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the BBDP with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

The BBDP shall require the Licensee to develop a campground facility on the southern portion of Big Bar Section C within five years of License issuance. The campground shall be development level "3" which is characterized by moderate site modification with design of improvements generally based on use of native materials. (FSM 2300, 2330) Primary development at Big Bar shall include, but not be limited to, approximately 15 to 20 universal campsites with parking spurs, picnic tables and fire rings, centrally located vault toilets, potable water, hardened access roads, xeric landscaping and meeting accessibility (ADA) requirements. The Licensee shall be responsible for all costs associated with the campground development.

The Licensee shall perform O&M at this facility as described in Condition No. 18 (See O&M Condition.)

Condition No. 14—Eagle Bar

Within three years of License issuance, the Licensee shall implement the site plan proposed in the draft Recreation Plan (FLA 2003), for Eagle Bar. Elements of the site plan include reconstructing the boat ramp, designating parking for boat ramp use and trailhead access, designating campsites with picnic shelters and fire rings, constructing a vault toilet, constructing a fishing pier using ADA guidelines and standards, and providing potable water.

The Licensee shall perform O&M at this facility as described in Condition No. 18 (See O&M Condition.)

Condition No. 15—Eckels Creek

Within three years of License issuance the Licensee shall implement the site plan proposed in the draft Recreation Plan (FLA 2003), for the Eckels Creek Dispersed Site. Designated sites shall be established to limit resource damage to the site, and shall be delineated using boulders and other natural features. The site shall be graveled and contain two to three single unit picnic/camp sites. Sites shall include one fire ring each (ADA) and one table each (ADA). A single-vault toilet shall be installed near the roadside that can be used by both overnight campers and by trail users parking to access Eckels Creek trail across the road.

The Licensee shall perform O&M at this facility as described in Condition No. 18 (See O&M Condition.)

Condition No. 16—Deep Creek Stairway

Within one year of License issuance, the USDA Forest Service shall complete a condition and safety inspection of Deep Creek Stairway/Trail #218. Upon completion of the safety inspection, the Licensee, USDA Forest Service and Idaho Department of Fish and Game shall coordinate and mutually agree upon measures to correct any deficiencies noted in the inspection. The Licensee shall implement the measures identified within two years of License issuance.

The Licensee, in coordination with the USDA Forest Service shall develop an O&M Plan and implementation schedule which provides for O&M and replacement as necessary at this facility. The Licensee shall not be required to assume the ownership of the Stairway/Trail Structure.

If repairing the Stairway/Trail appears to be economically unfeasible, other alternatives for access to Deep Creek will be explored with the Licensee, USDA Forest Service and Idaho Department of Fish and Game.

Condition No. 17—Parking Areas

Within two years of License issuance, the Licensee shall develop or improve and maintain parking and signing at four USDA Forest Service roadside parking areas along the Hells Canyon Reservoir. The parking areas are located adjacent to the paved Hells Canyon Road that connects Oxbow and Hells Canyon Dam. The four locations are Allison Creek, Kinney Creek, Eckels Creek, and Deep Creek. The improvement work includes developing surfaced parking lots large enough for two to four vehicles and providing information/interpretive signing.

The Licensee shall perform O&M at this facility as described in Condition No. 18 (See O&M Condition.)

Within five years of License issuance, the Licensee shall replace the toilet at Deep Creek.

Condition No. 18—Operations and Maintenance

For the term of the License, the Licensee shall perform the Operations and Maintenance necessary to meet USDA Forest Service Standards, Meaningful Measures as amended over the License term for Eagle Bar, Eckels, Big Bar, parking areas along Hells Canyon Reservoir, Black Point Viewpoint, and dispersed areas on NFS lands within the project boundary pursuant to the Recreation Plan.

Condition No. 19—Hells Canyon Reservoir Drawdown

For the term of the License, the Licensee shall manage reservoir levels to minimize impacts on recreation resources during the summer. Maximum draw down during the recreation season is presently limited to five feet from full pool elevation. If, based on operational modifications ordered by the Commission or system emergencies, the reservoir is drawn down for protracted periods below five feet from full pool elevation, the Licensee shall reconstruct or modify boat launching facilities to provide access to the reservoir.

Condition No. 20—Reservoir Trail Maintenance

Within one year of License issuance and over the remaining term of the License, the Licensee shall perform trail maintenance for the USDA Forest Service trails as shown in the table below.

USDA Forest Service Trails to be Maintained by Idaho Power

Trail Name	Beginning at	Ending at
Deep Creek Trail to Oxbow Creek (Trail # 219)	Eagle Bar	Deep Creek
Kinney Creek Trail (Trail # 221)	Road 545	Junction of Trail 222
Mid-Slope Trail (Trail # 222)	Junction of Trail 221	Eckels Creek
Eckels Creek Trail (Trail # 223)	Road 545	Junction of Trail 222
Allison Creek Trail (Trail # 514)	Road 545	Junction of Trail 222
Stud Creek Trail (Trail # 1781)	Hells Canyon Creek	Stud Creek
McGraw Creek Trail Loop (Trail #1879)	Junction of Trail #1890	Junction of Trails #1884
Bench Trail to McGraw Creek Trail Junction (Trail #1884)	Junction of Trail #1879	Milepost 2
HC Reservoir Trail to Leep Creek (Trail # 1890)	Copper Creek TH	Leep Creek

The Licensee shall maintain the trails according to Forest Service standards (Trail and Specification Handbook EM7720.103 specifications for trails) or as otherwise mutually agreed upon.

Within one year of License issuance, the License in coordination with the USDA Forest Service shall develop a plan that addresses the future management of the HC Reservoir Trail (Trail #1890) from Leep Creek mile 4.3 to its terminus mile 8.1.

Within five years of License issuance, the Licensee in coordination with the USDA Forest Service and the DOI Bureau of Land Management shall develop a plan that addresses the future management of the McGraw Creek trail (#1879A, 3.9 miles).

The HC Reservoir Trail and McGraw Creek plans shall be prepared in coordination with the USDA Forest Service and other appropriate entities. The Licensee shall include with the plans documentation of coordination, copies of comments and recommendations on the completed plans after they have been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the plans. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the plans with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

Condition No. 21—Hells Canyon Creek Launch Site and Reservoir Facilities

Within one year of License issuance, the Licensee shall prepare a plan for the USDA Forest Service site referred to as HC Creek Launch Site (HCCLS) and file the HCCLS Plan to the Commission for approval.

The HCCLS Plan shall be prepared in coordination with the USDA Forest Service. The Licensee shall include with the HCCLS Plan documentation of coordination, copies of comments and recommendations on the completed HCCLS Plan after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the HCCLS Plan. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the HCCLS Plan with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

The HCCLS Plan will address the items listed below:

1. Develop potable water and associated grey water disposal system at the Hells Canyon Creek Visitor Center if the proposed potable water/grey water disposal system is not developed at the Eagle Bar Site. The Licensee shall perform 100% of the O&M of these items as described in Condition No. 18 Operations and Maintenance.
2. The Licensee shall lead a cooperative effort with the USDA Forest Service and other partners to provide a sanitary cleaning system (SCAT) capable of cleaning portable human waste carry out systems within the Hells Canyon Reservoir area. The Licensee’s responsibility will consist of providing a location on or within their lands/parks for the device and annual O&M for these items for the term of the License.
3. Elements of the HCCLS Plan will address safety issues at the boat launch and may include modifying the existing ramp and/or evaluating the possibility of relocating it. The Licensee shall be responsible for costs associated with the boat launch enhancement and a schedule for implementation and maintenance.
4. The Licensee shall within one year of License issuance repair the footing on the ramp at the launch site.

5. Upon License issuance and for the remaining term of the License, the License shall maintain the existing level of Licensee staffing (as referenced in MOU No. 99-Mu-11061600-556 with Modification No. 001) at the Hells Canyon Creek Launch site and Visitor Center.
6. The Licensee shall be 100% responsible for the maintenance of the following items upon License issuance: the road to, parking areas, vault toilets, and ramps associated with the area know as the Hells Canyon Creek Launch for the life of the License.

Condition No. 22—Aesthetic Improvements to the Hells Canyon Dam Site and Recreation Portal

Within one year of License issuance, the Licensee shall, in coordination with the USDA Forest Service, develop an Aesthetic Improvement Plan (AIP) for enhancing the upper deck, and entrance and egress areas of Hells Canyon Dam that will be incorporated into the Scenery Management Plan and file the AIP with the Commission for approval. Alterations may include changes in fencing material, color of materials, screening of stop blocks, parking, signage, pedestrian walkways, interpretation, viewing areas and landscaping provided that such alterations are consistent with the FERC approved security plan for the Dam. A schedule for implementation, to be conducted by the Licensee, shall be included in the AIP.

Condition No. 23—There is no Condition No. 23

Condition No. 24—Aesthetics Resource Management

Within one year of License issuance, the Licensee shall, in coordination with the USDA Forest Service, prepare a Scenery Management Plan (SMP) for NFS lands within the Project boundary and adjacent to the Project boundary that are affected by the Project and file the SMP with the Commission for approval. The Licensee shall implement the SMP.

The Licensee shall include with the SMP documentation of coordination, copies of comments and recommendations on the completed plan after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are addressed by the SMP. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the SMP with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

The SMP shall include the following measures proposed by the Licensee in the FLA:

1. E.6.1.6 Existing Transmission Lines and Associated Service Roads.
2. E.6.4.3.1 Design Standards and Guidelines for Physical Structures.
3. E.6.4.3.2 Design Standards and Guidelines for Landscaping.
4. E.6.4.3.3 General Aesthetic Clean-Up and Implementation.
5. E.6.4.3.4 Replacement of Guardrails and Jersey Barriers.
6. E.6.4.3.5 Mitigation of Contrast from Project Facilities.
7. E.6.4.3.6 Enhancement of Others Facilities

Process for Modification of Visual Resources

A process for evaluating the licensee’s proposed modification to Project facilities and landscaping, in terms of their effect on visual resources, including consulting with agencies, will be developed through consultation with the USDA Forest Service. This SMP will consider compliance with the desired landscape character and scenic integrity level standards from all identified special places or key observation points from which the modifications can be seen as identified in Technical Report E.6.3. included in the FLA.

Condition No. 25—Cultural Resource Management

Within one year of License issuance, the Licensee shall, in coordination with the USDA Forest Service, Idaho SHPO, Oregon SHPO, Bureau of Land Management, and appropriate Native American Tribes, will finalize a Historic Properties Management Plan (HPMP) for cultural resources within the area of potential effect (APE) for the Project, which is defined as extending from the high water-mark line to 0.1 mile inland on the reservoirs within the Project boundaries and from the river shoreline to 100 meters inland on the free flowing section of the Snake River below Hells Canyon Dam to the confluence of the Salmon River, and file the HPMP with the Commission for approval.

The HPMP shall be prepared in coordination with the USDA Forest Service. The Licensee shall include with the HPMP documentation of coordination, copies of comments and recommendations on the completed HPMP after it has been prepared and provided to the USDA Forest Service, and specific descriptions of how the USDA Forest Service comments are accommodated by the HPMP. The Licensee shall allow a minimum of 60 days for the USDA Forest Service to comment and to make recommendations prior to filing the HPMP with the Commission for approval. If the Licensee does not adopt a recommendation, the filing shall include the Licensee's reasons, based on Project-specific information.

The HPMP will provide for the protection, management, and interpretation of historic properties within the HCC Project area and for the mitigation of Project-related impacts to historic properties.

The HPMP will include the following:

1. Provisions for an adaptive management strategy that will allow the HPMP to accommodate unforeseen challenges and changes in conditions that may affect historic properties. The HPMP will also include an evaluation and amendment process to insure that the document can be updated and revised as necessary to respond to changing technology and conditions, including changes in site eligibility as defined by regulation 36 C.F.R. 800 as amended.
2. Explanation of how consultation and the other requirements of 36 C.F.R. 800 as amended will be met.
3. Provisions for the evaluation of all future Project-related developments, including PM&E measures, for the compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA). The HPMP will provide a process to allow for revisions to the Project APE for future undertakings.
4. Provisions for a process for determining when and under what circumstances new survey, or resurvey of previously examined areas may be required. Recognizing the longevity of the license, the HPMP will provide for opportunities to conduct additional survey, if necessary, over the course of the license. Following the requirements of Section 106, the document will also provide guidelines for determining when archaeological inventories may be necessary on new Project lands added to the Project boundary.
5. Conduct additional inventories on newly exposed lands from shoreline erosion or increased reservoir draw down on NFS lands as circumstances allow or in cases where planned draw downs will occur over an extended period of time.
6. Provisions for the development of a detailed monitoring plan that will implement regular monitoring and assessment of all historic properties (cultural resources determined eligible

or potentially eligible for the NRHP) within the APE to monitor site condition and assess the possible need for the implementation of mitigation or protection measures on historic properties being adversely affected by Project operations. The monitoring program will commence within 1 year of approval of the HPMP, and will be the primary vehicle to collecting the additional data necessary to identify sites that may be adversely affected by Project operations, so that appropriate mitigation measures can be initiated.

7. Documentation shall, at a minimum, consist of a detailed description of the current site condition with accompanying photos and specific attention to determining adverse effects and possible needs for immediate protection or mitigation. If it is determined that the original site recordation is deficient, then the following elements will be added to the site monitoring protocol, as appropriate: mapping (GPS, hand drawn site map, clearly defined site boundaries), updating or completion of the appropriate SHPO form(s) and a detailed narrative describing the site, its contents and archaeological context.

8. The monitoring plan shall include a provision to use an established and recognized photographic protocol on some select rock art sites to be determined through coordination with the USDA Forest Service.

9. Provisions for the development of site specific treatment plans (treatment plans) and an implementation schedule for any sites that may need mitigation or treatment as a result of adverse effects from Project-related operations to sites on NFS lands within the APE. Treatment plans will be completed in consultation with the USDA Forest Service, appropriate agencies, Tribes and SHPOs for sites located on NFS lands within a mutually agreed upon timeframe. The treatment plans will employ archaeologically/scientifically sound methods of testing, oral histories, remote sensing, excavation, preservation, and stabilization. The treatment plans will emphasize site conservation and preservation oriented ethic that stress in-place protection and preservation over data recovery. Treatment plans will also provide for flexible mitigation alternatives that are responsive to the specific qualities for which a site is eligible, and which recognize the traditional archaeological data recovery may not always be the only or best mitigation alternative.

10. Make all collected data related to cultural resources on NFS lands available to the Payette and Wallowa-Whitman National Forests consistent with 36 C.F.R. 800 as amended, subject to provisions of any ARPA permit issued for study or inventory purposes.

11. Provisions for the establishment of a Cultural Resources Advisory Group (CRAG) that will provide an organized forum for continued consultation and coordination between the Licensee and agencies, Tribes and the SHPOs, in the implementation of the HPMP.

12. Provisions for the curation of any artifacts recovered during IPC-sponsored research conducted in conjunction with testing, mitigation, or treatment, in a facility that meets the requirements of 36 C.F.R. 79.

13. The revised HPMP will include all the provisions previously specified within the draft HPMP submitted as part of the Final License Application (Hells Canyon FLA Technical Report Appendix E.14-15), unless otherwise replaced or modified by the provisions listed above.

Condition No. 26—Project Boundary Modification

Within one year of License issuance, the Licensee shall provide the USDA Forest Service with a map and aerial photos depicting the approximate location of the project boundary together with Geographic Information System (GIS), compatible with USDA Forest Service GIS, shapefiles with Metadata for the project boundary on National Forest System lands. The project boundary GIS data will be positionally accurate to ±40 feet, in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale. At locations on National Forest System lands where the project boundary has been surveyed and monuments placed on the ground, monuments shall be logged using a Global Positioning System (GPS) with accuracies meeting National Standard for Spatial Data Accuracy (NSSDA) standards. This data shall be used to geo-reference the project boundary within the GIS

Condition No. 27—Reservation of Authority

The Licensee shall implement, upon order of the Commission, such additional measures as may be identified by the Secretary of Agriculture, pursuant to the authority provided in Section 4(e) of the Federal Power Act, as necessary to ensure the adequate protection and utilization of the public land reservations under the authority of the USDA Forest Service.

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Exhibit 1—Sandbar Inventory

River Mile	Bar Type		1964 (1000s ft^2)	1973 (1000s ft^2)	1982 (1000s ft^2)
246.91	CM	HCD-Launch	5		
246.9	CM	HCD-Launch	5		
246.9	CM	HCD-Launch	5		
245.8	CM	(Stud Ck)	15	5	
245.7	CM	Lamont Spr.	15		
245.3	CM	Square Beach	15	5	5
244.7	S	Brush Creek	25	15	15
244.6	CM		5	5	
244.2	CM	Fawn Bar	5		
244	CM		5	5	5
243.4	CM	Chimney Bar (Moose)	5		
243.3	R	Cactus Camp	15		
243.1	CM	Warm Springs	15		
242.91	CM		5		
242.9	R		5		
242.5(.6)	CM	(Daily Bar)	5	5	5
242.2 (1)	R	Battle Creek	15		
241.9 (.8)	CM	Sand Dunes	5		
241.6	CM	Birch Springs	0	5	
241.3	R	Wild Sheep	5		
241	CM		5		
240.7	CM		5	5	
240	S		5		
238.7	CM		5		
238.5	CM		5		
238.3	CM		5		
237	CM	Dry Gulch	5		
236.6	R	Hastings	5		
236.4	CM		5		
236.3	CF		5	5	
236(.2)	CM	Saddle Creek	5		
235.8	R		5		
235.5	CM		5		
235.1	CM	Bernard Creek	5	5	
234.02	CM		5		
234.01	CM		5		
234	CM		5		
231.3(.4)	CM	Rush Creek	5		
230.9	CM		5		
230.5	CM		5		
229.8	R	Johnson Bar Landing	35	25	15
229.7	CM		5		
229.3	CF		5		
229.2(.3)	S	Sheep Creek Cabin	5		
229.1	R		5		

River Mile	Bar Type		1964 (1000s ft^2)	1973 (1000s ft^2)	1982 (1000s ft^2)
229	S	Steep Creek	5	5	
228.8	R		15		
228.7	CF		15	5	5
228.6	CM	Yreka Bar	5		
228.5	CM	Upper Yreka Bar	5		
228.4	CM		5		
228.1	R	(Upper Sand Ck)	15		
228.01	CM		5		
228	CM		10		
227.9	CF	Sand Creek	5		
227.8	R		5		
227.6	CM		5	5	
227.5	R	Pine Bar	35	35	25
227.4	CF		5		
227.3	CF		5		
226.8	R		5		
226(.2)	R	(Lower Quartz Ck)	15	5	5
225.9	CM		5		
224.6	R	No Name	5		
224.4	R		15	5	
224.3	CM	Dry Gulch	5	5	
223.6(.8)	CM	Temperance	5		
223.1	CM		5		
223	CF		5		
222.9	CM	Hominy Bar 1	25		
222.8	CF	Hominy Bar 2	15		
222.4 (.6)	R	Salt Creek	35	35	35
222.2	CM	Two Corral	25		
222.1	R	(toad Bar)	15	5	
222	CM	Gracie Bar	5	5	
221.7	CM		5	5	5
221.6	S		5		
221.5(.4)	R	Half Moon Bar	25	5	
220.8	R	Kirkwood Ranch	35	25	25
220.6	CM		5		
220	CM	Yankee Bar	5	5	5
219.9(.6)	R	(Russell Bar)	25		
218.6	CM		15		
218.5	CM		5		
218.3	CM	Cat Gulch	5		
218.2	CM		5	5	
218.1	CM		5		
217.9	CM		5	5	
217.4 (.2)	CM	(Corral Ck)	15		
216.9(.7)	R	(Trail Ck)	25		
216.4	R	Fish Trap Bar	35	35	35
216.2	R	Upper Pittsburg	15		
215.7	R	Klopton Ck	5		

River Mile	Bar Type		1964 (1000s ft^2)	1973 (1000s ft^2)	1982 (1000s ft^2)
215.6	CM	Wilson Eddy/Tin Shed	15		
215.3	CM		15		
214.71(.8)	S	Pittsburg Admin	25	35	25
214.7	R	Pittsburg Admin	35	15	25
213.91	MC		5		
213.9	CM		15	15	5
213.2	CM		5		
213.11	CM		5		
213.1	CM		5		
212.6	CM		5	5	5
212.5	S		5		
212.4	R		15	5	
212.3	CM		5		
211.91	CM		5	5	5
211.9	CM	McCarty Creek	25	15	5
211.8	CF		5		
211.7	CM		5		
211.6	CM		5		
211.4	CF		5	5	5
211.2	CM		5	5	
210.7(.8)	CM	(Big Canyon)	5		
210.6(.4)	CM	(Lower Big Canyon)	5		
210.21	CF		5	5	
210.5	CM	(Elk Calf Camp)	5	5	
210.4(.0)	CM	Somers Range	5	5	5
210.3	CM		15	5	5
209.9	CM	Camp Creek	15	5	5
209.7	CM		5		
209.2	CF		5	5	5
208.3	R	Jones Creek	15	5	5
208.2	R	Lookout Creek	25		
206.9	CM		5	5	
206.8	CM		5	5	
205.9	CM		5	5	
205.51	CF		5	5	
205.5	CM		5	5	
205.3	R		15		
204.8	CF		5	5	
204.6	CM		5		
204.5	CM	Bob Creek	5	5	5
203.4	CF		15		
203.1	CM		5		
202.81	R		5		
202.41	CM		5	5	
201.9	S	Bar Creek	15	5	5
200.7	CM		5		
200.1	CM		5	5	5
199.5	CF		5		

River Mile	Bar Type		1964 (1000s ft^2)	1973 (1000s ft^2)	1982 (1000s ft^2)
199.2	CM		5		
199.1	CF		5		
199	S	Deep Creek Camp	5	5	5
198.5(.4)	CM	Robinson Gulch	5	5	5
198.3(.1)	CF	Dug Creek	15	5	
197.7	CF		5		
197.4	R		15		5
194.9	CM		5		
194.1	CM		5		
194	CM		5	5	5
193.8(.6)	R	(Mary Camp)	25	15	5
192.7	CM		5		
192.4	CF	China Bar	15	15	15
192.2	CM		5	5	5
192.1	CM		5	5	5
190.9	CM		35	25	15
190.3	CM		5		
190.2	CM		5		
189.6	CM		5	5	5
189.2	CF		5		
188.7	CM		5		
188.5	CF		5	5	5
188.4	CF		5		

Private Land on Idaho Side of River

River Mile	Bar Type		1964 (1000s ft^2)	1973 (1000s ft^2)	1982 (1000s ft^2)
218.8	CM	Kirby Creek Lodge	35	35	35
207.8	CM		5	5	
207.5	S	Marlboro B	5	5	5
207.4	CF		5		
207.3	S		5	5	5
206.7	S		5	5	5
206.3(.1)	R	High Range	25		
206	R		5	5	
205.8	CF	Getta Creek	5	5	5
205.7	R		5	5	
205.1(.0)	CF	(Ragtown Bar)	25	15	15
204.81	CM		35	35	
204.4	CF		5		
204.2(.0)	S	Cat Ck	15	15	
203.9	S		15	5	5
203.5	CM		5	5	5
202.9	CM	Wolf Creek Camp	5		

River Mile	Bar Type		1964 (1000s ft^2)	1973 (1000s ft^2)	1982 (1000s ft^2)
202.8	S		5	5	5
202.5	CM		5	5	5
202.4	CM		5	5	
201.61	CM		5		
201.6	CM		5		
201.5	R		15	5	5
201.2	CM	(Hitchcock Ranch)	35	25	25
201.1	CM		15	15	5
201	R	(Hitchcock Ranch)	15	5	5
200.9	R	Dry Cr Camp	15		
200.3	CM		5	5	5
199.4	CF		5		
199.3	CF		5		
199.21	CM	Deep Creek	5	5	
199.13	CF		5		
199.12	CF		5		
198.7	CM		15	5	
197.3	CM		5		
195.3	CM	Warm Springs Rapids	15	15	15
195	CM		5	5	5
194.7	CM		5		
194.31	CM		5		
194.3	CM		5		
194.2	CM		5		
194.11	CM		5	5	5
194.01	CM		5	5	5
193.5	CM		5	5	
193.3	CM		5	5	
192.21	CM		5	5	
190.8	CF		5	5	
190	CM		5	5	5
189.8	CM		5		
189.7	CM		5		
189.3	CM		5	5	5
188.6	CM		5		
188.4	CF				
188.3	CM	Salmon Mouth			

Exhibit 2—Escalation of Costs

Unless otherwise indicated, all costs or payment amounts specified in dollars shall be deemed to be stated as of the year 2006, and IPC shall escalate such sums as of January 1 of each following year (starting in January 2007) according to the following formula:

$$AD = D \times \left(\frac{NGDP}{IGDP}\right)$$

WHERE:

AD	=	Adjusted dollar amount as of January 1 of the year in which the adjustment is made.
D	=	Dollar amount prior to adjustment.
IGDP	=	GDP-IPD for the third quarter of the year before the previous adjustment date (or, in the case of the first adjustment, the third quarter of the year before the Effective Date).
NGDP	=	GDP-IPD for the third quarter of the year before the adjustment date.
"GDP-IPD"	=	the value published for the Gross Domestic Product Implicit Price Deflator by the U.S. Department of Commerce, Bureau of Economic Analysis in the publication *Survey of Current Business*, Table 7.1 (being on the basis of 1987 = 100), in the third month following the end of the applicable quarter. If that index ceases to be published, any reasonably equivalent index published by the Bureau of Economic Analysis may be substituted by the Parties. If the base year for GDP-IPD is changed or if publication of the index is discontinued, the Parties shall promptly make adjustments or, if necessary, select an appropriate alternative index to achieve the same economic effect.

INTERIOR SECTION 4(E) CONDITIONS

The Department of the Interior (Department) has reviewed the notice of application Ready for Environmental Analysis and Soliciting Comments, Recommendations, Terms and Conditions, and Prescriptions for the Hells Canyon Hydroelectric Project, FERC Project No. 1971-079, located on the Snake River in Wallowa and Baker Counties, Oregon, and Adams and Washington Counties, Idaho. Because a Draft Environmental Impact Statement (DEIS) or Draft Environmental Assessment (DEA) has not yet been issued by the Federal Energy Regulatory Commission (Commission), this response contains preliminary comments, recommendations, terms and conditions, and prescriptions only. The Department reserves the right to amend these preliminary comments, recommendations, terms and conditions, and prescriptions, if warranted, based on the results of new information and conclusions developed during the Commission's environmental analysis.

The preliminary comments, recommendations, terms and conditions, and prescriptions herein are provided in accordance with the provisions of the Fish and Wildlife Coordination Act (16 U.S.C. §661 *et seq.*), the Federal Power Act (FPA), (16 U.S.C. § 791 *et seq.*), the Endangered Species Act (ESA), (16 U.S.C. §1531 *et seq.*), the Federal Land Management and Policy Act (FLPMA), (43 U.S.C. § 1701 *et seq.*), and the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq.*). The Department does not intend to object to the issuance of a new license for the Hells Canyon Hydroelectric Project (Project), provided our comments, recommendations, terms and conditions, and prescriptions are incorporated into the new license.

Modified Condition No. 1—Activities on or Affecting Bureau of Land Management Administered Lands

(A) The Licensee shall consult with the Bureau of Land Management (BLM) to identify and resolve any potential conflicts with BLM policy and direction prior to initiating activities on BLM-administered lands that is beyond the scope of the Project license or for which the Licensee has not otherwise obtained BLM approval.

(B) The Licensee shall cooperate with the BLM to obtain the appropriate rights-of- way or permits for use or access to BLM-administered lands prior to engaging in any activity that has the potential to affect other federally authorized activities on those lands.

(C) The Licensee shall receive written approval from BLM prior to changing the location of any Project feature or facility located on BLM-administered lands. The Licensee shall also receive written approval for any actions which are inconsistent with activities authorizing use or occupancy of BLM-administered lands according the new license. Following BLM approval and at least 90 days prior to any change or departure, the Licensee shall file a report with the Federal Energy Regulatory Commission (Commission) and with the BLM, describing the change, reasons for the change, and demonstrating BLM approval of the change.

(D) The Licensee shall prepare site-specific plans for approval by the BLM for any ground disturbing activities on BLM-administered lands required by the license, including activities outlined in BLM resource management plans (RMP). RMPs prepared subsequent to issuance of the license shall be developed in reference to license articles that may be affected as a consequence of RMP implementation. The Licensee's site-specific plans shall include:

i. a map depicting the location of the proposed activity;

ii. a description of the land classification, designation, current management, applicable standards and guidelines, and current monitoring for the area of proposed activity;

iii. a description of alternative locations, designs, and mitigations for the proposed activity; and

iv. data from surveys, biological evaluations, or consultation required by regulation for ground- or habitat-disturbing activity on BLM-administered lands available at the time the plan is prepared;

(1) When surveys indicate that activities may affect an Endangered Species Act (ESA) listed or proposed listed species or their habitat, the Licensee shall evaluate the impacts of the action on the species or habitat and submit this evaluation to the BLM.

(2) When surveys indicate an activity may affect a BLM sensitive species or their habitat, the Licensee shall evaluate the impact of the action and submit conclusions to the BLM for review and approval. BLM reserves the authority to require mitigation for impacts to BLM sensitive species or their habitat.

(E) The Licensee shall file a Safety During Construction Plan with the Commission 60 days prior to initiating any ground-disturbing activity on BLM-administered lands. This plan will identify potential hazard areas s and measures to protect public safety, particularly for construction activities near public roads, trails, recreation sites, and BLM-administered facilities.

The Licensee shall perform daily (or according to a schedule otherwise agreed by the BLM) inspections of Licensee's construction operations on BLM-administered lands while construction is in progress. The Licensee shall document these inspections and provide documentation to the BLM on a schedule agreed by the Licensee and BLM. Inspections must evaluate fire plan compliance, public safety, and environmental protection. The Licensee shall act immediately to address any necessary corrections identified by BLM.

(F) The Licensee shall consult with BLM to prepare a Spoils Disposal Plan prior to initiating any ground disturbing activity on BLM-administered lands. Upon BLM approval, the plan shall be filed with the Commission. The plan shall address disposal and/or storage of waste soil and/or rock materials (spoils) generated by road maintenance, slope failures, and construction projects. The plan shall include provisions for:

i. identifying and characterizing the nature of the spoils in accordance with applicable BLM regulations;

ii. identifying sites for the disposal and/or storage of spoils to prevent surface or groundwater contamination; and

iii. developing and implementing stabilization, slope reconfiguration, erosion control, reclamation, and rehabilitation measures.

(G) The Licensee shall file a Hazardous Substances Plan for oil and hazardous substance storage, spill prevention, and clean up with the Commission prior to initiating activities on or that may affect BLM-administered lands adjacent to the Project. At least 90 days prior to submission to the Commission, the Licensee shall provide a copy of the plan to the BLM for its review and approval. At a minimum, the plan shall:

i. outline procedures for reporting and responding to releases of hazardous substances, including names and phone numbers of all emergency response personnel and their assigned responsibilities; and

ii. identify and locate a cache of hazardous spill cleanup equipment sufficient to contain any spill from the Project.

iii. include procedures for notifying the BLM as to the nature, time, date, location, and action taken for any spill affecting BLM administered lands. On a semi-annual basis, the Licensee shall provide the BLM information on the location of spill cleanup equipment on BLM-administered lands and the location, type, and quantity of oil and hazardous substances stored in the Project area on BLM-administered lands. The Licensee shall inform BLM immediately as to the nature, time, date, location and action taken for any spill affecting BLM administered lands.

(H) The Licensee shall avoid disturbing all public land survey monuments and BLM boundary markers. In the event a marker or monument is destroyed by action or omission oversight of the Licensee, depending on the type of monument destroyed, the Licensee shall reestablish the monument according to (1) procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) specifications of the County Surveyor, and/or (3) BLM specifications.. The Licensee shall ensure that official survey records affected are amended as required by law.

(I) The Licensee shall maintain Project-related improvements and facilities on BLM-administered lands to BLM standards of repair, orderliness, neatness, sanitation, and safety. The Licensee shall comply with all applicable Federal, State, and local laws, regulations, including but not limited to, the Federal Water Pollution Control Act, 33 U.S.C. § 1251 *et seq.*, the Resources Conservation and Recovery Act, 42 U.S.C. § 6901 *et seq.*, the Comprehensive Environmental Response, Control, and Liability Act, 42 U.S.C. § 9601 *et seq.*, and other relevant environmental laws, public health and safety laws, and other laws relating to the sighting, construction, operation, maintenance of any facility, improvement, or equipment.

(J) The Licensee shall restore BLM-administered lands to a condition satisfactory to the BLM prior to surrender of the Project license or abandonment of Project facilities, consistent with the Federal Power Act and Commission regulations. At least one year prior to filing an application for license surrender, the Licensee shall file a restoration plan approved by the BLM with the Commission. The restoration plan shall identify any capital improvements that will be removed, restoration measures, time frames, and costs. In addition, the Licensee shall commission an audit to assist the BLM in determining whether the Licensee has the financial ability to fund the decommissioning and restoration work specified in the plan.

As a condition of any transfer or surrender of the license or sale of the Project, the Licensee shall ensure that the cost of surrender and restoration will be borne by the Licensee or transferee. Any license amendment that authorizes use of BLM-administered lands shall be subject to such conditions the BLM deems necessary to protect and utilize affected BLM reservations.

(K) The Licensee shall indemnify, defend, and hold the United States harmless for any costs, damages, claims, liabilities, and judgments arising from past, present, and future action or oversight of the Licensee relating to use and/or occupancy of BLM-administered lands necessary for Project maintenance and operation and so authorized by the license. The indemnification and hold harmless provision applies to any action or oversight of the Licensee, heirs, assigns, agents, employees, affiliates, subsidiaries, fiduciaries, contractors, or lessees authorized to use or occupy Project lands and/or facilities that result in: (1) violation of law and regulation, including but not limited to the Comprehensive Environmental Response Compensation and Liability Act, Resource Conservation and Recover Act, Oil Pollution Act, Clean Water Act, and the Clean Air Act; (2) judgments, claims, demands, penalties, or fees assessed against the United States; (3) costs, expenses, and damages incurred by the United States; or (4) the release or potential release of any solid waste, hazardous substances, pollutants, or contaminants in any form in the environment.

Modified Condition No. 2—Consultation with the Bureau of Land Management

Commencing five years after a new license is issued and unless otherwise provided, the Licensee shall prepare and submit an annual, written report summarizing progress on implementing articles of the license that affect recreation, cultural, aquatic, and terrestrial resources administered by BLM on BLM lands within and adjacent to the Project boundary. The Licensee shall provide the report to BLM allowing a minimum of 60 days for review and to make recommendations prior to filing the report with the Commission. If the Licensee does not agree with or adopt a recommendation and does not negotiate a mutually agreeable alternative, the filing shall document the Licensee's rationale. The BLM reserves the right, after notice, comment and administrative review, to require changes to Project operation through revision of Mandatory Conditions.

Modified Condition No. 3—Travel and Access Management

Within three years of the issuance of the new license or on an alternate schedule agreed to by BLM and the Licensee, the Licensee in consultation with the BLM shall develop and file with the Federal Energy Regulatory Commission (Commission) an integrated Travel and Access Management Plan for Project lands and for lands administered by the Bureau of Land Management (BLM) affected by the Project. The Travel and Access Management Plan (TAMP) shall be incorporated into the Comprehensive Recreation Management Plan (CRMP) and coordinated with the Integrated Wildlife Habitat Program (IWHP) and Wildlife Mitigation and Management Plan (WMMP). The TAMP is intended to be a planning document to increase the effectiveness and efficiency of efforts to manage, maintain, and enhance travel and access to not only Project lands but also lands within the vicinity of the Project and assist in the assessment of the Licensee's role and responsibilities with regard to travel and access to the Project. The TAMP is also intended to foster coordination, cooperation and integration of efforts between the Licensee and the various federal, state, and local authorities with jurisdiction or authority over roads, trails or lands within the Hells Canyon area.

The TAMP shall be developed collaboratively in consultation with the BLM and other relevant state and federal agencies, including the U.S. Forest Service, Idaho Department of Parks and Recreation, the Oregon Department of Parks and Recreation, and members of the Recreation Resource Work Group (RRWG).

Documentation and a description of the consultation process including responses to any written comments received during the consultation process will be included as an appendix to the TAMP. The TAMP shall be based on the best data and information available and is intended to be an adaptive plan subject to amendment and revision during the term of the new license.

The purpose of the Travel and Access Management Plan is to provide transportation maintenance and management, provide for public safety, improve habitat effectiveness on the winter range, protect sensitive wildlife and plant populations from human interference during critical periods of the year, manage vehicle access and numbers consistent with resource goals, coordinate off-highway vehicle (OHV) management between Federal land use agencies and IPC, manage noxious weeds, improve aquatic connectivity, and protect cultural resources. The TAMP, at a minimum, shall include provisions to:

(i) Identify management goals and objectives consistent with BLM resource protection for BLM-administered lands affected by the Project;

(ii) Identify Licensee responsibilities for road management and maintenance for roads which it has assumed responsibility, and for roads on BLM-administered lands affected by the

Project as determined by the data and factual information developed during the consultation and planning process. At a minimum, the following roads will be addressed in the TAMP:

Road Name	State	Holder	Location	Est. Road Miles
Snake River Road	OR	Baker County	Huntington (RM 328*) to Swedes (RM 304) then inland to Richland	41
Homestead Road	OR	Baker County and Wallow County	Oxbow (RM 271) to Copper Creek (RM 261)	10
Oxbow Road	OR	Idaho Power Company	Oxbow (RM 271) to Oxbow bridge (RM 284)	13
Hells Canyon road	ID	Idaho Power Company	Oxbow (RM 271) to TNTY** (RM 267)	4
Brownlee Road	ID	Idaho State	Oxbow bridge (RM 284) to NETA** (RM 286)	2
Olds Ferry Road and beyond	ID	Weiser Road District	Weiser (RM 351) to ROCK** (RM 320)	31
Total				

* River Mile

** 4-digit code of most distant BLM dispersed site

With regard to the Olds Ferry Road, for the 11-mile section of the road between the end of the existing pavement and Steck Recreation Site, the TAMP shall consider the need for an upgrade of that road to AASHTO (American Association of State Highway and Transportation Officials) standard M147-65, along with appropriate maintenance to preserve the improved road surface. This evaluation shall include a consideration of the appropriateness of Licensee cooperation among others, in any funding for a road upgrade and maintenance for the license term. The evaluation shall also include the identification and potential acquisition of any grants available for a road upgrade and maintenance for the license term.

(iii) Within five years of the Commission's approval of the TAMP or on an alternate schedule agreed to by the BLM , the Licensee shall replace culverts to provide aquatic connectivity and re-connect riparian function and structure on all class 1 and 2 streams where shotgun culverts are located along: a) Hells Canyon Road: 14 culverts (13 full barriers and 1 partial) b) Brownlee Road: 4 culverts (4 full barriers).

(iv) Following the Commission's approval of the TAMP, the Licensee shall begin implementation of the provisions of the TAMP relating to the non-motorized use of trails connecting recreation sites along the Oregon side of Hells Canyon Reservoir. Implementation shall follow a schedule identified in the TAMP. As part of the TAMP, the Licensee shall also conduct a feasibility study relative to the development of a trail system along the Oregon side of the Hells Canyon, Brownlee, and Oxbow reservoirs connecting Farewell Bend State Park to Hells Canyon National Recreation Area,

(v) Within five years of the Commission's approval of the TAMP, the Licensee shall have evaluated Best Management Practices (BMP) and implemented measures, on those roads for which the licensee is responsible under the TAMP, to:

a) Maintain and improve roads to reduce potential for road failure as a consequence of reservoir fluctuation and/or weather;

b) Mitigate for soil erosion;

c Monitor road use and increased/decreased use of roads for recreation access;

d) Manage OHV use on and off roads within the Project and adjacent BLM-administered lands affected by the project. The Licensee shall assume responsibility for a proportion of the costs, as provided for in the TAMP, to implement and administer mitigation measures for impacts from OHV users on adjacent BLM-administered lands affected by OHV use as a result of the Project. Costs associated with these measures may include interpretive, directional and regulatory signs, road and trail closures (including fencing, berms, and rehabilitation of unauthorized routes), trail maintenance, use supervision and enforcement;

e) Construct barriers, guardrails and other safety measures that are aesthetically pleasing;

f) Identify and implement seasonal road closures as necessary to protect wildlife and decrease big game/vehicle interactions;

g) Identify and implement road closures as needed;

h) Prevent sidecasting; and

i) Identify and implement BMPs for maintenance necessary to protect cultural resources, control the spread of noxious weeds, protect sensitive plants and threatened and endangered species, minimize soil erosion, and protect aquatic resources;

(vi) Within five years of the Commission's approval of the TAMP, the Licensee shall develop a road atlas for all access and service roads in the rim-to-rim study area using a geographic information system. The intent is to provide spatially based information regarding roads and sensitive resources. The atlas should provide spatial and temporal information regarding existing and proposed road maintenance activities and the potential to impact at-risk resources and further reduce conflicts between road-related activities and sensitive resources. The GIS database should be accessible to all parties who administer resources affected by the action. The plan shall accommodate unrestricted access by the BLM for purposes necessary to manage and administer BLM lands and resources that are impacted by Project operations. The plan shall include provisions as necessary to restrict vehicular access to Project roads in locations and at times when access could cause damage to BLM-administered lands and resources. For example, access restrictions may be necessary during times of the year in order to protect nesting habitat for listed or sensitive wildlife species.

The Licensee shall consult the BLM for a list of times and locations when road access restrictions should be in effect. The plan shall include provisions for the maintenance of crossings and rights-of-way (ROW) required by and consistent with permit requirements for power lines, penstocks, ditches, and pipelines. The Licensee shall consult with the BLM prior to erecting any signs on BLM-administered lands that are necessary for operation or maintenance of the Project or related Licensee facilities. The Licensee must obtain approval from the BLM specific to the location, design, size, color, and content of signs. The Licensee shall be responsible for maintaining all Licensee erected signs to neat and presentable standards.

The TAMP shall be prepared in coordination with the BLM and the other parties described above. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan.

The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on Project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 4—Law Enforcement and Emergency Services

Within five years of license issuance or on an alternate schedule agreed to by BLM and the Licensee, the Licensee shall develop, and thereafter will begin implementation of, a Law Enforcement and Emergency Services Plan (LEESP) that includes provision for coordination and cooperative funding of law enforcement and emergency services personnel with jurisdiction within the Hells Canyon Hydroelectric Project (Project). The LEESP is intended to be a planning document to increase the effectiveness and efficiency of law enforcement and response for medical and other emergencies and foster coordination and cooperation between the Licensee and the various federal, state and local authorities with jurisdiction over law enforcement and emergency services in the Hells Canyon area.

The LEESP shall be developed collaboratively in consultation with the BLM and other relevant state, federal and local authorities, including the U.S. Forest Service, relevant Idaho and Oregon departments of law enforcement and emergency services, relevant local and county governments, and members of the Recreation Resource Work Group (RRWG). Documentation and a description of the consultation process including responses to any written comments received during the consultation process will be included as an appendix to the LEESP. The LEESP shall be based on the best data and information available and is intended to be an adaptive plan subject to amendment and revision during the term of the new license.

The LEESP may include provisions for law enforcement presence, other types of public contact personnel presence, enhanced emergency communication and response procedures, public safety and security, protection measures for natural resources, recreation resources, and heritage resources within the Project generally. The LEESP shall also address medical response measures, including the need for, number, placement, and time availability of quick response units and certified "first responders." At a minimum, the LEESP shall provide for three strategically placed certified "first responders" and associated quick response units during all high use periods. For the purposes of the LEESP, "first responders" shall mean persons who have completed sufficient emergency training (approximately 40 hours of certified instruction under applicable Oregon and Idaho standards) to provide stabilization and evaluation in an emergency situation; and "quick response units" shall mean a first responder along with some basic emergency equipment.

Licensee shall develop and implement the original LEESP and subsequent revisions as provided for in the LEESP.

The LEESP should include provisions to coordinate with the local counties and the Bureau of Land Management (BLM) to assess law enforcement needs and establish triggers to determine when and/or if additional law enforcement personnel are necessary to patrol BLM-administered lands that are impacted by the Project. This evaluation should include an assessment of the need for additional federal law enforcement. If additional law enforcement on BLM-administered lands is necessary over the period of the new license as a result of the operation, maintenance or use of the project, the LEESP shall contain provisions to assure adequate law enforcement, including funding for additional personnel (county, state, or federal) to the BLM and other law enforcement jurisdictions.

The LEESP shall include provisions for coordination with the BLM to evaluate the need for enhanced fire protection on IPC lands and BLM-administered lands affected by the project, including monitoring, evaluation, and appropriate management changes necessary to prevent recurring human-caused fires that affect BLM-administered lands. If monitoring demonstrates an increased need for fire prevention, detection, and suppression as a result of licensee activities in connection with the operation and maintenance of the Project, the LEESP shall contain provisions for 100% of the costs of these activities to be funded by the Licensee. Licensee shall not be responsible for fires caused by third parties regardless of whether such fires originate on or within the project.

The Licensee shall continue to implement actions necessary for the safe and legal use and access of Project reservoirs and facilities according Protection, Mitigation, and Enhancement Measure (PM&E) 5.4.3.1.3 on p. 283 and PM&E 5.4.4.1.4 on p. 290 in the Technical Report, Appendix E, of the Final License Application dated July 2003 (FLA).

The Licensee shall implement law enforcement provisions of the Baker County Settlement Agreement dated October 3, 2003.

The LEESP shall be prepared in coordination with the BLM and the other parties described above. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on Project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 5—Historic Properties Management Plan

(A) Within one year of license issuance, the Licensee shall file a revised final Historic Properties Management Plan (HPMP) with the Federal Energy Regulatory Commission (Commission). The plan shall be revised in consultation with the Bureau of Land Management (BLM), U.S. Forest Service, Oregon and Idaho State Historic Preservation Offices (SHPO) and Tribal governments. A draft of the revised plan shall be submitted to the BLM, providing for review and comment before completion of the final plan for submission to the Commission. As new historic properties are identified or additional Project effects are documented, site-specific monitoring, protection or mitigation measures shall be incorporated into HPMP updates, and subject to BLM review and comment.

The Licensee shall include with the HPMP submitted to the Commission documentation of consultation and copies of comments and recommendations on the HPMP. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the HPMP with the Commission for approval. The HPMP submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by the BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final HPMP. The Licensee shall implement the HPMP as approved by the Commission.

(B) The Licensee shall prepare and submit annual reports to BLM describing its activities involving BLM-administered cultural resources.

(C) The Licensee shall conduct periodic reviews of the HPMP focusing on the degree to which protection and mitigation measures are contributing to cultural resource maintenance and protection on BLM administered lands. The review shall include consultation with and comments from signatories to the Programmatic Agreement. A formal report of the review shall be prepared by Licensee and submitted to the BLM and Commission.

(D) In addition to following the Guidelines for an HPMP as described by the Commission and Advisory Council on Historic Preservation (ACHP), the revised HPMP will provide for the following:

i. Development of site-specific plans for evaluating eligibility, monitoring, protection and mitigation of historic properties on BLM land in consultation with and subject to review and approval of the BLM. Plans shall be submitted to the Commission before implementation. The following plans and actions shall be included:

1. Determinations of National Register Eligibility

During the license term, Licensee shall complete investigations necessary to determine eligibility for cultural resource properties on BLM-administered lands. Evaluations shall be completed within three years of discovery of any newly identified properties. Evaluation work plans shall be developed in consultation with BLM, SHPOs and Tribes, allowing at least 60 days for review and comment on proposed work plans. Final evaluation work plans shall be subject to prior BLM and SHPO approval.

Within five years of license issuance, Licensee shall complete evaluations of the National Register eligibility for Section 106 purposes for specific BLM heritage properties documented at the time of License issuance. These include the following sites: 35 BA 894, BK 489 (HC-6). An eligibility evaluation report for each site shall be submitted to BLM, Tribes and SHPO, allowing at least 60 days for review and comment before completion of the final report. Eligibility determinations shall be subject to the approval of BLM and the SHPO, prior to submission to the Commission. In addition, the Licensee shall endeavor to relocate, evaluate for significance and record the following sites in Idaho: 19N4W17/01; and 10WN557.

2. Site Monitoring

Within two years of issuance of a new project license, Licensee shall develop and submit a site monitoring program with data collection methods, timing, priorities and schedules for eligible and potentially eligible sites affected by the Project on BLM administered lands. The program will be developed in consultation with BLM and SHPOs, and subject to a minimum of 60 day review and comment, before submission of the final for approval by the BLM and SHPO. Methods and data collected for the initial monitoring program shall be standardized and quantifiable so as to provide adequate data for comparison of changes to site content, condition and impacts. At a minimum, documentation shall map site boundaries; update site records; provide a detailed description of the site, describe observed impacts; and provide recommendations for site protection or mitigation of any adverse effects. The monitoring protocol should describe how effects discovered during monitoring will be mitigated. Schedules, priorities and the list of sites identified for subsequent monitoring cycles will be adjusted based on initial results, and shall be prepared by Licensee in consultation with and subject to the approval of

BLM. Licensee shall update the monitoring program to incorporate new historic properties on BLM administered lands as they are identified. Monitoring reports and updated site records shall be provided to BLM at the end of each calendar year. The Licensee shall include the following known sites in the initial monitoring cycle: 35 BA 893; IPCBD 97-02; IPCBD 97-03; IPCBD 00-70; IPCBD 00-74; IPCBD 00-75; 10 WN 451, 10 AM 516, IPCBD 97-15, IPCBD 00-52, IPCBD 00-53, IPCBD 00-54, and IPCBD 00-61.

3. Site Protection and Stabilization

The Licensee shall prepare and implement site-specific plans for protection or stabilization of known or newly identified historic properties (including traditional cultural properties) on BLM land that are affected by Project operations. The Licensee shall develop the treatment plans in consultation with BLM, SHPOs, and Tribes, allowing a minimum of 60 days for review and comment on a draft prior to development of final plans. Plans shall be subject to BLM and SHPO approval.

Plans shall a) assess need for, feasibility of, and alternative methods for protection, stabilization or restoration of affected, eligible properties, b) identify treatment objectives, priorities, and implementation schedule and c) be responsive to the criteria under which a site is considered eligible for the National Register. The Licensee shall maintain the site protection measures until the treatment has achieved objectives and has been assessed as no longer needed in consultation with BLM and SHPO.

If monitoring results or condition assessments indicate that protection measures are needed, the Licensee shall prepare site-specific feasibility plans for protection or stabilization for six sites on BLM administered lands. Licensee shall complete the protection or stabilization measures, if feasible, for the following sites: 10WN 451, IPCBD 97-15, IPCBD 00-52; IPCBD 00-53, IPCBD 00-54, and IPCBD 00-61. Licensee shall conduct post treatment efficacy monitoring and provide a report of results to the BLM.

4. Data Recovery

When in-place protection is not technically feasible, the Licensee shall develop and implement plans to recover data from affected eligible historic properties on BLM administered lands impacted by the Project. Plans shall be developed and implemented in consultation with the Advisory Council on Historic Preservation (ACHP) as necessary, BLM, SHPOs, and Tribes, allowing a minimum of 60 days for review and comment on proposed plans.

Within five years following issuance of a new project License, the Licensee shall prepare plans to stabilize or recover data from IPCBD 97-03, and to recover data from IPCBD 00-75. Data recovery plans shall be responsive to the criteria under which the site is considered eligible to the National Register. Licensee shall assess protection alternatives and feasibility for stabilization prior to implementing data recovery at IPCBD 97-03. The Licensee shall implement the stabilization, if feasible, and/or data recovery plans for IPCBD 97-03 within ten years of issuance of the project license.

ii. Curation:

The Licensee shall arrange and fund long term curation, at a repository meeting federal curation standards, for collections and documentation resulting from Licensee's studies of BLM administered resources in the APE. The Licensee shall comply with the curation standards and requirements established by 36 C.F.R. 79, the curation repository and the Oregon and Idaho SHPOs.

iii. Plan for updated inventories within the APE; including:

If, over the period of the License, flow management or Project operations result in newly exposed, previously unsurveyed lands with potential for discoverable sites in the project APE, the Licensee shall inventory BLM administered lands and provide a report to BLM on known and newly identified sites.

The Licensee shall ensure that all surveys and documentation meet federal and state agency requirements, and shall consult with the BLM on the design of any new field inventories on BLM administered lands. The Licensee shall provide a minimum of 60 days for BLM review and comment on draft survey reports and site forms for BLM administered land. Final reports shall be subject to BLM approval.

iv. Interpretation and Education Plan

Licensee shall consult with BLM, SHPO and Tribes on the development and implementation of any cultural Interpretive and Educational plan(s) proposed by Licensee on BLM administered lands' in the APE. Interpretative facilities or protection signage proposed on BLM lands shall be subject to prior BLM approval.

v. Prior to requesting BLM approval on any plan or project which would potentially affect Native American historic or prehistoric properties, sacred sites, or properties of traditional cultural and religious importance on BLM administered land, the Licensee shall provide a minimum of 60 days for BLM to consult with affected Tribes.

vi. The Licensee shall make records available to BLM of cultural resource data gathered by Licensee for inventory, evaluation, monitoring, or site mitigation on BLM administered land.

vii. The Licensee should document procedures for maintaining confidentiality and security of sensitive site data and records protected under the ARPA and NHPA;

viii. The Licensee should outline procedures for protecting historic properties during emergency undertakings; including how emergency undertakings will be defined, and how the BLM will be notified and consulted when BLM lands are involved.

ix. The Licensee shall immediately notify BLM if any human remains, funerary items, sacred objects or objects of cultural patrimony, as defined in the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered on BLM administered land within the APE and Project. Discovery and stop work requirements shall be described, in accordance with 43 C.F.R.10, for inadvertent discoveries of Native American human remains and other items subject to NAGPRA on federal lands.

x. The Licensee shall immediately notify BLM of any discovery of previously unidentified cultural resources encountered during Licensee Project work on BLM lands.

Modified Condition No. 6—Comprehensive Recreation Management Plan (CRMP)

Within one year of license issuance, the Licensee shall prepare a Comprehensive Recreation Management Plan (CRMP) for the Project. The CRMP shall include but not be limited to provisions for:

1. Developing and implementing the recreation conditions;
2. Consultation with the Recreation Resource Work Group (RRWG), which may include but will not be limited to: U.S. Forest Service (USFS), BLM, Idaho Department of Parks and Recreation, Idaho Department of Fish and Game, Oregon Department of Fish and Wildlife, Oregon Parks and Recreation Department, and the Oregon and Idaho counties around the Hells Canyon Complex.
3. A decision making structure that involves all RRWG participants;
4. Implementing provisions of the Project CRMP according to the Americans with Disabilities Act;
5. Developing a framework for monitoring that incorporates a feedback loop and trigger points for adaptive management;
6. Monitoring recreation use and preferences. Monitoring methodology will be coordinated with the BLM to ensure that the level of detail and applicability of information is consistent with methodology identified in item 8 below.
7. Protocols for consultation with agencies;
8. Changes in recreation impacts at dispersed recreation sites will be monitored by periodic aerial photography. This effort will be supplemented by annual on-site examinations of the sites by litter and sanitation crews who will record any obvious newly-created impacts.
9. Law enforcement; and
10. A process to reassess need for capital and operations and maintenance (O&M) every 6th year. The CRMP would establish a "base" condition against which changes resultant of mitigations or adaptive management provisions could be compared. The CRMP shall include provisions for a range of recreation experiences in a variety of settings over the entire Hells Canyon Complex; will identify recreation facility needs; identify and correct public health and safety issues as they arise. The CRMP will identify the relevance of visitor contact, resource patrols, public outreach, interpretation, and information to best improve compliance with management goals.

The CRMP will assess use and resource conflicts at dispersed recreation sites and provide mitigation for impacts to the BLM reservation. The CRMP will identify and implement actions to mitigate impacts, including measures to limit or prohibit recreation use when necessary.

The CRMP will also define acceptable operational and maintenance standards for recreation facilities and enhancements, and will define monitoring and data collection standards used to evaluate facility condition, resource conflicts, public safety, levels of use, need for new or expanded facilities, and public satisfaction with recreation their recreation experience on Project and BLM-administered lands..

The CRMP shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The CRMP submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information.

The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final CRMP. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 7—Litter and Sanitation Plan

Within one year of license issuance, the Licensee shall develop and implement a litter and sanitation plan for the Project, including but not limited to: supplying dumpsters with appropriate frequency of service in appropriate locations near lands administered by the Bureau of Land Management (BLM) along the Homestead, Oxbow, and Snake River Roads, installation of permanent vault toilets at appropriate dispersed recreation sites, insuring the provision of at least one floating restroom on each reservoir, subject to capital and O&M funding provided by the Oregon State Marine Board, and by implementing a routine litter pickup program that is adequate to mitigate the litter problem. If monitoring indicates that a floating restroom is not feasible in the future at any of the Project's reservoirs, then the Licensee, with the concurrence of the BLM and the Commission, shall no longer be required to maintain a floating restroom on such reservoir(s). Parameters to determine appropriate locations for dumpsters, floating restrooms and vault toilets, and adequacy of litter program will be identified within the Litter and Sanitation Plan. Operation and maintenance (O&M) for this plan will be the responsibility of the Licensee. This plan will be incorporated into the Comprehensive Recreation Management Plan (CRMP).

The Licensee shall continue existing actions regarding litter and sanitation measures as described in Final License Application dated July 2003 (FLA).

The Licensee shall implement the litter and sanitation provisions of the Baker County Settlement Agreement dated October 3, 2003.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 8—Boat Moorage on Project Reservoirs

Within one year of license issuance, the Licensee shall develop a Project Boat Moorage Plan and submit this plan to the Commission for approval. The Plan shall be implemented within three years of Commission approval. The Plan shall provide a minimum of one moorage facility at Westfall, Bob Creek section C, Airstrip, and Copper Creek on Hells Canyon Reservoir; and Oxbow Boat Launch and Carter's Landing on Oxbow Reservoir. If monitoring indicates a need for additional moorage at these sites, they should be provided in accordance with the Plan.

The purpose of the BLM condition for boat moorage is to mitigate impacts to terrestrial and aquatic resources from trampling and removal of vegetation, shoreline erosion, and soil compaction. Moorage facilities shall be developed to meet standards of the Oregon State Marine Board (OSMB) or States Organization for Boating Access (SOBA) and shall incorporate the Americans with Disabilities Act (ADA) Access guidelines from the Unites States Access Board. Operation and maintenance (O&M) of the moorage facilities shall become the responsibility of the Licensee.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 9—Airstrip, Bob Creek section C, and Westfall

Within ten years of license issuance, the Licensee shall file for Commission approval an Enhancement Plan for the BLM sites Airstrip, Bob Creek section C, and Westfall and submit this plan to the Commission for approval. The Plan shall include three site plans and design drawings; a discussion of how the needs of the disabled were considered in the planning and design of each facility; detailed erosion and sediment control measures; and a schedule for implementation and maintenance. Elements of the site plans would include provisions for Americans with Disabilities Act (ADA) accessibility, boat moorage, and one camp host site for all three sites. The provision of a public potable water source in the vicinity of these BLM camp sites shall be evaluated in the Plan and implemented if feasible.

Operations and maintenance (O&M) for facilities included in this Plan shall be the responsibility of the Licensee.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 10—Swede's Landing

Within four years of completing the low water boat ramp and associated campground facilities at Private Dude's Cove, the Licensee shall prepare, fund and implement a plan, in coordination with BLM, to rehabilitate the BLM lands currently known as Swede's Landing. The plan shall address riparian habitat restoration, public safety and control, and revegetation of the site, along with assessing current and future uses of the site.

If the low water boat ramp and associated campground facilities at Private Dude's Cove are not developed within two years of license issuance, an enhancement plan for the BLM Swede's Landing Site will be developed within three years of license issuance. The Plan shall include provisions for enhanced campsites with kitchen areas, improved Americans with Disabilities Act (ADA) accessibility, enhancement of Quicksand Creek riparian area and rehabilitation, replacement of existing toilets, replacement of jersey barriers with a more aesthetic barrier, and shade shelters. The Plan shall include an implementation schedule. Operation and maintenance of the campsite facilities shall become the responsibility of the Licensee.

The Licensee shall implement the road maintenance provisions of the Baker County Settlement Agreement dated October 3, 2003.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 11—Spring Recreation Site Enhancement

Within three years of license issuance, or on an alternative schedule to be agreed to by the Bureau of Land Management (BLM), the licensee shall develop an enhancement plan for the BLM site referred to as Spring Recreation Site and submit this plan to the Commission for approval. The Plan shall be based on the best data and information available and is to be an adaptive plan, subject to amendment and revision during the term of the new license. The Plan is intended to a be a planning document which will assess the current condition of the site, the nature and extent of its current, and anticipated future, use and contain provisions to address any current deficiencies and prepare for any increases in use that may occur in the future. The Plan shall include an implementation and maintenance schedule for any measures proposed by the Plan. The Plan may explore options for funding that may be available through a cooperative venture between the licensee and third-party sources through recreational or similar grants.

The licensee shall develop the Spring Recreation Plan in consultation with the Recreation Resource Work Group (RRWG) and the BLM. The licensee shall submit a draft of the Spring Recreation Plan to members of the RRWG for review and comment. Documentation and a description of the consultation process including responses to any written comments received during the consultation process will be included as an appendix to the Plan.

The Plan shall include provisions, among others, addressing the need for, and feasibility of, the following measures:

- • Redesign vehicle circulation and relocate portions of the interior road;
- • Increase parking capacity for day use boat trailer parking;
- • Define camping sites, add electric and water hookups where appropriate;
- • Improve tent camping areas including parking and ADA toilets;
- • Surface new and existing roads and parking areas with asphalt;
- • Develop overflow parking;
- • Retrofit the existing boat launch and boat ramp to be ADA accessible;
- • Design access from boat ramps to boarding docks with accessible grade according to Oregon State Marine Board ADA design;
- • Replace boat dock system to minimize ongoing maintenance and to better accommodate reservoir drawdowns and refill;

- • Improve fish cleaning station to minimize ongoing maintenance, reduce offensive odors, and to meet DEQ septic requirements;
- • Retrofit water system throughout site. Develop an irrigation system for vegetation;
- • Upgrade one RV space for a campground host including shade and septic system; and
- • Landscape site to maximize shade and reduce dust. Install shade structures where appropriate.

The Plan shall provide for the Licensee's assumption of the responsibility associated with the operation and maintenance of existing and new facilities at this site, and, to the extent allowed by applicable law, the transfer and assignment to the Licensee of any use fees associated with this site for the life of the new license.

The Spring Recreation Plan shall be prepared in coordination with the BLM and the other parties described above. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on Project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 12—Steck Recreation Site

Within one year of license issuance, or on an alternative schedule agreed to by the Bureau of Land Management (BLM), the Licensee shall develop an Enhancement Plan for the BLM site referred to as Steck Recreation Site and submit this plan to the Commission for approval. The Plan shall be based on the best data and information available and is to be an adaptive plan, subject to amendment and revision during the term of the new license. The Plan is intended to be a planning document which will assess the current condition of the site, the nature and extent of its current use and anticipated future use, and contain provisions to address any current deficiencies and prepare for any increases in use that may occur in the future. The Plan shall include an implementation and maintenance schedule for any measures proposed by the Plan. The Plan may explore options for funding that may be available through a cooperative venture between the Licensee and third-party sources through recreational or similar grants.

The Licensee shall develop the Plan in consultation with members of the Recreation Resource Work Group (RRWG) and the BLM. The Licensee shall submit a draft of the Enhancement Plan to the RRWG for review and comment. Documentation and a description of the consultation process including responses to any written comments received during the consultation process will be included an appendix to the Plan.

The Plan shall include provisions, among others, addressing the need for, and feasibility of, communication capabilities for emergency and other necessary purposes to meet such needs based on site requirements; separate day-use facilities with shade structures, tables, cement pads, and grills, and an additional public information kiosk.

The Plan shall provide for the Licensee's assumption of the responsibility associated with the operation and maintenance of existing and new facilities at the site, and, to the extent allowed by applicable law, the transfer and assignment to the Licensee of any use fees associated with this site for the life of the new license.

The Steck Enhancement Plan shall be prepared in coordination with the BLM and the other parties described above. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by the BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on Project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 13—Jennifer's Alluvial Fan

Within two years of license issuance, the Licensee shall file for Commission approval an Enhancement Plan for the BLM site referred to as Jennifer's Alluvial Fan Site for the project. The plan shall include a site plan, design drawings; a discussion of how the needs of the disabled were considered in the planning and design; detailed erosion and sediment control measures; and a schedule for implementation and maintenance. The plan shall include, but not be limited to provisions for a toilet, information kiosk with map, and barriers to delineate the site and prevent expansion of vehicle impacts, and improvement of access from Olds Ferry Road. The Plan shall be prepared in coordination with BLM and members of the Recreation Resource Working Group. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on Project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission. The Licensee shall assume the responsibility associated with operation and maintenance of new facilities at this site for the life of the new license.

Modified Condition No. 14—Idaho Dispersed Sites

Within five years of license issuance, the Licensee shall develop and implement a Plan for the BCHB(2).[141] The Plan shall include a provision for a five vehicle gravel parking lot to be constructed adjacent to the primary paved Hells Canyon Road. The parking lot shall incorporate a barrier (such as natural boulders) to prevent motorized vehicle use from causing further damage to adjacent uplands. The Plan shall also include provisions for a portable toilet that will be available on a seasonal basis and the improvement of an existing trail leading from the parking area to nearby rock bluffs, if necessary. The BCHB(2) site will be designated as a day-use only facility.

Within one year of the completion of this project, the Licensee shall develop and implement a litter and sanitation plan for BCHB(2) and for other Idaho Dispersed Sites, including, but not limited to, WILS[142], and BICB[143], consistent with Condition No. 7 (Litter and Sanitation Plan).

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[141] BCHB is the acronym used by IPC to refer to Site No. 2 Below Hells Canyon Bridge. The site is located .01 miles below the Bridge across Hells Canyon Reservoir, on the Idaho side of the Snake River.

[142] WILS is the acronym used by IPC to refer to Williamson Creek. The site is primarily a boat-in camp located on the Idaho side of Oxbow Reservoir approximately 5.9 miles upstream of Oxbow Dam.

The Plan shall be prepared in coordination with BLM and members of the Recreation Resource Working Group. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on Project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission. The Licensee shall assume the responsibility associated with operation and maintenance of new facilities at these sites for the life of the new license.

Modified Condition No. 15—Oxbow Boat Launch and Carter's Landing

Within one year of license issuance, the Licensee shall, in consultation with the BLM, prepare an Enhancement Plan for each of the BLM sites referred to as Carter's Landing and Oxbow Boat Launch and file the Plans with the Commission for approval. Each Plan shall include a site plan, design drawings; a discussion of how the needs of the disabled were considered in the planning and design of each facility; detailed erosion and sediment control measures; and a schedule for implementation and maintenance. The Carter's Landing plan will include, but not be limited to, provisions for enhanced campsites with kitchen areas, improved Americans with Disabilities Act (ADA) accessibility, boat moorage, and shade shelters. Oxbow Boat Launch plan will include improved boat ramp, boarding floats, improved Americans with Disabilities Act (ADA) accessibility, and enhanced parking. The Licensee shall assume the responsibility associated with operation and maintenance of new facilities at these sites for the life of the new license.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 16—Oasis

Within two years of license issuance, or on an alternative schedule to be agreed to by the Bureau of Land Management (BLM), the Licensee shall develop an Enhancement Plan for the BLM site referred to as Oasis and submit this plan to the Commission for approval. The Plan shall be based on the best data and information available and is to be an adaptive plan, subject to amendment and revision during the term of the new license. The Plan is intended to a be a planning document which will assess the current condition of the site, the nature and extent of its current, and anticipated future, use and contain provisions to address any current deficiencies and prepare for any increases in use that may occur in the future. The

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WILS is located on IPC and private land.

[143] BICB is the acronym used by IPC to refer to Boat-in Camping Area #2. The site is primarily a boat-in camp located on the Idaho side of Oxbow Reservoir approximately 8.5 miles upstream of Oxbow Dam. BICB is located on BLM-managed land.

Plan shall include an implementation and maintenance schedule for any measures proposed by the Plan. The Plan may explore options for funding that may be available through a cooperative venture between the licensee and third-party sources through recreational or similar grants.

The Licensee shall develop the Enhancement Plan in consultation with members of the Recreation Resource Work Group (RRWG) and the BLM. Within eighteen months of license issuance, the licensee shall submit a draft of the Enhancement Plan to the RRWG for review and comment. Documentation and a description of the consultation process including responses to any written comments received during the consultation process will be included as an appendix to the Plan.

The plan shall include provisions, among others, addressing the need for, and feasibility of, enhanced restrooms, parking, vehicle control, day use activities, foot trail, and signing.

The Plan shall provide for the Licensee's assumption of the responsibility associated with the operation and maintenance of existing and new facilities and, to the extent allowed by applicable law, the transfer and assignment to the Licensee of any use fees associated with this site for the life of the new license.

The Oasis Enhancement Plan shall be prepared in coordination with the BLM and the other parties described above. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree [sic]

Modified Condition No. 17—Copper Creek

Within two years of license issuance, the Licensee shall file for Commission approval an Enhancement Plan, including an evaluation of potential effects to cultural resources, for the BLM site referred to as Copper Creek. Development and implementation shall be consistent with Section 106 of the National Historic Preservation Act (NHPA) and the requirements for the National Environmental Policy Act (NEPA). Depending on findings of these evaluations, the plan may include provisions for a road system serving designated campsites with picnic shelters and fire rings, trailhead parking, equestrian staging area, boat moorage and mitigations for soil erosion around point near mouth of Copper Creek. Enhancement design shall mitigate impacts to terrestrial and aquatic resources, i.e. trampling and removal of vegetation, shoreline erosion and soil compaction. If it is determined that enhancing the site would require substantial cultural site mitigation, the Licensee would consult with BLM to determine alternative actions that would preserve the integrity of cultural sites.

The Licensee shall assume the responsibility associated with the operation and maintenance of this site for the life of the new licensee.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

Modified Condition No. 18—Low Water Boat Launch

If, within one year of license issuance, the Licensee has not constructed a Low Water Boat Launch at Private Dude's Cove and if BLM Condition No. 10 for Swedes Landing has not been is implemented, then the following shall be implemented:

Within the second year after license issuance, the Licensee shall file for Commission approval a Low-Water Boat Launch Plan. The plan shall include provisions to find a suitable location at or near Swedes Landing, develop a site plan and implement the site plan for a low water boat launch. The Plan shall include site plan design drawings; a discussion of how the needs of the disabled were considered in the planning and design; detailed erosion and sediment control measures; and a schedule for implementation and maintenance. The Licensee shall assume the responsibility associated with operation and maintenance of this site for the life of the new license.

The Plan shall be prepared in coordination with the BLM and other appropriate parties. The Licensee shall include with the Plan submitted to the Commission documentation of coordination and copies of comments and recommendations on the Plan. The Licensee shall allow a minimum of 60 days for the BLM to comment and to make recommendations prior to filing the Plan with the Commission for approval. The Plan submitted to the Commission shall include all recommendations submitted by the BLM. If the Licensee does not agree with a recommendation made by BLM, the filing will include the Licensee's reasons for disagreeing with the BLM recommendation, based on project-specific information. The Commission may consider the Licensee's comments on the BLM recommendations in its decision adopting or modifying the final Plan. The Licensee shall implement the Plan as approved by the Commission.

INTERIOR—SECTION 18 PRESCRIPTIONS

Guidance for the Prescription of Fishways Pursuant to Section 18 of the FPA (USFWS 2002c).

Reservation of Authority to Prescribe Fishways

The Service has prepared its prescriptions for fishways in response to the proposals being considered by the Commission in this proceeding involving the proposed relicensing of the Hells Canyon Hydroelectric Project, FERC No. 1971. If any proposal is modified as a result of licensing or after licensing, then the Department, through the Service, will require adequate opportunity to reconsider each prescription and make modifications it deems appropriate and necessary for submittal to the Commission. Therefore, the Service requests that the Commission include the following condition in any license it may issue for the Project, Commission No. 1971:

> Authority is reserved for the Department of the Interior, as delegated to the U.S. Fish and Wildlife Service, to prescribe the construction, operation, and maintenance of fishways at the Hells Canyon Hydroelectric Project, Project No. 1971, as appropriate, including measures to determine, ensure, or improve the effectiveness of such fishways, pursuant to Section 18 of the Federal Power Act, as amended. This reservation includes, but is not limited to, authority to prescribe fishways for spring/summer Chinook salmon, summer steelhead trout, Pacific lamprey, bull trout, redband trout, fall Chinook salmon, white sturgeon, and any other fish to be managed, enhanced, protected, or restored to the Snake River Basin during the term of the license.

Modified Section 18 Fishway Prescription

1.0. Upstream and Downstream Fishways for Bull Trout

To provide for the safe, timely and effective upstream passage of adult and subadult bull trout at the Hells Canyon Project, the Licensee shall continue to rehabilitate, operate, and monitor the Hells Canyon Dam trap and haul fishway and modify the existing structure as described in the Preferred Alternative to the Additional Information Request—Aquatic Resources Number 1 (AIR AR-1) to the Hells Canyon Complex Final License Application. A second phase of the passage prescription is to construct a trap similar in operation and design to the Hells Canyon trap to provide for the safe, timely and effective upstream passage of adult and sub-adult bull trout at the base of Oxbow Dam. The future fishway/trap at the base of Oxbow Dam shall include measures and operations necessary to provide adequate attraction flow to safely and rapidly attract bull trout into the Oxbow trap for collection and transport upstream. Final documentation of what flows and/or mechanisms are necessary for effective fish collection at Oxbow Dam will occur in the amendment to the Bull Trout Passage Plan when the trigger criteria to pass bull trout upstream of Oxbow Dam has been met. All upstream facilities prescribed herein shall be designed and operated to meet the anadromous passage facility guideline and criteria established by NOAA Fisheries (NOAA Fisheries 2004).[144]

To provide for safe, timely and effective downstream passage of migrating adult and sub-adult bull trout from bull trout bearing (a tributary that supports all life stages of bull trout) tributaries into the reservoirs of the Hells Canyon Complex (Pine Creek, Indian Creek, and the Wildhorse River), the Licensee shall construct operate, maintain and monitor permanent weirs and trap and haul fishways near the mouths of these tributaries for the downstream passage and transport of adult and subadult bull trout

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[144] Ibid

to a suitable release point downstream of Hells Canyon Dam. The period of facility operation will be determined through the bull trout passage planning process and may be adapted based on information gathered through future monitoring efforts to meet the biological needs of bull trout in each identified tributary system. All downstream facilities prescribed herein shall be designed and operated to meet the anadromous passage facility guideline and criteria established by NOAA Fisheries (NOAA Fisheries 2004).[145]

Implementation of Fishway Prescription

To implement the above prescription, the Licensee shall, within 1 year of license issuance, in consultation with the Service, the Oregon Department of Fish and Wildlife, the Idaho Department of Fish and Game, and the affected consulting parties develop and file with Federal Energy Regulatory Commission (Commission), a Bull Trout Passage Plan. The Bull Trout Passage Plan shall be submitted to the consulting agencies for a 60-day period for review and comment period for approval prior to submittal to the Commission for approval and implementation. The Bull Trout Passage Plan shall include: 1) final engineering design plans of the Hells Canyon upstream trap fishway modification, 2) final engineering design plans of the Pine Creek monitoring weir and trap fishway including a schedule to construct the fishway within two years of license issuance; 3) specific protocols for the period of operation, location of release point and handling of all lifestages of bull trout and other fish captured for these two facilities; 4) provisions for transport of bull trout between Pine Creek and Hells Canyon Dam, 5) an assessment of monitoring necessary to evaluate the potential and risk of introductions of deleterious pathogens, and 6) a Post-construction monitoring plan. The Bull Trout Passage plan shall also include description of specific triggers related to the timeline of construction and implementation of the Oxbow upstream trap fishway, the Indian Creek permanent weir and trap fishway, and the Wildhorse River weir and trap fishway. The Plan will include specific monitoring necessary to determine when established triggers have been satisfied. Triggers that establish the timeline of construction and implementation of these facilities shall be based on the status of bull trout within these tributaries in terms of their abundance, the potential for hybridization with non-native brook trout, the potential of the fishways to contribute towards recovery, and habitat conditions necessary to support bull trout. The Bull Trout Passage Plan shall contain a provision that within 1 year of meeting the trigger criteria for one of these facilities, as determined by the consulting agencies, an Amendment to the Bull Trout Plan shall be filed that contains specifications for the period of operation, location, design, construction and operation of the facility, a provision for transport of captured fish to their designated release points, and establish suitable protocol and release point for handling all life-stages of bull trout and other fish captured in the facilities. The Amendment for each facility shall be submitted to the consulting agencies for a 60-day review and comment period for approval prior to submittal to the Commission for approval and implementation. Construction of passage facilities shall begin within 2 years of meeting trigger criteria, unless another timeframe is mutually agreed upon by the consulting agencies.

A Post-construction Monitoring Plan shall be developed for the Hells Canyon upstream fishway and Pine Creek weir and trap and shall be included with the Bull Trout Passage Plan. The Post-construction Monitoring Plan shall be to describe the evaluation and monitoring necessary to determine the effectiveness of each facility. Such a plan will be part of each Amendment to the Bull Trout Passage Plan that initiates Commission approval of each fishway as trigger criteria are met. The Post-construction monitoring plan shall include operation and maintenance (O&M) procedures (including operator training and supervision) of each facility as they are constructed to insure effective operation. The O&M procedures shall include provisions for prior notification and coordination with the consulting agencies regarding maintenance scheduling or emergency operations that affect the functioning of each fishway.

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[145] Ibid

APPENDIX D

MODELED CONSTRAINTS FOR IDAHO POWER COMPANY'S PROPOSED OPERATION AND OPERATIONAL ALTERNATIVES

To support the evaluation of resource effects of alternative operating regimes, Idaho Power used a simulation computer model for hydropower systems, called CHEOPS.[146] CHEOPS evaluates physical and operational changes at multiple-development hydroelectric projects. It is designed to emphasize long-term simulations of project operations, and it emphasizes maintaining correct mass balances in reported flows and meeting all project-related operating constraints. This appendix presents the constraints used in the CHEOPS modeling of project operations for the Applicant's Proposed Operation (Section 2.2.2) and for the several alternative operating scenarios described in DEIS Section 2.3.2.

Following are the operating scenarios evaluated:

- Applicant's Proposed Operation
- Alternative Operating Scenarios
  - Scenario 1(a). Stabilized Hells Canyon Release, with instantaneous outflow from Hells Canyon dam equaling the average inflow to the Hells Canyon reservoir during the previous 24 hours.
  - Scenario 1(b). Stabilized Hells Canyon Release, with maximum ramping rate of 2 inches per hour (year-round).
  - Scenario 1(c). Stabilized Hells Canyon Release, with maximum ramping rate of 6 inches per hour (year-round).
  - Scenario 1(d). Stabilized Hells Canyon Release, with maximum ramping rate of 2 inches per hour (March 1 through May 31).
  - Scenario 1(e). Stabilized Hells Canyon Release, with maximum ramping rate of 6 inches per hour (March 1 through May 31).
  - Scenario 1(f). Stabilized Hells Canyon Release, with maximum ramping rate of 2 inches per hour March 1 through May 31 and 6 inches per hour for the rest of the year, plus a maximum total daily fluctuation of 2.0 feet year-round.
  - Scenario 2. Flow Augmentation with Stabilized Release.
  - Scenario 3. Navigation Target Flow.
  - Scenario 7. Stabilized Hells Canyon Release, with a seasonal maximum ramping rate of 4 inches per hour March 15 through June 15 and 1 foot per hour the remainder of the year. Ramp rate compliance was modeled at Johnson Bar.
  - Scenario 8. A 237-kaf release of flow augmentation water from Brownlee reservoir by refilling to elevation 2,077 feet msl by June 20, beginning augmentation on June 21, with target reservoir elevations set to 2,066 feet msl on July 15 and 2,059 feet msl on July 31, with no refill to occur before August 31.
  - Scenario 9. A combination of Scenarios 7 and 8.

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[146] The content of the appendix is based on Idaho Power's Responses to FERC Additional Information Request OP-1(a) Operational Scenarios, Power Economics, February 2005 (scenarios 1, 2 and 3) and Idaho Power's March 30, 2007 response to FERC's February 23, 2007, Additional Information Request (scenarios 7, 8, and 9).

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Table 1. Constraints for modeled proposed operations and Scenarios 1a and 1b for the Brownlee development.

	Constraints		
Brownlee Development	**Modeled Proposed Operations**	**Scenario 1a**	**Scenario 1b**
Maximum reservoir elevation	2,077 feet msl	2,077 feet msl	2,077 feet msl
Minimum reservoir elevation	1,976 feet msl	1,976 feet msl	1,976 feet msl
Flood-control Requirements			
Brownlee reservoir official target elevations specified for February 28, March 31, April 15, and April 30	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]
Daily Reservoir-level Fluctuation[b]			
January 1 through May 20	3 feet	3 feet	3 feet
May 21 through June 21 for resident fish spawning	1 foot	1 foot	1 foot
June 22 through December 31	3 feet	3 feet	3 feet
Reservoir Target Elevation			
June 7	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]
June 8 through July 5	2,075 feet msl[d]	2,075 feet msl[d]	2,075 feet msl[d]
August 31[e]			
High water year	2,059 feet msl	2,059 feet msl	2,059 feet msl
Medium water year	2,069 feet msl	2,069 feet msl	2,069 feet msl
Low water year	2,072 feet msl	2,072 feet msl	2,072 feet msl
October 21[f]	2,040 feet msl or higher	2,040 feet msl or higher	2,040 feet msl or higher
December 11 through 31[g]	2,075 feet msl	2,075 feet msl	2,075 feet msl

[a] For modeling purposes, reservoir target elevations are calculated in the model using the Corps' 1998 modified rule curve procedure and are based on observed inflows (not monthly forecasts). Flood-control requirements are not modeled past the last April 30 target date.

[b] Dates specified are for modeling purposes only and may vary under actual operations.

[c] The elevation of 2,069 feet msl or higher was set as a target in the model for June 7 for resident fish spawning requirements.

[d] A full reservoir during this period helps Idaho Power meet peak summer load demands. The dates specified are for modeling purposes only and would vary as a function of Idaho Power's system needs and water conditions.

[e] This target was only specified in the model for this date as a means of modeling power needs of the system by drafting Brownlee reservoir. The specified target was also a function of water year type.

[f] Reservoir elevation for modeling purposes was calculated as a function of the specified fall Chinook flow for water year type for Hells Canyon Development discharge (see table 6). This calculation resulted in reservoir elevations typically 2,040 feet msl or higher, except under extreme high-water conditions for the model runs.

[g] In the late fall, the reservoir is operated to accommodate the fall Chinook program, and in early December, Idaho Power attempts to have a full reservoir, typically around 2,075 feet msl, to help meet peak winter load conditions. December 11 was specified for modeling purposes only and is a function of inflow and system or load needs during this period.

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Table 2. Constraints for Scenarios 1c, 1d, and 1e for the Brownlee development.

Brownlee Development	Constraints		
	Scenario 1c	**Scenario 1d**	**Scenario 1e**
Maximum reservoir elevation	2,077 feet msl	2,077 feet msl	2,077 feet msl
Minimum reservoir elevation	1,976 feet msl	1,976 feet msl	1,976 feet msl
Flood-control Requirements			
Brownlee reservoir official target elevations specified for February 28, March 31, April 15, and April 30	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]
Daily Reservoir-level Fluctuation[b]			
January 1 through May 20	3 feet	3 feet	3 feet
May 21 through June 21 for resident fish spawning	1 foot	1 foot	1 foot
June 22 through December 31	3 feet	3 feet	3 feet
Reservoir Target Elevation			
June 7	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]
June 8 through July 5	2,075 feet msl[d]	2,075 feet msl[d]	2,075 feet msl[d]
August 31[e]			
High water year	2,059 feet msl	2,059 feet msl	2,059 feet msl
Medium water year	2,069 feet msl	2,069 feet msl	2,069 feet msl
Low water year	2,072 feet msl	2,072 feet msl	2,072 feet msl
October 21[f]	2,040 feet msl or higher	2,040 feet msl or higher	2,040 feet msl or higher
December 11 through 31[g]	2,075 feet msl	2,075 feet msl	2,075 feet msl

[a] For modeling purposes, reservoir target elevations are calculated in the model using the Corps' 1998 modified rule curve procedure and are based on observed inflows (not monthly forecasts). Flood-control requirements are not modeled past the last April 30 target date.

[b] Dates specified are for modeling purposes only and may vary under actual operations.

[c] The elevation of 2,069 feet msl or higher was set as a target in the model for June 7 for resident fish spawning requirements.

[d] A full reservoir during this period helps Idaho Power meet peak summer load demands. The dates specified are for modeling purposes only and would vary as a function of Idaho Power's system needs and water conditions.

[e] This target was only specified in the model for this date as a means of modeling power needs of the system by drafting Brownlee reservoir. The specified target was also a function of water year type.

[f] Reservoir elevation for modeling purposes was calculated as a function of the specified fall Chinook flow for water year type for Hells Canyon Development discharge (see table 6). This calculation resulted in reservoir elevations typically 2,040 feet msl or higher, except under extreme high-water conditions for the model runs.

[g] In the late fall, the reservoir is operated to accommodate the fall Chinook program, and in early December, Idaho Power attempts to have a full reservoir, typically around 2,075 feet msl, to help meet peak winter load conditions. December 11 was specified for modeling purposes only and is a function of inflow and system or load needs during this period.

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Table 3. Constraints for Scenarios 1f, 2, and 3 for the Brownlee development.

Brownlee Development	Constraints		
	Scenario 1f	**Scenario 2**	**Scenario 3**
Maximum reservoir elevation	2,077 feet msl	2,077 feet msl	2,077 feet msl
Minimum reservoir elevation	1,976 feet msl	1,976 feet msl	1,976 feet msl
Flood-control Requirements			
Brownlee reservoir official target elevations specified for February 28, March 31, April 15, and April 30	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]
Daily Reservoir-level Fluctuation[b]			
January 1 through May 20	3 feet	3 feet	3 feet
May 21 through June 21 for resident fish spawning	1 foot	1 foot	1 foot
June 22 through December 31	3 feet	3 feet	3 feet
Reservoir Target Elevation			
June 7	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]
June 8 through July 5	2,075 feet msl[d]	NA	2,075 feet msl[d]
June 8 through June 20	NA	2,075 feet msl	NA
July 5	NA	2,069 feet msl	NA
July 31 through August 31	NA	2,049 feet msl	NA
August 31[e]			
High water year	2,059 feet msl	2,049 feet msl	2,059 feet msl
Medium water year	2,069 feet msl	2,049 feet msl	2,069 feet msl
Low water year	2,072 feet msl	2,049 feet msl	2,072 feet msl
October 21[f]	2,040 feet msl or higher	2,040 feet msl or higher	2,040 feet msl or higher
December 11 through 31[g]	2,075 feet msl	2,075 feet msl	2,075 feet msl

Note: NA – Not applicable

[a] For modeling purposes, reservoir target elevations are calculated in the model using the Corps' 1998 modified rule curve procedure and are based on observed inflows (not monthly forecasts). Flood-control requirements are not modeled past the last April 30 target date.

[b] Dates specified are for modeling purposes only and may vary under actual operations.

[c] The elevation of 2,069 feet msl or higher was set as a target in the model for June 7 for resident fish spawning requirements.

[d] A full reservoir during this period helps Idaho Power meet peak summer load demands. The dates specified are for modeling purposes only and would vary as a function of Idaho Power's system needs and water conditions.

[e] This target was only specified in the model for this date as a means of modeling power needs of the system by drafting Brownlee reservoir. The specified target was also a function of water year type.

[f] Reservoir elevation for modeling purposes was calculated as a function of the specified fall Chinook flow for water year type for Hells Canyon Development discharge (see table 6). This calculation resulted in reservoir elevations typically 2,040 feet msl or higher, except under extreme high-water conditions for the model runs.

[g] In the late fall, the reservoir is operated to accommodate the fall Chinook program, and in early December,

Idaho Power attempts to have a full reservoir, typically around 2,075 feet msl, to help meet peak winter load conditions. December 11 was specified for modeling purposes only and is a function of inflow and system or load needs during this period.

Table 4. Constraints for Scenarios 7, 8, and 9 for the Brownlee development.

Brownlee Development	Constraints		
	Scenario 7	**Scenario 8**	**Scenario 9**
Maximum reservoir elevation	2,077 feet msl	2,077 feet msl	2,077 feet msl
Minimum reservoir elevation	1,976 feet msl	1,976 feet msl	1,976 feet msl
Flood-control Requirements			
Brownlee reservoir official target elevations specified for February 28, March 31, April 15, and April 30	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]	Corps flood-control rule curve requirements[a]
Daily Reservoir-level Fluctuation[b]			
January 1 through May 20	3 feet	3 feet	3 feet
May 21 through June 21 for resident fish spawning	1 foot	1 foot	1 foot
June 22 through December 31	3 feet	3 feet	3 feet
Reservoir Target Elevation			
June 7	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]	2,069 feet msl or higher[c]
June 21	2,075 feet msl[d]	2,077 feet msl[d]	2,077 feet msl[d]
July 15	2,075 feet msl[d]	2,066 feet msl[e]	2,066 feet msl[e]
July 31	2,075 feet msl[d]	2,059 feet msl[e]	2,059 feet msl[e]
August 31[f]			
High water year	2,059 feet msl	2,059 feet msl	2,059 feet msl
Medium water year	2,069 feet msl	2,059 feet msl	2,059 feet msl
Low water year	2,072 feet msl	2,059 feet msl	2,059 feet msl
October 21[g]	2,040 feet msl or higher	2,040 feet msl or higher	2,040 feet msl or higher
December 11 through 31[h]	2,075 feet msl	2,075 feet msl	2,075 feet msl

[a] For modeling purposes, reservoir target elevations are calculated in the model using the Corps' 1998 modified rule curve procedure and are based on observed inflows (not monthly forecasts). Flood-control requirements are not modeled past the last April 30 target date.

[b] Dates specified are for modeling purposes only and may vary under actual operations.

[c] The elevation of 2,069 feet msl or higher was set as a target in the model for June 7 for resident fish spawning requirements.

[d] A full reservoir during this period helps Idaho Power meet peak summer load demands. The dates specified are for modeling purposes only and would vary as a function of Idaho Power's system needs and water conditions.

[e] Brownlee flow augmentation contribution of 237,000 acre-feet.

[f] This target was only specified in the model for this date as a means of modeling power needs of the system by drafting Brownlee reservoir. The specified target was also a function of water year type except for Scenarios 8 and 9.

[g] Reservoir elevation for modeling purposes was calculated as a function of the specified fall Chinook flow for water year type for Hells Canyon Development discharge. This calculation resulted in reservoir elevations typically 2,040 feet msl or higher, except under extreme high-water conditions for the model runs.

[h] In the late fall, the reservoir is operated to accommodate the fall Chinook program, and in early December, Idaho Power attempts to have a full reservoir, typically around 2,075 feet msl, to help meet peak winter load

conditions. December 11 was specified for modeling purposes only and is a function of inflow and system or load needs during this period.

Table 5. Constraints for modeled proposed operations and alternative scenarios for the Oxbow development.

	Constraints	
Oxbow Development	**Modeled Proposed Operations**	**Scenarios 1a, 1b, 1c, 1d, 1e, 1f, 2, 3, 7, 8, and 9**
Maximum reservoir elevation	1,805 feet msl	1,805 feet msl
Minimum reservoir elevation	1,800 feet msl	1,800 feet msl
Daily reservoir-level fluctuation (January 1 through December 31)[a]	5 feet	5 feet
Bypass flow (January 1 through December 31)	100 cfs	100 cfs

[a] The typical operating limit for modeling purposes was 5 feet.

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Table 6. Constraints for modeled proposed operations and Scenarios 1a and 1b for the Hells Canyon development.

Hells Canyon Development	Constraints		
	Modeled Proposed Operations	Scenario 1a[a]	Scenario 1b
Maximum reservoir elevation	1,688 feet msl	1,688 feet msl	1,688 feet msl
Minimum reservoir elevation	1,683 feet msl[b]	1,668 feet msl[c]	1,668 feet msl[c]
Daily reservoir-level fluctuation limit (January 1 through December 31)	5 feet	None	None
Ramp-rate Restriction[b]			
Ramp rate	1 foot per hour	None	2 inches per hour
Compliance ramp-rate curve[d]	Johnson Bar	Hells Canyon	Hells Canyon
Daily Limit Between Minimum and Maximum Flows			
December 12 through May 31	None	No load following	None
June 1 through September 30	10,000 cfs[e]	No load following	10,000 cfs[e]
October 1 through October 20	None	No load following	None
October 21 through December 11[f]	No load following	No load following	No load following
Minimum Instantaneous Flows			
December 12 through May 31[g]			
Low	8,500 cfs	8,500 cfs	8,500 cfs
Medium	10,500 cfs	10,500 cfs	10,500 cfs
High	12,000 cfs	12,000 cfs	12,000 cfs
June 1 through October 20			
Low	6,500 cfs[h]	6,500 cfs[h]	6,500 cfs[h]
Medium	6,500 cfs[h]	6,500 cfs[h]	6,500 cfs[h]
High	6,500 cfs[h]	6,500 cfs[h]	6,500 cfs[h]
October 21 through December 11[f]			
Low	9,000 cfs	9,000 cfs	9,000 cfs
Medium	11,500 cfs	11,500 cfs	11,500 cfs
High	13,000 cfs	13,000 cfs	13,000 cfs

[a] The model passed daily average flow below Hells Canyon dam in this scenario with no load following. Flood control and the fall Chinook program are also modeled in this scenario.

[b] The typical operating limit for modeling purposes was 5 feet.

[c] An extreme minimum was defined for modeling purposes such that the model was not constrained under these scenario constraints.

[d] Compliance was modeled at either the Johnson Bar gage, located approximately 17.6 miles downstream of Hells Canyon dam or at the Hells Canyon gage, located 0.6 mile downstream of Hells Canyon Dam.

[e] A limit of 10,000 cfs was modeled during this time frame to represent typical operations.

[f] For modeling purposes only, flows under the fall Chinook program began October 21 and ended December 11.

[g] Releases under the fall Chinook program are reduced in the model and assume that the most critical shallow redd is still protected under load-following conditions downstream of the Hells Canyon Complex. The

December 12 date was specified for modeling purposes only, since the actual date that fall Chinook spawning is completed can vary.

[h] Minimum flow modeled was 6,500 cfs or project inflow during this period to avoid drafting Brownlee reservoir.

Table 7. Constraints for Scenarios 1c, 1d, and 1e for the Hells Canyon development.

Hells Canyon Development	Constraints		
	Scenario 1c	**Scenario 1d**	**Scenario 1e**
Maximum reservoir elevation	1,688 feet msl	1,688 feet msl	1,688 feet msl
Minimum reservoir elevation	1,668 feet msl[a]	1,668 feet msl[a]	1,668 feet msl[a]
Daily reservoir-level fluctuation limit (January 1 through December 31)	None	None	None
Ramp-rate Restriction[b]			
Ramp rate	6 inches per hour	1 foot per hour (except 2 inches per hour from March 1–May 31)	1 foot per hour (except 6 inches per hour from March 1–May 31)
Compliance ramp-rate curve[c]	Hells Canyon	Hells Canyon	Hells Canyon
Daily Limit Between Minimum and Maximum Flows			
December 12 through May 31	None	None	None
June 1 through September 30	10,000 cfs[d]	10,000 cfs[d]	10,000 cfs[d]
October 1 through October 20	None	None	None
October 21 through December 11[e]	No load following	No load following	No load following
Minimum Instantaneous Flows			
December 12 through May 31[f]			
Low	8,500 cfs	8,500 cfs	8,500 cfs
Medium	10,500 cfs	10,500 cfs	10,500 cfs
High	12,000 cfs	12,000 cfs	12,000 cfs
June 1 through October 20			
Low	6,500 cfs[g]	6,500 cfs[g]	6,500 cfs[g]
Medium	6,500 cfs[g]	6,500 cfs[g]	6,500 cfs[g]
High	6,500 cfs[g]	6,500 cfs[g]	6,500 cfs[g]
October 21 through December 11[e]			
Low	9,000 cfs	9,000 cfs	9,000 cfs
Medium	11,500 cfs	11,500 cfs	11,500 cfs
High	13,000 cfs	13,000 cfs	13,000 cfs

[a] An extreme minimum was defined for modeling purposes such that the model was not constrained under these scenario constraints.

[b] The typical operating limit for modeling purposes was 5 feet.

[c] Compliance was modeled at either the Johnson Bar gage, located approximately 17.6 miles downstream of Hells Canyon dam or at the Hells Canyon gage, located 0.6 mile downstream of Hells Canyon Dam.

[d] A limit of 10,000 cfs was modeled during this time frame to represent typical operations.

[e] For modeling purposes only, flows under the fall Chinook program began October 21 and ended December 11.

[f] Releases under the fall Chinook program are reduced in the model and assume that the most critical shallow redd is still protected under load-following conditions downstream of the Hells Canyon Complex. The December 12 date was specified for modeling purposes only, since the actual date that fall Chinook spawning is

completed can vary.

[g] Minimum flow modeled was 6,500 cfs or project inflow during this period to avoid drafting Brownlee reservoir.

Table 8. Constraints for Scenarios 1f, 2, and 3 for the Hells Canyon development.

Hells Canyon Development	Constraints		
	Scenario 1f	**Scenario 2**	**Scenario 3**
Maximum reservoir elevation	1,688 feet msl	1,688 feet msl	1,688 feet msl
Minimum reservoir elevation	1,668 feet msl[a]	1,683 feet msl[b] (except 1,668 feet msl from March 1–May 31)[a]	1,683 feet msl[b]
Daily reservoir-level fluctuation limit (January 1 through December 31)	None	5 feet (except none from March 1–May 31)	5 feet
Ramp-rate Restriction[b]			
Ramp rate	6 inches per hour	1 foot per hour	1 foot per hour
	2 inches per hour (March 1–May 31)	2 inches per hour (March 1–May 31)	
Compliance ramp-rate curve[c]	Hells Canyon	Hells Canyon	Johnson Bar
Daily Limit Between Minimum and Maximum Flows			
December 12 through May 31	2 feet on gage	None	None
June 1 through September 30	2 feet on gage	10,000 cfs[d]	10,000 cfs[d]
October 1 through October 20	2 feet on gage	None	None
October 21 through December 11[e]	No load following	No load following	No load following
Minimum Instantaneous Flows			
December 12 through May 31[f]			
Low	8,500 cfs	8,500 cfs	8,500 cfs
Medium	10,500 cfs	10,500 cfs	10,500 cfs
High	12,000 cfs	12,000 cfs	12,000 cfs
June 1 through October 20			
Low	6,500 cfs[g]	6,500 cfs[g]	8,500 cfs[h]
Medium	6,500 cfs[g]	6,500 cfs[g]	8,500 cfs[h]
High	6,500 cfs[g]	6,500 cfs[g]	8,500 cfs[h]
October 21 through December 11[e]			
Low	9,000 cfs	9,000 cfs	9,000 cfs[i]
Medium	11,500 cfs	11,500 cfs	11,500 cfs
High	13,000 cfs	13,000 cfs	13,000 cfs

[a] An extreme minimum was defined for modeling purposes such that the model was not constrained under these scenario constraints.

[b] The typical operating limit for modeling purposes was 5 feet.

[c] Compliance was modeled at either the Johnson Bar gage, located approximately 17.6 miles downstream of Hells Canyon dam or at the Hells Canyon gage, located 0.6 mile downstream of Hells Canyon dam.

[d] A limit of 10,000 cfs was modeled during this time frame to represent typical operations.

[e] For modeling purposes only, flows under the fall Chinook program began October 21 and ended December 11.

[f] Releases under the fall Chinook program are reduced in the model and assume that the most critical shallow redd is still protected under load-following conditions downstream of the Hells Canyon Complex. The

December 12 date was specified for modeling purposes only, since the actual date that fall Chinook spawning is completed can vary.

g Minimum flow modeled was 6,500 cfs or project inflow during this period to avoid drafting Brownlee reservoir.

h The minimum instantaneous flow modeled was 8,500 cfs unless inflows to Brownlee reservoir dropped below 8,500 cfs. When this occurred, the modeled minimum instantaneous flow below the Hells Canyon development was calculated as the 3-day moving average of Brownlee reservoir inflow.

i The constant flows below the Hells Canyon development were not modified during the fall Chinook program to achieve 11,500 cfs downstream of the mouth of the Salmon River.

Table 9. Constraints for Scenarios 7, 8, and 9 for the Hells Canyon development.

Hells Canyon Development	Constraints Scenario 7	Scenario 8	Scenario 9
Maximum reservoir elevation	1,688 feet msl	1,688 feet msl	1,688 feet msl
Minimum reservoir elevation	1,683 feet msl[a]	1,683 feet msl[a]	1,683 feet msl[a]
Daily reservoir-level fluctuation limit (January 1 through December 31)	5 feet	5 feet	5 feet
Ramp-rate Restriction[a]			
Ramp rate	4 inches per hour (March 15–June 15)	1 foot per hour	4 inches per year (March 15–June 15)
Compliance ramp-rate curve[b]	Johnson Bar	Johnson Bar	Johnson Bar
Daily Limit Between Minimum and Maximum Flows			
December 12 through May 31	None	None	None
June 1 through September 30	10,000 cfs[c]	10,000 cfs[c]	10,000 cfs[c]
October 1 through October 20	None	None	None
October 21 through December 11[d]	No load following	No load following	No load following
Minimum Instantaneous Flows			
December 12 through May 31[e]			
Low	8,500 cfs	8,500 cfs	8,500 cfs
Medium	10,500 cfs	10,500 cfs	10,500 cfs
High	12,000 cfs	12,000 cfs	12,000 cfs
June 1 through October 20			
Low	6,500 cfs[f]	6,500 cfs[f]	6,500 cfs[f]
Medium	6,500 cfs[f]	6,500 cfs[f]	6,500 cfs[f]
High	6,500 cfs[f]	6,500 cfs[f]	6,500 cfs[f]
October 21 through December 11[d]			
Low	9,000 cfs	9,000 cfs	9,000 cfs[i]
Medium	11,500 cfs	11,500 cfs	11,500 cfs
High	13,000 cfs	13,000 cfs	13,000 cfs

[a] The typical operating limit for modeling purposes was 5 feet.

[b] Compliance was modeled at either the Johnson Bar gage, located approximately 17.6 miles downstream of Hells Canyon dam.

[c] A limit of 10,000 cfs was modeled during this time frame to represent typical operations.

[d] For modeling purposes only, flows under the fall Chinook program began October 21 and ended December 11.

[e] Releases under the fall Chinook program are reduced in the model and assume that the most critical shallow redd is still protected under load-following conditions downstream of the Hells Canyon Complex. The December 12 date was specified for modeling purposes only, since the actual date that fall Chinook spawning is completed can vary.

[f] Minimum flow modeled was 6,500 cfs or project inflow during this period to avoid drafting Brownlee reservoir.

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APPENDIX E

FLOW FLUCTUATIONS DOWNSTREAM OF HELLS CANYON DAM—FIGURES

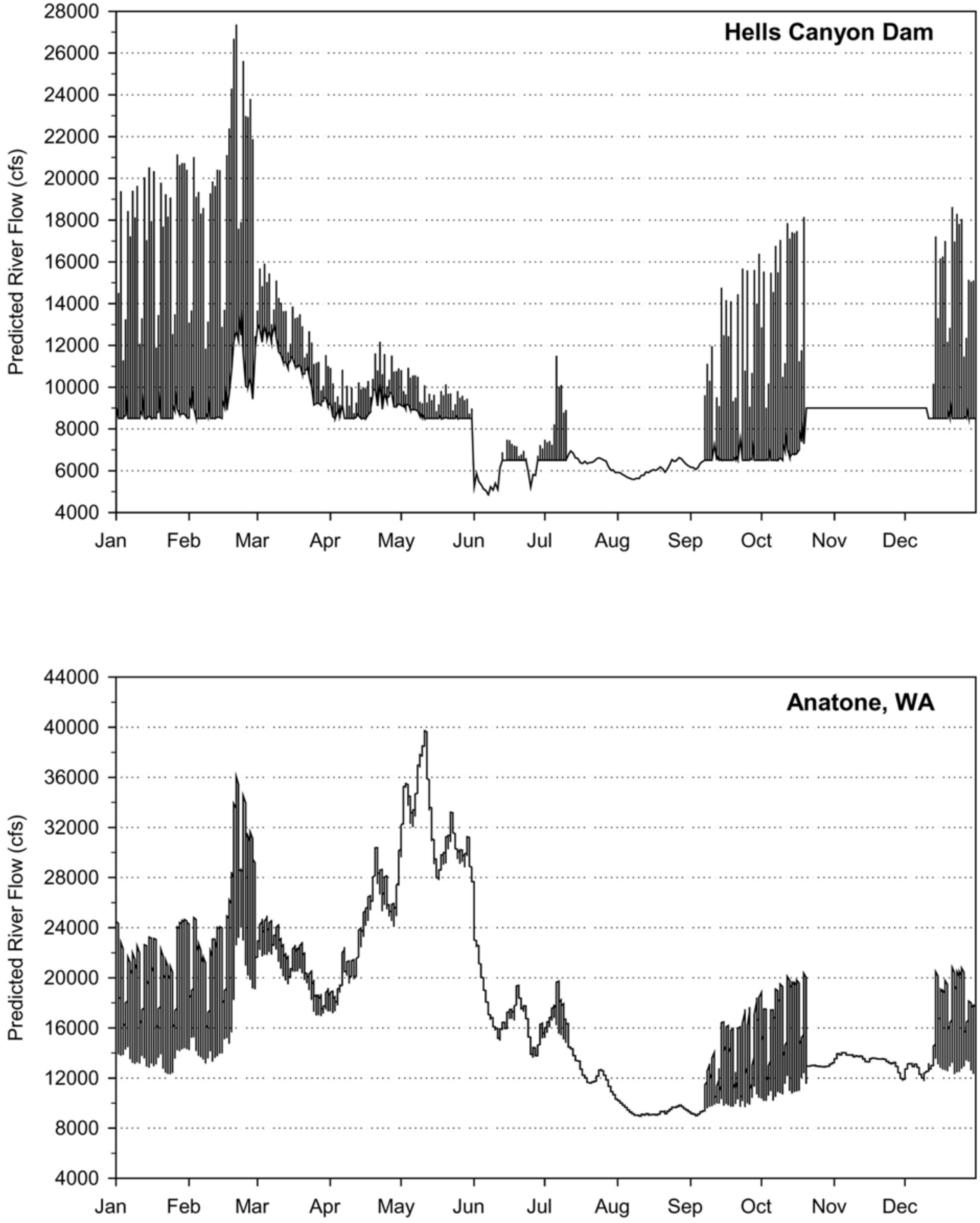
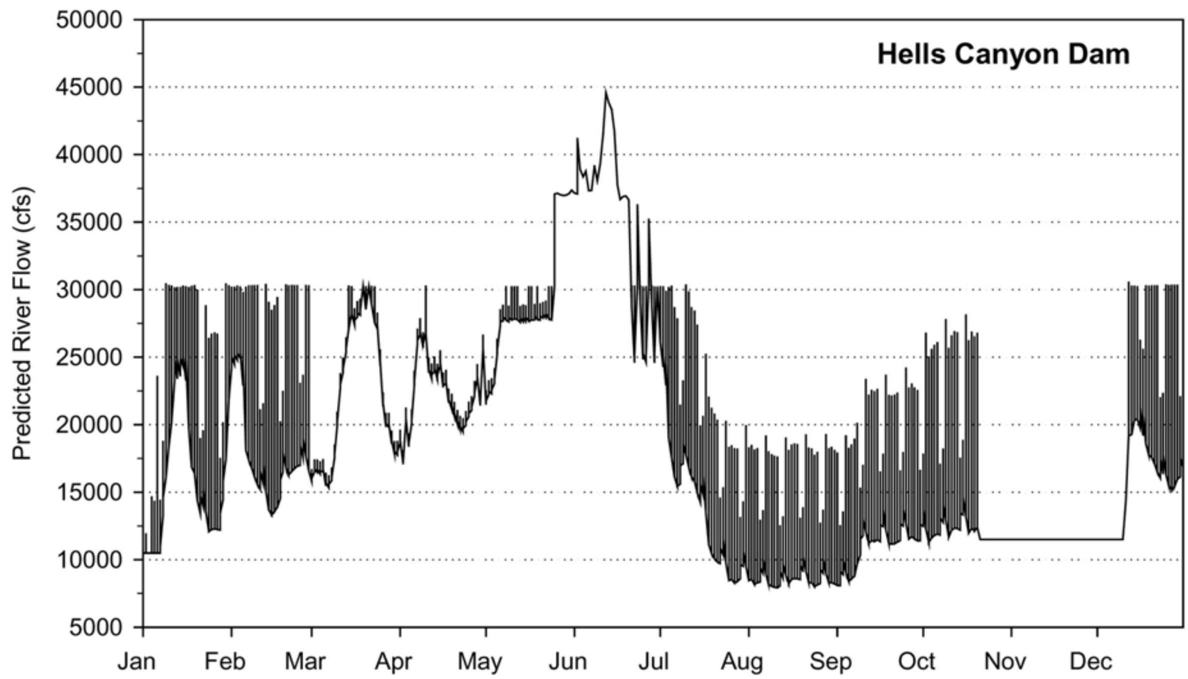


Figure E-1 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Proposed Operations for extremely low water conditions. (Source: Brink and Chandler, 2005-OP-1f)



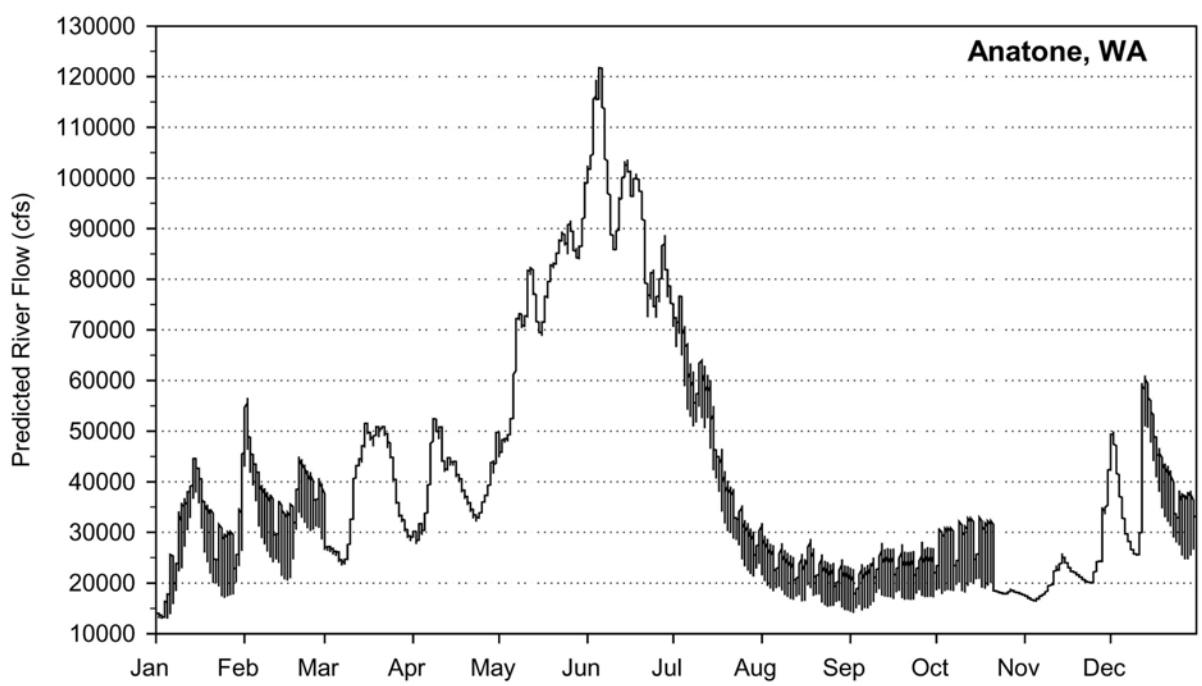
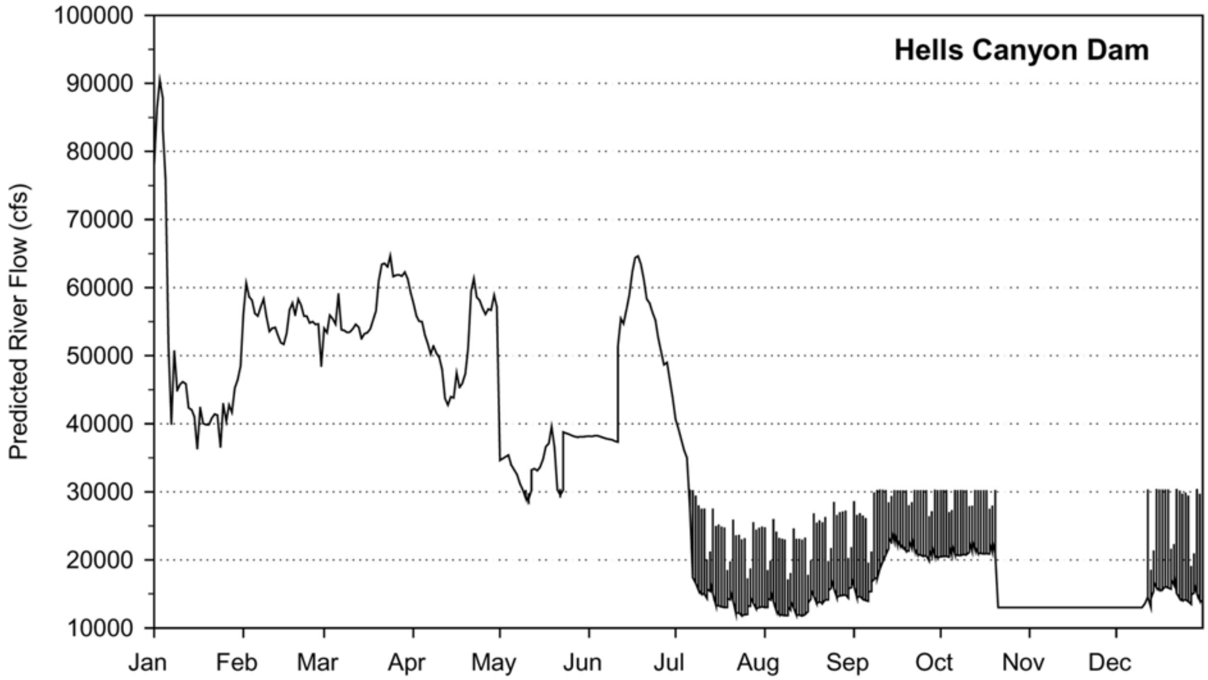


Figure E-2 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Proposed Operations for medium water condition. (Source: Brink and Chandler, 2005-OP-1f)



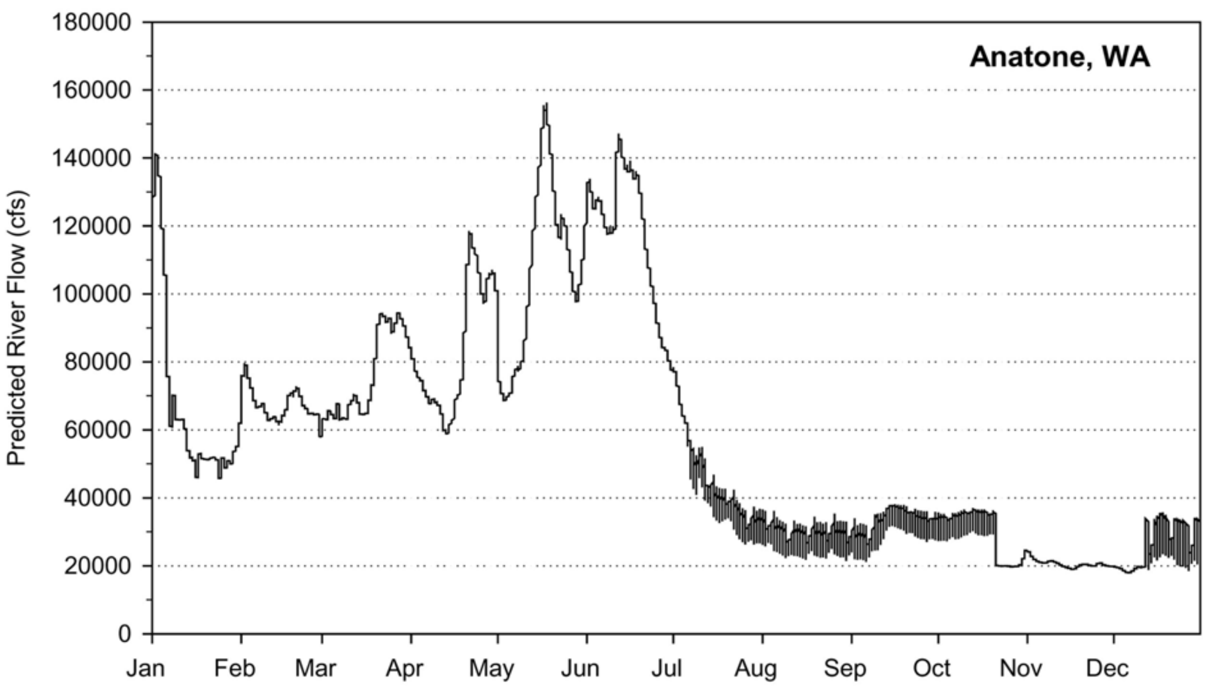
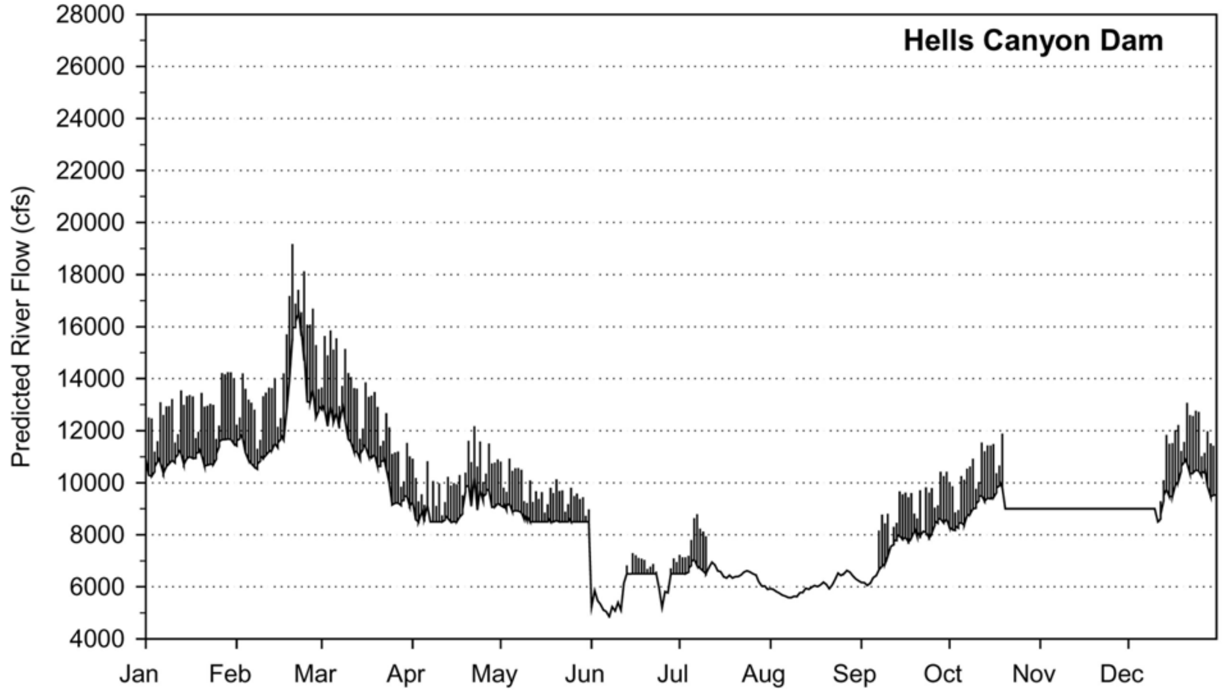


Figure E-3 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Proposed Operations for extremely high water conditions. (Source: Brink and Chandler, 2005-OP-1f)



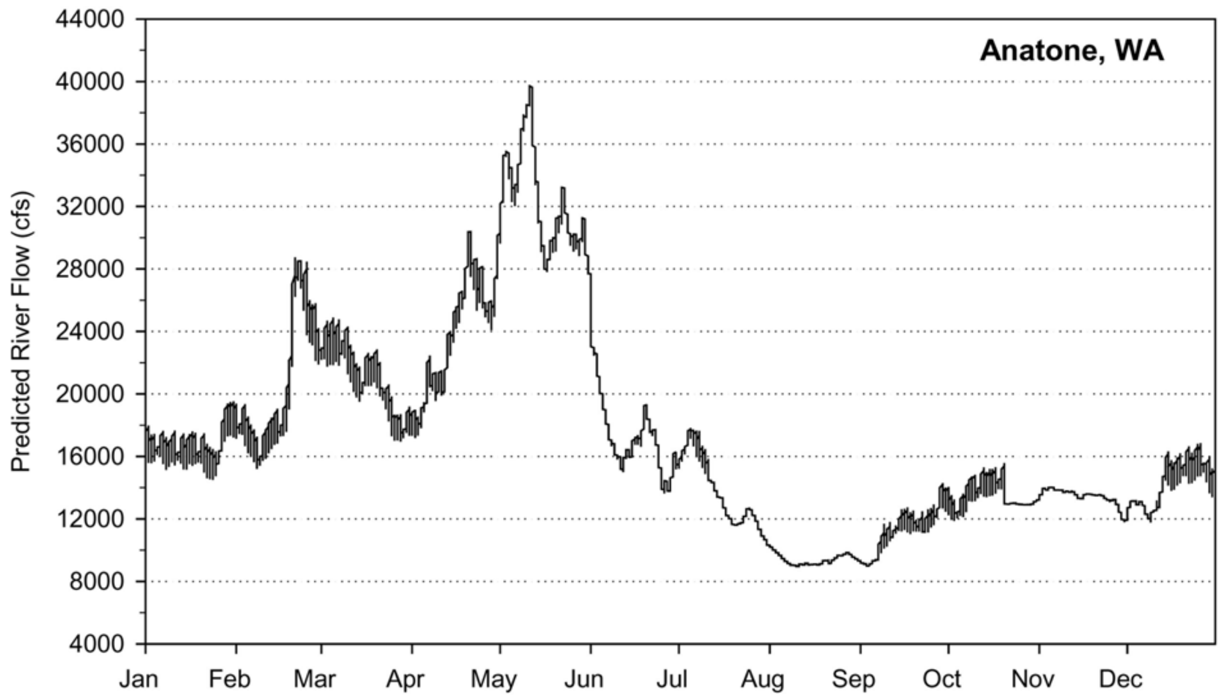
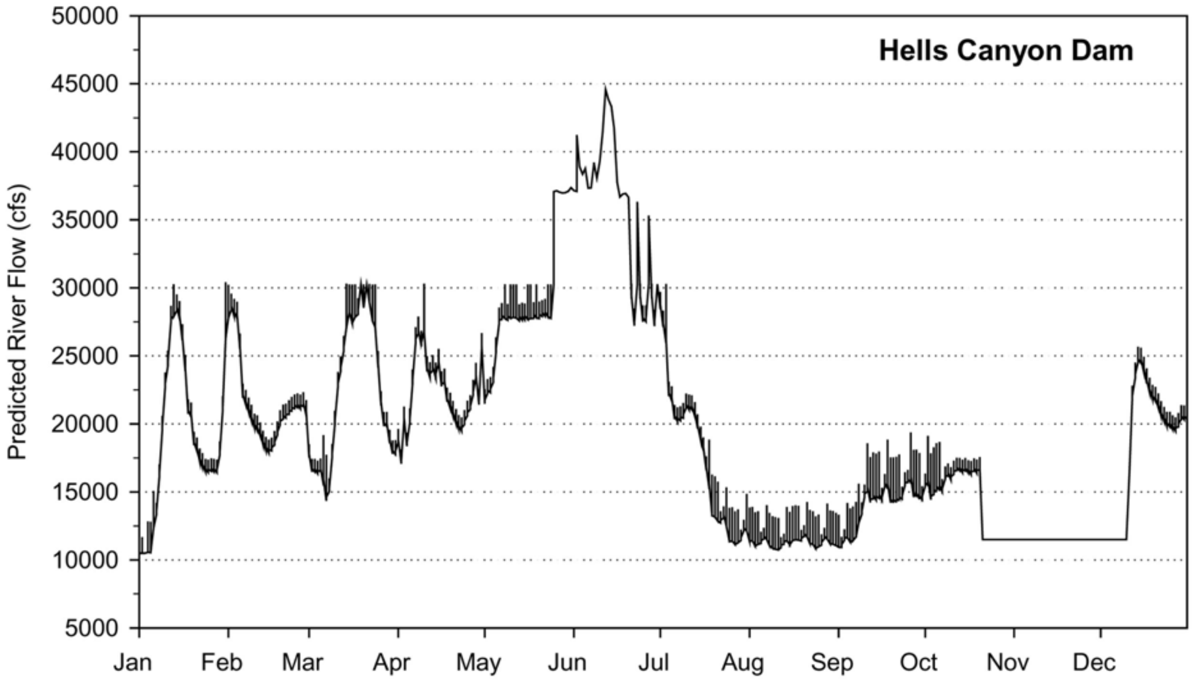


Figure E-4 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate) for extremely low water conditions. (Source: Brink and Chandler, 2005-OP-1f)



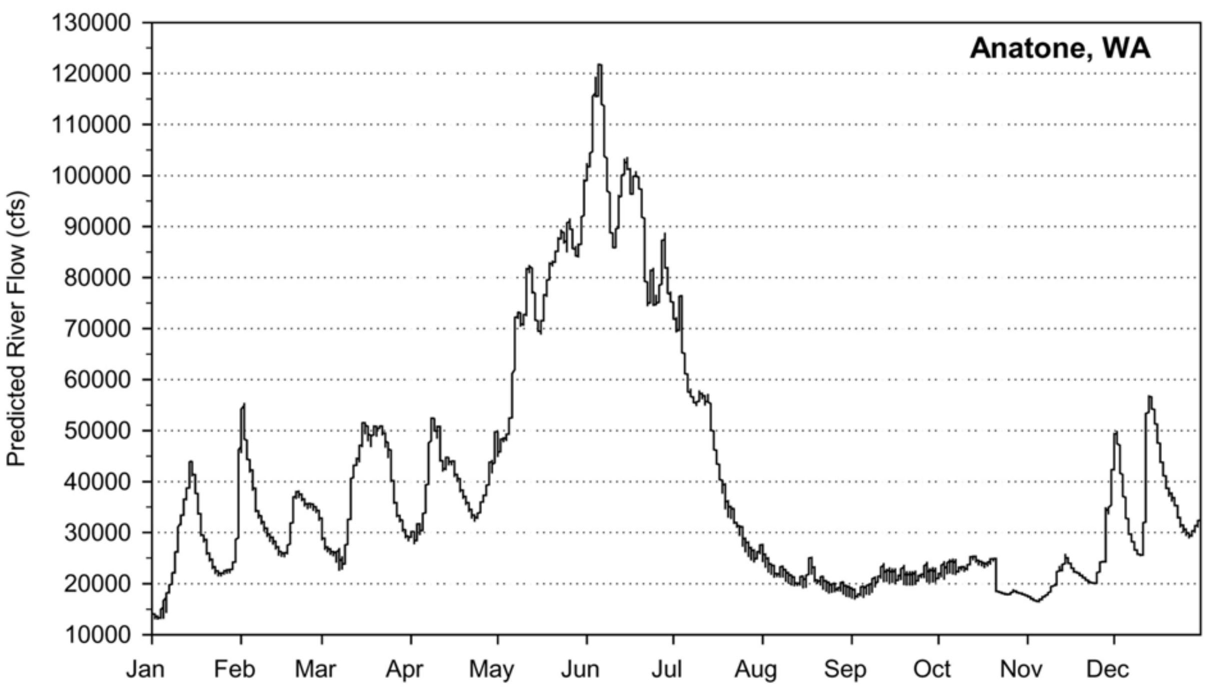
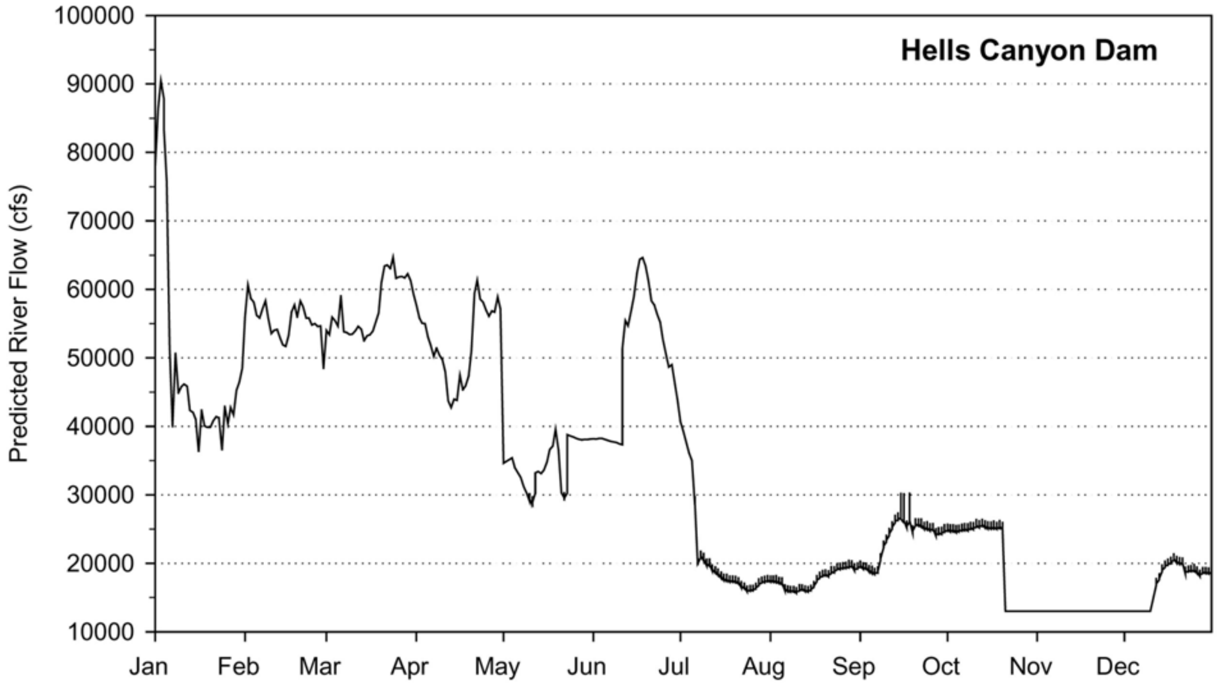


Figure E-5 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate) for medium water conditions. (Source: Brink and Chandler, 2005-OP-1f)



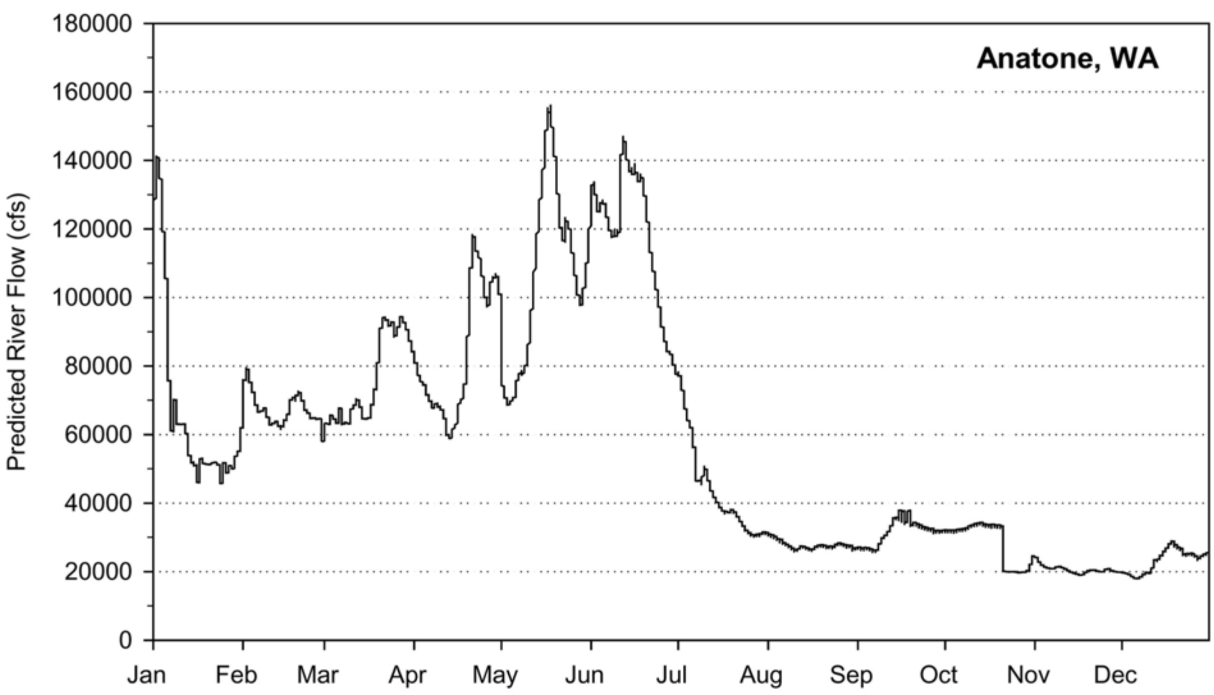
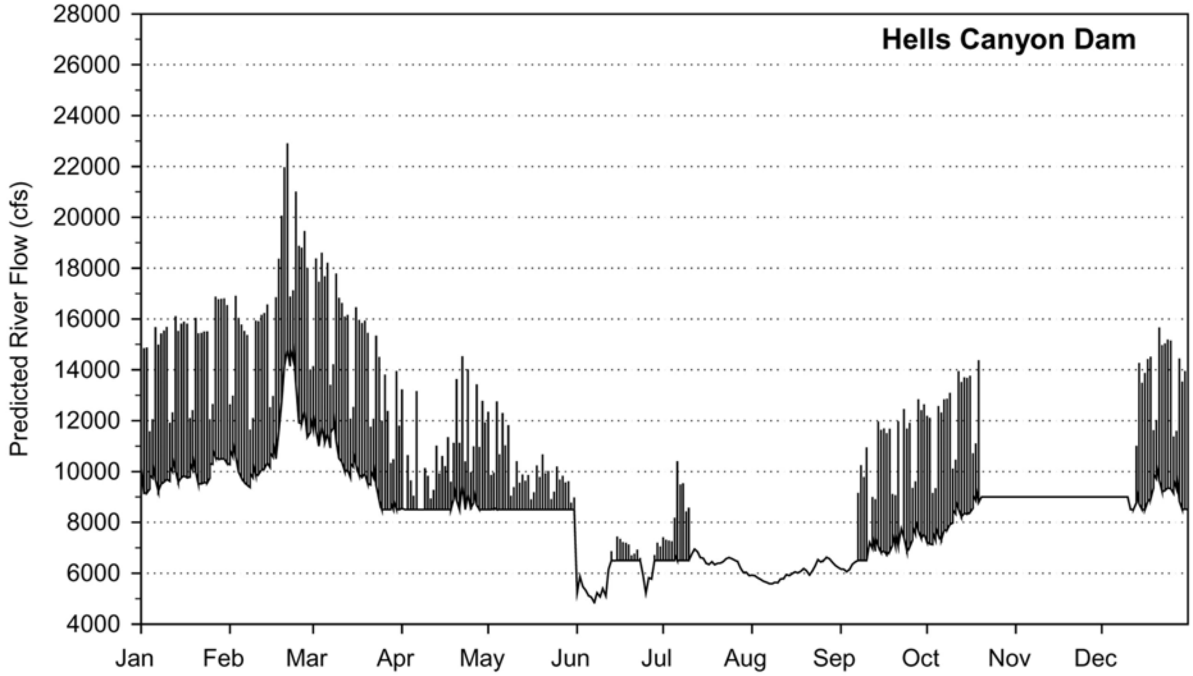


Figure E-6 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 1b (Year-round 2-Inches-Per-Hour Ramping Rate) for extremely high water conditions. (Source: Brink and Chandler, 2005-OP-1f)



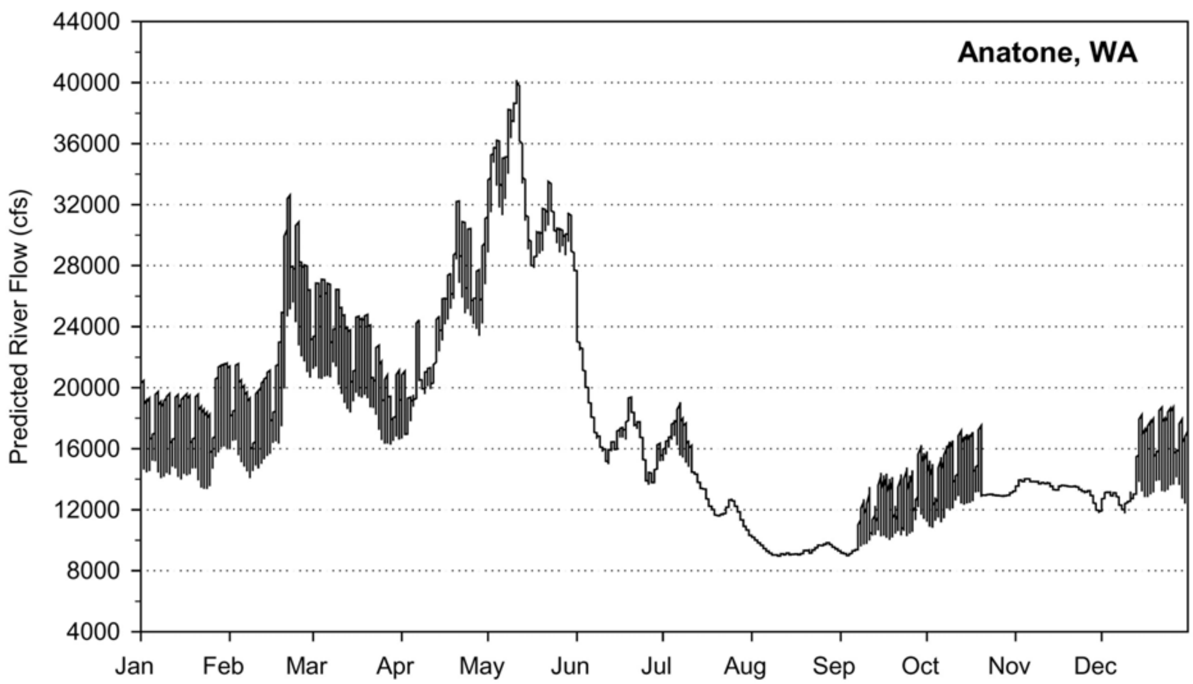
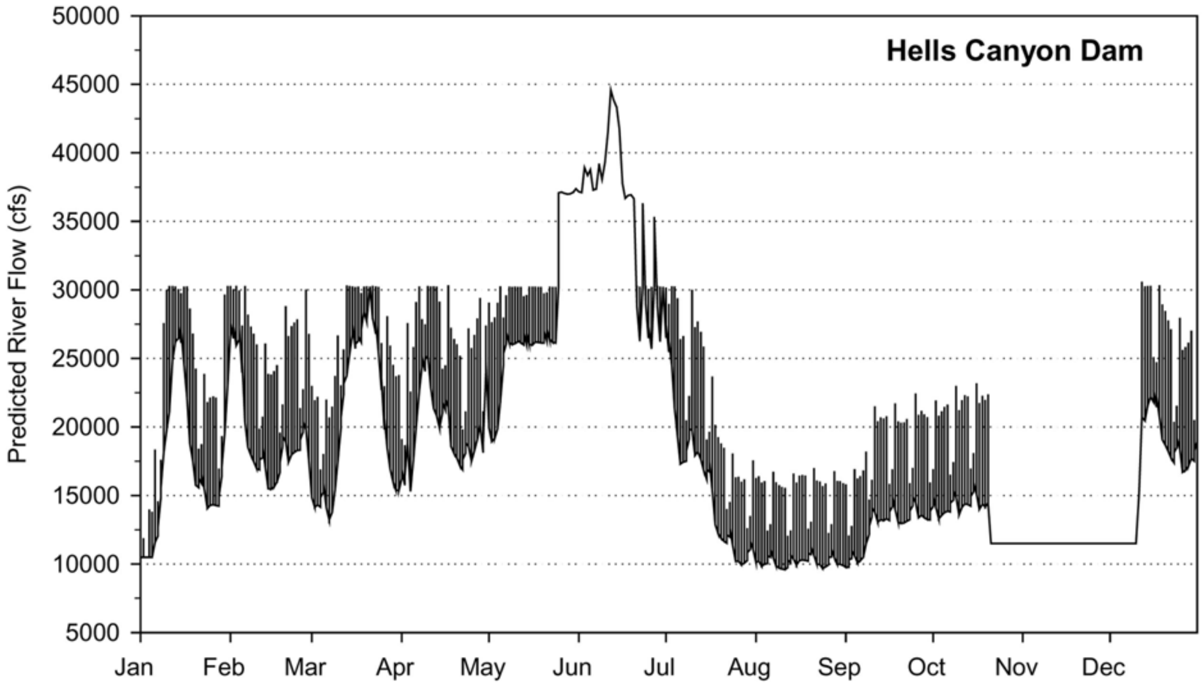


Figure E-7 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate) for extremely low water conditions. (Source: Brink and Chandler, 2005-OP-1f)



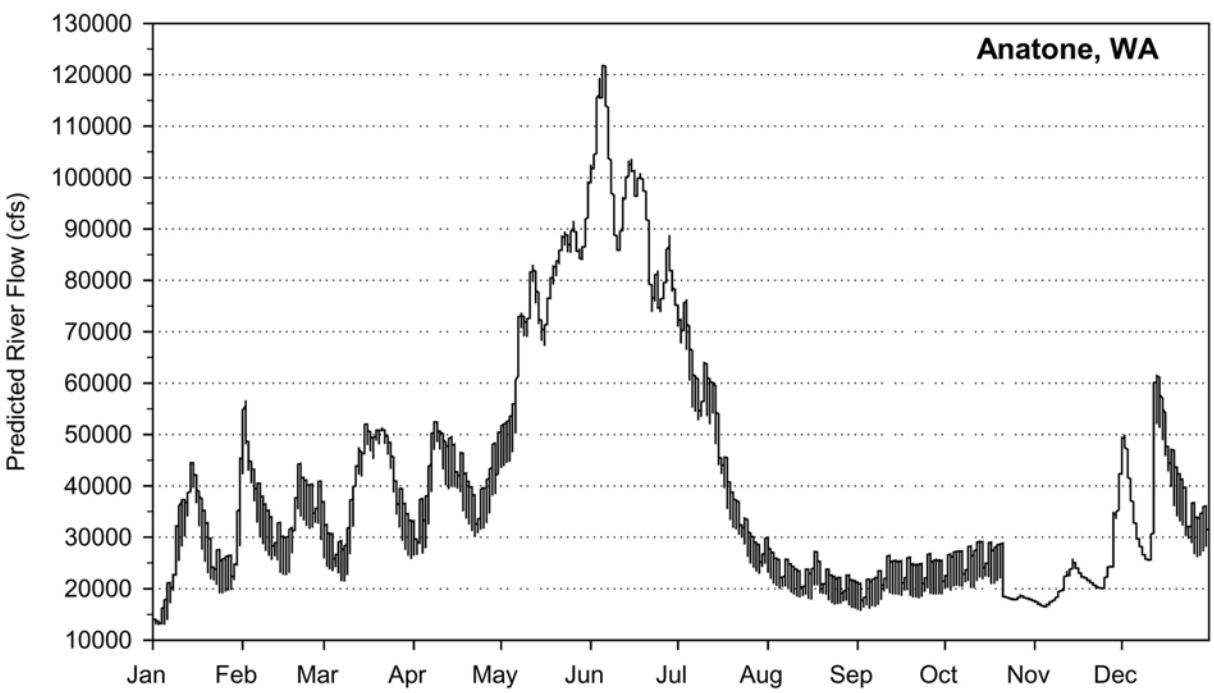
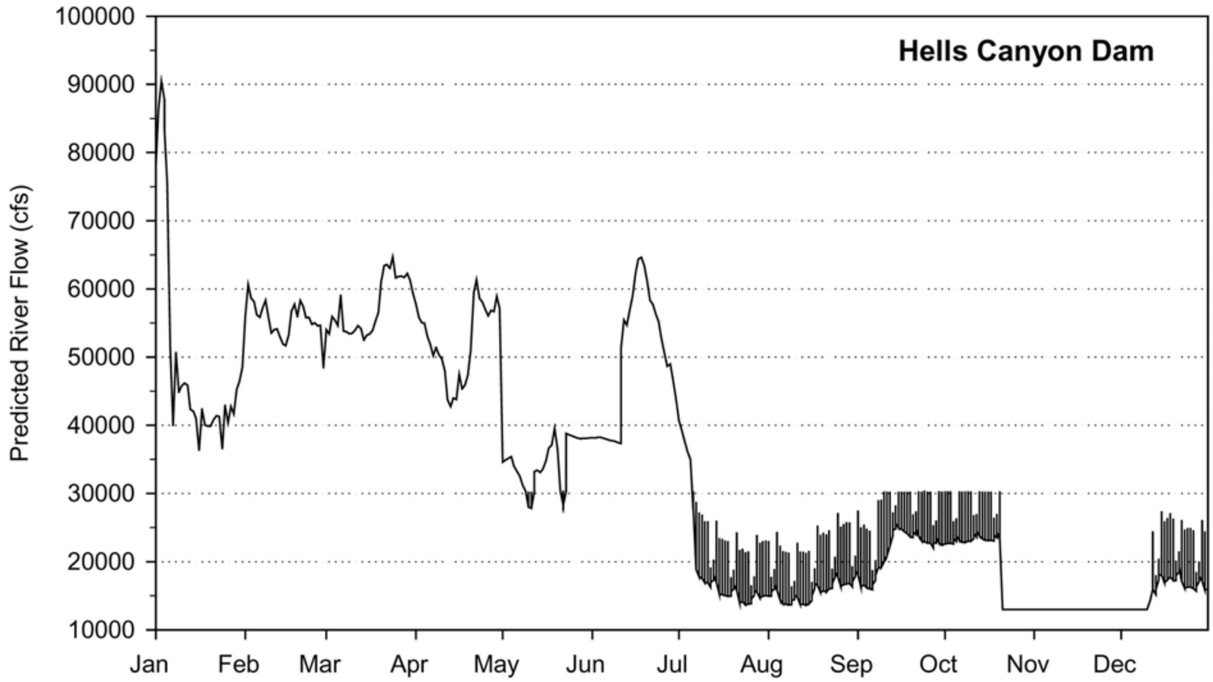


Figure E-8 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate) for medium water conditions. (Source: Brink and Chandler, 2005-OP-1f)



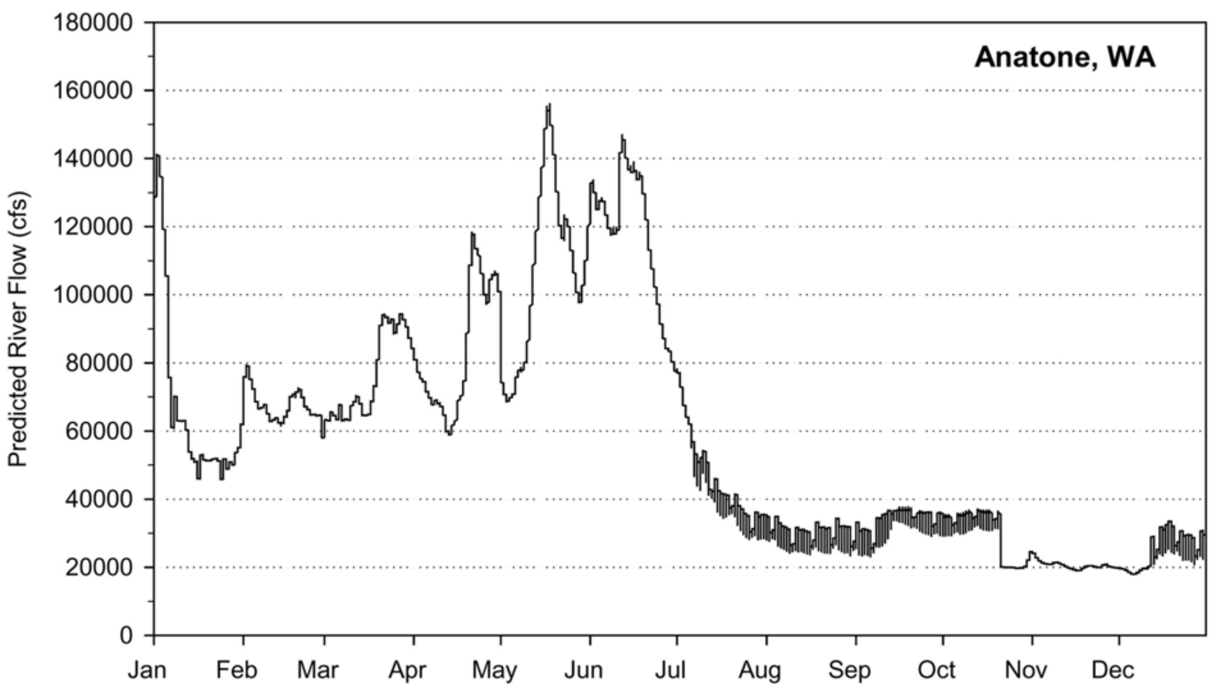
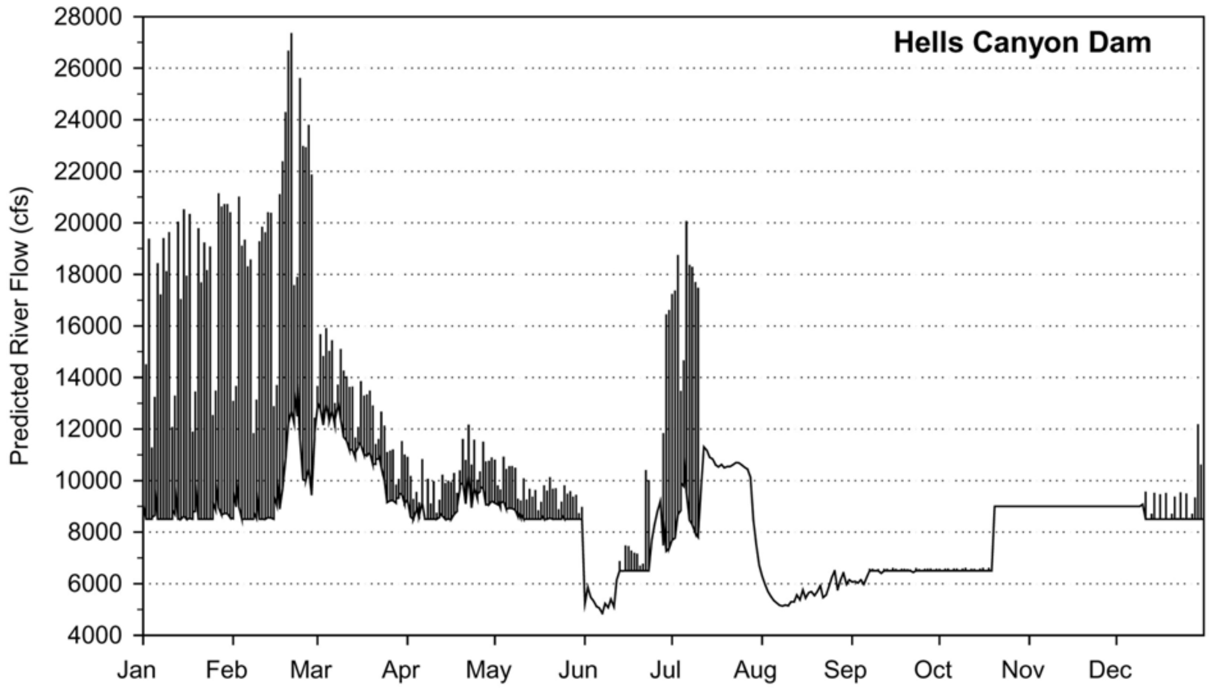


Figure E-9 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 1c (Year-round 6-Inches-Per-Hour Ramping Rate) for extremely high water conditions. (Source: Brink and Chandler, 2005-OP-1f)



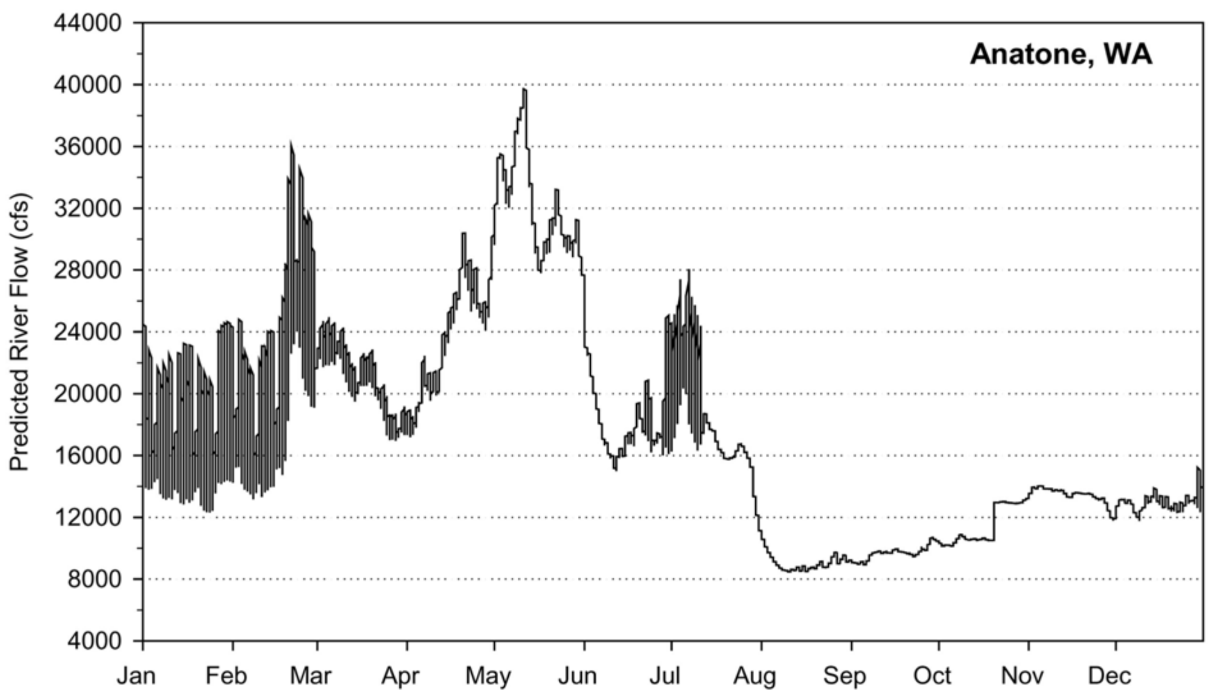
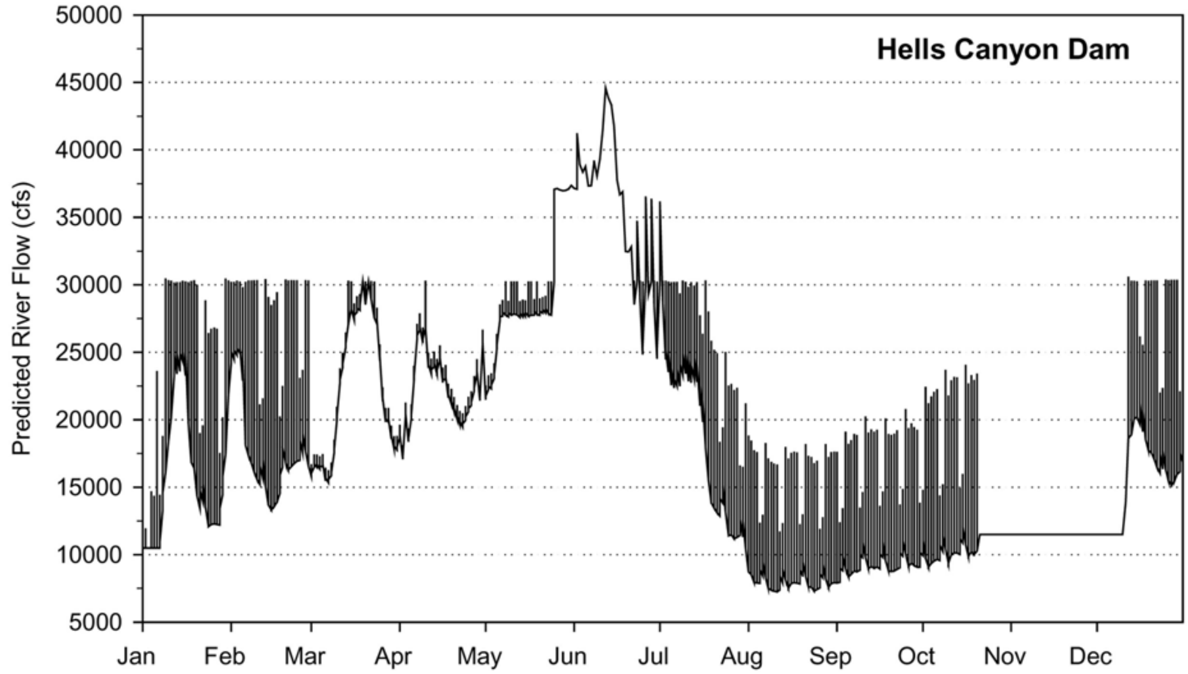


Figure E-10 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 2 (Flow Augmentation) for extremely low water conditions. (Source: Brink and Chandler, 2005-OP-1f)



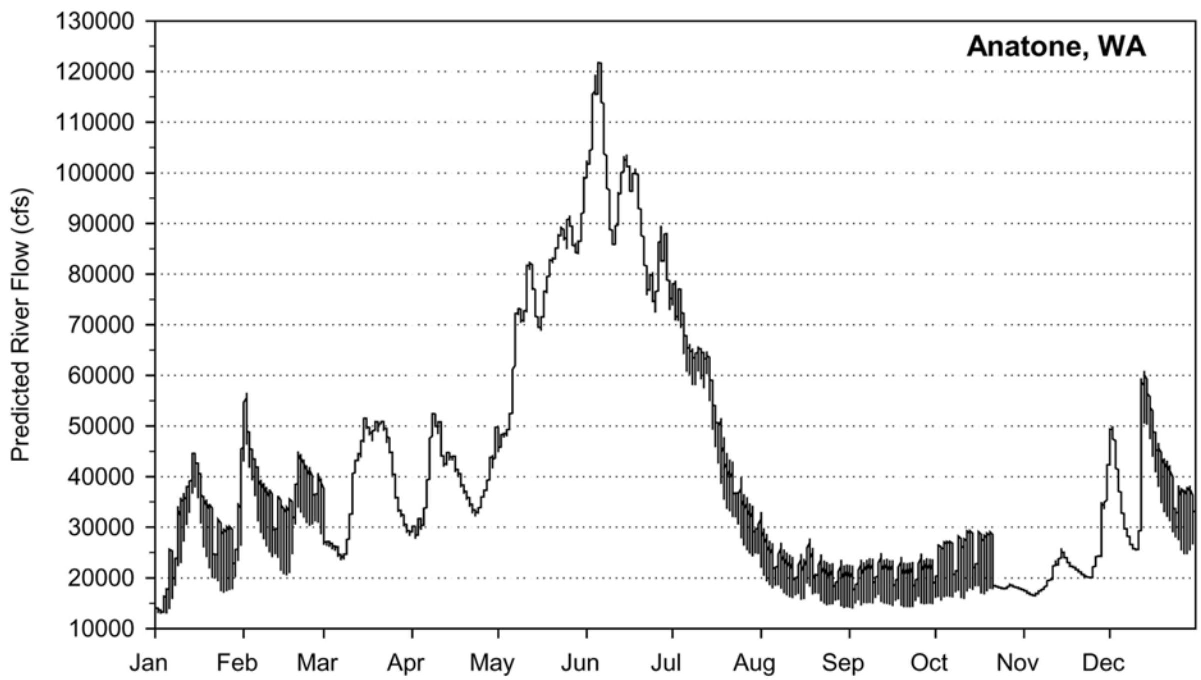
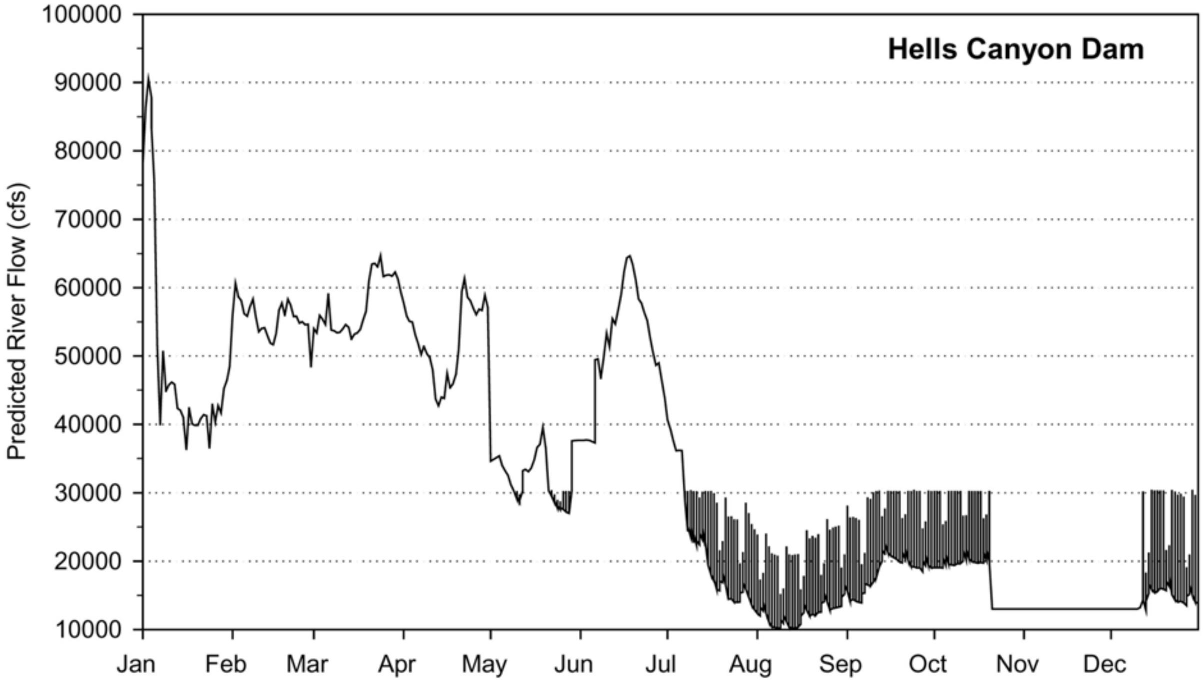


Figure E-11 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 2 (Flow Augmentation) for medium water conditions. (Source: Brink and Chandler, 2005-OP-1f)



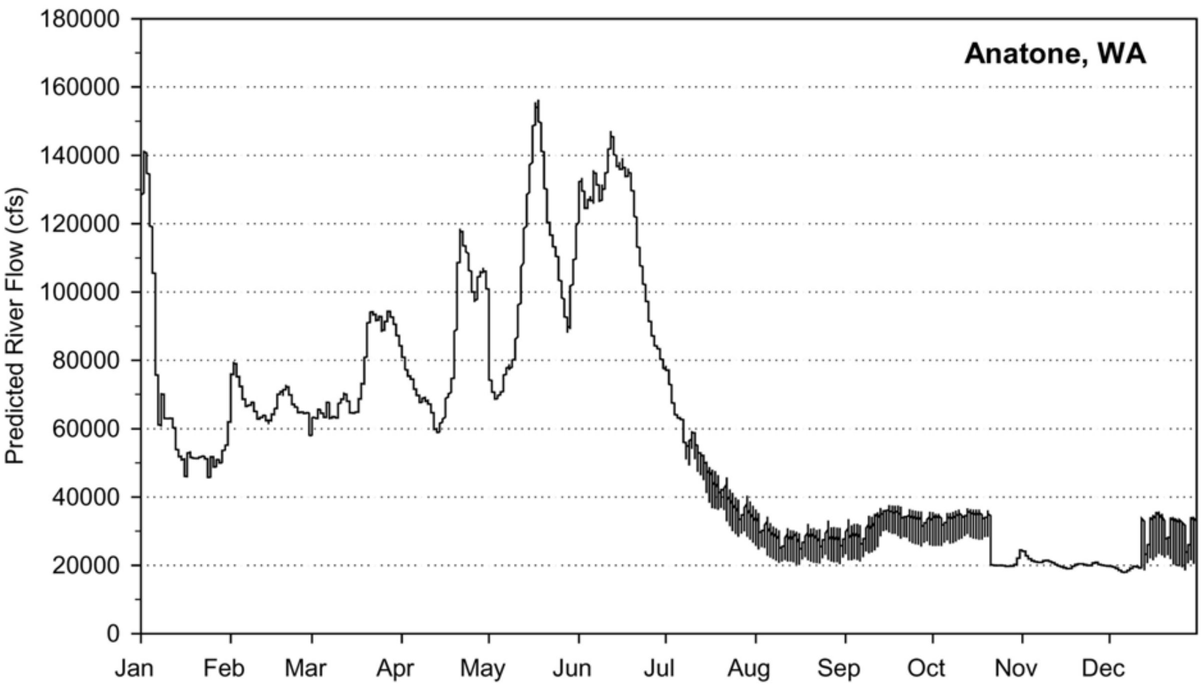
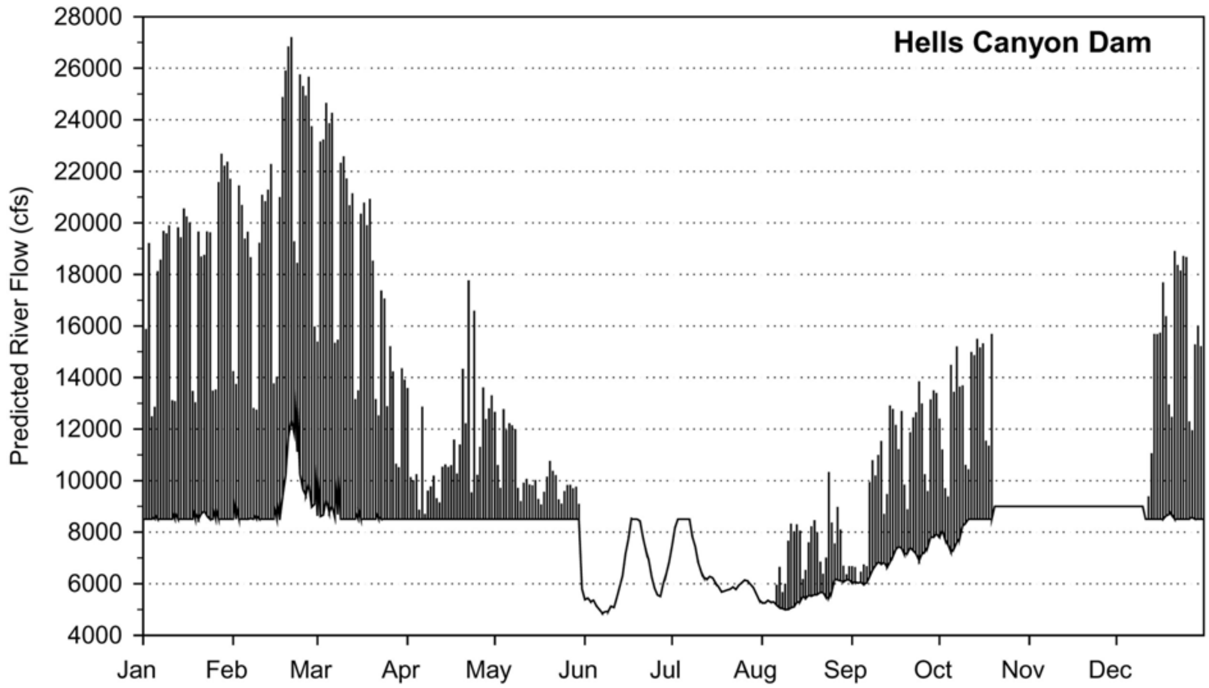


Figure E-12 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 2 (Flow Augmentation) for extremely high water conditions. (Source: Brink and Chandler, 2005-OP-1f)



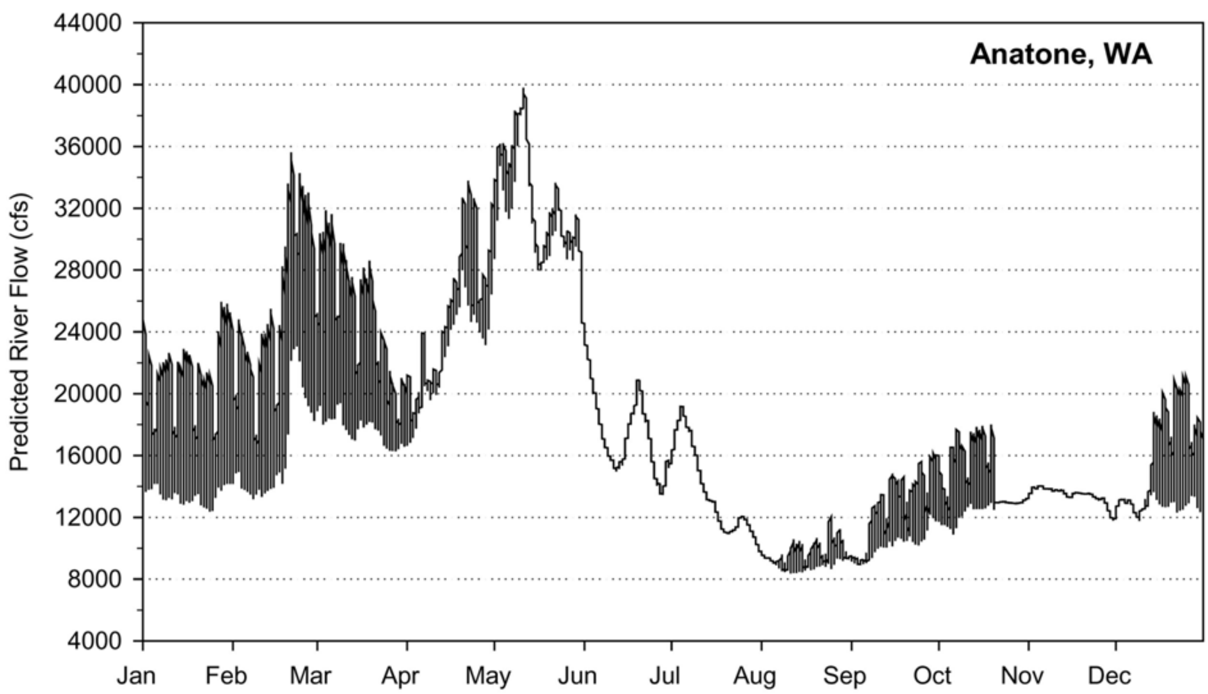
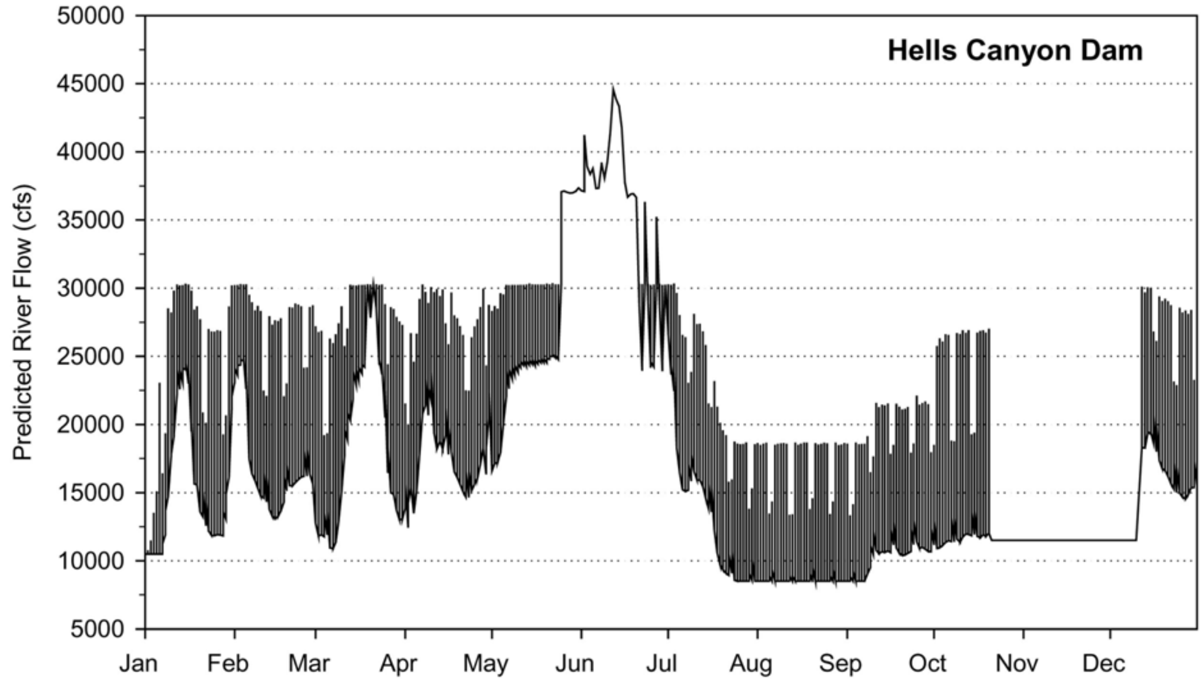


Figure E-13 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 3 (Navigation) for extremely low water conditions. (Source: Brink and Chandler, 2005-OP-1f)



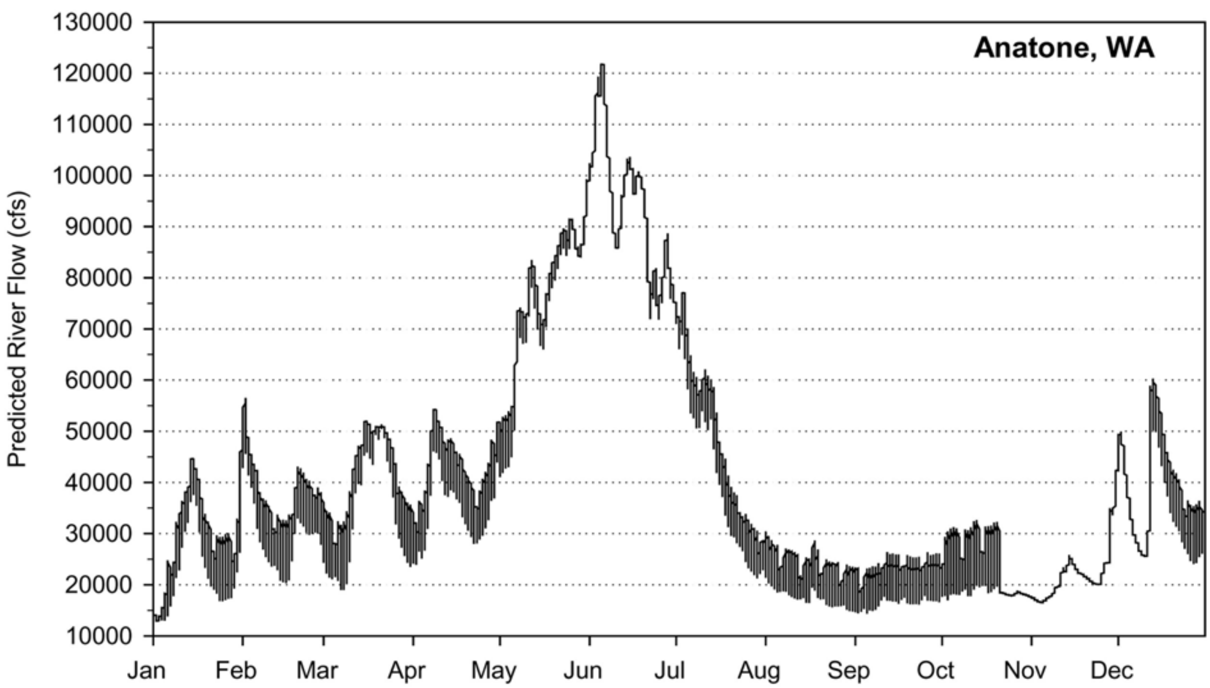
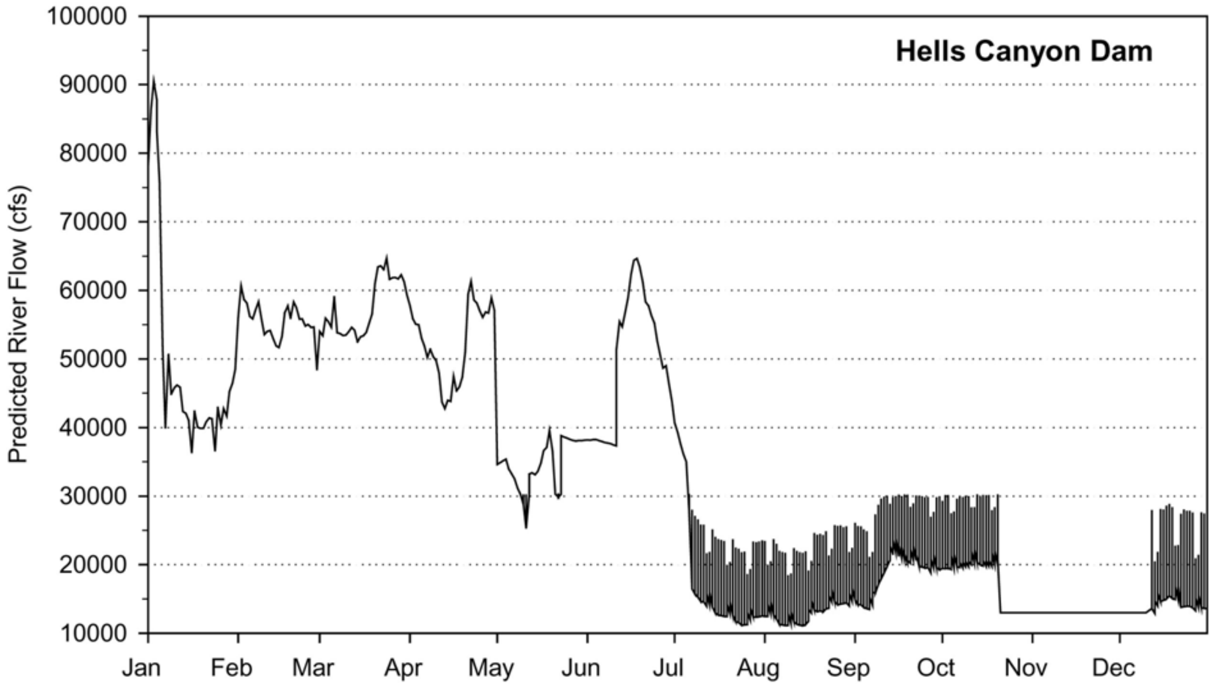


Figure E-14 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 3 (Navigation) for medium water conditions. (Source: Brink and Chandler, 2005-OP-1f)



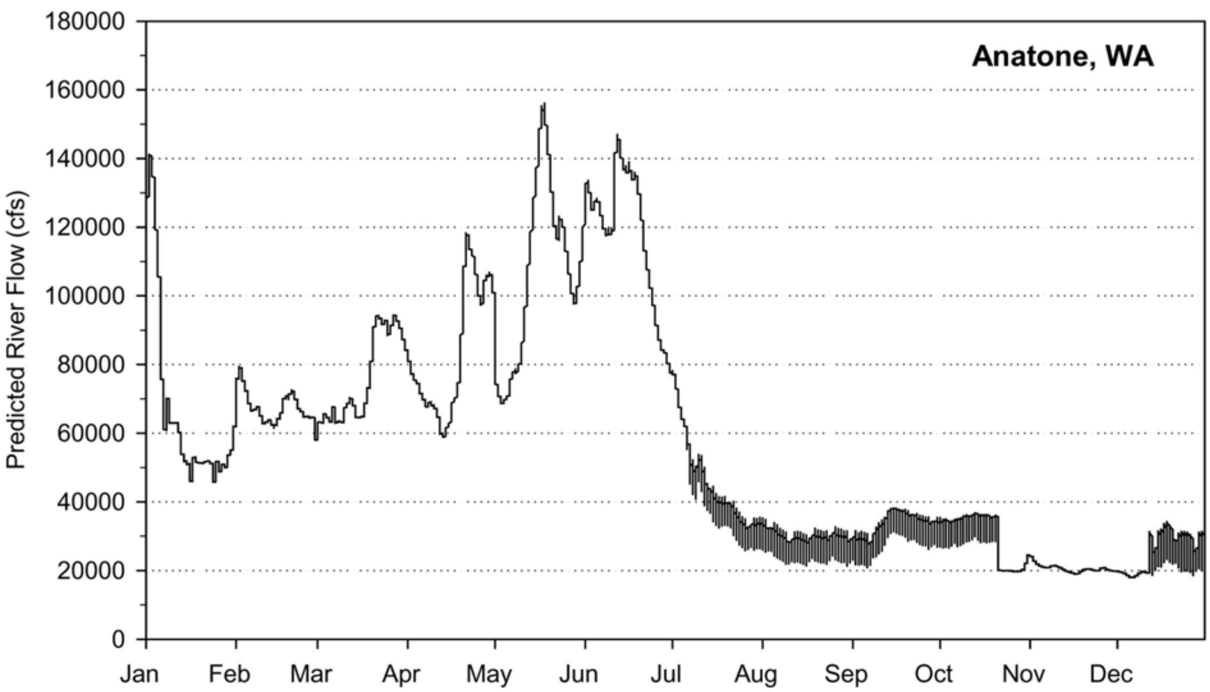


Figure E-15 Simulated river flows for the Snake River near Hells Canyon dam (top) and near Anatone (bottom) modeled under Scenario 3 (Navigation) for extremely high water conditions. (Source: Brink and Chandler, 2005-OP-1f)

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APPENDIX F

INFORMATION ABOUT THE STATUS OF BULL TROUT FROM FWS 2005 UPPER SNAKE RIVER BIOLOGICAL OPINION

BULL TROUT STATUS AND ENVIRONMENTAL BASELINE

(excerpt from March 2005 U.S. Fish and Wildlife Service's Biological Opinion on the U.S. Bureau of Reclamation's Upper Snake River Basin Projects)

Chapter 9

BULL TROUT

I. Status of the Species

A. Regulatory Status

The Service (1998) issued a final rule listing the Columbia River and Klamath River populations of bull trout as threatened. With the listing of the Jarbidge River population (Service 1999c) and the Coastal-Puget Sound and St. Mary-Belly River populations (Service 1999b) as threatened, all bull trout in the coterminous United States were considered threatened. The Service designated critical habitat for bull trout, but there is none designated within the action area. The Service (2002) published a draft recovery plan for bull trout, but the final recovery plan will not be released until the Service completes a 5-year status review (scheduled for completion in spring 2005). The purpose of the review is to determine if the bull trout should be removed from the threatened species list, if its status should be changed to endangered, or if its status should remain the same.

B. Description of the Species

Bull trout (*Salvelinus confluentus*), member of the family Salmonidae, is a char native to the Pacific Northwest and western Canada. Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to their northern boundary in the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978; Bond 1992). To the west, the bull trout range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). Bull trout are widespread throughout the Columbia River basin, including its headwaters in Montana and Canada, and also occur in the Klamath River basin of south central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978; Brewin and Brewin 1997). Girard first described bull trout as *Salmo spectabilis* in 1856 from a specimen collected on the lower Columbia River, and it was subsequently described under a number of names such as *Salmo confluentus* and *Salvelinus malma* (Cavender 1978). Bull trout and Dolly Varden (*Salvelinus malma*) were previously considered a single species (Cavender 1978; Bond 1992). Cavender (1978) presented morphometric (measurement), meristic (geometrical relation), osteological (bone structure), and distributional evidence to document specific distinctions between bull trout and Dolly Varden. The American Fisheries Society formally recognized bull trout and Dolly Varden as separate species in 1980 (Robins *et al*. 1980).

C. Status and Distribution

Though widely distributed in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 44 to 45 percent of their potential historical range (Quigley and Arbelbide 1997; Rieman *et al*. 1997). Habitat loss, fragmentation, and associated declining populations have been documented rangewide (Bond 1992; Schill 1992; Thomas 1992; Ziller 1992; Rieman and McIntyre 1993; Newton and Pribyl 1994; Idaho Department of Fish and Game, *in litt*., 1995). Several local extinctions have been reported, beginning in the 1950s (Rode 1990; Ratliff and Howell 1992; Donald and Alger 1993; Goetz 1994; Newton and Pribyl 1994; Berg and Priest 1995; Light *et al*.

1996; Buchanan and Gregory 1997; Washington Department of Fish and Wildlife 2004). The combined effects of habitat degradation and fragmentation, blockage of migratory corridors, degraded water quality, angler harvest and poaching, entrainment into diversion channels and dams, introduced non-native species (*e.g.*, brook trout (*Salvelinus fontinalis*)), and climate change (Reiman *et al*. 1997) have resulted in declines in bull trout distribution and abundance. Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (Service 2002).

The Columbia River distinct population segment includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. The Columbia River distinct population segment has declined in overall range and numbers of fish. In some areas within the distinct population segment, robust populations of bull trout still exist. However, many occur as isolated local populations in headwater lakes or tributaries where migratory fish have been lost, potentially as a result of habitat fragmentation, isolation, and barriers that limit bull trout distribution and migration within the basin.

In its draft recovery plan for bull trout, the Service (2002) divides the Columbia River distinct population segment into 22 recovery units, each of which is comprised of one or more core areas and further divided into local populations. These divisions were intended to provide a structure that considers both the genetic relationship of local population and management options (recovery units), to reflect metapopulation structure (core areas), and to approximate a panmictic (completely random breeding) group of individuals (Service 2002; Whitesel *et al*. 2004). Whitesel *et al*. (2004) evaluated the appropriateness of these divisions. They found that the definitions and delineations of local populations and core areas hold true to theory in some cases but not all. In general, they indicated that this scale of delineation is appropriate. However, they found that recovery units, as defined, did not adequately represent biological groupings of bull trout, and they recommended the use of Conservation Units instead, as described below.

Recent literature (Spruell *et al*. 2003) provides updated information on the genetic population structure of bull trout across the northwestern United States. Based on analysis of four microsatellite loci, Spruell *et al*. (2003) suggested that there are three major genetically differentiated groups (lineages) of bull trout represented within the Columbia River distinct population segment. They described these as “Coastal” populations, “Snake River” populations, and “Upper Columbia” populations (including primarily the Lake Pend Oreille and Clark Fork basin populations), with populations further subdivided, primarily at the level of major river basins. Whitesel *et al*. (2004) used this and other information to describe four “Conservation Units” (upper Columbia River, Snake River, Klamath River, and Coastal- Puget Sound) that are thought to represent the best estimate for delineation of areas that are necessary to ensure evolutionary persistence of bull trout.

The action area for this consultation falls within the Snake River Conservation Unit, which includes the Clearwater, Salmon, Grande Ronde, Umatilla/Walla Walla, John Day, Malheur, Boise, Payette, Weiser, Imnaha/Snake, Jarbidge, and Powder River basins, and Pine and Indian Creeks. The status of populations within these basins varies widely, and overall abundance of bull trout in some populations is largely unknown (*e.g.*, in the Salmon River basin). We do not have reliable abundance information for all of these basins, but we can characterize them in a qualitative way based on number of local populations and some incomplete abundance information. For the purposes of this document, strong populations are those that are considered well distributed and relatively abundant within the capability of the watersheds in which they exist. The Clearwater, Salmon, Umatilla/Walla Walla, and Imnaha/Snake River basins have bull trout populations in a variety of conditions, including some that are relatively strong (areas with 2,500 to 5,000 adults or more). The Grande Ronde, John Day, Boise, and Payette River basins also have bull trout populations in a variety of conditions, with the whole basin abundance best characterized as moderate (*e.g.*, approximately 500 adults). Populations in the Weiser, Jarbidge, Malheur, and Powder

River basins, and Pine and Indian Creeks are weak, with less than 500 adults in the total basin.

1. Historical Distribution

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 and 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978; Bond 1992). The range extended east of the continental divide in the headwaters of the Saskatchwan River in Alberta and Montana and in the Mackenzie River system in Alberta and British Columbia, Canada (Cavender 1978; Brewin and Brewin 1997).

Bull trout were present throughout the Snake River basin and in the western section of Idaho downstream from Shoshone Falls, including the Clearwater, Salmon, Boise, and Payette River systems. The species is reported to have been widely dispersed throughout the basin, limited only by natural passage and thermal barriers. In this drainage, their historical range approximates that of spring, summer, and fall Chinook salmon (Thurow 1987; Rieman and McIntyre 1993) and possibly included the Owyhee and Bruneau River basins and other tributaries upstream as far as Salmon Falls Creek. They are not known to have occurred in the Snake River upstream from Shoshone Falls, the Wood River system, Birch Creek, or any stream in Idaho that drains the Centennial Mountains between Henrys Lake and the Bitterroot Range. An isolated population exists in the Little Lost River near Howe, Idaho, between the Lost River and Lemhi mountain ranges (Batt 1996).

In eastern Oregon, bull trout are present in the Grand Ronde, Malheur, and Powder River systems, but they are not known to occur in the Burnt River system. Data on its historical distribution in the Malheur River drainage is limited and dates from Oregon Department of Fish and Wildlife observations beginning in 1955 (Buchanan *et al*. 1997). Before the construction of dams, bull trout could access the Snake River from the Malheur and North Fork Malheur Rivers. Anadromous salmon and steelhead historically spawned in the upper Malheur River basin (Northwest Power and Conservation Council 2002). The lower Malheur River was most likely too warm for bull trout spawning or juvenile rearing but would have provided migratory habitat to and from the Snake River and overwintering habitat (Hanson *et al*. 1990 in Buchanan *et al*. 1997).

The Snake River Hells Canyon subbasin lies within the historical native range of bull trout, although no clear documentation of the historical distribution of bull trout within the subbasin exists (Nez Perce Tribe 2004). According to Buchanan *et al*. (1997), there is no documentation of bull trout in the Powder River basin prior to the 1960s. It is suspected that they were widespread in the upper Powder River drainage and seasonally connected to the Snake River. Historical information about the distribution of bull trout below Hells Canyon Dam in the mainstem Snake River is very limited (Chandler 2003). Buchanan *et al*. (1997) reported that the Idaho Department of Fish and Game observed bull trout at the mouth of Sheep, Granite, Deep, and Wolf Creeks between Hells Canyon Dam and the Imnaha River. The distribution of bull trout may have paralleled the distribution of potential prey such as whitefish and sculpins. In several river basins where bull trout evolved with populations of juvenile salmon, bull trout abundance declined when juvenile salmon prey declined or were eliminated (Ratliff 1992).

2. Current Distribution

The Service (2002) has identified 22 management units for bull trout in the Columbia River basin. Draft recovery plans for each of these units contain information relating to the current distribution of bull trout. The “Environmental Baseline” discussion in Section II of this chapter describes the current distribution of bull trout within the action area.

D. Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in or near the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for 1 to 4 years before migrating downstream to either a lake/reservoir (adfluvial), river (fluvial), or in certain coastal areas, to salt water (anadromous), where they reach maturity (Fraley and Shepard 1989; Goetz 1989). Resident and migratory forms often occur together, and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993).

Bull trout have specific habitat requirements that distinguish them from other salmonids (Rieman and McIntyre 1993). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear, and that the characteristics are not necessarily ubiquitous throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), the fish should not be expected to simultaneously occupy all available habitats (Rieman *et al*. 1997).

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the Columbia River basin (Fraley and Shepard 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman *et al*. 1997). Dunham *et al*. (2003) found that the probability of bull trout occurrences is low when mean daily temperatures exceed 14 to 16 °C; Selong *et al*. (2001) reported that maximum growth of bull trout occurred at 13.2 °C. These temperature requirements may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989; Rieman and McIntyre 1995). Spawning areas are often associated with high elevation, colE-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman *et al*. 1997). Goetz (1989) suggested optimum water temperatures for rearing of about 7 to 8 °C and optimum water temperatures for egg incubation of 2 to 4 °C. In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 to 9 °C within a temperature gradient of 8 to 15 °C. Dunham *et al*. (2003) found that maximum bull trout use during the summer (July 15 to September 30) occurred between 7 and 12 °C. All bull trout life history stages are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). In general, bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993). Jakober (1995) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997).

Fraley and Shepard (1989) found that bull trout select spawning habitat in low gradient stream sections with gravel substrates; Goetz (1989) found preferred spawning water temperatures of 5 to 9 °C. They typically spawn from August to mid-October during periods of decreasing water temperatures. High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentage of fine sediments (Shepard *et al*. 1984). Pratt (1992) indicated that increases in fine sediments reduce egg survival and emergence.

Life history strategy influences bull trout size. Growth of resident fish is generally slower than growth of migratory fish; resident fish tend to be smaller at maturity and less fecund (Fraley and Shepard 1989; Goetz 1989). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Repeat and alternate-year spawning has been reported, although repeat spawning frequency and post-spawning mortality are not well understood (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

Migratory bull trout frequently begin migrations as early as April and have been known to move upstream as far as 250 kilometers (155 miles) to spawning grounds (Fraley and Shepard 1989). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to fry emergence may exceed 200 days. Fry normally emerge from early April through May, depending upon water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivores (Fraley and Shepard 1989; Donald and Alger 1993). Rieman and McIntyre (1993) indicated that diverse life history strategies are important to the stability and persistence of populations of any species. Such diversity is thought to stabilize populations in highly variable environments or to reestablish segments of populations that have disappeared due to anthropogenic or natural events.

Variation in the timing of migration and in the timing and frequency of spawning within a metapopulation also represents diversity in life history. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). Bull trout may spawn each year or in alternate years (Block *et al.* in Batt 1996). It is possible that four or more age-classes could comprise any spawning population, with each age-class including up to three migration strategies (Rieman and McIntyre 1993). This theory supports the idea that the multiple life history strategies found in bull trout populations represent important diversity within populations.

E. Population Dynamics

Migratory corridors link seasonal habitats for all bull trout life history forms, and the ability to migrate is important to the persistence of local bull trout populations (Rieman and McIntyre 1993; Rieman *et al.* 1997). Pre- and post-spawning migrations facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to non-natal streams. Local populations extirpated by catastrophic events may also become reestablished in this manner. Metapopulation concepts of conservation biology theory are applicable to the distribution and characteristics of bull trout (Rieman and McIntyre 1993). Local populations may become extinct, but they may be reestablished by individuals from other nearby local populations. Metapopulations provide a mechanism for reducing the risk of local extinction because the simultaneous loss of all local populations is unlikely, and multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events (Rieman and McIntyre 1993).

F. Conservation Needs

Bull trout conservation requires the long-term persistence of self-sustaining, complex, interacting groups of fish distributed throughout the species' native range. Two of the factors identified as necessary for recovery also translate into general factors that address the conservation needs of the species. These two factors include restoring and maintaining suitable habitat conditions for all bull trout life stages and life history strategies, and conserving genetic diversity and providing opportunity for genetic exchange. To achieve these general needs, several specific conservation measures should be addressed. The first involves metapopulation theory. As described above, a functioning metapopulation is comprised of multiple local populations distributed and interconnected throughout a watershed, which provides a mechanism for reducing the risk of extirpation associated with stochastic events.

The second measure involves connectivity between populations. A migratory component in bull trout populations is recognized as important to overall health, long-term persistence, and recovery because it allows for reestablishment of populations in reaches where bull trout have been extirpated (Rieman and McIntyre 1993; Whiteley *et al*. 2003). In addition, migratory bull trout are larger and more fecund than their resident counterparts. The greater reproductive capacity of migratory bull trout is also thought to provide an important contribution to the abundance and long-term persistence of local populations (Rieman and McIntyre 1993). In addition, migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to non-natal streams. Dams, irrigation diversions, and other waterway alterations have interrupted bull trout migration. Dams need adequate fish passage to maintain populations with migratory life histories that habitat conditions are not available. Without fish passage, dams may isolate upstream and downstream bull trout populations or limit them exclusively to one or the other.

An adequate prey base is another essential component for bull trout conservation. Bull trout are described as having voracious appetites, which makes them vulnerable to angling injury or mortality (Post *et al*. 2003). Fish are considered to be the major item in the diet of large bull trout. They feed primarily along the bottom and mid-water levels, consuming insects and other fish species such as suckers, sculpins, minnows, and trout (Pratt 1992). Mountain whitefish and kokanee salmon are two of the bull trout's preferred prey (Fraley and Shepard 1989; Vidergar 2000).

Appropriate habitat conditions are also essential for bull trout survival. Bull trout have more specific habitat requirements than other native trout species, mainly because they require water that is especially cold with clean cobble or gravel size substrate for spawning and development of embryos and alevins. Available overwintering habitat, bank stability, winter precipitation, drought, substrate type, available cover, cold water temperature, and the presence of migration corridors consistently appear to influence bull trout distribution and abundance (see Allan *et al*. in Batt 1996; Dunham and Rieman 1999; Salow 2001; Salow and Cross 2003). Reductions in road construction for timber harvest and fire control measures are needed since they lead to increased siltation, channelization, and loss of habitat complexity and may have lead to historical declines in bull trout.

Conservation of bull trout is also dependent on protecting bull trout genetic diversity and phenotypic adaptation within each distinct population segment and spreading or reducing the risk of extinction through the maintenance of multiple populations across the range. Retaining a species' genetic variation is important because this variation allows populations to adapt to changing environmental conditions over short (inter-generational) and long (evolutionary) time frames (Allendorf and Leary 1986) and is the basis for maintaining a species' evolutionary legacy, including its geographical distribution, and morphological, physiological, and life-history variation (Allendorf *et al*. 1997).

Loss of genetic variation negatively affects the development, growth, fertility, and disease resistance of fishes. This loss of variation may also reduce fitness and preclude adaptive change in populations (Frankham 1995) or affect the species' ability to recover from disturbance events (Rieman *et al*. 1997). Genetic variation needs to be preserved in order to increase the likelihood of a species survival (Allendorf and Leary 1986), and maintaining genetic variation within populations should be a primary goal of conservation and management of species (Wang *et al*. 2002), bull trout included. In general, an effective population size (Ne) of 50 is necessary to avoid inbreeding depression, and a Ne of 500 is necessary to avoid the loss of genetic and phenotypic variation through genetic drift over the long term. However, Rieman and Allendorf (2001) found that populations with a Ne of 500 may still lose genetic variation over the long term (200 years) and recommended that long-term management goals, where appropriate, include populations with at least 1,000 spawning adults each year. Bull trout populations on the margin of the species' range may be adapted to unique environments and may represent a disproportionate part of the total diversity within the species, although the importance of this in a given population is affected by gene flow, generational time, life history, and ecological conditions (Rieman *et al*. 1997; Lesica and Allendorf 1995). The preceding section, "Status and Distribution," describes new scientific information indicating that Conservation Units (as described in Whitesel *et al*. 2004) may be the most accurate representation of the evolutionary lineage and genetic structure of populations of bull trout (see Spruell *et al*. 2003; Whitesel *et al*. 2004). Each Conservation Unit across the range of bull trout contains an environmental template that allows the full expression of genotypic, phenotypic, and spatial diversity among bull trout populations. The conservation of this template will help ensure resilience and persistence of the species when environmental changes occur. To ensure the evolutionary persistence of bull trout within a Conservation Unit, Whitesel *et al*. (2004) suggested that an effective population size of at least 5,000 is necessary. They also suggested that conservation of the species within a Conservation Unit is necessary to ensure the evolutionary persistence of the species as a whole. This represents the most recent scientific information available regarding appropriate conservation units for bull trout. In this Opinion, the Service will consider effects to bull trout within the Snake River Conservation Unit and the subsequent relationship to the larger Columbia River distinct population segment.

A related conservation need of the species involves the development of conservation assessments and prioritization of populations for management and conservation actions across the range (see Epifanio *et al*. 2003; Allendorf *et al*. 1997). Currently, work has not been completed range-wide to describe the conditions affecting individual populations or metapopulations, the risk of local extinction, or the ecological and evolutionary importance of metapopulations or river basins to the larger Conservation Units or to the Columbia River distinct population segment. Because bull trout are a wide-ranging species, and scientific, financial, and human resources are limited, it is likely an unrealistic goal to treat and conserve all populations equally (Epifanio *et al*. 2003). Prioritizing areas or populations for protection should consider the risk of extinction, any potentially unique genetic or phenotypic expressions, including habitat usage and life history, and evolutionary and ecological legacy (Allendorf *et al*. 1997). Epifanio *et al*. (2003) described six strategies that could be used to prioritize bull trout populations based on the factors described above. The prioritization of bull trout populations would help ensure that those populations with disproportionately high conservation value are more strictly managed to ensure their persistence, and that over the long term, the fullest range of ecological and evolutionary characteristics is conserved. These activities would provide a better mechanism for protecting the long-term viability of bull trout populations. Prevention of human-caused mortality is another conservation need for bull trout. Adequate angler education and enforcement of existing fishing regulations are necessary to reduce both unintentional angler mortality and poaching.

II. Environmental Baseline

Regulations implementing the Act (50 CFR §402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. The environmental baseline also includes the anticipated impacts of all proposed Federal projects in the action area that have already undergone section 7 consultations, and the impacts of state and private actions that are contemporaneous with the consultations in progress.

A. Status of the Species in the Action Area

Bull trout within the action area are located in the Boise, Payette, Malheur, and Powder River basins, and in the mainstem Snake River downstream from Brownlee Dam. Many bull trout populations in the Boise, Payette, and Malheur River basins have developed life history strategies associated with Reclamation facilities (adfluvial form), although it is not known to what degree this has altered the productivity and diversity of existing populations. Resident populations of bull trout also occur in tributaries to the mainstem rivers affected by the action (*e.g.*, Deadwood River). In the Boise River basin, Reclamation and

Corps dams have constrained bull trout movement patterns within the larger stream network, and this has resulted in discontinuities in genetic factors related to dispersal and gene flow (Whiteley *et al*. 2003). Populations in the Powder River basin, and some populations in the other basins, consist primarily or exclusively of resident bull trout, which use headwater streams and tributaries year-round and do not migrate seasonally.

The action area lies entirely within the Snake River Conservation Unit (Spruell *et al*. 2003; Whitesel *et al*. 2004). The proposed action will affect bull trout in 3 of 15 watersheds: the Boise, Payette, and Malheur River basins. The Boise and Malheur River basins are on the extreme southern edge of the Snake River Conservation Unit (excepting the Jarbidge River basin). Bull trout populations on the margin of the species' range may be adapted to unique environments and may represent a disproportionate part of the total diversity within the species (Rieman *et al*. 1997; Lesica and Allendorf 1995), although we do not have information regarding the specific role of these populations in conserving the Snake River Conservation Unit. Spruell *et al*. (2003) found that the Boise, Malheur, and Jarbidge River basins formed a discrete genetic cluster compared to other river basins within the Conservation Unit, indicating a similar evolutionary lineage.

Figure 18 shows the known bull trout distributions and upstream migratory, spawning, and rearing habitats in the middle Snake River basin. The following sections describe the current known distribution of bull trout in the action area by river basin.

Figure 18. Bull trout distribution within the action area at the watershed scale.

1. Boise River Basin [omitted]

2. Payette River Basin [omitted]

3. Weiser River Basin [omitted]

4. Malheur River Basin [omitted]

5. Powder River Basin

Current distribution of bull trout in the Powder River basin is in two headwater tributaries of the Powder River in the Elkhorn Mountain range; one local population is located 8 to 17 miles upstream from Phillips Lake, and the other 20 to 25 miles upstream from Thief Valley Reservoir. All bull trout inhabiting the Powder River basin are thought to be resident fish (Service 2002). To date, no bull trout have been documented in either Phillips Lake or Thief Valley Reservoir (Buchanan *et al*. 1997; Schwabe *et al*. 2003). Historical dredge mining along most of the Powder River upstream from Phillips Lake severely degraded habitats in those reaches; this likely limits the current bull trout distribution to the headwater tributaries (Service 2002).

6. Snake River from Brownlee Reservoir to the Columbia River and the Columbia River below the Snake River Confluence

Historically, the mainstem Snake River served as a migratory corridor for anadromous salmonids, including steelhead and Chinook, that were documented throughout the Owyhee, Malheur, Weiser, Payette and Boise River drainages in the 1800s and 1900s (Pratt *et al*. 2001; Welsh *et al*. 1965). Bull trout also used the area Brownlee Reservoir currently inundates. Bull trout were reported in creel records from Brownlee Reservoir before and after the dam's completion in 1959. Although bull trout are not currently known to occur in or use Brownlee Reservoir, it is likely that bull trout would use the reservoir as overwintering habitat if migratory individuals become reestablished in the Weiser River drainage.

Currently, the mainstem Snake River, specifically downstream from the Weiser River within the Southwest Idaho Recovery Unit, may have the potential to function as both migratory and overwintering habitat for bull trout. However, the extent and nature of bull trout use, as well as the quality of habitat provided by the reservoirs on the mainstem Snake River, are not well understood. To function as migratory habitat, the mainstem Snake River and reservoirs must provide holding water with adequate temperature, depth, and cover to ensure successful bull trout movement. To function as overwintering habitat, the mainstem Snake River and reservoirs must also provide sufficient forage for bull trout to either maintain or gain mass.

Information about the use of the mainstem Snake River by bull trout from the Weiser River drainage (the only major river that lacks large dams) has been identified as a research need in the Southwest Idaho Recovery Unit. Habitat conditions in lakes and reservoirs can determine the relative availability of bull trout forage and may mediate interactions of bull trout with potential competitors, predators, or prey in complex and lake/reservoir-specific ways (Montana Bull Trout Scientific Group 1998). Relationships between depth distributions of potential forage and bull trout habitat use have not been thoroughly investigated in Brownlee Reservoir and the mainstem Snake River upstream. These interactions are likely important in determining whether Brownlee Reservoir and the mainstem Snake River could provide suitable bull trout foraging and overwintering habitat in the future. Further investigation is needed to determine if bull trout from the Weiser River could use Brownlee Reservoir as foraging, migrating and overwintering habitat in a recovered condition.

Bull trout currently occur in Oxbow Reservoir, the Oxbow Bypass Reach, and Hells Canyon Reservoir (Chandler 2003). No bull trout have been documented above Brownlee Dam (Chandler 2003). Bull trout occur in several tributaries to the Hells Canyon Projects, including the Wildhorse River, Indian Creek, and Pine Creek; they also occur in the mainstem Snake River below Hells Canyon Dam.

B. Factors Affecting Species Environment within the Action Area

There are numerous natural and anthropogenic influences on bull trout in the action area. Although some restoration actions and ongoing research efforts have positively affected bull trout, the majority of anthropogenic influences have contributed to the species decline by reducing bull trout numbers, reproduction, and distribution. Factors affecting the species within the action area include migration barriers; diversions; water, forestry, and past sport fisheries management practices; habitat fragmentation and degradation through grazing and road construction; reduced water quality from development, road construction, and mining; and introduction of non-native competitive species (Service 2002).

The Service (1999a, 2002) determined that the Reclamation facilities that affect bull trout within the action area include Arrowrock, Anderson Ranch, Deadwood, and Agency Valley Dams. Winter pool content is an important habitat factor for bull trout at Arrowrock, Anderson Ranch, Deadwood, and Beulah Reservoirs. This consultation also considers Reclamation operations that control the conveyance and storage of irrigation water at Lucky Peak Dam and Reservoir. Construction and operation of these facilities have modified streamflows, changed stream temperature regimes, blocked migration routes, entrained bull trout, and changed bull trout forage bases. None of these facilities has fish passage, and they function as barriers to upstream and downstream fish migration. Though little information is known about the extent of the impacts to historical migration of bull trout from these facilities, populations of bull trout have been found upstream, downstream, or adjacent to these facilities.

1. Boise River Basin [omitted]

2. Payette River Basin [omitted]

3. Malheur River Basin [omitted]

4. Snake River from Brownlee Reservoir to the Columbia River and the Columbia River below the Snake River Confluence

Chandler (2003) reported that bull trout found in the Oxbow Bypass Reach and Hells Canyon Reservoir appeared to be extremely low in abundance. Chandler (2003) also reported that bull trout populations found in the tributaries to the Complex upstream from Hells Canyon Dam had extremely low numbers and that they were absent from lower reaches in the drainage. A significant number of bull trout captured in Oxbow and Hells Canyon Reservoirs showed signs of hybridization with brook trout, a result of bull trout and brook trout being present in the tributaries (Chandler 2003); this is a major concern for bull trout populations in this area. Below the Hells Canyon Complex, bull trout do not show any signs of hybridization with brook trout, an exotic species that has been widely introduced in Snake River tributaries (Chandler 2003).

Chandler (2003) found that bull trout use the Oxbow Bypass Reach and Hells Canyon Reservoir primarily during late fall and winter. Telemetry studies showed fluvial bull trout within the Complex migrating to tributaries between April and early June where they likely oversummer and then spawn in the fall (Chandler 2003).

Chandler (2003) documented bull trout below Hells Canyon Dam that exhibited "classic fluvial migrations" during the years that they monitored movement. Over half of the bull trout monitored made spring migratory movements downstream to the Imnaha River after wintering in the mainstem Snake River (Chandler 2003). Other bull trout that spawned the previous year but did not exhibit fluvial behavior may have remained in the Snake River throughout the summer. Fluvial bull trout were then documented to return to the Snake River following spawning in the tributaries, sometime in November and December, and to remain in the Snake River from January to April (Chandler 2003). Chapter 9 – Bull Trout Effects of the Proposed Action 234 U.S. Fish and Wildlife Service March 2005

C. Recent Section 7 Consultations

Effects from activities or projects that have already undergone section 7 consultation, as reported in a biological opinion, are an important component of objectively characterizing the current condition of the species. The Snake River Fish and Wildlife Office (for the Deadwood/South Fork Payette River and Boise River basins) and La Grande Field Office (for the Malheur River basin) have completed 20 biological opinions for bull trout in the action area since the year 2000. Eight of these biological opinions applied to activities affecting bull trout in the Boise River basin (including Anderson Ranch, Arrowrock, and Lucky Peak Reservoirs). Activities or projects included a hydroelectric plant, Arrowrock Dam valve replacement, a forest plan revision, water quality standards criteria, and emergency wildfire and road repairs. Three biological opinions applied to activities affecting bull trout in the Deadwood River drainage (South Fork Payette basin) and addressed flow augmentation, a forest plan revision, and water quality standards (the forest plan revision and water quality standards criteria consultations are common to both the Deadwood and Boise River watersheds). Eleven biological opinions applied to activities affecting bull trout in the Malheur River basin and addressed grazing programs, emergency fire consultation, road reconstruction, and bridge removal.

Our analysis showed that we consulted on a wide array of actions, which had varying levels of effects. Many of the actions consisted of only short-term adverse effects, but some had long-term beneficial effects. Some of the actions resulted in long-term adverse effects. No actions that have undergone consultation were found to appreciably reduce the likelihood of survival and recovery of the bull trout. Furthermore, no actions that have undergone consultation were anticipated to result in the loss of any subpopulations or local populations of bull trout. A more detailed analysis of consulted-on effects to bull trout is available in our files and is hereby incorporated by reference.

APPENDIX G

INFORMATION ABOUT THE STATUS OF COLUMBIA RIVER SALMON AND STEELHEAD ESUs FROM THE NMFS 2005 UPPER SNAKE RIVER BIOLOGICAL OPINION

STATUS OF COLUMBIA RIVER SALON AND STEELHEAD ESUS AND FACTORS AFFECTING SALMON AND STEELHEAD IN THE ACTION AREA

(excerpt from March 31, 2005, NMFS Biological Opinion on the U.S. Bureau of Reclmation's Upper Snake River Basin Projects)

4.3.1 SR Spring/Summer Chinook Salmon

4.3.1.1 ESU Structure

Based on genetic and geographic considerations, the Interior TRT (2003) established five major population groups in this ESU: the Lower Snake River Tributaries, the Grande Ronde and Imnaha Rivers, the South Fork Salmon River, the Middle Fork Salmon River, and the Upper Salmon River. The Interior TRT further subdivided these groupings into a total of 31 extant, demographically independent populations (Appendix B, Figure B-1). However, Chinook salmon have been extirpated from the Snake River and its tributaries above Hells Canyon Dam, an area that encompassed about 50% of the pre-European spawning areas in the Snake River Basin (NRC 1996). Major subbasins in the Clearwater were blocked to Chinook salmon in 1927 by the Lewiston Dam. Although the number of spring-run spawning aggregations that were lost due to construction of the Snake River mainstem dams is unknown, the ESU still has a wide spatial distribution in a variety of locations and habitat types.

4.3.1.2 The BRT Findings

NMFS recently conducted a status review of the SR spring/summer Chinook salmon and other ESUs. As part of that status review, NMFS convened a BRT to evaluate the available scientific data. The BRT analysis included dam counts and spawner returns for natural-origin fish through 2001. As indicated in Section 1, NMFS must examine the criteria for a sufficient number and distribution of VSPs in order to assess the range-wide biological requirements of the ESU. The BRT did the same thing in assessing whether or not the ESU should be listed as an endangered or threatened species. In this case, the BRT found that, compared to the levels needed for a healthy species, there was a moderately high risk that the abundance and productivity criteria were not currently being met and a low risk that the spatial structure and diversity criteria were not currently being met. Concerns regarding diversity were somewhat alleviated, because out-of- ESU Rapid River broodstock had been phased out of the Grande Ronde. Despite the recent positive signs, the BRT still felt that the ESU was at some level of risk.

4.3.1.3 2004 Status Review

An indicator of the current range-wide status of this ESU is the number of spawners returning to natural production areas. In 1995, NMFS established abundance levels for natural production areas that would be indicative of a recovered population (NMFS 1995b), and these levels were updated as "interim abundance and productivity targets" in 2002 (NMFS 2002). Many, but not all of the 29 extant natural production areas within this ESU have experienced large increases in the number of returning spawners in the last 2 to 3 years, with two populations (Grande Ronde and Imnaha) nearing the previously specified recovery abundance levels. Due to the severe declines in the populations since the 1960s and the short-term nature of the recent high returns, long-term productivity trends remain below replacement for all natural production areas, despite the recent increases. However, the short-term productivity trends for the majority of the natural production areas in the ESU are at or above replacement, which is a positive sign.

During the Status Review, NMFS evaluated whether conservation efforts, such as the extensive artificial propagation program, within this ESU reduced or eliminated the risk to SR spring/summer Chinook salmon. In performing this analysis, NMFS was guided by the NMFS/USFWS "Policy for Evaluation of Conservation Efforts When Making Listing Decisions" ("PECE," 68 FR 15100; March 28, 2003). NMFS concluded that the artificial propagation programs did provide benefits to the ESU in terms of abundance, spatial structure, and diversity, but that the programs had neutral or uncertain effects in terms of overall ESU productivity. As a result, NMFS did not believe that the artificial propagation programs were sufficient to substantially reduce the long-term extinction risk of the ESU. Thus, even though the ESU is likely to benefit from strong upcoming brood years,[147] NMFS proposed to retain the current listing of this species as threatened (i.e., likely to become an endangered species within the foreseeable future). Actions under the 2000 FCRPS Biological Opinion and improvements in hatchery practices are addressing some of the ESU's factors for decline.

4.3.1.4 Recent Dam Counts and Returns to the Spawning Grounds

Cooney (2004) updated the spawner count data used by the BRT (2003) for use by the Interior Columbia Basin TRT, adding data for 2002 and 2003, which he requested from the co-managers. In general, for most of the 24 populations where recent data were available, indices of abundance (i.e., redd counts) for natural-origin SR spring/summer Chinook salmon were high in 2002 and 2003 compared to the 1990s. Fisher and Hinrichsen (2004) provided a preliminary evaluation of the effects of recent natural-origin spring Chinook salmon returns on past geometric mean abundance levels and population trends. The latter were calculated as the slope of the regression line for the (log transformed) index of abundance over time. They assessed whether the geomean was greater when calculated from the most recent data (beginning in 2001) compared to a base period (1996-2000) and whether the trend was greater when counts for 2001-2003 were added to the 1990-2000 data series. Their methods were taken from those used by NMFS' BRT (2003). The geomean for 2001-2003 (33,581) exhibited a 548% increase over the 1996-2000 base period (5,186 fish). The slope of the trend for the natural-origin population increased 17% (from 0.97 to 1.14) when the data for 2001-2003 were added to the 1990-2000 series, reversing the decline and indicating that, at least for the short-term, the natural-origin population has been increasing. Hatchery fish constituted 69% of the return during the recent period compared to an average of 60% during 1990-2000 (Fisher 2004). Even so, natural-origin fish exhibited the substantial increase in numbers described above. Neither the BRT nor the Interior TRT has reviewed Fisher and Hinrichsen (2004) or Fisher (2004).

4.3.2 SR Fall Chinook Salmon

4.3.2.1 ESU Structure

A majority of the fish in this ESU spawn in the mainstem Snake River between the head of Lower Granite Reservoir and Hells Canyon Dam, with the remaining fish distributed among lower sections of the major tributaries (Connor et al. 2002). Fish in the mainstem Snake appear to be distributed in a series of aggregates from the mouth of Asotin Creek to River Mile (RM) 219, although smaller numbers have been reported spawning in the tailraces of the Lower Snake dams (Connor et al. 1993; Dauble et al. 1995). Due to their proximity and the likelihood that individual tributaries could not support a sufficiently large population, the Interior TRT (2003) considered these aggregates and the associated reaches in the lower major tributaries to the Snake to be a single population (Appendix B, Figure B-2). This is consistent with past practice in prior biological opinions.

Before European impact, Snake River fall Chinook salmon are believed to have once occupied and spawned in the mainstem Snake River from its confluence with the Columbia River upstream to Shoshone Falls (RM 615). The spawning grounds between Huntington, Oregon (RM 328) and Auger Falls in Idaho (RM 607) were historically the most important for this species. Historically, only limited spawning activity occurred downstream of RM 273 (Waples et al. 1991), which is about one mile below Oxbow Dam. However, the development of irrigation and hydropower projects on the mainstem Snake River has inundated or blocked access to most of this area in the past century. Construction of Swan Falls Dam (RM 458) in 1901 eliminated access to 157 miles (about 25%) of total potential habitat, leaving 458 miles of habitat. Construction of the Hells Canyon Dam complex (1958-1967) cut off anadromous fish access to 211 miles (or 46%) of the remaining historical fall Chinook salmon habitat upstream of RM

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[147] That is, the upcoming brood years were derived from strong spawning escapements and improved conditions during the ocean phase of the life cycle.

247. Additional fall Chinook salmon habitat was lost through inundation as a result of the construction of the four lower mainstem Snake River dams. Currently, SR fall Chinook salmon have access to approximately 100 miles of mainstem Snake River habitat, which is roughly 22% of the 458 miles of historical habitat available prior to completion of the Hells Canyon Complex and the four lower Snake River dams. Historical use of habitat in the Clearwater River is uncertain. Tiffan et al. (2001) concluded that there was "no conclusive evidence" whether the lower Clearwater River supported the basin subyearling migrant life-history pattern associated with Snake River fall Chinook salmon.

4.3.2.2 The BRT Findings

Approximately 80% of historical spawning habitat was lost with the construction of a series of dams on the mainstem Snake River. The loss of spawning habitat, restricting the extant ESU to a single naturally spawning population, increased the ESU's vulnerability to environmental variability and catastrophic events. The diversity associated with populations that once resided above the Snake River dams has been lost, and the impact of out-of-ESU fish straying to the spawning grounds has the potential to further compromise the genetic diversity of the ESU. Although recent improvements in the marking of out-of-ESU hatchery fish and their removal at Lower Granite Dam have reduced the impact of these strays, introgression below Lower Granite Dam remains a concern. The BRT found moderately high risk for all VSP categories and therefore felt that, despite the recent positive signs, the ESU was at some level of risk.

4.3.2.3 2004 Status Review

During the Status Review, NMFS evaluated whether artificial propagation programs within this ESU reduce or eliminate risks to its viability, guided by the PECE policy (Section 4.3.1). NMFS concluded that the artificial propagation programs have provided benefits to the ESU in terms of abundance, spatial distribution, and diversity in recent years, although the contribution of these programs to overall ESU productivity is uncertain and the artificial propagation programs are not sufficient to substantially reduce the long-term risk of extinction. Depending upon the assumption made about the likelihood of the progeny of hatchery fish returning as productive adults, long- and short-term trends in productivity are at or above replacement. Thus, NMFS proposed to retain the current listing of this species as threatened (i.e., likely to become an endangered species within the foreseeable future) even though it is not likely to go extinct in the near future. Actions under the 2000 FCRPS Biological Opinion and improvements in hatchery practices have provided some encouraging signs in addressing the ESU's factors for decline.

4.3.2.4 Recent Dam Counts and Returns to the Spawning Grounds

Cooney (2004) reported that the high counts of natural-origin SR fall Chinook salmon continued in 2002 and 2003 (2,114 and 3,896 adults at Lower Granite Dam, respectively). In their preliminary analysis of recent returns, Fisher and Hinrichsen (2004) reported that the geometric mean abundance of naturally-produced fall Chinook salmon was 3,462 during 2001-2003, compared to 694 in 1996-2000 (a 398% increase). The slope of the population trend increased 8.0% (from 1.16 to 1.24) when the data for 2001-2003 were added to the 1990-2000 series. These results indicate that, at least for the short-term, the population has been increasing. Approximately 64% of the aggregate run at Lower Granite Dam was hatchery fish in 2001-2003, compared to 67% during 1990-2000 (Fisher 2004).

4.3.3 UCR Spring Chinook Salmon

4.3.3.1 ESU Structure

The Interior TRT (2003) identified one major population group consisting of three demographically independent populations in the UCR spring Chinook salmon ESU (Appendix B, Figure B-3). Due to the relatively small size of the area, they did not identify any major groupings. Within the current boundary of the ESU, spring Chinook salmon are considered extirpated from the Okanogan drainage. The historical status of spring-run, stream-type fish belonging to this ESU in the Okanogan is uncertain. The Interior TRT could not determine definitively whether an independent population of UCR spring Chinook salmon existed there in the past but recognized the possibility that the area may have supported one. The construction of Grand Coulee Dam in 1939 blocked access to over 50% of the river miles formerly available to UCR spring Chinook salmon (NRC 1996). Tributaries in this blocked area may have supported one or more populations, but the lack of data on distribution and genetic makeup made it impossible for the Interior TRT to make any definitive determination.

4.3.3.2 The BRT Findings

The five hatchery spring-run Chinook salmon populations considered to be part of this ESU are programs aimed at supplementing natural production areas. These programs have contributed substantially to the abundance of natural spawners in recent years. However, little information is available to assess the impact of these high levels of supplementation on the long-term productivity of natural populations. The BRT (2003) concluded that spatial structure in this ESU was of little concern, because there is passage and connectivity among almost all populations. During years of critically low escapement (1996 and 1998), extreme management measures were taken in one of the three major spring Chinook salmon producing basins where all returning adults were collected and taken into the hatchery supplementation programs, reflecting the ongoing vulnerability of certain segments of this ESU. The BRT expressed concern that these actions, while appropriately guarding against the catastrophic loss of populations, may have compromised ESU population structure and diversity. The BRT's assessment of risk for the four VSP categories reflects strong concerns regarding abundance and productivity and comparatively less concern for ESU spatial structure and diversity (BRT 2003).

4.3.3.3 2004 Status Review

In its Status Review, NMFS' assessment of the effects of artificial propagation concluded that the within-ESU hatchery programs do not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). Protective efforts, as evaluated pursuant to the PECE, did not alter NMFS' assessment that the ESU is in danger of extinction or likely to become so in the foreseeable future. Actions under the 2000 FCRPS Biological Opinion, Federally funded habitat restoration efforts, and other protective efforts are encouraging signs in addressing the ESU's factors for decline, but they do not as yet substantially reduce the ESU's extinction risk. Artificial propagation practices within the geographic range of the ESU do not fully support the conservation and recovery of UCR spring-run Chinook salmon. In particular, NMFS is concerned that the non-ESU Entiat National Fish Hatchery has compromised the genetic integrity of the native natural population of spring-run Chinook salmon in the Entiat Basin.

4.3.3.4 Recent Dam Counts and Returns to the Spawning Grounds

Cooney (2004) reported that natural-origin returns to the Methow subbasin in 2002 and to the Entiat and Wenatchee during 2002 and 2003 continued to exceed those observed during much of the 1990s. However, returns to the Methow declined during 2003. In their preliminary analysis, Fisher and Hinrichsen (2004) reported that the geometric mean of aggregate numbers of UCR spring Chinook salmon increased 1,038% from 1996-2000 (4,959) to 2001-2003 (436 fish). The slope of the aggregate population trend increased 9.3% (from 1.00 to 1.10) when the data for 2001-2003 were added to the 1990-2000 series. These results indicate that, at least in the short term, the aggregate population and the natural-origin populations in the Entiat and Wenatchee subbasins have been increasing.

4.3.4 UWR Chinook Salmon

4.3.4.1 ESU Structure

The Willamette/Lower Columbia River (W/LC) TRT (McElhany et al. 2004) identified seven demographically independent populations of UWR Chinook salmon in a single major group (Appendix B, Figure B.4). All of these populations are extant, although they vary in degree of viability.

4.3.4.2 The BRT Findings

Numbers passing Willamette Falls have remained relatively steady over the past 50 years (ranging from approximately 20,000 to 75,000), but are an order of magnitude below the peak abundance levels observed in the 1920s (approximately 300,000 adults). The Clackamas and McKenzie River populations have shown substantial increases in total abundance since 2000. Trends in the other populations are difficult to determine. However, interpretation of the difference in abundance levels for the other populations remains confounded by a high but uncertain fraction of hatchery-origin fish.

The BRT estimated that, despite improving trends in total productivity since 1995, productivity would be below replacement in the absence of artificial propagation. The BRT was particularly concerned that a majority of the historical spawning habitat and approximately 30% to 40% of total historical habitat are now inaccessible behind dams. The restriction of natural production to just a few areas increases the ESU's vulnerability to environmental variability and catastrophic events. Losses of local adaptation and genetic diversity through the mixing of hatchery stocks within the ESU and the introgression of out-of-ESU hatchery fall-run Chinook salmon represent threats to ESU diversity. However, the BRT was encouraged by the recent closure of the fall-run hatchery and by improved marking rates of hatchery fish to assist in monitoring and in the management of a marked-fish selective fishery. The BRT found moderately high risks for all VSP categories.

4.3.4.3 2004 Status Review

There are no direct estimates of total natural-origin spawner abundance for the UWR Chinook salmon ESU. The abundance of the aggregate run passing Willamette Falls has remained relatively steady over the past 50 years (ranging from approximately 20,000 to 70,000 fish), but is only a fraction of peak abundance levels observed in the 1920s (approximately 300,000 adults). Interpretation of abundance levels is confounded by a high but uncertain fraction of hatchery-produced fish. The McKenzie River population has shown substantial increases in total abundance (hatchery origin and natural origin fish) in the last 2 years, while trends in other natural populations in the ESU are generally mixed. With the relatively large incidence of hatchery fish spawning in the wild, it is difficult to determine trends in productivity for natural origin fish.

Seven artificial propagation programs in the Willamette River produce fish that are considered to be part of the UWR Chinook salmon ESU. All of these programs are funded to mitigate for lost or degraded habitat and produce fish for harvest purposes. During the Status Review, NMFS' assessment of the effects of artificial propagation concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU (NMFS 2004c). An increasing proportion of hatchery-origin returns has contributed to increases in total ESU abundance. However, it is unclear whether these returning hatchery and natural fish actually survive over winter to spawn. Estimates of pre-spawning mortality indicate that a high proportion (more than 70%) of spring Chinook salmon in most ESU populations die before spawning. In recent years, hatchery fish have been used to reintroduce spring Chinook salmon back into historical habitats above impassible dams (e.g., in the North Santiam, McKenzie, and Middle Fork Willamette Rivers), slightly decreasing risks to ESU spatial structure. Within-ESU hatchery fish exhibit different life-history characteristics from natural ESU fish. High proportions of hatchery-origin natural spawners in remaining natural production areas (i.e., in the Clackamas and McKenzie Rivers) may thereby have negative impacts on within- and among population genetic and life-history diversity. Collectively, artificial propagation programs in the ESU have a slight beneficial effect on ESU abundance and spatial structure but neutral or uncertain effects on ESU productivity and diversity. Protective efforts, as evaluated pursuant to the PECE, did not alter the assessments of the BRT and the Artificial Propagation Evaluation Workshop participants that the ESU is "likely to become endangered within the foreseeable future." The USFWS Greenspaces Program, the Oregon Plan, hatchery reform efforts, and other protective initiatives are encouraging signs. However, restoration efforts in the ESU are very local in scale and have yet to provide benefits at the scale of watersheds or at the larger spatial scale of the ESU. The blockage of historical spawning habitat and the restriction of natural production areas remain to be addressed.

4.3.4.4 Recent Dam Counts and Returns to the Spawning Grounds

Fisher and Hinrichsen (2004) report that the preliminary geometric mean aggregate abundance of UWR Chinook salmon in the Clackamas and McKenzie Rivers is equal to 12,530 for 2001-2003, compared to 3,041 in 1996-2000, a 312% increase. The slope of the aggregate population trend increased 15.2% (from 0.89 to 1.02) when the data for 2001-2003 were added to the 1990-2000 series, reversing the decline and indicating that, at least in the short-term, the aggregate population has been increasing.

4.3.5 LCR Chinook Salmon

4.3.5.1 ESU Structure

The W/LC TRT (McElhany et al. 2004) identified a total of 23 extant, demographically independent populations in six major population groups: the Coastal fall-run, Cascade fall-run, Cascade late fall-run, Cascade spring-run, Gorge fall-run, and Gorge spring-run (Appendix B, Figures B.5a and B.5b).

4.3.5.2 The BRT Findings

Abundance estimates of naturally produced spring Chinook salmon have improved since 2001 due to the marking of all hatchery spring Chinook salmon releases (compared to a previous marking rate of only 1% to 2%), which allows for the separation in counts at weirs and traps and on spawning grounds. Despite recent improvements, long-term trends in productivity are below replacement for the majority of populations. Of the historical populations, 8 to 10 have been extirpated or nearly extirpated. Although approximately 35% of historical habitat has been lost behind impassable barriers, the ESU exhibits a broad spatial distribution in a variety of watersheds and habitat types. Natural production currently occurs in approximately 20 populations, although only one population has a mean spawner abundance exceeding 1,000 fish. The BRT expressed concern that most of the extirpated populations are spring-run, and the disproportionate loss of this life history type represents a risk to ESU diversity. Additionally, of the 4 hatchery spring-run Chinook salmon populations considered to be part of the ESU, 2 are propagated in rivers that, although they are within the historical geographic range of the ESU, probably did not support spring-run populations. High hatchery production poses genetic and ecological risks to the natural populations and complicates assessments of their performance. The BRT also expressed concern over the introgression of out-of-ESU hatchery stocks. The BRT found moderately high risk for all VSP categories.

4.3.5.3 2004 Status Review

In its Status Review, NMFS notes that many populations within the LCR Chinook salmon ESU have exhibited pronounced increases in abundance and productivity in recent years, possibly due to improved ocean conditions. Abundance estimates of naturally spawned populations have been uncertain until recently due to a high (approximately 70%) fraction of naturally spawning hatchery fish. Abundance estimates of naturally-produced spring Chinook salmon have improved since 2001 due to the marking of all hatchery spring Chinook salmon releases (compared to a previous marking rate of only 1% to 2%), which allows for the separation in counts at weirs and traps and on spawning grounds. Despite recent improvements, long-term trends in productivity through 2001 were below replacement for the majority of populations in the ESU. Of the historical populations, 8 to 10 were extirpated or nearly extirpated. Although approximately 35% of historical habitat is behind impassable barriers, the ESU exhibits a broad spatial distribution in a variety of watersheds and habitat types. Natural production occurs in approximately 20 populations, although as of 2001, only one population had a mean spawner abundance exceeding 1,000 fish.

Seventeen artificial propagation programs releasing hatchery Chinook salmon are considered part of the LCR Chinook salmon ESU. All of these programs are designed to produce fish for harvest, and three of these programs are also intended to augment naturally spawning populations in the basins where the fish are released. These three programs integrate naturally produced spring Chinook salmon into the broodstock in an attempt to minimize the genetic effects of returning hatchery adults that spawn in the wild.

During the 2004 Status Review, NMFS' assessment of the effects of artificial propagation concluded that these hatchery programs do not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). Although the hatchery programs have been successful at producing substantial numbers of fish, thereby reducing risks to ESU abundance, their effect on the productivity of the ESU in total is uncertain. Additionally, the high level of hatchery production in this ESU poses potential genetic and ecological risks to the ESU and confounds the monitoring and evaluation of abundance trends and productivity. The Cowlitz River spring Chinook salmon program releases parr into the Upper Cowlitz River Basin in an attempt to reestablish a naturally spawning population above Cowlitz Falls Dam. Such reintroduction efforts increase the ESU's spatial distribution into historical habitats and slightly reduce risks to ESU spatial structure. The few programs that regularly integrate natural fish into the broodstock may help preserve genetic diversity within the ESU. However, the majority of hatchery programs in the ESU have not converted to the practice of regularly incorporating natural broodstock, thus limiting this risk-reducing feature at the ESU scale. Past and ongoing transfers of broodstock among hatchery programs in different basins represent risks to within- and among-population diversity. Collectively, artificial propagation programs in the ESU provide slight benefits to ESU abundance, spatial structure, and diversity but have neutral or uncertain effects on productivity.

NMFS' assessment of the effects of artificial propagation concluded that the within-ESU hatchery programs do not substantially reduce the risk of the ESU in total (NMFS 2004c). Protective efforts, as evaluated pursuant to the PECE, did not alter NMFS' assessment that the ESU is "likely to become endangered within the foreseeable future." Planned dam removals on the Sandy River, Federally funded habitat restoration efforts, the Washington Department of Natural Resources HCP, and other protective efforts are encouraging signs that the ESU's factors for decline are being addressed, but they do not as yet substantially reduce threats to the ESU.

4.3.5.4 Recent Dam Counts and Returns to the Spawning Grounds

Fisher and Hinrichsen (2004) compared the aggregate abundance of 41,450 during 2001 to a geomean of 11,135 for the years 1996-2000, a 272% increase. The slope of the aggregate population trend increased 6.6% (from 0.76 to 1.03) when the count for 2001 was added to the 1990-2000 data series, reversing the decline and indicating that, at least in the short-term, the aggregate population is increasing.

4.3.6 SR Steelhead

4.3.6.1 ESU Structure

The Interior TRT (2003) identified 23 populations[148] in 6 major population groups in this ESU: the Clearwater River, the Grande Ronde River, Hells Canyon, the Imnaha River, the Lower Snake River, and the Salmon River (Appendix B, Figure B.6). Like SR spring/summer Chinook salmon, SR steelhead were blocked from portions of the Upper Snake River beginning in the late 1800s and culminating with the construction of Hells Canyon Dam in the 1960s. The SR steelhead ESU includes all naturally spawned populations of steelhead (and their progeny) in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho (62 FR 43937; August 18, 1997).

NMFS' June 14, 2004, listing proposal did not resolve the ESU membership of native resident populations that are above recent (usually manmade) impassable barriers but below natural barriers. It was provisionally proposed that these resident populations not be considered part of the revised SR steelhead ESU until such time as significant scientific information becomes available to afford a case-by-

[148] The Interior TRT (2003) identified one additional group of tributaries, Hells Canyon, which members thought was not large enough to support a demographically independent population.

case evaluation of their ESU relationships. There was one exception in the listing proposal: recent genetic data suggest that native resident steelhead above Dworshak Dam on the North Fork Clearwater River are part of the ESU. However, NMFS did not propose that hatchery rainbow trout introduced to the Clearwater River (and other areas within the ESU) be included in the ESU. The presence of 6 major population groups in this ESU means that it is less likely that any single group is significant for this ESU's survival and recovery, compared to ESUs with fewer major population groups.

4.3.6.2 The BRT Findings

The BRT (2003) noted that the ESU remains spatially well distributed in each of the six major geographic areas in the Snake River Basin. However, the Snake River Basin steelhead "B run"[149] was particularly depressed. The BRT was also concerned about the predominance of hatchery origin fish in this ESU, the inferred displacement of naturally produced fish by hatchery-origin fish, and potential impacts on ESU diversity. High straying rates exhibited by some hatchery programs generated concern about the possible homogenization of population structure and diversity. However, recent efforts to improve the use of local broodstock and release hatchery fish away from natural production areas are encouraging. For many BRT members, the presence of relatively numerous resident fish reduces risks to ESU abundance but provides an uncertain contribution to ESU productivity, spatial structure, and diversity (NMFS 2003, 2004b). The BRT found moderate risk for the abundance, productivity, and diversity VSP categories and comparatively lower risk in the spatial structure category.

4.3.6.3 2004 Status Review

The paucity of information on adult spawning escapement for specific tributary production areas in the SR steelhead ESU made a quantitative assessment of viability difficult. Annual return estimates are limited to counts of the aggregate return over Lower Granite Dam, and spawner estimates for the Tucannon, Grande Ronde, and Imnaha Rivers. The 2001 return over Lower Granite Dam was substantially higher relative to the low levels seen in the 1990s; the recent 5- year mean abundance (14,768 natural returns) approximately 28% of the interim recovery target level. The abundance surveyed in sections of the Grande Ronde, Imnaha, and Tucannon Rivers was generally improved in 2001. However, recent 5-year abundance and productivity trends (through 2001) were mixed. Five of the nine available data series exhibit positive long- and short-term trends in abundance. The majority of long-term population growth rate estimates for the nine available series were below replacement. The majority of short-term population growth rates (through 2001) were marginally above replacement or well below replacement, depending upon the assumption made regarding the effectiveness of hatchery fish in contributing to natural production.

There are six artificial propagation programs producing steelhead in the Snake River Basin that are considered to be part of the ESU. Artificial propagation enhancement efforts occur in the Imnaha River (Oregon), Tucannon River (Washington), East Fork Salmon River (Idaho, in the initial stages of broodstock development), and South Fork Clearwater River (Idaho). In addition, Dworshak Hatchery acts as a gene bank to preserve the North Fork Clearwater River "B-run" steelhead population, which no longer has access to historical habitat due to construction of Dworshak Dam. During the Status Review, NMFS' assessment of the effects of artificial propagation concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). Snake River Basin hatchery programs may be providing some benefit to the local target, but only the Dworshak-based programs have appreciably benefited the total number of adult spawners. The Little Sheep Hatchery program is contributing to total abundance in the Imnaha River but has not contributed to increased natural productivity. The Tucannon and East Fork Salmon River programs were only recently initiated

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[149] B-run steelhead have a 2-year ocean residence and larger body size and are believed to be produced only in the Clearwater, Middle Fork Salmon, and South Fork Salmon Rivers.

and have yet to produce appreciable adult returns. Thus, the overall contribution of the hatchery programs in reducing risks to ESU abundance is small, and the contribution of ESU hatchery programs to the productivity of the ESU in total is uncertain. Most returning Snake River Basin hatchery steelhead are collected at hatchery weirs or have access to unproductive mainstem habitats, limiting potential contributions to the productivity of the entire ESU. The artificial propagation programs affect only a small portion of the ESU's spatial distribution and confer only slight benefits to ESU spatial structure. Large steelhead programs not considered to be part of the ESU occur in the mainstem Snake, Grande Ronde, and Salmon Rivers and may adversely affect ESU diversity. These out-of-ESU programs are currently undergoing review to determine the level of isolation between the natural and hatchery stocks and to define what reforms may be needed. Collectively, artificial propagation programs in the ESU provide a slight beneficial effect to ESU abundance and spatial structure but have neutral or uncertain effects on ESU productivity and diversity.

4.3.6.4 Recent Dam Counts and Returns to the Spawning Grounds

The lack of information on adult spawning escapement to many tributary production areas makes it difficult to assess quantitatively the viability of the SR steelhead ESU. Estimates of annual returns are limited to estimates of aggregate numbers over Lower Granite Dam and spawner estimates for the Tucannon, Grande Ronde, and Imnaha Rivers. Cooney (2004) reported continuing high returns of natural-origin SR steelhead (both A- and B-run fish) during 2002 and 2003 compared to those observed during much of the 1990s. In their preliminary report, Fisher and Hinrichsen (2004) estimated that the geometric mean of the natural-origin run was 37,784 during 2001-2003, a 253% increase over the 1996-2000 period (10,694 steelhead). The slope of the population trend increased 9.3% (from 1.00 to 1.10) when the counts for 2001-2003 were added to the 1990-2000 data series. These data indicate that, at least in the short-term, the natural-origin run has been increasing.

4.3.7 UCR Steelhead

4.3.7.1 ESU Structure

The Interior TRT (2003) identified four historical, demographically independent populations in a single major population group in this ESU (Appendix B, Figure B.7). As described above for UCR spring Chinook salmon, the construction of Grand Coulee Dam in 1939 blocked access to over 50% of the river miles formerly available to UCR steelhead (NRC 1996). Tributaries in this blocked area may have supported one or more populations, but the lack of data on distribution and genetic makeup made it impossible for the Interior TRT to make a definitive determination. The UCR steelhead ESU includes all naturally spawned populations of steelhead in streams in the Columbia River Basin upstream from the Yakima River in Washington to the United States- Canada border (62 FR 43937; August 18, 1997).

NMFS' June 14, 2004, listing proposal did not resolve the ESU membership of native resident populations that are above recent (usually man-made) impassable barriers but below natural barriers. It was provisionally proposed that these resident populations not be considered part of the revised UCR steelhead ESU, until such time as significant scientific information becomes available, thereby affording a case-by-case evaluation of their ESU relationships.

4.3.7.2 The BRT Findings

The BRT (2003) was concerned about the general lack of detailed information regarding the productivity of natural populations. The extremely low replacement rate of naturally spawning fish (0.25-0.30 at the time of the last status review in 1998) does not appear to have improved appreciably. The predominance of hatchery-origin natural spawners (approximately 70% to 90% of adult returns) is a significant source of concern for the diversity of the ESU and generates uncertainty about long-term trends in natural abundance and productivity. The natural component of the anadromous run over Priest Rapids Dam has increased from an average of 1,040 (1992-1996) to 2,200 (1997-2001). This pattern, however, is not consistent for other production areas within the ESU. The mean proportion of natural-origin spawners declined by 10% from 1992-1996 to 1997-2001. For many BRT members, the presence of relatively numerous resident fish reduced risks to ESU abundance but provided an uncertain contribution to ESU productivity, spatial structure, and diversity (NMFS 2003, 2004b). The BRT found high risk for productivity and comparatively lower risk for abundance, diversity, and spatial structure.

4.3.7.3 2004 Status Review

In its Status Review, NMFS reported that the last 2-3 years (through 2001) had seen an encouraging increase in the number of naturally produced fish in the UCR steelhead ESU. The 1996-2001 average aggregate return through the Priest Rapids Dam fish ladder (just below the upper Columbia steelhead production areas) was approximately 12,900 total adults, compared to 7,800 adults for 1992–1996. However, the recent 5-year mean abundances (through 2001) for naturally spawned populations in this ESU were 14% to 30% of their interim recovery target abundance levels.

Six artificial propagation programs that produce hatchery steelhead are considered to be part of the UCR steelhead ESU. These programs are intended to contribute to the recovery of the ESU by increasing the abundance of natural spawners, increasing spatial distribution, and improving local adaptation and diversity (particularly with respect to the Wenatchee River steelhead). Research projects to investigate the spawner productivity of hatchery-reared fish are being developed. Some of the hatchery-reared steelhead adults that return to the basin may be in excess of needs of the naturally spawning population in years when survival is high, potentially posing a risk to the natural-origin component of the ESU. The artificial propagation programs included in this ESU adhere to strict protocols for the collection, rearing, maintenance, and mating of the captive brood populations. Genetic evidence suggests that these programs remain closely related to the naturally spawned populations and maintain local genetic distinctiveness of populations within the ESU. HCPs with the Chelan and Douglas Public Utility Districts and binding mitigation agreements ensure that these programs will have secure funding and will therefore continue into the future. These hatchery programs have undergone ESA Section 7 consultation to ensure that they do not jeopardize the recovery of the ESU and have received ESA Section 10 permits for production though 2007. Annual reports and other specific information reporting requirements are used to ensure that the terms and conditions specified by NMFS are followed. These programs, through adherence to best professional practices, have not experienced disease outbreaks or other catastrophic losses.

During the Status Review, NMFS' assessment of the effects of artificial propagation concluded that hatchery programs collectively mitigate the immediacy of extinction risk for the UCR steelhead ESU in total in the short-term, but the contributions of these programs to the long-term survival and recovery of the species is uncertain (NMFS 2004c). The ESU hatchery programs substantially increase total ESU returns, particularly in the Methow Basin, where hatchery-origin fish make up an average of 92% of all returns. The contribution of hatchery programs to the abundance of naturally spawning fish is uncertain, as is their contribution to the productivity of the ESU in total. However, the presence of large numbers of hatchery-origin steelhead in excess of both broodstock needs and available spawning habitat capacity may decrease the productivity of the ESU. With increasing ESU abundance in recent years, naturally spawning, hatchery-origin fish have expanded into unoccupied spawning areas. Collectively, artificial propagation programs benefit ESU abundance and spatial structure but have neutral or uncertain effects on ESU productivity and diversity.

4.3.7.4 Recent Dam Counts and Returns to the Spawning Grounds

Fisher and Hinrichsen's (2004) preliminary estimate of the geometric mean of natural-origin UCR steelhead was 3,643 during 2001-2003, compared to 1,146 in 1996-2000, a 218% increase. The slope of the natural-origin population trend increased 9.2% (from 0.97 to 1.06,) when the data for 2001-2003 were added to the 1990-2000 series, reversing the decline and indicating, at least in the short-term, that the run size has been increasing.

4.3.8 MCR Steelhead

4.3.8.1 ESU Structure

The Interior TRT (2003) identified 15 populations in 4 major population groups (Cascades Eastern Slopes Tributaries, John Day River, the Walla Walla and Umatilla Rivers, and the Yakima River) and 1 unaffiliated independent population (Rock Creek) in this ESU (Appendix B, Figure B.8). There are 2 extinct populations in the Cascades Eastern Slope major population group (MPG), the White Salmon and Deschutes Rivers above Pelton Dam.

The MCR steelhead ESU includes all naturally spawned populations of steelhead in streams from above the Wind River in Washington and the Hood River in Oregon (exclusive), upstream to and including the Yakima River in Washington, excluding steelhead from the Snake River Basin (64 FR 14517; March 25, 1999).

NMFS' June 14, 2004, listing proposal did not resolve the ESU membership of native resident populations that are above recent (usually manmade) impassable barriers but below natural barriers. It was provisionally proposed that these resident populations not be considered part of the revised MCR steelhead ESU until such time as significant scientific information becomes available, thereby affording a case-by-case evaluation of their ESU relationships.

4.3.8.2 The BRT Findings

The continued low number of natural returns to the Yakima River (10% of the interim recovery target abundance level, for a subbasin that was a major historical production center for the ESU) generated concern in the BRT. However, steelhead remain well distributed in the majority of subbasins in the ESU. The presence of substantial numbers of out-of-basin (and largely out-of- ESU) natural spawners in the Deschutes River raised substantial concern regarding the genetic integrity and productivity of the native Deschutes population. The extent to which this straying is a historical natural phenomenon is unknown. The cool Deschutes River temperatures may attract fish migrating in the comparatively warm Columbia River, inducing high stray rates. The BRT noted a particular difficulty in evaluating the contribution of resident fish to ESU-level extinction risk. Several sources indicate that resident fish are very common in the ESU and may greatly outnumber anadromous fish. The BRT concluded that the relatively abundant and widely distributed resident fish in the ESU reduce risks to overall ESU abundance but provide an uncertain contribution to ESU productivity, spatial structure, and diversity (NMFS 2003, 2004b).

4.3.8.3 2004 Status Review

In its Status Review, NMFS noted that the abundance of natural populations in the MCR steelhead ESU increased substantially in 2001 over the previous 5 years. The Deschutes and Upper John Day Rivers had recent 5-year mean abundance levels in excess of their respective interim recovery target abundance levels (NMFS 2002). Due to an uncertain proportion of out-of-ESU strays in the Deschutes River, the recent increases in this population were difficult to interpret.

There are seven hatchery steelhead programs considered to be part of the MCR steelhead ESU. These programs propagate steelhead in 3 of 16 ESU populations and improve kelt (post-spawned steelhead) survival in 1 population. There are no artificial programs producing the winter-run life history in the Klickitat River and Fifteenmile Creek populations. All of the ESU hatchery programs are designed to produce fish for harvest, although two are also implemented to augment the naturally spawning populations in the basins where the fish are released. During the Status Review, NMFS' assessment of the effects of artificial propagation on ESU extinction risk concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). ESU hatchery programs may provide a slight benefit to ESU abundance. Artificial propagation increases total ESU abundance, principally in the Umatilla and Deschutes Rivers. The kelt reconditioning efforts in the Yakima River do not augment natural abundance but do benefit the survival of the natural populations.

The Touchet River Hatchery program has only recently been established, and its contribution to ESU viability is uncertain. The contribution of ESU hatchery programs to the productivity of the three target populations and the ESU in total is uncertain. The hatchery programs affect a small proportion of the ESU, providing a negligible contribution to ESU spatial structure. Overall, the impacts to ESU diversity are neutral. Collectively, artificial propagation programs in the ESU provide a slight beneficial effect to ESU abundance but have neutral or uncertain effects on ESU productivity, spatial structure, and diversity.

4.3.8.4 Recent Dam Counts and Returns to the Spawning Grounds
In their preliminary report, Fisher and Hinrichsen (2004) estimated a geometric mean of natural-origin MCR steelhead equal to 17,553 during 2001-2002, compared to 7,228 in 1996-2000, a 143% increase. The slope of the population trend for natural-origin fish increased 6.2% (from 0.99 to 1.05) when the data for 2001-2002 were added to the 1990-2000 series, reversing the decline and indicating that, at least in the short run, the natural-origin population has been increasing.

4.3.9 UWR Steelhead
4.3.9.1 ESU Structure
The UWR steelhead ESU includes all naturally spawned populations of winter-run steelhead in the Willamette River in Oregon and its tributaries upstream from Willamette Falls to the Calapooia River (inclusive) (64 FR 14517; March 25, 1999). The W/LC TRT (McElhany et al. 2004) identified four extant, demographically independent populations in one major population group (Appendix B, Figure B.9). NMFS' June 14, 2004, listing proposal did not resolve the ESU membership of native resident populations that are above recent (usually manmade) impassable barriers but below natural barriers. It was provisionally proposed that these resident populations not be considered part of the revised UWR steelhead ESU, until such time as significant scientific information becomes available to afford a case-by-case evaluation of their ESU relationships.

This ESU does not include any artificially propagated steelhead stocks that reside within the historical geographic range of the ESU. Hatchery summer steelhead occur in the Willamette Basin but are an out-of-basin stock that is not included in the ESU.

4.3.9.2 The BRT Findings
The BRT considered the cessation of the "early" winter-run hatchery program a positive sign for ESU diversity risk but remained concerned that releases of non-native summer steelhead continue. Because coastal cutthroat trout are dominant in the basin, resident steelhead are not as abundant or widespread here as in the inland proposed steelhead ESUs. The BRT did not consider resident fish to reduce risks to ESU abundance, and their contribution to ESU productivity, spatial structure, and diversity is uncertain (NMFS 2003, 2004b). The BRT found moderate risks for each of the VSP categories.

4.3.9.3 2004 Status Review
In its Status Review, NMFS noted that approximately one-third of the LCR steelhead ESU's historically accessible spawning habitat is now blocked. Notwithstanding the lost spawning habitat, the ESU continues to be spatially well distributed, occupying each of the four major subbasins (the Molalla, North Santiam, South Santiam, and Calapooia Rivers). There was some uncertainty about the historical occurrence of steelhead in drainages of the Oregon Coastal Range. Coastal cutthroat trout is a dominant species in the Willamette Basin, and thus steelhead are not expected to have been as widespread in this ESU as they are east of the Cascade Mountains.

4.3.9.4 Recent Dam Counts and Returns to the Spawning Grounds
In their preliminary report, Fisher and Hinrichsen (2004) estimated a geometric mean of natural origin UWR steelhead at Willamette Falls equal to 9,541 during 2001-2004, compared to 3,961 in 1996-2000, a 141% increase. The slope of the population trend increased 10.4% (from 0.93 to 1.02) when the data for

2001-2004 were added to the 1990-2000 series, reversing the decline and indicating that, at least in the short run, the natural-origin population has been increasing.

4.3.10 LCR Steelhead

4.3.10.1 ESU Structure

The LCR steelhead ESU includes all naturally spawned populations of steelhead in streams and tributaries to the Columbia River between the Cowlitz and Wind Rivers in Washington (inclusive) and the Willamette and Hood Rivers in Oregon (inclusive). Excluded are steelhead in the Upper Willamette River Basin above Willamette Falls and steelhead from the Little and Big White Salmon Rivers in Washington (62 FR 43937; August 18, 1997). The W/LC TRT (McElhany et al. 2004) identified a total of 20 extant, demographically independent populations in four major populations groups: Cascade winter-run, Cascade summer-run, Gorge winter-run, and Gorge summer-run in this ESU (Appendix B, Figure B.10).

NMFS' June 14, 2004, listing proposal did not resolve the ESU membership of native resident populations that are above recent (usually manmade) impassable barriers but below natural barriers. It was provisionally proposed that these resident populations not be considered part of the revised LCR steelhead ESU until such time as significant scientific information becomes available to afford a case-by-case evaluation of their ESU relationships. The presence of four major population groups in this ESU makes it is less likely that any single group is significant for this ESU's survival and recovery, compared to ESUs with fewer major population groups.

4.3.10.2 The BRT Findings

Approximately 35% of historical habitat has been lost in this ESU due to the construction of dams or other impassible barriers, but the ESU exhibits a broad spatial distribution in a variety of watersheds and habitat types. The BRT was particularly concerned about the impact on ESU diversity of the high proportion of hatchery-origin spawners in the ESU, the disproportionate declines in the summer steelhead life history, and the release of nonnative hatchery summer steelhead in the Cowlitz, Toutle, Sandy, Lewis, Elochoman, Kalama, Wind, and Clackamas Rivers. Resident fish are not as abundant in this ESU as they are in the proposed steelhead ESUs. The BRT did not consider resident fish to reduce risks to ESU abundance, and their contribution to ESU productivity, spatial structure, and diversity is uncertain (NMFS 2003, 2004b).

The BRT found moderate risks in each of the VSP categories.

4.3.10.3 2004 Status Review

In its Status Review, NMFS noted that some anadromous populations in the LCR steelhead ESU, particularly summer-run steelhead populations, had shown encouraging increases in abundance in the 2 to 3 years ending 2001. However, population abundance levels remained small (no population had a recent 5-year mean abundance greater than 750 spawners).

There are 10 artificial propagation programs releasing hatchery steelhead that are considered to be part of the LCR steelhead ESU. All of these programs are designed to produce fish for harvest, but several are also implemented to augment the natural spawning populations in the basins where the fish are released. Four of these programs are part of research activities to determine the effects of artificial propagation programs that use naturally produced steelhead for broodstock in an attempt to minimize the genetic effects of returning hatchery adults that spawn naturally. One of these programs, the Cowlitz River late-run winter steelhead program, is also producing fish for release into the Upper Cowlitz River Basin in an attempt to reestablish a natural spawning population above Cowlitz Falls Dam.

NMFS concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). The hatchery programs have reduced risks to ESU abundance by increasing total ESU abundance and the abundance of fish spawning naturally in the ESU. The contribution of ESU hatchery programs to the productivity of the ESU in total is uncertain. It is also uncertain if steelhead reintroduced into the Upper Cowlitz River will be viable in the foreseeable future, because outmigrant survival appears to be quite low. As noted by the BRT, out-of-ESU hatchery programs have negatively impacted ESU productivity. The within-ESU hatchery programs provide a slight decrease in risks to ESU spatial structure, principally through the re-introduction of steelhead into the Upper Cowlitz River Basin. The eventual success of these reintroduction efforts, however, is uncertain. Collectively, artificial propagation programs in the ESU provide a slight beneficial effect on ESU abundance, spatial structure, and diversity but uncertain effects on ESU productivity.

4.3.10.4 Recent Dam Counts and Returns to the Spawning Grounds

In their preliminary report, Fisher and Hinrichsen (2004) estimated that the aggregate abundance of LCR steelhead was equal to 4,429 during 2001, compared to 6,333 during the period 1996- 2000, a 30% decrease in abundance. The slope of the aggregate population trend declined by 0.8% (from 0.93 to 0.92) when the 2001 count was added to the 1990-2000 data series.

4.3.11 CR Chum Salmon

4.3.11.1 ESU Structure

The W/LC TRT (McElhany et al. 2004) identified a total of 8 extant, demographically independent populations in three major population groups in this ESU: Coastal, Cascade, and Gorge (Appendix B, Figure B.11). Approximately 90% of the historical populations in the Columbia River chum ESU are extirpated or nearly so, and the Gorge population group was established by inferring that the approximately 100 adult chum salmon that ascend the Bonneville Dam fish ladders each year are spawning upstream. However, the Washington Department of Fish and Wildlife (WDFW) found only one and two carcasses in its 2002 and 2003 spawning ground surveys in the Gorge area, respectively, and its radio-tag data indicate that at least some fish fall back downstream (Ehlke and Keller 2003). The Smolt Monitoring Program has no record of juvenile chum salmon at Bonneville Dam.

4.3.11.2 The BRT Findings

The loss of off-channel habitats and the extirpation of approximately 17 historical populations increase the ESU’s vulnerability to environmental variability and catastrophic events. The populations that remain are low in abundance and have limited distribution and poor connectivity. The BRT found high risks for each of the VSP categories, particularly for the ESU’s spatial structure and diversity.

4.3.11.3 2004 Status Review

In its Status Review, NMFS noted that approximately 90% of the historical populations in the CR chum salmon ESU are extirpated or nearly so. During the 1980s and 1990s, the combined abundance of natural spawners for the Lower and Upper Columbia River Gorge, Washougal, and Grays River populations was below 4,000 adults. In 2002, however, the abundance of natural spawners exhibited a substantial increase at several locations. The preliminary estimate of natural spawners in 2002 was approximately 20,000 adults. The cause of this dramatic increase in abundance is unknown. Improved ocean conditions, the initiation of a supplementation program the Grays River, improved flow management at Bonneville Dam, favorable freshwater conditions, and increased survey sampling effort may have contributed to the elevated 2002 abundance. However, long- and short-term productivity trends for ESU populations were at or below replacement. The loss of off-channel habitats and the extirpation of approximately 17 historical populations increase the ESU’s vulnerability to environmental variability and catastrophic events. The populations that remain are low in abundance, have limited distribution and poor connectivity.

There are three artificial propagation programs producing chum salmon considered to be part of the Columbia River chum salmon ESU. These are conservation programs designed to support natural productivity. The Washougal Hatchery artificial propagation program provides artificially propagated chum salmon for reintroduction into recently restored habitat in Duncan Creek, Washington. This program also provides a safety net for the naturally spawning population in the mainstem Columbia River below Bonneville Dam. That population can access only a portion of spawning habitat during low-flow conditions. The other two programs are designed to augment natural production in the Grays River and the Chinook River in Washington. All these programs use naturally produced adults for broodstock. These programs were only recently established (1998-2002), with the first hatchery chum salmon returning in 2002.

NMFS' assessment of the effects of artificial propagation on ESU extinction risk concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). They have only recently been initiated and are just beginning to provide benefits to ESU abundance. The contribution of ESU hatchery programs to the productivity of the ESU in total is uncertain. The Sea Resources and Washougal Hatchery programs have begun to provide benefits to ESU spatial structure through reintroductions of chum salmon into restored habitats in the Chinook River and Duncan Creek, respectively. These three programs have a neutral effect on ESU diversity. Collectively, artificial propagation programs in the ESU provide a slight beneficial effect to ESU abundance and spatial structure but have neutral or uncertain effects on ESU productivity and diversity.

4.3.11.4 Recent Returns to the Spawning Grounds

In their preliminary report, Fisher and Hinrichsen (2004) estimated a geometric mean of the aggregate number of CR chum salmon in two index areas (Grays River and Hamilton and Hardy Creeks) equal to 1,776 during 2001-2003, compared to 2,114 in 1996-2000, a 16% decrease. The slope of the aggregate population trend decreased 1.5% (from 1.02 to 1.00) when the data for 2001-2003 were added to the 1990-2000 series.

4.3.12 SR Sockeye Salmon

4.3.12.1 ESU Structure

Anadromous sockeye salmon were once abundant in a variety of lakes throughout the Snake River Basin, including the Alturas, Pettit, Redfish, Stanley, and Yellowbelly Lakes in the Sawtooth Valley and in Wallowa, Payette, and Warm Lakes (Appendix B, Figure B.12), but the only remaining population resides in Redfish Lake. Beginning in the late nineteenth century, anadromous sockeye salmon were affected by heavy harvest pressures, unscreened irrigation diversions, and dam construction (TRT 2003). In addition, in the 1950s and 1960s, the Idaho Department of Fish and Game (IDFG) actively eradicated sockeye salmon from some locations. The SR sockeye salmon ESU includes populations of anadromous sockeye salmon from the Snake River Basin in Idaho, though extant populations occur only in the Stanley Basin (56 FR 58619; November 20, 1991). The ESU also includes residual sockeye salmon in Idaho's Redfish Lake, as well as one captive propagation hatchery program. Artificially propagated sockeye salmon from the Redfish Lake Captive Broodstock Program are considered part of this ESU. NMFS has determined that this artificially propagated stock is genetically no more than moderately divergent from the natural population (NMFS 2004c). Subsequent to the 1991 listing determination for SR sockeye salmon, a "residual" form of Snake River sockeye salmon (hereinafter residuals) was identified. The residuals often occur together with anadromous sockeye salmon and exhibit similar behavior in the timing and location of spawning. Residuals are thought to be the progeny of anadromous sockeye salmon but are generally non-anadromous. In 1993, NMFS determined that the residual population of Snake River sockeye salmon that exists in Redfish Lake is substantially reproductively isolated from kokanee (i.e., non-anadromous populations of *O. nerka* that become resident in lake environments over long periods of time), represents an important component in the evolutionary legacy of the biological species, and thus merits inclusion in the SR sockeye salmon ESU.

Only 16 naturally produced adults have returned to Redfish Lake since the Snake River sockeye salmon ESU was listed as an endangered species in 1991. All 16 fish were taken into the Redfish Lake Captive

Broodstock Program, which was initiated as an emergency measure in 1991. The return of over 250 adults in 2000 was encouraging; however, subsequent returns from the captive program in 2001 and 2002 have been fewer than 30 fish. The BRT found extremely high risks for all four VSP categories.

4.3.12.2 The BRT Findings and the 2004 Status Review

There is a single artificial propagation program producing SR sockeye salmon in the Snake River Basin. The Redfish Lake sockeye salmon stock was originally founded by collecting the entire anadromous adult return of 16 fish between 1990 and 1997, the collection of a small number of residual sockeye salmon, and the collection of a few hundred smolts migrating from Redfish Lake. These fish were put into a Captive Broodstock program as an emergency measure to prevent extinction of this ESU. Since 1997, nearly 400 hatchery-origin anadromous sockeye salmon adults have returned to the Stanley Basin from juveniles released by the program. Redfish Lake sockeye salmon have also been reintroduced into Alturas and Pettit Lakes using progeny from the captive broodstock program. The captive broodstock program presently consists of several hundred fish of different year classes maintained at facilities in Eagle, Idaho, and Manchester, Washington.

NMFS' assessment of the effects of artificial propagation on ESU extinction risk concluded that the Redfish Lake Captive Broodstock Program does not substantially reduce the extinction risk of the ESU in total (NMFS 2004c). The Artificial Propagation Evaluation Workshop noted that the Redfish Lake Captive Broodstock Program has likely prevented extinction of the ESU. This program has increased the total number of anadromous adults, attempted to increase the number of lakes in which sockeye salmon are present in the Upper Salmon River (Stanley Basin), and preserved what genetic diversity remains in the ESU. Although the program has increased the number of anadromous adults in some years, it has yet to produce consistent returns, and the long-term effects of captive rearing are unknown. The consideration of artificial propagation does not substantially mitigate the BRT's assessment of extreme risks to ESU abundance, productivity, spatial structure, and diversity.

4.3.12.3 Recent Dam Counts and Returns to the Spawning Grounds

In their preliminary report, Fisher and Hinrichsen (2004) estimated a geometric mean of aggregate numbers of SR sockeye salmon equal to 14 during 2001-2004 compared to 4 in 1996- 2000, a 211% increase. However, because returns were higher in 2001 and 2002 than in 2003, the slope of the aggregate population trend decreased 3.7% (from 1.26 to 1.22) when the data for 2001-2004 were added to the 1990-2000 series.

4.3.13 LCR Coho Salmon

4.3.13.1 ESU Structure

The W/LC TRT (McElhany et al. 2004) identified a total of 21 extant, demographically independent populations in three major population groups in this ESU: Coastal, Cascade, and Gorge (Appendix B, Figure B-13). There are only 2 extant populations in the LCR coho salmon ESU with appreciable natural productivity, the Clackamas and Sandy River populations, down from an estimated 23 historical populations in the ESU.

4.3.13.2 The BRT Findings

Short- and long-term trends in productivity are below replacement. Approximately 40% of historical habitat is currently inaccessible, which restricts the number of areas that might support natural productivity and further increases the ESU's vulnerability to environmental variability and catastrophic events. The extreme loss of naturally spawning populations, the low abundance of extant populations, diminished diversity, and fragmentation and isolation of the remaining naturally produced fish confer considerable risks on the ESU. The lack of naturally produced spawners in this ESU is contrasted by the very large number of hatchery-produced adults. The abundance of hatchery coho salmon returning to the Lower Columbia River in 2001 and 2002 exceeded 1 million and 600,000 fish, respectively. The BRT expressed concern that the magnitude of hatchery production continues to pose significant genetic and ecological threats to the extant natural populations in the ESU. However, these hatchery stocks collectively represent a significant portion of the ESU's remaining genetic resources. The 21 hatchery stocks considered to be part of the ESU, if appropriately managed, may prove essential to the restoration of more widespread naturally spawning populations. The BRT found extremely high risks for all VSP categories.

4.3.13.3 2004 Status Review

There are only 2 extant populations in the LCR coho salmon ESU with appreciable natural production (the Clackamas and Sandy River populations), from an estimated 23 historical populations in the ESU. Although adult returns in 2000 and 2001 for the Clackamas and Sandy River populations exhibited moderate increases, the recent 5-year mean of natural-origin spawners for both populations represented less than 1,500 adults. The Sandy River population had exhibited recruitment failure in 5 of 10 years (i.e., 1992-2001), and had exhibited a poor response to reductions in harvest. During the 1980s and 1990s, natural spawners were not observed in lower basin tributaries. Coincident with the 2000–2001 abundance increases in the Sandy and Clackamas populations, a small number of coho salmon spawners of unknown origin have been surveyed in some of these areas. Short- and long-term trends in productivity are below replacement.

Approximately 40% of historical habitat is currently inaccessible, which restricts the number of areas that might support natural production, and further increases the ESU's vulnerability to environmental variability and catastrophic events. The extreme loss of naturally spawning populations, the low abundance of extant populations, diminished diversity, fragmentation, and isolation of the remaining naturally produced fish confer considerable risks. The paucity of natural-origin spawners is contrasted by the very large number of hatchery-produced adults. The numbers of hatchery coho salmon returning to the lower Columbia River in 2001 and 2002 exceeded 1 million and 600,000 fish, respectively.

All of the 21 hatchery programs included in the LCR coho salmon ESU are designed to produce fish for harvest, and 2 of the smaller programs are also designed to augment the natural spawning populations in the Lewis River Basin. Artificial propagation in this ESU continues to represent a threat to the genetic, ecological, and behavioral diversity of the ESU. Past artificial propagation efforts imported out-of-ESU fish for broodstock, generally did not mark hatchery fish, mixed broodstocks derived from different local populations, and transplanted stocks among basins throughout the ESU. The result is that the hatchery stocks considered to be part of the ESU represent a homogenization of populations. Several of these risks have recently begun to be addressed by improvements in hatchery practices. Out-of-ESU broodstock is no longer used, and near 100% marking of hatchery fish is employed to improve monitoring and evaluation of broodstock and (hatchery- and natural-origin) returns. However, many of the within-ESU hatchery programs do not adhere to best hatchery practices. Eggs are often transferred among basins in an effort to meet individual program goals, further compromising ESU spatial structure and diversity. Programs may use broodstock that does not reflect what was historically present in a given basin, limiting the potential for artificial propagation to establish locally adapted naturally spawning populations. Many programs lack Hatchery and Genetic Management Plans (HGMPs) that establish escapement goals appropriate for the natural capacity of each basin and that identify goals for the incorporation of natural-origin fish into the broodstock.

During the Status Review, NMFS' assessment of the effects of artificial propagation on ESU extinction risk concluded that hatchery programs collectively mitigate the immediacy of extinction risk for the LCR coho salmon ESU in total in the short-term, but these programs do not substantially reduce the extinction risk of the ESU in the foreseeable future (NMFS 2004c). At present, within-ESU hatchery programs significantly increase the abundance of the ESU in total. Without adequate long-term monitoring, the contribution of ESU hatchery programs to the productivity of the ESU in total is uncertain. The hatchery programs are widely distributed throughout the Lower Columbia River, reducing the spatial distribution of risk from catastrophic events.

Additionally, reintroduction programs in the Upper Cowlitz River may provide additional reduction of ESU spatial structure risks. As mentioned above, the majority of the ESU's genetic diversity exists in the hatchery programs. Although these programs have the potential of preserving historical local adaptation and behavioral and ecological diversity, the manner in which these potential genetic resources are presently being managed poses significant risks to the diversity of the ESU in total. At present, the LCR coho salmon hatchery programs reduce risks to ESU abundance and spatial structure, provide uncertain benefits to ESU productivity, and pose risks to ESU diversity. Overall, artificial propagation mitigates the immediacy of ESU extinction risk in the short-term but is of uncertain contribution in the long-term.

Over the long-term, reliance on the continued operation of these hatchery programs is risky (NMFS 2004c). Several LCR coho salmon hatchery programs have been terminated, and there is the prospect of additional closures in the future. With each hatchery closure, any potential benefits to ESU abundance and spatial structure are reduced. Risks of operational failure, disease, and environmental catastrophes further complicate assessments of hatchery contributions over the long-term. Additionally, the two extant naturally spawning populations in the ESU were described by the BRT as being "in danger of extinction." Accordingly, it is likely that the LCR coho salmon ESU may exist in hatcheries only within the foreseeable future. It is uncertain whether these isolated hatchery programs can persist without the incorporation of natural-origin fish into the broodstock. Although there are examples of salmonid hatchery programs having been in operation for relatively long periods of time, these programs have not existed in complete isolation. Long-lived hatchery programs historically required infusions of wild fish in order to meet broodstock goals. The long-term sustainability of such isolated hatchery programs is unknown. It is uncertain whether the LCR coho salmon isolated hatchery programs are capable of mitigating risks to ESU abundance and productivity into the foreseeable future. In isolation, these programs may also become more than moderately diverged from the evolutionary legacy of the ESU and hence no longer merit inclusion in the ESU. Under either circumstance, the ability of artificial propagation to buffer the immediacy of extinction risk over the long-term is uncertain.

4.3.13.4 Recent Dam Counts and Returns to the Spawning Grounds
In their preliminary report, Fisher and Hinrichsen (2004) estimated a geometric mean of aggregate numbers of LCR coho salmon equal to 3,027 during 2001-2003, compared to 822 in 1996-2000, a 268% increase. The slope of the aggregate population trend increased 10.4% (from 0.92 to 1.02) when the data for 2001-2003 were added to the 1990-2000 series, reversing the decline and indicating that, at least in the short run, the aggregate run is increasing.

5.3 Factors Affecting Salmon and Steelhead Survival in the Action Area
An array of factors influences salmon and steelhead survival in the action area. These factors include dam and reservoir passage conditions at the eight FCRPS mainstem dams, hydrologic conditions, water quality conditions, predation, disease, artificial propagation programs, and harvest. The PA under consideration in this Opinion directly and indirectly affects hydrologic conditions in the action area. Changes in hydrologic conditions can affect dam and reservoir passage survival, water quality conditions (primarily water temperature), and disease and predation rates (by its influence on water temperature).

5.3.1 Baseline Physical Habitat Conditions in the Action Area
The Columbia River is a dynamic system. It has been affected and shaped over eons by a variety of natural forces, including volcanic activity, storms, floods, natural events, and climate changes. These forces had, and continue to have, a significant influence on biological factors, habitat, inhabitants, and the whole riverine and estuarine environment of the Columbia River. The Snake River and lower Columbia River and estuary habitats have been affected over the past 60 years by the existence and operation of the

series of mainstem hydropower dams and reservoirs (Section 5.2.1), as well as by the operation of both Federal and non-Federal upstream multipurpose storage projects. The impoundments have also inundated extensive salmon spawning and rearing habitat. Historically, fall chinook salmon spawned in mainstem reaches from near The Dalles, Oregon, upstream to the Pend Oreille and Kootenai Rivers in Idaho, and to

Table 5-1 Federal storage and diversion facilities and associated actions to develop a "Without Projects Operations" scenario.[1] Source: USBR 2004.

Storage Facility	Action
Jackson Lake Dam	Removed
Grassy lake Dam	Removed
Island Park Dam	Removed
American falls Dam	Removed
Minidoka Dam	Removed
Palisades Dam	Removed
Ririe Dam	Removed
Little Wood River Dam	Removed
Owyhee Dam	Removed
Anderson Ranch Dam	Removed
Arrowrock Dam	Removed
Lucky Peak Dam	Removed
Deadwood Dam	Removed
Cascade Dam	Removed
Hubbard Dam	Not modeled
Deer Flats Dam	Removed

Diversion Facility	Action
Cascade Creek Diversion Dam	Not modeled
Minidoka Northside Headworks	Diverts 40% of natural flow right
Minidoka Southside Headworks	Diverts 40% of natural flow right
Unit A Pumping Plant	Removed
Milner-Gooding Canal Headworks	Removed
falls Irrigation Pumping Plant	Removed
Tunnel No. 1	Removed
Dead Ox Pumping Plant	Removed
Ontario-Nyssa Pumping Plant	Removed
Gem Pumping Plants #1 and #2	Diverts private natural flow only
Boise River Diversion Dam	Diverts private natural flow only
Black Canyon Diversion Dam	Diverts private natural flow only

1 Project facilities and operations associated with the Vale, Mann Creek, Burnt River, and Baker Projects were not included in the Upper Snake River MODSIM model and therefore are not modeled in the "Without Projects Operations" simulation. Storage facilities associated with these projects include Warm Springs, Agency Valley, Bully Creek, Mann Creek, Unity, Mason, and Thief Valley Dams. Diversion facilities associated with these projects include Harper Diversion Dam, Bully Creek Diversion Dam, Mann Creek Dam Outlet, and Savely Dam and Lilley Pumping Plant.

the Snake River downstream of Shoshone Falls. Presently, mainstem production areas for fall chinook salmon are confined to the Hanford Reach of the Columbia River, the Hells Canyon Reach of the Snake River, the mid-Columbia River, and in the tailrace areas downstream from the lower Snake River projects and Bonneville Dam. The Hanford Reach is the only known mainstem spawning area for steelhead. Spawning habitat used historically by LCR Chinook salmon, CR chum salmon, and LCR steelhead was probably inundated by the Bonneville pool. Mainstem habitats in the lower Columbia and Willamette Rivers have been greatly reduced. What once were complex channels with bars, islands, and intricate flow patterns have often been reduced to a single thread. Floodplains have been reduced, off-channel habitat features have been eliminated or disconnected from the main channel, and the amounts of large woody debris in the channels have been greatly reduced. Finally, most of the remaining habitats are affected by flow fluctuations associated with reservoir water management for power peaking, flood control, irrigation, and other operations.

Estuarine habitat has been lost or altered directly through diking, filling, and dredging. Estuarine habitat has also been removed indirectly through changes to flow regulation that affect sediment transport and salinity within specific habitats in the estuary. Not only have rearing habitats been removed, but the habitats needed to support tidal and seasonal movements of juvenile salmon are no longer accessible because connections have been lost.

Major changes in the estuary resulting from anthropogenic alterations include a loss of vegetated, shallow-water habitat and changes in the size, seasonality, and behavior of the plume. These changes have significant consequences for salmonid diversity and population productivity. ESUs with fry and fingerling life-history strategies that use and depend upon these shallow-water habitat areas are most significantly affected by these changes (Fresh et al. 2004).

The lower Columbia River estuary lost about 43% of its historical tidal marsh (from 16,180 to 9,200 acres) and 77% of historical tidal swamp habitats (from 32,020 to 6,950 acres) between 1870 and 1970 (Thomas 1983). One example is the diking and filling of floodplains formerly connected to the tidal river that have resulted in the loss of large expanses of low-energy, offchannel habitat for salmon rearing and migrating during high flows. Similarly, diking of estuarine marshes and forested wetlands within the estuary have removed most of these important off-channel habitats. Sherwood et al. (1990) estimated that the Columbia River estuary lost 20,000 acres of tidal swamps; 10,000 acres of tidal marshes; and 3,000 acres of tidal flats between 1870 and 1970.

The total volume of the estuary inside the entrance has declined by about 12% since 1868 (Sherwood et al. 1990). This study further estimated an 80% reduction in emergent vegetation production and a 15% decline in benthic algal production. The authors analyzed early navigational charts and noted profound bedform changes in the river entrance from year to year. The pre-development river mouth was characterized by shifting shoals, sandbars, and channels forming ebb and flood tide deltas. Prior to jetty construction, the navigable channel over the tidal delta varied from a single, relatively deep channel in some years to two or more shallow channels in other years.

Within the lower Columbia River, diking, river training devices (pile dikes and riprap), railroads, and highways have narrowed and confined the river to its present location. Between the Willamette River and the mouth of the Columbia River, diking, flow regulation, and other human activities have resulted in the confinement of 84,000 acres of floodplain that likely contained large amounts of aquatic habitat (i.e. tidal marsh, and swamp). The lower Columbia River's remaining tidal marsh and swamp habitats are located in a narrow band along the banks of the Columbia River and its tributaries and around undeveloped islands.

Since the late 1800s, the Corps has been responsible for maintaining navigation safety on the Columbia River. During that time, the Corps has taken many actions to improve and maintain the navigation channel. The channel has been dredged periodically to make it deeper and wider and annually for maintenance. To improve navigation and reduce the frequency of maintenance dredging, the navigation channel has also been realigned and hydraulic control structures, such as in-water fills, channel constrictions, and pile dikes, which act as break-waters, have been built. Most of the present day pile dike system was built in the periods 1917-1923 and 1933-1939, with an additional 35 pile dikes constructed between 1957 and 1967.

The existing navigation channel pile dike system consists of 256 pile dikes, totaling 240,000 linear feet. Ogden Beeman and Associates (1997) noted that navigation channel maintenance activities from 1885 to 1985 required closing of river side channels, realigning river banks, removing rock sills, stabilizing river banks, and placement of river "training" features. Most of these habitat alterations were constructed or occurred before the listings of any Pacific salmonids as endangered and threatened species.

These aforementioned physical changes also affect other factors in the riverine and estuarine environment. Tides raise and lower river levels at least 4 feet and up to 12 feet twice every day. The historical range for tides was probably similar, but seasonal ranges and extremes in water surface elevations have certainly changed because of river flow regulation and stream bank development. The salinity level in areas of the estuary can vary from zero to 34 parts per thousand (ppt), depending on tidal intrusion, river flows, and storms. The salinity wedge is believed to have ranged from the river mouth to as far upstream as RM 37.5 in the past. It is now generally believed that the upper edge of the wedge ranges between the mouth and RM 30. The river bed within the navigation channel is composed of a continuously moving series of sand waves that can migrate downstream up to 20 feet per day at flows of 400,000 cfs or greater and the lesser rates at lower flows.

As development has changed the circulation pattern in the estuary, it has increased shoaling rates such that the estuary is now a more effective sediment trap (Independent Science Group 1996). Although the Columbia River is characterized as a highly energetic system, it has been changing as a result of development and is now similar to more developed and less energetic estuaries throughout the world (Sherwood et al. 1990).

In addition, model studies indicate that the hydrosystem and climate change together have decreased suspended particulate matter to the lower river and estuary by about 40% (as measured at Vancouver, Washington) and have reduced fine sediment transport by 50% or more (Bottom et al. 2001). Overbank flow events, important to habitat diversity, have become rare, in part because water storage and irrigation withdrawals prevent high flows, and in part because diking and revetments have increased the "bank full" flow level (from about 18,000 to 24,000 m^3/s). The dynamics of estuarine habitat have changed in other ways relative to flow and stream bank development. The availability of shallow (between 10 cm and 2 m depth), low-velocity (less than 30 cm/s) habitat now appears to decrease at a steeper rate with increasing flow than during the 1880s, and the absorption capacity of the estuary appears to have declined.

The significance of these changes for salmonids is unclear. Estuarine habitat is likely to have provided services (food and refuge from predators) to subyearling migrants that resided in estuaries for up to two months or more (Casillas 1999). Historical data from Rich (1920) indicate that small juvenile salmon (< 50 mm), which entered the Columbia River estuary during May, grew 50 mm to 100 mm during June, July, and August. Data from a more contemporary period (Dawley et al. 1986; CREDDP 1980) show neither small juveniles entering the estuary in May nor growth over the summer season.

The Columbia River plume also appears to be an important habitat for juvenile salmonids, particularly during the first month or two of ocean residence. The plume may simply represent an extension of the estuarine habitat. More likely, it represents a unique habitat created by interaction of the Columbia River freshwater flow with the California current and local oceanographic conditions. Ongoing studies show that nutrient concentrations in the plume are similar to nutrient concentrations associated with upwelled waters. Upwelling is a well recognized oceanographic process that produces highly productive areas for fish. Primary productivity, and more important, the abundance of zooplankton prey, is higher in the plume compared with adjacent non-plume waters. Further, salmon appear to prefer low surface salinity, as the abundance and distribution of juvenile salmon are higher and more concentrated in the Columbia River plume than in adjacent, more saline waters. These findings support the notion that the plume is an important habitat for juvenile salmonids. What is not known precisely is how Columbia River flows affect the structure of the plume relative to salmonid biological requirements during outmigration periods, and whether critical threshold flows are needed.

5.3.2 Hydrologic Conditions

Hydrologic conditions influence salmonid survival through the migratory corridor by changing the rate of migration; affecting water quality, particularly water temperature, turbidity, and TDG concentrations; and by influencing FCRPS project operations.

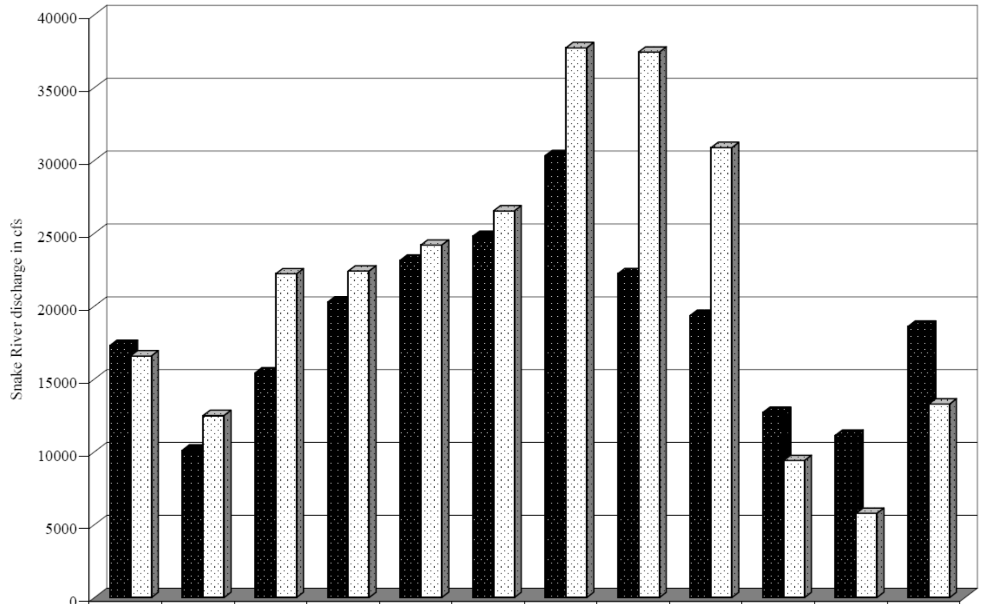
Flow regulation, water withdrawal, and climate change have reduced the Columbia River's average flow and altered its seasonality, sediment discharge and turbidity, thereby changing the estuarine ecosystem (National Research Council 1996; Sherwood et al. 1990; Simenstad et al. 1982, 1990; Weitkamp 1994). Annual spring freshet flows through the Columbia River estuary are about one-half of the traditional levels that flushed the estuary and carried smolts to sea, and total sediment discharge is about one-third of nineteenth-century levels. For instance, reservoir storage and flow regulation that began in the 1970s has reduced the 2-year flood peak discharge, as measured at The Dalles, Oregon, from 580,000 cfs to 360,000 cfs (Corps 1999).

Decreased spring flows and sediment discharges have also reduced the extent, speed of movement, thickness, and turbidity of the plume that extended far out and south into the Pacific Ocean during the spring and summer (Cudaback and Jay 1996; Hickey et al. 1997). Changes in estuarine bathymetry and flow have altered the extent and pattern of salinity intrusion up the Columbia River and have increased stratification and reduced mixing (Sherwood et al. 1990). The direct effects of flow on juvenile survival are the relationships between flow and travel time and flow and the distribution of fish among the various dam passage routes. In general, the lower the flow through the series of FCRPS reservoirs, the longer the travel time of outmigrating juveniles. The longer juveniles remain in project reservoirs, the greater their exposure to predation, disease, and other mortality factors. Also, the longer juveniles remain in the project reservoirs, the greater the potential that they will residualize (remain in fresh water for months to another year). Changing flows can also affect dam operations as operating protocols are often defined in terms of streamflow criteria. For example, at spring flows of less than 85,000 cfs at Lower Granite Dam, the spill rate and duration are reduced. Spillways are widely considered the safest route of juvenile dam passage (Ferguson et al. 2004). Changing flows indirectly affect juvenile survival by changing water temperatures. Lower flows result in higher summer water temperatures (all other conditions being equal). High summer water temperatures increase disease, predation rates, and thermal stress on juvenile salmonids.

Very high flow conditions can cause high rates of involuntary spill at FCRPS projects in the migratory corridor. High spill rates can generate supersaturated TDG concentrations in downstream waters. This effect is discussed in Section 5.3.3, Water Quality Conditions. Streamflows are directly affected by the PA and these effects and their associated effects on salmon survival are the focus of the analysis of effects generated in developing this Opinion (Section 6).

Agricultural water use in the Snake and Columbia Basins began around 1850 and accelerated rapidly in the early twentieth century (Volkman 1997). Today, about 85% of water consumption in the basins is associated with irrigated agriculture. For example, at Brownlee Reservoir, all upstream water use reduces flows by about 6 million acre-feet (Maf) annually, about one-third of native flows (USBR 1999). At Lower Granite Dam, upstream water developments consume about 6.4 Maf, about 7% of native flows. At McNary Dam, upstream water uses consume about 12 Maf annually, about 12% of native flows. At Bonneville Dam, about 13.3 Maf is consumed at upstream water developments. This water consumption reduces streamflows primarily during the growing season (April through October), has affected the status of the species in the action area, and is included in the environmental baseline (reference operation). Future water consumption is discussed in Section 7.2, Cumulative Effects.

The principal change in environmental conditions between those currently existing and those under the reference operation (current conditions absent the effects of the USBR's upper Snake project operations) is the change in Snake and Columbia River flows. Because all project facilities are located upstream from Brownlee Reservoir, Idaho, this change is best illustrated by estimated inflows to Brownlee Reservoir (Figure 5-2). This depiction of Snake River flow conditions is intended to illustrate how the baseline hydrology used in this Opinion differs from the existing conditions.



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
■ Current Flows	17294	10122	15416	20273	23136	24787	30333	22230	19366	12708	11138	18610
□ Reference Operation	16584	12504	22217	22417	24186	26534	37731	37440	30876	9413	5780	13286

Figure 5-2. Mean monthly Snake River inflow (cfs) at Brownlee Dam under current conditions and under the reference operation. Sources: current conditions, BPA HYDSIM model run

5.3.3 Water Quality Conditions

Water and sediment quality is another important aspect of the environmental condition of the lower Columbia River ecosystem with the potential to affect salmonids' growth and survival. Water quality in streams throughout the Columbia River Basin has been degraded by human activities such as dams and diversion structures, water withdrawals, farming and grazing, road construction, timber harvest activities, mining activities, and urbanization. Over 2,500 streams and river segments and lakes do not meet Federally approved, State, and tribal water quality standards and are now listed as water quality-limited under Section 303(d) of the Clean Water Act (CWA). Tributary water quality problems contribute to poor water quality where sediment and contaminants from the tributaries settle in mainstem reaches and the estuary.

The importance of three water quality characteristics—water temperature, TDG concentrations, and water and sediment pollutants—are discussed below.

5.3.3.1 Water Temperature

Salmonids evolved to take advantage of the natural cold, freshwater environments of the Pacific Northwest. Temperature directly governs their metabolic rate and directly influences their life history. Natural or anthropogenic fluctuations in water temperature can induce a wide array of behavioral and physiological responses in these fish. Feeding, growth, resistance to disease, successful reproduction, sufficient activity for competition and predator avoidance, and successful migrations are all affected by water temperatures (Yearsley 1999). These behavioral and physiological effects may lead to impaired functioning of the individual and decreases viability at the organism, population, and species level.

Williams (2004) noted that multivariate models indicated that the condition that had the strongest effect on survival of yearling chinook salmon through the Snake River was water temperature. For yearling chinook salmon, temperatures above 13°C appeared detrimental to survival. The date on which temperatures at Lower Monumental Dam reached 13°C varied from year to year, ranging from May 7 in 1998 to June 11 in 1997. The average date on which this apparent threshold temperature was reached was May 25 (Williams et al 2004). Zaugg and Wagner (1973) found that gill Na + -K + ATPase (an indicator of migratory readiness) and migratory urge declined at water temperatures of 13°C and higher. Steelhead that migrate too late in the season, when water temperatures are above this threshold, may have a tendency to residualize. For subyearling chinook salmon, Williams et al (2004) noted that average survival was nearly constant for water temperature below 19.3°C, and nearly constant, but considerably lower for water temperature above 20.6°C.

For Snake River fall chinook salmon juveniles, Connor et al (2003) determined that flow and temperature explained 92% of the observed variability in cohort survival from points of release in Hells Canyon to the tailrace of Lower Granite Dam and built a multiple regression model of cohort survival based on these parameters. Cohort survival generally increased as flow increased, and decreased as temperature increased (Connor 2003). Based on the regression model developed, survival is predicted to change by approximately 3% with each change of 100 m^3/s in flow when temperature is held constant. The change in survival is approximately 7% for each 1°C change in temperature when flow is held constant (Connor 2003).

The Snake River from its confluence with the Salmon River at RM 188 to its confluence with the Columbia River has been included on the 303(d) list (a list of impaired waters compiled under Section 303(d) of the CWA) for water temperature by Idaho, Oregon, and Washington. Additionally, Oregon and Washington include most of the mainstem Columbia River on their lists as impaired for temperature. Most of the water bodies in Oregon, Washington, and Idaho that are on the 303(d) list are included because they do not meet water quality standards for temperature. Water temperature alterations affect salmonid metabolism, growth rate, and disease resistance, as well as the timing of adult migrations, fry emergence, and smoltification (EPA 2002). Many factors can cause high stream temperatures, but they are primarily related to land- and water-use practices rather than point-source discharges (Coutant 1999).

Water temperatures in excess of the States of Washington and Oregon's 20°C (68°F) water quality standards (e.g., OAR, Ch. 30, Division 041) stress anadromous salmonids and can directly or indirectly cause mortality (e.g., increase fish susceptibility to disease, increase predation rates of piscivorous fish). Some common actions that have resulted in high stream temperatures are the removal of trees or shrubs that directly shade streams, excessive water withdrawals for irrigation or other purposes, and warm irrigation return flows. Loss of wetlands and increases in groundwater withdrawals have contributed to lower base-stream flows, which in turn contribute to temperature increases. Water temperature is also directly affected by streamflow conditions through the effects of changes in the mass affected by heat flux. For this Opinion, NMFS has employed both Environmental Protection Agency (EPA) and Corps water temperature modeling. Under the reference operation, EPA (2005) estimated water temperature conditions in the Snake and Columbia Rivers throughout the peak juvenile migration season (April through September) for low, average, and high water years (Table 5-2).

Table 5-2. Estimated water temperatures (in °C) at selected FCRPS dams for low, average, and high flow years under the reference operation. Source: EPA 2005.

	Lower Granite Dam			Ice Harbor Dam			McNary Dam		
	Low 2000	Ave 1995	High 1997	Low 2000	Ave 1995	High 1997	Low 2000	Ave 1995	High 1997
April	9.7	8.4	8.3	9.8	8.3	8.4	8.7	8.1	7.9
May	12.5	11.5	10.9	13.2	11.9	11.4	12.2	11.9	11.6
June	15.5	14.5	14.1	15.9	14.6	14.5	15.3	15.1	14.8
July	18.7	18.7	19.5	21.0	20.0	19.9	20.0	19.5	18.6
August	20.2	19.2	19.6	22.7	21.5	23.0	21.6	20.0	21.5
September	19.0	19.6	18.4	20.9	20.6	20.1	19.7	18.3	19.2

In some instances, these modeling results appear to be counterintuitive. For example, at Lower Granite Dam under the high water conditions of 1997, a lower July water temperature than the average or dry years would be expected, all other conditions being equal. However, the Snake River upstream from Lower Granite Dam is a warmer river than the Clearwater River, the other major Snake River tributary entering Lower Granite Reservoir. Therefore, higher flows in the Snake River can result in warmer water temperatures at Lower Granite Dam. The Corps attempts to control water temperatures at Lower Granite Dam by releasing cold water (7°C) from Dworshak Dam on the Clearwater River at rates up to 14 kcfs. When flows are warm and high coming out of the Snake River Basin, this measure would have a lesser effect on water temperatures at Lower Granite Dam.

5.3.3.2. Total Dissolved Gas

High rates of spill at mainstem FCRPS dams can cause high TDG concentrations. High TDG concentrations can cause gas bubble trauma (GBT) in adult and juvenile salmonids resulting in injury or death. Biological monitoring shows that the incidence of GBT in both migrating smolts and adults remains below 1% when TDG concentrations in the upper water column do not exceed the Oregon and Washington water quality standard (110%) and gas waiver levels of 120% in FCRPS project tailraces and 115% in forebays. When those levels are exceeded, there is a corresponding increase in the incidence of signs of GBT. Exceedence of this standard is generally associated with high rates of involuntary spill associated with the peak of the annual runoff hydrograph. Current reservoir operations typically limit gas-generating, high-spill events to a few days or weeks during high-flow years. Historically, TDG supersaturation was considered a major contributor to juvenile salmon mortality, and TDG control has been a focus of efforts to improve salmon survival. The Corps has invested heavily in controlling TDG at its projects in the migratory corridor through the installation of spillway improvements and by managing spill operations to reduce gas entrainment, and thorough TDG monitoring and abatement evaluation.

As part of the TDG abatement program, the Corps has developed spill limits at its projects designed to prevent the creation of adverse TDG conditions downstream. For example, the spill cap at Lower Granite Dam in the 2004 Water Management Plan (Corps 2004) is 43,000 cfs. Using the 50-year simulated hydrology for the environmental baseline (reference operation), the spill cap at Lower Granite Dam would be exceeded on a monthly average basis as follows: March, 1 out of 50; April, 2 out of 50; May, 12 out of 50; and June, 14 out of 50.

5.3.3.3 Pollutants

Background or ambient levels of pollutants in inflows carry cumulative loads from upstream areas in variable and generally unknown amounts. Municipal and industrial waste discharges have occurred in the greater Lewiston, Idaho-Clarkston, Washington area and have been received from larger population centers in the Upper Snake River Basin. Major tributaries and drainages have delivered higher background concentrations of metals, which are generally associated with mining areas that are common in portions of the Clearwater and Salmon Rivers and in tributaries throughout the Upper Snake River.

Current environmental conditions in the Columbia River estuary indicate the presence of contaminants in the food chain of juvenile salmonids including DDT, PCBs, and polyaromatic hydrocarbons (PAH) (NWFSC Environmental Conservation Division 2001). These data indicate that juvenile salmonids within the Columbia River estuary have contaminant body burdens that may already be within the range where sublethal effects may occur, although the sources of exposure could be widespread and are not clear. In field studies, juvenile salmon from sites in the Pacific Northwest have demonstrated immunosuppression, reduced disease resistance, and reduced growth rates due to contaminant exposure during their period of estuarine residence (Arkoosh et al. 1991, 1994, 1998; Varanasi et al. 1993; Casillas et al. 1995a, 1995b, 1998a).

5.3.4 Predation

Salmon and steelhead are exposed to high rates of natural predation, particularly during freshwater rearing and migration stages. Ocean predation may also contribute to significant natural mortality, although the levels of predation are largely unknown. In general, salmonids are prey for pelagic fishes, birds, and marine mammals, including harbor seals, sea lions, and killer whales. There have been recent concerns that the rebound of seal and sea lion populations, following their protection under the Marine Mammal Protection Act of 1972, has resulted in substantial mortality for salmonids. In recent years, for example, sea lions have learned to target UWR spring chinook salmon in the fish ladder at Willamette Falls and other spring Chinook salmon ESUs in the tailrace area downstream from Bonneville Dam.

Dams and reservoirs are generally believed to have increased the incidence of predation over historical levels (Poe et al. 1994). Effects such as the increase in habitat suitable for predatory fish, warmer near-surface water temperatures that increase their foraging rates, and the delay and aggregation of migrating salmonids in project forebays and tailraces all increase the susceptibility of anadromous fish to predation (NMFS 2004a, Section 5.3.1).

5.3.5 Disease

Columbia Basin salmonids co-exist with a range of viruses, bacteria, fungi, and parasites. Some of these organisms have significant effects on salmon populations through mortality or reduced fitness (morbidity). These organisms are collectively known as pathogens. For salmonid and pathogen populations to persist, interactions between host and pathogen, like interactions between predator and prey, must maintain a dynamic balance where neither party is wholly eliminated. Three major factors in this balance have been identified as host, environment, and pathogen. A change in one or more of these three factors will result in a change in the equilibrium, often resulting in large outbreaks of disease (epizootics) which may decimate salmonid populations (Hedrick 1998; Gerstman 2003; Arkoosh et al. 2004).

With the development of the Columbia Basin, a number of factors emerged which have the potential to cause shifts in the host-pathogen equilibria, increasing risks of epizootics. Dams and other impoundments increased summer water temperatures, creating conditions where some pathogens increased their infectivity (rate of spread) and virulence (severity of effects on the host organism), while at the same time stressing salmonids and reducing their resistance to disease (Becker and Fujihara 1978; WDOE 2002; Mesa et al. 2000). The introduction of exotic species and the between-basin transfer of native fishes creates opportunities for the introduction of new pathogens, or for endemic pathogens to increase their range. Large-scale intensive hatchery culture provides conditions where pathogens could spread rapidly within the hatchery, and increases the risk of transfer of disease out of the hatchery through hatchery effluents and the release of infected fish. Changing environmental conditions altered relationships between parasites and their hosts, potentially increasing the severity of parasitic infection. Handling and transport of fish at dams has led to fish being held at much higher densities than observed in the wild, increasing chances of disease transmission. Thus, with changes in host, pathogen, and environment, a shift in host-pathogen relationships from pre-development conditions has occurred.

The effects of disease on wild salmonid populations are notoriously hard to enumerate, and the significance of a particular pathogen may also widely vary among different salmonid populations (Hedrick 1998). Diseases which have been observed to cause significant losses to migrating fish (both hatchery and wild) in the Columbia River system are Columnaris (*Flexibacter columnaris*) (Becker and Fujihara 1978), bacterial kidney disease (*Renibacterium salmoninarum*) (Arkoosh et al. 2004; Elliot et al. 1997), and ceratomyxosis (*Ceratomyxa shasta*) (Ratliff 1981; Bartholomew 1998). With the interruptions of natural disease control mechanisms through shifts in environmental conditions, introductions of new pathogens (or changes in distribution of endemic ones), or introduction of new potential sources of pathogens, such as hatcheries, this equilibrium has been substantially altered and the potential for large epizootics and high losses to salmonid populations has increased.

Effects of Temperature on Disease. In addition to the stress and direct physiological damage suffered by salmonids when exposed to elevated water temperatures, risks of mortality due to disease also increase. There appear to be two primary reasons for this increase. Temperature related stress reduces the capacity of the fish to resist infection and eliminate pathogens.

Pathogens also respond to changes in temperature. There is a particular range of optimum temperatures for each pathogen and in this range the reproduction, infectivity, and virulence of a pathogen are maximized. The combination of reduced resistance of fish and increased virulence and infectivity of a particular pathogen can result in epizootics and high rates of mortality due to disease. In a summary of issues related to temperature criteria for salmon, the EPA (2001) summarized the effects of water temperature on disease risk as follows:

Risk Temperature range (°C)
Minimized <12-13°
Elevated 14-17°
Severe 18-20°

There are a number of pathogens known in the Columbia Basin which show a direct increase in infectivity and virulence with increased water temperature. Some diseases, such as Columnaris (*Flexibacter columnaris*), are rare within the natural range of water temperatures in the Columbia Basin (i.e., temperatures that would be observed absent man-caused effects) (Becker and Fujihara 1978). A brief summary of Columbia Basin pathogens with the potential for causing increased mortality among salmonids under elevated water temperature conditions is described in Table 5-3.

Table 5-3. Fish diseases known from the Columbia Basin showing increases in infectivity and virulence with increasing water temperature (WDOE 2002; EPA 1999; EPA 2001)

Organism	Disease	Temperature effects	Susceptible species	Severity of effects
		Bacteria		
Flexibacter columnaris	Columnaris	epizootics strongly related to high water temperature (>15	All species	Has been observed to cause high levels of mortality among wild and hatchery populations, ° C)
Renibacterium salmoninarum	Bacterial Kidney Disease (BKD)	Increased temperatures reduce infectivity, but increase the severity of infections (time until death) in laboratory trials.	All salmonids, especially chinook and sockeye	Often causes high levels of mortality in hatcheries. High prevalence in some wild fish populations.
Aeromonas salmonicida	Furunculosis	Epizootics strongly correlated with temperature	All fishes	Has been observed to cause high levels of mortality in the wild and hatcheries
Myxobacter sp.	Bacterial Gill Disease (BGD)	Epizootics strongly correlated with water temperature and poor water quality	All fishes	
		Parasites		
Ceratomyxa Shasta	Ceratomyxosis	Increased temperatures reduced time from exposure to death in laboratory studies.	Salmonids, especially chinook	Has been observe to cause high levels of mortality in the wild and in hatcheries.
Icthyopthirius multifilis	Ich	Epizootics strongly associated with temps >15 ° C	All fishes	Has been observed to cause high levels of mortality in the wild and in hatcheries

Organism Disease Temperature effects Susceptible species
Severity of effects Bacteria
Juvenile salmon and steelhead mortalities from an array of disease have been observed at many fish collection and handling systems in the migratory corridor. Columnaris and BKD are two common diseases observed at mainstem FCRPS juvenile fish collection facilities. In many cases, the proximate causes of fish mortality in the action area are largely unknown. While it is known that juvenile passage survival is lower under low-flow, high-temperature conditions, it is seldom known whether the direct cause of death is thermal stress, increased predation, or increased susceptibility to disease, or a combination of these factors.

5.3.6 Artificial Propagation

Artificial propagation programs mandated by Congress under the Lower Snake River Compensation Program are included in the environmental baseline for this consultation. Many artificial propagation facilities under this program were originally authorized to help mitigate for the construction of the four Federal lower Snake River hydroelectric dams. Other Federally funded artificial propagation programs in the Snake Basin are not included in the environmental baseline for this consultation, as they are currently undergoing consultation.

Although located outside of the action area, all Federal and non-Federal artificial propagation programs in the Columbia Basin above Priest Rapids Dam are also part of the environmental baseline for this consultation. They are included because hatchery progeny pass through the lower Columbia River migration corridor and interact with ESA-listed fish that are the focus of this consultation. The current Section 7 biological opinion for hatchery operations associated with unlisted salmon species (for Federally funded programs) and Permit 1347 (for Stateoperated programs) both expire October 22, 2013. ESA permits (1396, USFWS and 1412, Confederated Tribes of the Colville Reservation) associated with listed steelhead are in place through October 2, 2008, and permit 1395 (issued to WDFW) is in place through October 2, 2013. ESA permit 1300 issued to the USFWS to propagate listed spring chinook salmon is in place through December 31, 2007, and permit 1196 issued to WDFW expires January 20, 2014. Artificial propagation programs in the Columbia Basin below the confluence with the Snake River are not included in the environmental baseline for this consultation. New ESA authorization is in process for these programs.

Because hatcheries have traditionally focused on providing fish for harvest, it is only recently that the substantial adverse effects of hatcheries on natural populations have been demonstrated. For example, hatchery practices, among other factors, have contributed to the 90% reduction in natural coho salmon runs in the lower Columbia River over the past 30 years (Flagg et al. 1995). NMFS has identified four primary ways hatcheries harm natural-origin salmon and steelhead: 1) ecological effects, 2) genetic effects, 3) overharvest effects, and 4) masking effects.

Ecologically, hatchery-origin fish can prey on, displace, and compete with natural fish. These effects are most likely to occur when hatchery-reared juveniles are released in poor condition and remain in the fresh water for extended rearing periods rather than migrating to marine waters. Hatchery-origin fish also can transmit hatchery-borne diseases, and hatcheries themselves can release disease-carrying effluent into streams. Hatchery-origin fish can affect the genetic variability of native fish by interbreeding with them. Outbreeding depression can result from the introduction of stocks from other areas. Genetic interactions like these can result in fish being less adapted to the local habitats where the original native stock evolved, and may therefore be less productive there.

In many areas, hatchery-origin fish provide increased fishing opportunities. However, when natural fish mix with hatchery-origin fish in these areas, naturally produced fish can be overharvested. Moreover, when migrating adult hatchery and natural fish mix on the spawning grounds, the health of the natural runs and the habitat's ability to support them can be overestimated because hatchery fish can mask the actual natural run status from surveyors' observations.

The role hatcheries play in the Columbia Basin is being redefined by NMFS' proposed hatcherylisting policy, developing environmental impact statements, and recovery planning efforts. These efforts will focus on maintaining and improving ESU viability. Research designed to clarify interactions between natural and hatchery fish and quantify the effects of artificial propagation on natural fish will play a pivotal role in informing these efforts. The final facet of these initiatives is to use hatcheries to create fishing opportunities that are benign to listed populations (e.g., terminal area fisheries).

5.3.7 Harvest

Treaty Indian Harvest. Treaty Indian fishing rights are included in the environmental baseline for this consultation. The four Columbia River "Stevens" Treaty Tribes (the Nez Perce, Umatilla, and Warm Springs Tribes, and the Yakama Indian Nation) entered into treaties with the United States in 1855. In exchange for the Indians relinquishing their interest in certain lands, the treaties reserved to the Tribes "exclusive" on-reservation rights and the right to take "fish at all usual and accustomed places in common with citizens of the United States" outside the reservations on the Columbia River and major tributaries.

Indian treaty rights, such as hunting and fishing rights, are reserved rights that generally date from time immemorial. See Felix S. Cohen, *Handbook of Federal Indian Law*, 441-448 (1982); *United States v. Winans*, 198 U.S. 371, 381 (1905), 25 S.Ct. 662, 49 L.Ed. 1089 ("In other words, the treaty was not a grant of rights to the Indians, but a grant of right from them -- a reservation of those not granted. There was an exclusive right of fishing reserved within certain boundaries. There was a right outside of those boundaries reserved 'in common with the citizens of the territories"). Starting in 1977, Tribal and State fisheries subject to U.S. v. Oregon have been regulated pursuant to a series of Court orders reflecting Court-approved settlement agreements among the parties. The last long-term agreement, known as the Columbia River Fishery Management Plan (CRFMP), was adopted and approved by the Court in 1988 and expired in 1999. At the Court's direction and under its supervision, the parties are currently in the process of negotiating a new long-term agreement.

During the past 10 years, harvest has been managed pursuant to the CRFMP and successor agreements that contain restraints on the fisheries necessitated by the ESA listings of some of the ESUs. As a result, NMFS has conducted ESA Section 7 consultations and issued no-jeopardy opinions covering these agreements and their impact on ESA-listed species.

Agreed-to and estimated harvest rates for various stocks under the current U.S. v. Oregon agreements are set forth in Tables 5-4 and 5-5. For the purpose of projecting the environmental baseline into the future, these current harvest rates are assumed to continue through the term of this Opinion. In terms of the analysis in the Opinion, it does not matter whether the Tribes harvest all of the harvest available to them or, as has been the practice, allocate a portion of that harvest to the States. Accordingly, to estimate the extent of this baseline harvest, NMFS will presume that treaty and non-treaty harvest rates comparable to the current harvest rates will continue into the future pursuant to Court-approved settlement agreements. In addition, the Colville Confederated Tribal fisheries have been consulted on and remain in effect through October 2012.

Non-Indian Harvest. Non-Indian fisheries include both commercial and sport fishing harvest and mortality. Commercial harvest of listed ESUs occurs as an unintentional bycatch during fisheries aimed at hatchery fish. Intentional sport fishing harvest of listed fish is limited to populations considered healthy. Most hatchery progeny in the basin are marked by the removal of their adipose fins and anglers are required to release unmarked fish in most fisheries to protect listed stocks. However, a small fraction of the unmarked fish caught and released by sport fishermen suffer injury or stress and subsequently die. Estimates of total non-Indian harvests are shown in Tables 5-4 and 5-4 and are considered part of the environmental baseline for this consultation.

Table 5-4. Expected harvest rates for listed salmonids in winter, spring, and summer season fisheries in the mainstem Columbia River and in tributary recreational fisheries under the 2001 - 2005 Spring Agreement in U.S. v. Oregon NA—similar estimates not available for other areas. (Table modified from NMFS 2004b)

ESU	Non-Indian Fisheries Mainstem	Non-Indian Fisheries Tributary Fisheries	Treaty Indian Fisheries Mainstem
Snake River fall chinook	0	0	0
Snake River spring/summer chinook	<0.5-2.0%[a]	NA	5.0-15.0%[a]
Upper Columbia River spring chinook	<0.5-2.0%[a]	NA	5.0-15.0%[a]
Lower Columbia River chinook	2.7%[b]	NA	0
Upper Willamette River chinook	<15%[d]	-[d]	0
Snake River steelhead			
A-run	0.2%	2.5%[e]	2.7%[f]
B-run	0	2.5%[e]	0[f]
Upper Columbia River steelhead			
Naturally-produced	0.6%	NA	3.8%
Hatchery-produced	4.5%	NA	2.7%
Mid-Columbia River steelhead	<2.0%[g]	NA	3.6%
Lower Columbia River steelhead	<2.0%[g]	NA	1.6%
Upper Willamette River steelhead	<2.0%[g]	<1.2%	0
Lower Columbia River coho	0	0	0
Columbia River chum	0	0[h]	0
Snake River sockeye	<1.0%	0	<7.0%

[a] Allowable harvest rate varies depending on run size.
[b] Spring component of the Lower Columbia River ESU only.
[c] Impacts in tributary fisheries will be population specific depending on where the fisheries occur.
[d] Harvest rate limited to 15% or less in all non-Indian mainstem and tributary fisheries.
[e] Maximum harvest rate applied to wild fish passing through terminal fishery areas where hatchery fish are being targeted; hooking mortality of 5% applied to an assumed 50% encounter rate. Harvest rates to stocks not passing through targeted terminal fishing areas will be less.
[f] B-run steelhead of the current return year are primarily caught in fall season fisheries. However, a portion of the summer steelhead run holds over in the Lower Columbia River above Bonneville dam until the following winter and spring; these fish, thought to be mostly A-run, are caught in fisheries in those seasons.
[g] Harvest rate limits for winter-run populations.
[h] Chum may be taken occasionally in tributary fisheries below Bonneville Dam. Retention is prohibited.

5.3.8 Population Response to Environmental Variation

The abundance of salmonid populations is substantially affected by changes in the freshwater and marine environments that are in turn the result of large-scale environmental variations. For example, large-scale climatic regimes, such as El Niño, affect changes in ocean productivity. Much of the Pacific Coast was subject to a series of very dry years during the first part of the 1990s and since 2000. In the latter 1990s, severe flooding adversely affected some stocks. For example, the low return of Lewis River bright fall chinook salmon in 1999 is attributed to flood events during 1995 and 1996.

Among the known variations in ocean conditions are the phenomena termed El Niño and the Pacific Decadal Oscillation (PDO).

Table 5-5. Expected harvest rates for listed salmonids in fall season fisheries in the mainstem Columbia River under the 2004 Fall Agreement in U.S. v. Oregon. (Table modified from NMFS 2004b).

ESU	Non-Indian Fisheries	Treaty Indian Fisheries
Snake River fall chinook	8.25%	23.04%
Snake River spring/sum chinook	0	0
Upper Columbia River spring chinook	0	0
Lower Columbia River chinook		
Spring component	0%	0%
Tule component	12.4%	0%
Bright component	11.8%	0%
Upper Willamette River chinook	0	0
Snake River steelhead		
A-run	≤2% (1.1%)[a]	3.4%
B-run	≤2% (1.7%)[a]	15% (13.6%)[a]
Upper Columbia River steelhead		
Natural-origin	≤2% (1.1%)[a]	3.4%
Hatchery-origin	10.9%	5.7%
Mid-Columbia River steelhead	≤2% (1.1%)[a]	3.4%
Lower Columbia River steelhead	≤2% (0.3%)[a]	0.1%
Upper Willamette River steelhead	0	0
Lower Columbia River coho	6.4%	0
Columbia River chum	5% (1.6%)[a]	0%
Snake River sockeye	[b]	[b]

[a]Maximum proposed harvest rates with the expected harvest rates associated with the proposed fisheries shown in parenthesis.

[b]8% cap (combined Tribal and non-Tribal harvest)

El Niño is a disruption of the ocean-atmosphere system in the tropical Pacific having important consequences for global weather patterns and near-shore Pacific Ocean productivity (http://www.pmel.noaa.gov/tao/elnino/gif/summer_winter1-nns.gif). Among these consequences are warmer near-surface ocean water temperatures along the U.S. west coast, and generally warmer, drier weather in the Pacific Northwest. This warmer surface layer reduces thermodynamic upwelling off the U.S. coast, reducing nutrient inputs to the euphotic zone, which reduces near-shore ocean productivity. This reduction in productivity has been shown to reduce juvenile salmon growth and survival (Mantua and Francis in press). Warmer surface waters can also change the spatial distribution of marine fishes with potential predator-prey effects on salmon. The warmer, drier weather in the Pacific Northwest often associated with El Niño can also cause or increase the severity of regional droughts. Droughts reduce streamflows through the Columbia and Snake River migratory corridor, increase water temperatures, and reduce the extent of suitable habitat in some drainages. Each of these physical effects has been shown to adversely affect salmon survival. Thus, El Niño events can present a substantial drag on anadromous fish populations.

The PDO is a long-lived El Niño-like pattern of Pacific climate variability. While the two climate oscillations have similar spatial climate fingerprints, they have very different behavior in time. Fisheries scientist Steven Hare coined the term "Pacific Decadal Oscillation" (PDO) in 1996 while researching connections between Alaska salmon production cycles and Pacific climate. Two main characteristics distinguish the PDO from El Niño. First, 20th century PDO "events" persisted for 20 to 30 years, while typical El Niño events persisted for 6 to 18 months. Second, the climatic fingerprints of the PDO are most visible in the North Pacific/North American sector, while secondary signatures exist in the tropics. The opposite is true for El Niño. Several independent studies find evidence for just two full PDO cycles in the past century. "Cool" PDO regimes prevailed from 1890-1924 and again from 1947-1976, while "warm" PDO regimes dominated from 1925-1946 and from 1977 through (at least) the mid- 1990s. Shoshiro Minobe has shown that twentieth century PDO fluctuations were most energetic in two general periodicities, one from 15 to 25 years, and the other from 50 to 70 years. (Quoted from: http://tao.atmos.washington.edu/pdo/.) Major changes in northeast Pacific marine ecosystems have been correlated with phase changes in the PDO. Warm eras have seen enhanced coastal ocean biological productivity in Alaska and inhibited productivity off the west coast of the contiguous United States, while cold PDO eras have seen the opposite north-south pattern of marine ecosystem productivity. Causes for the PDO are not currently known. Likewise, the potential predictability for this climate oscillation is not known. Some climate simulation models produce PDO-like oscillations, although often for different reasons. Discovery of the mechanisms giving rise to PDO will determine whether skillful, decades-long PDO climate predictions are possible. For example, if PDO arises from air-sea interactions that require 10-year ocean adjustment times, then aspects of the phenomenon will (in theory) be predictable at lead times of up to 10 years. Even in the absence of a long-term predictive understanding, PDO climate information improves season-to-season and year-to-year climate forecasts for North America because of its strong tendency for multi-season and multi-year persistence. From a societal impacts perspective, recognition of PDO is important, because it shows that "normal" climate conditions can vary over time periods comparable to the length of a human's lifetime.

Recent evidence suggests that marine survival of salmonids fluctuates in response to the PDO's 20- to 30-year cycles of climatic conditions and ocean productivity (Cramer et al. 1999). Ocean conditions that affect the productivity of Northwest salmonid populations appear to have been in a low phase of the cycle for some time and an important contributor to the decline of many stocks. The survival and recovery of these species will depend on their ability to persist through periods of low natural ocean survival, but the mechanism whereby stocks are affected is not well understood. The pattern of response to these changing ocean conditions has differed among stocks, presumably due to differences in their ocean timing and distribution. NMFS presumes that juvenile fish survival is driven largely by events occurring between ocean entry and recruitment to a subadult life stage. One indicator of early ocean survival can be computed as a ratio of coded-wire-tag (CWT) recoveries of subadults relative to the number of CWTs released from that brood year. Time series of survival rate information for UWR spring chinook salmon, Lewis River fall chinook salmon, and Skagit fall chinook salmon show highly variable or declining trends in early ocean survival, with very low survival rates in recent years (NMFS 1999b).

5.3.9 Dam and Reservoir Passage

As stated above, the eight Federal dams on the mainstem Columbia and lower Snake Rivers that dominate the characteristics of fish habitat in the migratory corridor in the action area from the upstream limit of Lower Granite Reservoir on the Snake River to Bonneville Dam on the Columbia River, are part of the environmental baseline. A substantial amount of juvenile mortality occurs in this reach and delay in passing the dams can affect adult survival and may affect fecundity.

The effects of changes in flow due to the operation and maintenance of the USBR's Upper Snake Basin projects on dam and reservoir passage survival through the mainstem Columbia and lower Snake River FCRPS projects are a focus of the analysis conducted for this Opinion. The 2004 FCRPS UPA included an array of measures to improve dam passage survival. Those improvements that have already occurred or are expected to occur within the next year (by spring 2006) are included in the near-term environmental baseline analysis. The effects of those system configuration improvements are expected to continue until the long-term FCRPS configuration improvements are implemented fully by 2014. FCRPS fish passage facility improvements and operations beyond 2014 are undefined but, for the purposes of this consultation, are assumed to result in survival rates that are the same or higher than those estimated in the long-term (2014) analysis in the 2004 FCRPS Biological Opinion (NMFS 2004a). Thus, for the purposes of this consultation, the long-term effects of all of those FCRPS configuration improvements are assumed to remain about the same as those estimated in the long-term (2014) analysis and are expected to continue throughout the term of this biological opinion as part of the long-term environmental baseline.

5.3.9.1 Passage Effects on Juvenile Salmon and Steelhead Survival

Juvenile salmon dam and reservoir passage survival has been the subject of extensive research and evaluation and has dominated efforts taken to improve survival of the species through numerous ESA Section 7 consultations.

NMFS placed the first Pacific Northwest salmon ESU on the Endangered Species list in 1991. Since then, NMFS and the FCRPS Action Agencies have engaged in numerous consultations. The focus of those consultations has been on the survival of listed juvenile salmon and steelhead as they migrate through the FCRPS and measures to improve it. Biological opinions outlining a number of proposed operations and structural configuration changes to FCRPS dams designed to improve juvenile survival were issued in 1993, 1994, 1995, 1998, 2000, and 2004. Measures taken to improve juvenile salmon survival through the FCRPS migratory corridor include: water management to increase spring and summer migration season flows, juvenile collection systems and transportation programs, voluntary spills at FCRPS dams, improved spillway juvenile passage efficiency (e.g., removable spillway weirs [RSW]), predatory fish control, and other measures. As a result of these operations and configuration improvements, juvenile survival through the FCRPS migration corridor has improved significantly since the early 1990s. For Snake River spring/summer chinook salmon juveniles migrating in-river, Williams et al. (2004) estimated survival through the eight mainstem Federal dams is now between 28% and 58%, compared with an estimated survival rate during the 1970s of 3% to 30% (Williams et al. 2001). For Snake River steelhead juveniles migrating in-river, Williams et al. (2004) estimated survival through the eight mainstem Federal dams to currently range between 4% and 50%, compared with an estimated survival rate during the 1970s of 1% to 27% (Williams et al. 2001). The transportation of smolts from the Snake River and McNary Dam on the Columbia River has also improved FCRPS system passage survival rates.

Although changes in FCRPS operations and configuration, including juvenile transportation around portions of the Federal hydrosystem, have improved juvenile passage survival, periods of warm weather and low runoff continue to cause high rates of mortality among out-migrants in Lower Granite Reservoir. Lower Granite is the uppermost FCRPS reservoir in the migratory corridor and juvenile fish must pass through this reach without the aid of transportation (i.e., the juvenile collection facilities are located downstream at Lower Granite Dam).

5.3.9.1.1 Methods Used to Estimate Juvenile Passage Survival Rates. [omitted]

5.3.9.2 Passage Effects on Adult Salmon and Steelhead

Adult salmon and steelhead must pass up to eight FCRPS dams and reservoirs in the action area to reach their natal spawning streams and river reaches. Each FCRPS project within the action area imposes stresses on migrating adults. Those project-induced effects most likely to adversely affect adult survival are delay and delay-induced predation, water quality changes (e.g., TDG concentrations and water temperatures), and fallback and volitional downstream passage (e.g., steelhead kelts).

Delay. To pass each mainstem FCRPS dam, adult fish must successfully locate and ascend the project fish ladder(s). The ability to successfully pass each dam has been found to be affected by project configuration and various operating characteristics, principally attraction flow rates, project spill patterns, and powerhouse discharge patterns. However, Bjornn et al. (2000) estimated that the median time to transit the lower Snake River in 1993 was the same or less with dams than it would be without dams, suggesting that adult passage timing through the FCRPS dams and reservoirs is relatively unaffected by the FCRPS. This is due to the faster transit times through project reservoirs than would occur in a naturally flowing river combined with any dam passage delays.

Available data suggest that mainstem FCRPS projects with well designed and carefully operatedfishways result in very low mortality rates for migrating adults. High per-project and system survivals indicate adult salmonid biological requirements are generally being met during passage through the FCRPS under the environmental baseline.

Increasing pinniped predation of adult salmon and steelhead near the fishway entrances at Bonneville Dam is a concern for all ESUs that have populations upstream of Bonneville Dam. Efforts to evaluate and minimize this problem are part of the 2004 FCRPS UPA (Corps et al. 2004). As solution of this problem is uncertain, pinniped predation at Bonneville Dam's fishway entrances is part of the environmental baseline for this consultation.

Fallback and Volitional Downstream Passage. Fallback refers to adult fish that pass a dam and then are entrained in the spillway, navigation lock, or powerhouse intakes, and pass back through the dam. Fallback of adult spring/summer chinook salmon passing mainstem dams during spill has been found to reduce the number of fish that passed between tops of ladders at Bonneville Dam and Lower Granite or Priest Rapids Dams (after adjustments for harvest). Fallback of steelhead at Bonneville and Ice Harbor Dams similarly has been found to reduce escapement (Keefer and Peery 2004). During 1996-2002, escapement, on average, was lower for fallback fish by 6.5% for spring/summer chinook salmon ($P<0.05$), 19.5% for fall chinook salmon ($P<0.005$), and 13.2% for steelhead ($P<0.005$) (Keefer et al. 2004). Multiplying the percentage reduction in escapement for fish that fall-back by the percentage of fish that actually fallback provides an estimate of the reduction in overall system escapement (e.g., steelhead: 13.2% lower escapement for fallback fish * 21.4% fish that fell back = 2.82% reduction in escapement). Accordingly, average reductions in overall run escapements were estimated at 1.30% (range=0.46-2.27%), 2.26% (range=1.32-2.91%) and 2.82% (range = 1.34-4.02%) for spring/summer chinook salmon, fall chinook salmon, and steelhead, respectively as a result of dam passage.

However, system-wide adult passage information showed no significant difference in spring/summer chinook salmon and steelhead escapement due to fallback during spill (about 30- 50 kcfs) and no spill periods in 2001 (Keefer and Peery 2004). Escapements of adult steelhead from Bonneville to Lower Granite Dam adjusted for harvest in 2000, 2001, and 2002, were very similar (87.6, 85.2, and 85.6%, respectively), even though 2001 had very little spill at dams compared with 2000 and 2002. No differences ($P<0.05$) in escapement were found for fallback of spring/summer and fall chinook salmon with and without spill for all years (1996-2002) pooled (Keefer et al. 2004). These similar escapements with and without spill may be due to so few fish falling back during non-spill periods. Further, with all years combined, steelhead escapement was significantly higher ($P=0.002$) during no spill at John Day Dam, and marginally higher ($P=0.056$) during no spill at Bonneville Dam.

Steelhead Kelts. Only recently have studies been conducted to identify kelt (post-spawning, downstream-migrating adult steelhead) numbers and to investigate downstream passage success and route-specific passage at dams. Studies conducted since 2000 have shown that over 13,000 kelts passed John Day Dam, and 83% of the kelts observed at Lower Granite Dam were females. For fish tagged and released at Lower Granite Dam, 3.8%, 13.3%, and 34.4% were detected below Bonneville Dam in 2001, 2002, and 2003, respectively (Boggs and Peery 2004). Migration rates in 2003 were positively correlated with river flow ($P<0.0001$, $R_2 = 0.63$). Conditions that provided the 34% survival to below Bonneville Dam in 2003 include spill at dams and a very large freshet in late May/early June when kelts were migrating.

Repeat spawning rates for Snake River steelhead currently average less than 2% (Ferguson et al. 2004).

This is about the same repeat spawning rate observed by Whitt (1954) when returning fish only had to negotiate two dams compared to the current eight, suggesting that factors other than dam passage may have a more significant effect on kelt survival.

Sublethal Effects. Adult salmon exposed to suboptimal water quality conditions in the migratory corridor and/or delayed by FCRPS dams may succeed in reaching their spawning grounds yet exhibit poor spawning success due to sublethal dam passage experience. For example, stressed fish are known to produce smaller and fewer eggs than fish in excellent condition. Information is not currently available to determine whether such sublethal effects occur as a result of FCRPS dam passage or whether such effects are biologically significant.

5.3.10 Anticipated Changes in Environmental Baseline Conditions in the Action Area

Over the 30-year life of this Opinion, numerous changes in the action area environment are likely. For those anticipated future actions for which ESA Section 7 consultations have been completed, the nature and characteristics of anticipated changes in the action area environment are evaluated as part of the environmental baseline for this Opinion. Those actions anticipated to be completed or to show marked effects on the environmental baseline only after March 2006 are part of the long-term environmental baseline for this consultation and are described below. The Corps constructed riprap levees along the lower Snake and Clearwater Rivers and continues to regularly dredge sediment from channels in the upper part of Lower Granite Reservoir in order to maintain flood conveyance and navigation channels to ports in the Lewiston and Clarkston area. These actions were analyzed in NMFS' March 15, 2004, Biological Opinion, "Lower Snake and Clearwater Rivers 2004-2005 Dredging Snake River fall chinook salmon, Snake River spring/summer chinook salmon, and Snake River steelhead" (NMFS 2004d), and are part of the environmental baseline for this Opinion. Discharge from Potlatch Pulp and Paper Mill in Lewiston, Idaho, into the surface waters and sediments in the lower Clearwater and Snake Rivers is expected to increase levels of total suspended solids and elevate concentrations of some organic constituents. This action was analyzed in NMFS' April 2, 2004, Biological Opinion, "Potlatch Pulp and Paper Mill, Lewiston, Idaho, National Pollution Discharge Elimination System (NPDES) Permit No.: ID-000116-3 for the discharge of effluents into the Snake River, Nez Perce County, Idaho and Asotin County, WA (1 Project)" (NMFS 2004e).

The 2004 FCRPS UPA includes an array of actions that will be completed or show marked effect on the environment after March 2005 (Corps et al. 2004). As the various measures in the UPA are implemented; NMFS anticipates dam passage survival, particularly for juvenile fish, will continue to improve. The long-term environmental baseline analyzed for this Opinion includes all the configuration and operational changes and the increased predator control proposed in the 2004 FCRPS UPA (Corps et al. 2004).

Several actions in the 2004 FCRPS UPA are designed to improve the performance of fish protection systems (e.g. improved inspections, maintenance, and spare part inventories). Although these actions are expected to improve fish survival within the action area for this Opinion, their effects are implicitly included in our analysis in that our approach assumes that all fish protection systems are constantly functioning at their normal performance levels. Other 2004 FCRPS UPA actions that will provide greater system flexibility (e.g., reducing electrical transmission system constraints) are important to facilitating an adaptive management approach to fish protection, but the fish survival benefits are impossible to quantify at this time. Others are likely to improve fish survival outside the action area for this Opinion (e.g., tributary habitat enhancements).

5.3.10.1 Anticipated Operations and Configurations Improvements at FCRPS Dams That Will Improve Long-term Fish Survival in the Action Area

In their 2004 FCRPS UPA and subsequent Records of Decision, the Action Agencies committed to numerous fish passage facility improvements. In addition, individual dams will be operated as further detailed in the water management plans, the implementation plans, the processes afforded through the Regional Forum, and the project decision documents. These measures include a number of actions that would measurably improve juvenile passage survival. NMFS modified SIMPAS parameters to simulate these long-term FCRPS operations and configuration improvements and estimated juvenile passage survival in the long-term environmental baseline (Table 5-7). Appendix A describes the anticipated system configuration and operation changes included in the long-term environmental baseline.

5.3.10.2 Expanded Predator Control

The FCRPS Action Agencies will expand efforts to reduce predation of juvenile salmon by birds and other fish. Caspian tern management actions are expected to be implemented as early as 2005 (pending completion of environmental review and approval), with resulting juvenile survival improvements as early as 2006. Increased incentives under the NPMP will also improve the survival of juveniles from all ESUs in the Columbia Basin. It is not currently possible to quantitatively estimate the long-term juvenile survival improvements for listed ESUs from these expanded predator control efforts.

Table 5-7. Estimated average juvenile survival rates through the FCRPS under the long-term reference operation. Estimated survivals in the free-flowing river (survival in the absence of the FCRPS dams) are presented for comparison. These estimates do not include possible post- Bonneville latent mortality of in-river migrants. Source: NMFS staff (Appendix A)

ESU	Estimated Juvenile In-river Survival Rate	Estimated Juvenile System Survival Rate (including transport latent effects)	Estimated Free-Flowing River Survival Rate[h]
SR Spring/Summer Chinook Salmon[a]	58.5% (49.1% to 64.9%)	53.5% (49.5% to 57.3%)	78.6%
SR Fall Chinook Salmon[a-g]	14.9% (3.4% to 24.5%) 6.2 in-river fish per 1000 @ LGR pool alive below BON (2.4-10.8)	N/A	50.8%
UCR Spring Chinook Salmon	73.4% (58.0% to 80.6%)	N/A	85.5%
LCR Chinook:			
Gorge Fall MPGs[b]	86.1% (81.9% to 97.3%)	N/A	95.5%
Gorge Spring MPGs[c]	90.9% (85.0% to 94.1%)	N/A	98.4%
Below BON Dam MPGs	N/A	N/A	N/A
UWR Chinook Salmon	N/A	N/A	N/A
SR Steelhead[a]	38.0% (9.0% to 50.8%)	50.5% (43.0% to 54.9%)	82.1%
UCR Steelhead	55.4% (24.3% to 69.8%)	N/A	87.9%
MCR Steelhead:[d]			
Passing MCN-BON	55.4% (24.3% to 69.8%)	N/A	88.9%
Passing JDA Pool-BON	62.5% (32.2% to 78.0%)	N/A	91.5%
From JDA Dam-BON	76.5% (45.8% to 93.0%)	N/A	95.6%
Passing TDA-BON	78.6% (47.0% to 95.5%)	N/A	96.4%
Passing BON Dam	87.2% (64.9% to 97.6%)	N/A	99.1%
LCR Steelhead:[e]			
Passing BON Dam	87.2% (64.9% to 97.6%)	N/A	99.1%
Below BON Dam	N/A	N/A	N/A
UWR Steelhead	N/A	N/A	N/A
CR Chum	N/A	N/A	N/A
SR Sockeye	N/A	N/A	N/A
LCR Coho[f]	90.9% (85.0% to 94.1%)	N/A	95.5%

[a] The estimated juvenile in-river survival rates shown in this table for transported ESUs are only for those fish that remain in-river for their entire juvenile migration and are not transported.
[b] Estimated juvenile survival rates for LCR (fall) chinook salmon are based on per-project survival rate of SR fall chinook salmon.
[c] Estimated juvenile survival rates for LCR (spring) chinook salmon are based on per-project survival rate of SR spring/summer chinook salmon.
[d] Estimated juvenile survival rates for MCR steelhead are based on per-project survival rate of SR steelhead.
[e] Estimated juvenile survival rates for LCR steelhead are based on per-project survival rate of SR steelhead.
[f] Estimated juvenile survival rates for LCR coho salmon are based on per-project survival rate of SR spring chinook salmon.

APPENDIX H

DEVELOPMENTAL ANALYSIS OF NEW ENVIRONMENTAL MEASURES PROPOSED BY IDAHO POWER

Table H-1. Developmental analysis of new sediment transport measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-101	Develop and implement a program to monitor beach and terrace erosion, substrate, and gravel (101P).	Idaho Power	$0	$280,000	$280,000	Estimate based on IPC 11-3-06 comment response—Appendix B.	Yes
IPC-102	Create a mitigation fund to be used by the Forest Service to restore and maintain 14 acres of sandbars on or adjacent to National Forest System lands between Hells Canyon dam and the confluence of the Snake and Salmon rivers (102P)	Idaho Power, Forest Service	$0	$534,100	$534,100	Staff estimate based on $937,000 per year for first 10 years	Yes
Total Idaho Power Proposal			$0	$814,100	$814,100		
Subtotal Staff Alternative			$0	$814,100	$814,100		

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Table H-2. Developmental analysis of new water quality measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-84	Implement one of two measures to fully meet the SR-HC TMDL Brownlee reservoir DO allocation (an average of 1,125 tons of oxygen during the summer into the transition zone of Brownlee reservoir): in-reservoir aeration or upstream phosphorus trading (4P).	Idaho Power	$1,817,400	$291,500	$447,800	Staff estimate based on Idaho Power's Feb-05 AIR WQ-1 response.	Yes
IPC-103	Aerate Hells Canyon outflows using a forced air (blower) system at Hells Canyon powerhouse that would add 1,500 tons of oxygen per year (103P).	Idaho Power	$635,000	$120,000	$184,700	Staff estimate based on IPC estimate provided on April 26, 2007.	Yes
IPC-104	Install and operate a destratification system in the Oxbow bypassed reach at the deep pool just upstream of the Indian Creek confluence to prevent anoxic conditions at this location (104P).	Idaho Power	$52,000	$11,100	$16,000	Staff estimate based on IPC estimate provided on April 26, 2007.	Yes
IPC-85	Install Hells Canyon dam spillway flow deflectors to reduce TDG levels in the tailrace of Hells Canyon dam and the Snake River downstream of the dam (5P).	Idaho Power	$2,060,000	$0	$182,700	Staff estimate based on IPC estimate provided on April 26, 2007.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-105	Install Brownlee dam spillway flow deflectors to reduce TDG levels in Oxbow and Hells Canyon reservoirs and the Snake River downstream of Hells Canyon dam (105P).	Idaho Power	$2,560,000	$0	$197,500	Staff estimate based on IPC estimate provided on April 26, 2007.	Yes
IPC-106	Evaluate and implement measures on the Oxbow dam spillway or bypassed reach to reduce TDG levels as necessary to meet the SR-HC TMDL load allocation (106P).	Idaho Power	$4,400,000	$2,700	$278,200	Staff estimate based on IPC estimate provided on April 26, 2007.	Yes
IPC-107	Adaptively manage TDG-abatement measures to ensure that Idaho Power meets its TDG load allocation below each of the project's dams (107P)	Idaho Power	$0	$2,000	$2,000	Staff estimate.	Yes
IPC-108	Work with ODEQ and IDEQ to develop a TDG monitoring plan that would include monitoring during spill to determine compliance with the TMDL load allocation assigned to Idaho Power (108P).	Idaho Power	$0	$37,200	$37,200	Staff estimate.	Yes
IPC-109	Implement Idaho Power's Temperature Adaptive Management Plan, which would (1) define the extent of the project's temperature responsibility, (2) evaluate potential measures and select the appropriate measure, and (3) implement the appropriate measure (109P).	Idaho Power Idaho Power	$4,210,000	$158,600	$452,000	Staff estimate based on IPC estimate provided on April 26, 2007.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
Total Idaho Power Proposal			$15,734,400	$623,100	$1,798,100		
Subtotal Staff Alternative			$15,734,400	$623,100	$1,798,100		

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Table H-3. Developmental analysis of new operational measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Annualized Reduction in Energy Benefit	Comment	Included in Staff Alternative
IP-OPs	Protect peak spawning periods for smallmouth bass and crappie by limiting Brownlee reservoir drafts to no more than 1 foot from the highest elevation reached during a 30-day period starting on May 21, and by maintaining an elevation of at least 2,069 feet msl from the end of the 30-day period through July 4 (7Pa).	Idaho Power				$0	No incremental power benefits estimated by Idaho Power relative to current conditions	Yes
	Subtotal Staff Alternative (this table)		$0	$0	$0	$0		
	Subtotal Staff Alternative (IPC table)		$0	$0	$0	$0		
	Total Staff Alternative		$0	$0	$0	$0		

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Table H-4. Developmental analysis of new aquatic resources measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-110	Implement the fall Chinook salmon spawning and gravel monitoring plan described in appendix B of Idaho Power's comments on the draft EIS (110P).	Idaho Power, Forest Service				Costs associated with this measure are included in IPC-101 in table H-1.	Yes
IPC-15	Conduct pathogen survey in the Pine-Indian-Wildhorse core area to support development of a pathogen risk assessment plan (8Pa)	Idaho Power	$0	$34,700	$34,700	Idaho Power estimate with staff parameters.	Adopted, but not included in the staff subtotal to avoid double counting. See Interior-87 in table I-4.
IPC-7	Prepare and implement a plan to allow for the capture of resident salmonids and other species migrating upstream and for their transfer to areas above Hells Canyon and Oxbow dams. The plan includes modification of the Hells Canyon fish trap to capture juvenile salmonids, construction of facilities for sorting and holding fish and for scanning PIT-tag returns, and potentially expansion of year-round operations. The plan also includes a provision to construct a fish trap at Oxbow dam a minimum of 5 years after the Hells Canyon trap has been modified (8Pb.i).	Idaho Power	$2,800,000	$369,500	$675,300	Idaho Power estimate with staff parameters.	Adopted, but not included in the staff subtotal to avoid double counting. See Interior-87 in table I-4

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-20	Purchase two new tanker trucks to support fish passage plan (8Pb.ii).	Idaho Power	$400,000	$0	$43,700	Idaho Power estimate with staff parameters.	Adopted, but not included in the staff subtotal to avoid double counting. See Interior-87 in table I-4.
IPC-14	The plan also includes a provision to construct a fish trap at Oxbow dam a minimum of 5 years after the Hells Canyon trap has been modified (8Pb.iii.).	Idaho Power	$2,800,000	$153,100	$458,900	Idaho Power estimate with staff parameters.	Adopted, but not included in the staff subtotal to avoid double counting. See Interior-87 in table I-4.
IPC-16	Design, construct, and monitor a permanent monitoring weir at Pine Creek to establish a long-term monitoring program of fluvial fish migrating upstream and downstream in the Pine Creek system (8Pf).	Idaho Power	$2,500,000	$92,400	$365,500	Idaho Power estimate with staff parameters.	Adopted, but not included in the staff subtotal to avoid double counting. See Interior-87 in table I-4.
IPC-18	Prepare and implement a tributary habitat enhancement plan within the Pine Creek, Indian Creek, and Wildhorse River basins and smaller tributaries to the Hells Canyon Complex reservoirs (8Pc).	Idaho Power	$8,500,000	$0	$928,400	Idaho Power estimate with staff parameters.	Adopted, but not included in the staff subtotal to avoid double counting. See ST-AQ-Trib.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-6	Supplement marine-derived nutrients to enhance the forage base within bull trout rearing areas (Pine, Indian, and Wildhorse core area) (8Pd).	Idaho Power	$0	$40,000	$40,000	Idaho Power estimate with staff parameters. Idaho Power includes these costs within the Oxbow hatchery and Rapid River hatchery upgrades.	Yes
IPC-21	Conduct Eagle Creek presence/absence survey to determine, with statistical probability, the presence or absence of bull trout within the Eagle Creek basin (8Pe).	Idaho Power	$0	$42,700	$42,700	Idaho Power estimate with staff parameters.	Yes
IPC-13	Evaluate the feasibility of, and possibly implement, an experimental brook trout suppression program in Indian Creek (8Pg).	Idaho Power	$0	$51,700	$51,700	Idaho Power estimate with staff parameters.	Yes
IPC-19	Assess water quality-related effects on early life stages of white sturgeon in the Swan Falls-Brownlee reach (11Pa).	Idaho Power	$0	$24,000	$24,000	Idaho Power estimate with staff parameters.	Yes
IPC-17	Translocate reproductive-sized white sturgeon into the Swan Falls-Brownlee reach to increase spawner abundance and population productivity, if water quality is found to be adequate and if genetic and demographic risks to the donor population are found to be acceptable (11Pb).	Idaho Power	$0	$20,600	$20,600	Idaho Power estimate with staff parameters.	Yes
IPC-22	Develop an experimental conservation aquaculture plan to maintain adequate population	Idaho Power	$0	$28,000	$28,000	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
	size and genetic variability of white sturgeon in the Swan Falls-Brownlee reach, if approved IDFG and ODFW (11Pc).						
IPC-12	Make periodic population assessments to monitor white sturgeon populations in the Swan Falls-Brownlee, Brownlee-Hells Canyon, and Hells Canyon-Lower Granite reaches of the Snake River (11Pd).	Idaho Power	$0	$95,900	$95,900	Idaho Power estimate with staff parameters.	Yes
IPC-23	Monitor genotypic frequencies of white sturgeon between Shoshone Falls and Lower Granite dams (11Pe).	Idaho Power	$0	$2,300	$2,300	Idaho Power estimate with staff parameters. Scope restricted to Swan Falls to Lower Granite dams, upstream areas are covered under the mid-Snake licenses.	Yes
Total Idaho Power Proposal			$17,000,000	$954,900	$2,811,700		
Subtotal Staff Alternative			$0	$305,200	$305,200		

Table H-5. Developmental analysis of new hatchery measures included in the Idaho Power Proposal.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-10a	Make improvements to the Pahsimeroi fish hatchery to control pathogens (IPC 10Pa).	Idaho Power	$6,320,000	$187,500	$877,800	Idaho Power estimate with staff parameters.	Yes
IPC-10b	Develop a locally adapted steelhead broodstock at Pahsimeroi hatchery (IPC 10Pa).	Idaho Power	$20,000	$8,500	$10,700	Idaho Power estimate with staff parameters.	Yes
IPC-10c	Monitor and evaluate hatchery performance at Pahsimeroi fish hatchery through one FTE fish biologist (IPC 10Pa).	Idaho Power	$0	$46,200	$46,200	Idaho Power estimate with staff parameters.	Yes
IPC-9a	Make improvements to the Oxbow fish hatchery by constructing adult holding pond and spawning facilities, distributing carcasses, and generally upgrading the hatchery facilities (IPC 10Pb).	Idaho Power	$2,783,000	$24,900	$328,900	Idaho Power estimate with staff parameters.	Yes
IPC-9b	Make improvements to the Oxbow fish hatchery by expanding the fall Chinook rearing program (IPC 10Pb).	Idaho Power	$2,500,000	$10,000	$283,100	Idaho Power estimate with staff parameters.	Yes
IPC-9c	Monitor and evaluate hatchery performance at Oxbow hatchery through one FTE fish biologist (IPC 10Pb).	Idaho Power	$0	$46,200	$46,200	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-8a	Make improvements to the Niagara Springs fish hatchery by expanding the hatchery building, acquiring an additional smolt tanker, acquiring a fish marking unit, upgrading employee housing, and monitoring and evaluating hatchery performance (IPC 10Pc).	Idaho Power	$1,550,000	$9,200	$178,500	Idaho Power estimate with staff parameters.	Yes
IPC-8b	Acquire a fish marking unit (IPC 10Pc).	Idaho Power	$750,000	$4,600	$86,500	Idaho Power estimate with staff parameters.	Yes
IPC-8c	Monitor and evaluate hatchery performance at Niagara Springs through one FTE fish biologist (IPC 10Pc).	Idaho Power	$0	$46,200	$46,200	Idaho Power estimate with staff parameters.	Yes
IPC-11a	Make improvements to the Rapid River fish hatchery by constructing an adult holding pond and spawning facilities, distributing carcasses, upgrading employee housing, generally upgrading the hatchery facilities, constructing an offsite smolt acclimation/ adult collection facility, and monitoring and evaluating hatchery performance (IPC 10Pd).	Idaho Power	$3,083,000	$39,700	$376,400	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-11b	Monitor and evaluate hatchery performance at Rapid River hatchery through one FTE fish biologist (IPC 10Pd).	Idaho Power	$0	$46,200	$46,200	Idaho Power estimate with staff parameters.	Yes
Total Idaho Power Proposal			$17,006,000	$469,200	$2,326,700		
Subtotal Staff Alternative			$17,006,000	$469,200	$2,326,700		

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Table H-6. Developmental analysis of new terrestrial resources measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-86	Acquire, enhance, and manage approximately 22,761 acres of upland and 821 acres of riparian habitat near the Hells Canyon Project reservoirs and downstream of Hells Canyon dam to mitigate for the estimated effects of project operations on wildlife (12P).	Idaho Power	$16,190,700	$0	$1,768,400	Idaho Power estimate	Yes
IPC-88a	In cooperation with ODFW, enhance habitat on two Snake River islands (Hoffman and Porter) for waterfowl and for threatened, endangered, candidate, and special status species (13P).	Idaho Power	$0	$6,000	$6,000	Idaho Power estimate with staff parameters.	Yes
IPC-88b	In cooperation with ODFW and IDFG, enhance habitat on two Snake River islands (Gold and Patch) for waterfowl and for threatened, endangered, candidate, and special status species (13P).	Idaho Power	$0	$20,000	$20,000	Idaho Power estimate with staff parameters.	Yes
IPC-87	Cooperate with state and federal wildlife management agencies to enhance low-elevation riparian habitat and reintroduce mountain quail in areas adjacent to the Hells Canyon Project reservoirs, providing $20,000/yr for 5 yrs (14P).	Idaho Power	$100,000	$0	$9,600	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-90	Through an interdisciplinary team, develop and implement an integrated wildlife habitat program to manage wildlife resources (15P).	Idaho Power	$663,200	$954,300	$1,026,700	Extrapolated from Idaho Power estimate.	Yes
IPC-89	Develop and implement an operation and maintenance plan for the Pine Creek-Hells Canyon transmission line to minimize effects on wildlife, protect wildlife resources, and enhance habitat conditions (16P).	Idaho Power	$0	$5,500	$5,500	Idaho Power estimate.	Yes
IPC-1	Formalize cooperative relationships to accomplish noxious weed control and non-native invasive weed management, site monitoring, and re-seeding along the Snake River corridor from Weiser downstream to the confluence of the Salmon River (18P).	Idaho Power	$0	$50,000	$50,000	Idaho Power estimate.	Yes
IPC-2	Formalize cooperative relationships, including establishment of a rare plant advisory board, to protect and monitor sensitive plant sites along the Snake River corridor from the headwaters of Brownlee reservoir downstream to the confluence of the Salmon River (19P).	Idaho Power	$0	$6,000	$6,000	Idaho Power estimate.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-3	Develop and implement an operation and maintenance plan for the Pine Creek-Hells Canyon transmission line to minimize effects on rare plants, protect botanical resources, and enhance habitat conditions. (20P and 21P).	Idaho Power	$0	$4,200	$4,200	Idaho Power estimate.	Yes
Total Idaho Power Proposal			$16,953,900	$1,046,000	$2,896,400		
Subtotal Staff Alternative			$16,953,900	$1,046,000	$2,896,400		

Table H-7. Developmental analysis of new cultural resources measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-30	Monitor sites along transmission line 945 that are eligible for inclusion on the National Register (22P)	Idaho Power	$0	$2,400	$2,400	Idaho Power estimate with staff parameters.	Yes
IPC-31	Monitor the known burial site on Oxbow reservoir (23P).	Idaho Power	$0	$800	$800	Idaho Power estimate with staff parameters.	Yes
IPC-34	Monitor selected known eligible sites on Oxbow and Hells Canyon reservoirs (24P).	Idaho Power	$0	$20,800	$20,800	Idaho Power estimate with staff parameters.	No
IPC-33	Monitor selected known eligible sites on Brownlee reservoir (25P).	Idaho Power	$0	$20,100	$20,100	Idaho Power estimate with staff parameters.	No
IPC-32	Monitor selected known eligible sites downstream of Hells Canyon dam (26P).	Idaho Power	$0	$65,000	$65,000	Idaho Power estimate with staff parameters.	No
IPC-43	Stabilize approximately 20 archaeological sites downstream of Hells Canyon dam after identifying sites requiring stabilization (27P).	Idaho Power	$0	$106,700	$106,700	Idaho Power estimate with staff parameters.	Yes
IPC-44	Stabilize seven archaeological sites on Brownlee reservoir (28P).	Idaho Power	$0	$34,700	$34,700	Idaho Power estimate with staff parameters.	Yes
IPC-26	Recover archaeological data at four archaeological sites on Brownlee reservoir to prevent possible damage by reservoir operations (29P).	Idaho Power	$0	$35,400	$35,400	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-35	Establish Native American interpretive sites on Brownlee reservoir to enhance visitors' awareness of Native American presence and land use in the project area (30P).	Idaho Power	$22,000	$2,200	$4,600	Idaho Power estimate with staff parameters.	Yes
IPC-36	Establish Native American interpretive sites on Oxbow and Hells Canyon reservoirs to enhance visitors' awareness of Native American presence and land use in the project area (31P).	Idaho Power	$11,000	$1,100	$2,300	Idaho Power estimate with staff parameters.	Yes
IPC-28	Establish European-American interpretive sites on Brownlee, Oxbow, and Hells Canyon reservoirs to enhance visitors' awareness of European-American presence and land use in the project area (32P).	Idaho Power	$22,000	$2,200	$4,600	Idaho Power estimate with staff parameters.	Yes
IPC-25	Establish Asian-American interpretive sites on Brownlee, Oxbow, and/or Hells Canyon reservoirs to enhance visitors' awareness of Asian-American presence and land use in the project area (33P)	Idaho Power	$22,000	$2,200	$4,600	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-27	Support European-American and Asian-American interpretive projects by assisting local community museums with collections acquisition, display, and curation related to Hells Canyon area trappers, miners, homesteaders, ranchers, and river runners of European and Asian descent (34P).	Idaho Power	$0	$5,800	$5,800	Idaho Power estimate with staff parameters.	Yes
IPC-37a	Provide support for Native American programs of the Burns Paiute Tribe in its efforts to obtain funding for participating in and/or administering cultural resources PME measures (35Pa).	Idaho Power	$0	$10,000	$10,000	Staff estimate.	Yes
IPC-37b	Provide support for Native American programs of the Burns Paiute Tribe in its efforts to educate its youth by providing scholarship/ training funds (35Pb).	Idaho Power	$0	$11,700	$11,700	Staff estimate. If this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license.	No
IPC-37c	Provide support for Native American programs of the Burns Paiute Tribe in its efforts to obtain funding to facilitate several cultural enhancement programs (35Pc).	Idaho Power	$0	$11,700	$11,700	Staff estimate.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-39a	Provide support for Native American programs of the Confederated Tribes of the Warm Springs Indian Reservation in its efforts to obtain funding for participating in and/or administering cultural resources PME measures (36Pa).	Idaho Power	$0	$10,000	$10,000	Staff estimate.	Yes
IPC-39b	Provide support for Native American programs of the Confederated Tribes of the Warm Springs Indian Reservation in its efforts educate its youth by providing scholarship/ training funds (36Pb).	Idaho Power	$0	$11,700	$11,700	Staff estimate. If this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license.	No
IPC-39c	Provide support for Native American programs of the Confederated Tribes of the Warm Springs Indian Reservation in its efforts to obtain funding to facilitate several cultural enhancement programs (36Pc).	Idaho Power	$0	$11,700	$11,700	Staff estimate.	Yes
IPC-40a	Provide support for Native American Programs of the Nez Perce Tribe in its efforts to obtain funding for participating in and/or administering cultural resources PME measures (37Pa).	Idaho Power	$0	$10,000	$10,000	Staff estimate.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-40b	Provide support for Native American programs of the Nez Perce Tribe in its efforts to educate its youth by providing scholarship/ training funds (37Pb).	Idaho Power	$0	$11,700	$11,700	Staff estimate. If this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license.	No
IPC-40c	Provide support for Native American programs of the Nez Perce Tribe in its efforts to obtain funding to facilitate several cultural enhancement programs (37Pc)	Idaho Power	$0	$11,700	$11,700	Staff estimate.	Yes
IPC-41a	Provide support for Native American Programs of the Confederated Tribes of the Umatilla Indian Reservation in its efforts to obtain funding for participating in and/or administering cultural resources PME measures (38Pa).	Idaho Power	$0	$10,000	$10,000	Staff estimate.	Yes
IPC-41b	Provide support for Native American Programs of the Confederated Tribes of the Umatilla Indian Reservation in its efforts to educate its youth by providing scholarship/ training funds (38Pb).	Idaho Power	$0	$11,700	$11,700	Staff estimate. If this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license.	No

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-41c	Provide support for Native American programs of the Confederated Tribes of the Umatilla Indian Reservation in its efforts to obtain funding to facilitate several cultural enhancement programs (38Pc).	Idaho Power	$0	$11,700	$11,700	Staff estimate.	Yes
IPC-38a	Provide support for Native American programs of the Confederated Tribes of the Shoshone Paiute Indian Reservation in its efforts to obtain funding for participating in and/or administering cultural resources PME measures (39Pa).	Idaho Power	$0	$10,000	$10,000	Staff estimate.	Yes
IPC-38b	Provide support for Native American programs of the Shoshone Paiute Tribe in its efforts to educate its youth by providing scholarship/ training funds (39Pb).	Idaho Power	$0	$11,700	$11,700	Staff estimate. If this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license.	No
IPC-38c	Provide support for Native American programs of the Shoshone Paiute Tribe in its efforts to obtain funding to facilitate several cultural enhancement programs (39Pc).	Idaho Power	$0	$11,700	$11,700	Staff estimate.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-42a	Provide support for Native American Programs of the Shoshone-Bannock Tribes in its efforts to obtain funding for participating in and/or administering cultural resources PME measures (40Pa).	Idaho Power	$0	$10,000	$10,000	Staff estimate.	Yes
IPC-42b	Provide support for Native American Programs of the Shoshone-Bannock Tribes in its efforts to educate its youth by providing scholarship/ training funds (40Pb).	Idaho Power	$0	$11,700	$11,700	Staff estimate. If this commitment of funding is not included in a new license, it would in no way preclude Idaho Power from fulfilling this commitment outside the license.	No
IPC-42c	Provide support for Native American Programs of the Shoshone-Bannock Tribes in its efforts to obtain funding to facilitate several cultural enhancement programs (40Pc).	Idaho Power	$0	$11,700	$11,700	Staff estimate.	Yes
IPC-24	Fund additional Section 106 projects to protect sites and mitigate for any unforeseen adverse effects attributed to Hells Canyon Project operations (41P).	Idaho Power	$0	$0	$0	Cannot estimate until projects identified	Yes
Total Idaho Power Proposal			$77,000	$499,800	$508,200		
Subtotal Staff Alternative			$77,000	$323,700	$332,100		

Table H-8. Developmental analysis of new recreation measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-76	Provide additional boat moorage on Hells Canyon Project reservoirs to improve angling access (45P).	Idaho Power	$180,000	$3,300	$19,300	Idaho Power estimate with staff parameters.	Yes
IPC-67	Enhance litter and sanitation plan to improve litter cleanup and access to portable and vault toilets at dispersed recreational sites (46P).	Idaho Power	$60,000	$55,000	$61,600	Idaho Power estimate with staff parameters.	Yes
IPC-74	Develop and implement an integrated Information and Education (I&E) Plan to promote protection and preservation of cultural, natural, and historical resources through education (47P).	Idaho Power	$1,380,000	$18,400	$149,800	Idaho Power estimate with staff parameters.	Yes
IPC-75	Coordinate the prioritization of law enforcement resource use among appropriate law enforcement agencies to address public safety issues (48P).	Idaho Power	$0	$15,000	$15,000	Idaho Power estimate with staff parameters.	Yes
IPC-79	Develop and implement a Recreation Adaptive Management Plan to identify and address the adequacy of Idaho Power's Recreation Plan over the life of the new license (49P).	Idaho Power	$1,270,000	$58,000	$108,100	Idaho Power estimate with staff parameters. Measure includes FS 4e condition 12.	Yes
IPC-70	Enhance road maintenance to improve public safety and further protect at-risk cultural and natural resources (50P).	Idaho Power	$20,000	$25,600	$27,800	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-81	Perform operation and maintenance at Idaho Power-enhanced BLM and Forest Service reservoir-related recreational sites to benefit recreation, provide public access, enhance visitor services and user satisfaction, and reduce the responsibilities of federal agencies to provide operations and maintenance (O&M) services (51P).	Idaho Power	$0	$85,300	$85,300	Idaho Power estimate with staff parameters.	Yes
IPC-65	Enhance Eagle Bar dispersed recreational site and improve boat ramp access to Hells Canyon reservoir (52P).	Idaho Power	$150,000	$0	$15,300	Idaho Power estimate with staff parameters.	Yes
IPC-57	Develop site plan for Big Bar recreational site to accommodate recreational use and provide cultural and natural resource protection (53P).	Idaho Power	$50,000	$10,000	$15,500	Idaho Power estimate with staff parameters. O&M cost estimated by staff.	Yes
IPC-58	Enhance boat ramp and associated facilities at Big Bar Section D recreational site to improve access to lower Hells Canyon reservoir and provide cultural and natural resource protection (54P).	Idaho Power	$249,900	$0	$25,500	Idaho Power estimate with staff parameters.	Yes
IPC-56	Develop site plan and enhance Eckels Creek dispersed recreational site to benefit recreation and provide cultural and natural resource protection (55P)	Idaho Power	$30,000	$0	$3,100	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-68	Supplement the existing O&M budget to accommodate enhancements at Idaho Power-managed parks and recreational facilities (56P).	Idaho Power	$0	$85,300	$85,300	Idaho Power estimate with staff parameters.	Yes
IPC-63	Develop and implement a site plan for the Copper Creek dispersed recreational site to benefit recreation and provide cultural and natural resource protection (57P).	Idaho Power	$50,000	$0	$5,100	Idaho Power estimate with staff parameters.	Yes
IPC-77	Reconstruct Hells Canyon Park to benefit recreation, improve public access, and protect cultural and natural resources (58P).	Idaho Power	$2,000,000	$0	$176,100	Idaho Power estimate with staff parameters.	Yes
IPC-54	Develop Airstrip A&B dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources (59P).	Idaho Power	$40,000	$0	$4,100	Idaho Power estimate with staff parameters.	Yes
IPC-59	Develop and implement a site plan for Bob Creek Section A dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources (60P).	Idaho Power	$50,000	$0	$5,100	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-60	Develop and implement a site plan for Bob Creek Section B dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources (61P).	Idaho Power	$25,000	$0	$2,500	Idaho Power estimate with staff parameters.	Yes
IPC-61	Develop and implement a site plan for Bob Creek Section C dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources (62P).	Idaho Power	$50,000	$0	$5,100	Idaho Power estimate with staff parameters.	Yes
IPC-73	Develop and implement a site plan for Westfall dispersed recreational site to benefit recreation, improve public access, and protect cultural and natural resources (63P).	Idaho Power	$60,000	$0	$6,100	Idaho Power estimate with staff parameters.	Yes
IPC-64	Enhance Copperfield boat launch area to benefit day-use activities (64P).	Idaho Power	$100,000	$0	$9,500	Idaho Power estimate with staff parameters.	Yes
IPC-69	Implement a site plan for Oxbow boat launch to benefit recreation, improve public access, and protect cultural and natural resources (65P).	Idaho Power	$80,000	$0	$7,600	Idaho Power estimate with staff parameters.	Yes
IPC-62	Implement a site plan for Carters Landing and Old Carters Landing recreational sites to benefit recreation, improve public access, and protect cultural and natural resources (66P).	Idaho Power	$80,000	$0	$8,200	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-78	Reconstruct McCormick Park to meet current standards of services, benefit recreation, improve public access, and protect cultural and natural resources (67P).	Idaho Power	$3,000,000	$0	$266,500	Idaho Power estimate with staff parameters.	Yes
IPC-66	Develop and implement a site plan for Hewitt and Holcomb Parks to accommodate recreational use and provide cultural and natural resource protection (68P).	Idaho Power	$99,900	$0	$10,200	Idaho Power estimate with staff parameters.	Yes
IPC-55	Develop and implement a site plan for a low-water boat launch at or near Swedes Landing to improve boat access to Brownlee reservoir during seasonal reservoir drawdowns and periods of low reservoir levels (69P).	Idaho Power	$250,000	$0	$25,200	Idaho Power estimate with staff parameters.	Yes
IPC-72	Develop and implement a site plan for Swedes Landing to benefit recreation, improve public access, and protect cultural and natural resources (70P).	Idaho Power	$75,000	$0	$7,300	Idaho Power estimate with staff parameters.	Yes
IPC-71	Develop and implement a site plan for Spring recreational site to enhance recreational facilities and improve boat ramp access to Brownlee reservoir (71P).	Idaho Power	$500,000	$0	$46,000	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-101	Complete a condition and safety inspection of Deep Creek Stairway/Trail #218 and correct any deficiencies found during inspection (21Se).		$80,000	$3,000	$11,700	Staff estimate. Measure was subsequently adopted by Idaho Power for the FEIS.	Yes
Total Idaho Power Proposal			$9,929,800	$358,900	$1,207,900		
Subtotal Staff Alternative			$9,929,800	$358,900	$1,207,900		

Table H-9. Developmental analysis of new land use and aesthetic resources measures proposed by Idaho Power.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-53	Incorporate aesthetic concerns when upgrading or repairing the existing transmission line 945 (73P).	Idaho Power	$20,000	$3,300	$5,500	Idaho Power estimate with staff parameters.	Yes
IPC-46	74. Develop standards and guidelines for designing new physical structures and modifying existing structures to achieve aesthetic and other goals (74P, 112P).	Idaho Power	$35,000	$0	$3,800	Idaho Power estimate with staff parameters.	Yes
IPC-45	75. Establish standards and guidelines for the design of vegetation and hardscape elements and structures in developed areas to control noxious weeds and to achieve aesthetic and other goals (75P, 112P).	Idaho Power	$55,000	$0	$6,000	Idaho Power estimate with staff parameters. Includes FS-24.	Yes
IPC-48	76. Implement a general aesthetic clean-up plan to enhance the quality of the recreational experience in specific areas (76P, 112P).	Idaho Power	$215,000	$4,600	$28,100	Idaho Power estimate with staff parameters. Includes FS-22.	Yes
IPC-52	77. Replace guardrails and Jersey barriers with barriers of corten steel or other visually acceptable material, except where Jersey barriers function as barriers to slides and falling rocks along roads and developed areas (77P, 112P).	Idaho Power	$160,000	$0	$13,900	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-50	78. Reduce the visual contrast of certain project facilities with their environment to improve aesthetics and enhance the recreational experience near those facilities (78P, 112P).	Idaho Power	$304,000	$4,100	$32,900	Idaho Power estimate with staff parameters.	Yes
IPC-47	Cooperate with BLM and the Forest Service to develop and assist them with implementing proposed design standards and guidelines at specific BLM and Forest Service facilities, including the Spring recreational site on Brownlee reservoir (BLM), Copper Creek trailhead on Hells Canyon reservoir (BLM), and Big Bar and Eagle Bar on Hells Canyon reservoir (Forest Service) (79P).	Idaho Power	$10,000	$0	$1,100	Idaho Power estimate with staff parameters.	Yes
IPC-49	Provide signs and/or facilities that interpret some elements of the Hells Canyon Project that cannot be effectively modified to reduce their visual contrast (80P).	Idaho Power	$11,000	$0	$1,200	Idaho Power estimate with staff parameters.	Yes
IPC-51	Implement the common policies of the Hells Canyon Resource Management Plan to provide for the management, protection, and/or conservation of natural and cultural resources (81P).	Idaho Power	$10,000	$71,000	$72,100	Idaho Power estimate with staff parameters.	Yes

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment	Included in the Staff Alternative
IPC-113	Provide the Forest Service with a map and aerial photos depicting the approximate location of the project boundary, together with GIS shape files of the project boundary on National Forest System lands (113P).	Idaho Power	$20,000	$0	$2,200	Staff estimate.	Yes
Total Idaho Power Proposal			$840,000	$83,000	$166,800		
Subtotal Staff Alternative			$840,000	$83,000	$166,800		

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APPENDIX I

DEVELOPMENTAL ANALYSIS OF OTHER MEASURES INCLUDED IN THE STAFF ALTERNATIVE

Table I-1. Developmental analysis of new sediment transport measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Interior-68	5-year volumetric monitoring of sand and gravel bars (1S, 101P).	Interior	$0	$28,800	$28,800	Staff estimate.
OPRD-1	Apply a bank stabilization treatment to Farewell Bend State Park (Staff 21Sc).	OPRD	$720,400	$0	$78,700	Staff estimate. Although discussed under recreation, this is primarily a soils and geology measure.
	Subtotal Staff Alternative (this table)		$720,400	$28,800	$107,500	
	Subtotal Staff Alternative (IPC table)		$0	$814,100	$814,100	
	Total Staff Alternative		$720,400	$842,900	$921,600	

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Table I-2. Developmental analysis of new water quality measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
ST-WQ-1	Develop and implement operational compliance and water quality monitoring plan (4S and 6S).	Staff	$50,000	$25,000	$30,500	Staff estimate.
Interior-64	Comply with IDEQ and ODEQ water quality certifications (WQC).	Interior	$0	$0	$0	WQCs have not yet been issued, hence these costs have not been estimated. It is likely that staff would include this measure.
ODFW-54a	Develop TDG-abatement plan (107S).	ODFW	$20,000	$0	$2,200	Staff estimate.
ODFW-55	Develop and implement a dissolved oxygen enhancement plan to ensure that the project does not contribute to violation of dissolved oxygen standards within or below the project (4P).	ODFW	$20,000	$0	$2,200	Staff estimate, cost for plan only–no control measures.
ODFW-43&57 (partial)	If requested by IDEQ or ODEQ, collect tissue samples from white sturgeon within and downstream of the project area and from Brownlee reservoir fish for the purpose of monitoring toxic bioaccumulants (5S).	ODFW	$0	$2,000	$2,000	Staff estimate. These samples would be collected during the routine population monitoring efforts proposed by Idaho Power (Idaho Power measures 7b and 11d) and only entail a small incremental effort.
	Subtotal Staff Alternative (this table)		$90,000	$27,000	$36,900	
	Subtotal Staff Alternative (IPC table)		$15,734,400	$623,100	$1,798,100	
	Total Staff Alternative		$15,824,400	$650,100	$1,835,000	

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Table I-3. Developmental analysis of new operational measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Annualized Reduction in Energy Benefit	Comment
ST-1	Implement a 4-inch-per-hour ramp rate measured at Johnson Bar from March 15 through June 15, to be adjusted if warranted based on monitoring studies (Staff Op-3).	Staff	$1,600,000	$68,000	$242,800	$1,831,000	Staff estimate based on Idaho Power response to AIR OP-1. Value interpolated between scenarios 1d and 1e.
Corps-1	The flood control draft for Brownlee in preparation of the spring runoff should be determined consistent with the November 1998 Procedure for Determining Flood Control Draft at Brownlee reservoir (IPC).	Corps	$0	$0	$0	$0	No incremental power benefits effect relative to current conditions.
Corps-2	Handle future winter flood control operations for Brownlee reservoir in conjunction with the Corps on a case-by case basis (IPC).	Corps	$0	$0	$0	$0	No incremental power benefits effect relative to current conditions.
Corps-6	Prevent the maximum variation in river stage from exceeding 1 foot per hour as measured at the Snake River at Johnson Bar gaging station (Staff Op-3).	Corps	$0	$0	$0	$0	No incremental power benefits effect relative to current conditions.
IDFG-1a	Continue Idaho Power's fall Chinook spawning program which includes providing stable flows (IPC).	IDFG	$0	$0	$0	$0	No incremental power benefits effect relative to current conditions.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Annualized Reduction in Energy Benefit	Comment
NMFS-1	Provide stable flows between 8,500 and 13,500 cfs below Hells Canyon dam throughout fall Chinook salmon spawning season (IPC).	NMFS	$0	$0	$0	$0	No incremental power benefits effect relative to current conditions.
NMFS-2	Provide instantaneous minimum flows below Hells Canyon dam throughout the fall Chinook salmon incubation period that are equal to, or greater than, the stable flows provided during the spawning period unless surveys indicate that shallow water redds can be fully protected at a lower flow (IPC).	NMFS	$0	$0	$0	$0	No incremental power benefits effect relative to current conditions.
NMFS-8	Refill Brownlee reservoir to within 1 foot of the April 15 and April 30 minimum elevations necessary to meet the Corps flood control requirements and coordinate refill with NMFS (Staff Op-1)	NMFS	$0	$0	$0	$0	Not estimated.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Annualized Reduction in Energy Benefit	Comment
NMFS-9	Refill Brownlee reservoir to full pool by June 20, release 237 kaf of stored water from Brownlee reservoir between June 21 and July 31 (release at least 150 kaf of this water by July 15) and not refill until after August 31 (Staff Op-2).	NMFS	$0	$0	$0	$9,033,000	Staff estimate based on Idaho Power response to AIR OP-1. Value estimated from scenario 2 times ratio of 237 to 350 KAF.
	Subtotal Staff Alternative (this table)		$1,600,000	$68,000	$242,800	$10,478,000	Subtotal does not add up since there are overlapping effects.
	Subtotal Staff Alternative (IPC table)		$0	$0	$0	$0	
	Total Staff Alternative		$1,600,000	$68,000	$242,800	$10,478,000	

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Table I-4. Developmental analysis of new aquatic resources measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Interior-87	Develop and implement a bull trout passage plan, modify the Hells Canyon fish trap and construct a permanent monitoring weir at Pine Creek, conduct pathogen surveys, conduct monitoring studies needed to determine when trigger criteria have been met to construct an adult trap at Oxbow dam and permanent monitoring weirs on Indian Creek and the Wildhorse River, evaluate and monitor fishway effectiveness (8Pb).	Idaho Power	$16,258,000	$667,200	$1,974,300	Idaho Power cost estimates used for Hells Canyon fish trap modification and monitoring weir at Pine Creek. Other components estimated by staff. Assumes modification of Hells Canyon trap in year 2, construction of Pine Creek weir in year 2, construction of Indian Creek weir in year 10, Oxbow trap and Wildhorse weir in year 20.
ST-AQ-Strand	Develop and implement a stranding and entrapment monitoring plan (9S).	Staff	$0	$107,000	$107,000	Staff estimate.
ST-AQ-6	Develop and implement a fall Chinook spawning and incubation flow management plan (10S).	Staff	$25,000	$0	$2,700	Staff estimate.
ST-AQ-7	Prepare a flow augmentation evaluation report (105S).	Staff	$25,000	$0	$1,800	Staff estimate.
ST-AQ-Lamp	Participate in regional lamprey forums, report findings relevant to restoration opportunities every 5 years (8S).	Staff	$0	$5,000	$5,000	Staff estimate.
ST-AQ-Sturg	Conduct a feasibility assessment of translocation and aquaculture approaches for restoring sturgeon in reaches between Swan Falls and Lower Granite dams (11Pc).	Staff	$20,000	$0	$2,200	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
ST-AQ-Inv	Develop and implement an invertebrate monitoring plan (101S).	Staff		$57,000	$57,000	Staff estimate. Assumes monitoring for first 10 years at $100,000 per year.
ST-AQ-Trib	Develop and implement an expanded tributary enhancement plan (Pine, Indian, Wildhorse, Powder and Burnt basins) (8Pc).	Staff	$18,000,000	$0	$1,466,700	Staff estimate.
	Subtotal Staff Alternative (this table)		$34,328,000	$836,200	$3,616,700	
	Subtotal Staff Alternative (IPC table)		$0	$305,200	$305,200	
	Total Staff Alternative		$34,328,000	$1,141,400	$3,921,900	

Table I-5. Developmental analysis of new hatchery measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
ST-HT-1	Fund the development and implementation of HGMPs for each hatchery (9P).	Staff	$0	$66,700	$66,700	Staff estimate.
IDFG-7	Purchase new adult fish transport vehicle (10Pc).	IDFG	$160,000	$2,000	$18,300	Staff estimate.
NMFS-13l	Screen hatchery water intakes to meet NMFS juvenile fish screen criteria (9P).	NMFS	$10,000	$0	$1,100	Staff estimate.
NMFS-13m	Assess and minimize impacts of hatchery steelhead to listed ESUs (9P).	NMFS	$0	$8,300	$8,300	Staff estimate.
ST-HT-2	Develop and implement, in consultation with the Burns-Paiute Tribe, the Shoshone-Paiute tribes, ODFW, IDFG, FWS and NMFS, a plan to use surplus adult hatchery spring Chinook and steelhead to support ceremonial and subsistence fisheries for the Burns-Paiute and Shoshone-Paiute tribes and to improve forage for bull trout in tributaries within the project area (103S)	Staff, NMFS, Burns-Paiute Tribe,[a] Shoshone-Paiute Tribe	$0	$80,900	$80,900	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
ST-HT-3	Develop a plan, in consultation with the Shoshone-Bannock tribes, IDFG, NMFS, and FWS, to fund the design, construction and operation of facilities on the Yankee Fork of the Salmon River to spawn and incubate 1,000,000 salmon or steelhead eggs to support the Shoshone-Bannock Tribe's streamside incubator program (104S)	Staff and the Shoshone-Bannock Tribes	$205,000	$69,900	$89,600	Staff estimate.
	Subtotal Staff Alternative (this table)		$375,000	$227,800	$264,900	
	Subtotal Staff Alternative (IPC table)		$17,006,000	$469,200	$2,326,700	
	Total Staff Alternative		$17,381,000	$697,000	$2,591,600	

[a] This specific measure was not described by the Burns Paiute Tribe, but the tribe identified fisheries restoration in the Malheur River as being especially important to the tribe during tribal consultation meeting held on March 29, 2007 in Boise, Idaho.

Table I-6. Developmental analysis of new terrestrial resources measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
FS-5	Finalize and implement the Hells Canyon Resource Management Plan, Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan (15S).	FS	$50,000	$20,000	$25,500	Staff estimate.
FS-6a	Acquire 56.3 acres of riparian habitat to mitigate for project effects downstream of Hells Canyon dam (14S).	FS	$954,300	$56,300	$160,500	
FS-7	Prepare an Integrated Weed Management Plan (18P).	FS	$5,000	$30,000	$30,500	Staff estimate.
FS-8	Prepare and implement a Threatened and Endangered Species Management and Monitoring Strategy (12S).	FS	$1,000	$0	$100	Staff estimate.
FS-9	Develop and implement a Sensitive Species Management Plan (12S).	FS	$5,000	$62,000	$62,500	IPC estimate.
FS-11	Develop and implement a Transmission Line Operation and Maintenance Plan (13S, 16P, 20P).	FS	$2,000	$1,000	$1,200	Staff estimate.
IDFG-31	Fund habitat management on 4 state-owned islands (13P).	IDFG	$100,000	$0	$10,900	IDFG estimate
Interior-23	Submit pesticide plans and reports to BLM (18P).	Interior	$1,000	$500	$600	Staff estimate.
Interior-77	Develop and implement Integrated Weed Management Plan for project lands, including cooperative projects on adjacent lands (18P).	Interior	$10,000	$85,000	$86,100	Staff estimate plus Idaho Power estimate.
Interior-82	As part of Threatened, Endangered, and Sensitive Species Management Plan, implement measures to protect Townsend's big-eared bat maternity sites and hibernacula (12S).	Interior	$0	$1,500	$1,500	Idaho Power estimate.
Interior-83	As part of Threatened, Endangered, and Sensitive Species Management Plan, implement measures to protect southern Idaho ground squirrel (12S).	Interior	$2,000	$1,000	$1,200	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Interior-85	As part of Threatened, Endangered, and Sensitive Species Management Plan, implement measures to protect special status amphibians and reptiles (12S).	Interior	$0	$1,000	$1,000	Staff estimate.
Interior-34b	As part of project-wide plan, develop and implement Threatened, Endangered, and Sensitive Species Management Plan for BLM-administered lands inside project boundary (12S).	Interior	$1,000	$1,000	$1,100	Staff estimate.
ODFW-62	Additional funding of habitat management on 4 state-owned islands (13P)	ODFW	$198,800	$0	$21,700	ODFW estimate
ODFW-72	As part of WMMP, schedule O&M to minimize disturbance on deer winter range (15S).	ODFW	$0	$1,000	$1,000	Staff estimate.
ODFW-73	As part of WMMP, develop and implement I&E program to minimize risk of wildlife disturbance (15S).	ODFW	$5,000	$1,000	$1,500	Staff estimate.
ODFW-60b	Establish a Terrestrial Resources Work Group (15P).	ODFW	$5,000	$12,000	$12,500	Staff estimate.
Staff-TR-1	Develop and implement project-wide Threatened, Endangered, and Sensitive Species Management Plan (12S).	Staff	$10,000	$47,500	$48,600	Staff estimate.
Staff-TR-2	Monitor bald eagles and manage nest and roost sites as part of project-wide Threatened, Endangered, and Sensitive Species Management Plan (12S).	Staff	$5,000	$10,000	$10,500	Staff estimate.
Staff-TR-3 – now FS-6b	Conduct riparian planting feasibility assessment and implement stabilization/revegetation program if possible; if not, acquire 70 acres of riparian habitat off-site (11S).	FS	$300,000	$20,000	$52,800	Staff estimate.
Staff-TR-4	As part of Transmission Line O&M Plan for transmission line 945, monitor electrocution and collision and implement measures to reduce risks (13S).	Staff	$0	$1,000	$1,000	Staff estimate.
Staff-TR-5	Acquire 5.9 acres of riparian habitat to mitigate for anticipated effects of preferred flow alternative (14S).	Staff	$100,000	$5,900	$16,800	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
	Subtotal Staff Alternative (this table)		$1,755,100	$357,700	$549,100	
	Subtotal Staff Alternative (IPC table)		$16,953,900	$1,046,000	$2,896,400	
	Total Staff Alternative		$18,709,000	$1,403,700	$3,445,500	

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Table I-7. Developmental analysis of new cultural resources measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
AMC-FS-25	Revised Preliminary FS Condition 25—in consultation with the FS, BLM, SHPOs and tribes, finalize a Historic Properties Management Plan (HPMP) for cultural resources within the area of potential effect (APE) for the project (19S).	Idaho Power	$0	$800	$800	Staff estimate.
BPT-15	Establish a Cultural Resources Task Force that adds an oversight committee (27S).	BPT	$0	$1,000	$1,000	Staff estimate.
Staff-CR-1	Renew, within a specified time frame, the offer to fund oral histories for the Shoshone-Bannock and Shoshone-Paiute Tribes (16S).	Staff	$0	$7,600	$7,600	Staff estimate.
Staff-CR-2	Within 1 year of license issue, develop monitoring plan for archaeological sites, rock art and TCPs in consultation with the tribes, SHPOs, Forest Service and BLM and file with the Commission (17S).	Staff	$0	$2,300	$2,300	Staff estimate. This measure in combination with Idaho Power's measures would further meet the goals of Interior-5 and FS-25.
Staff-CR-3	Within 1 year of license issue, in consultation with the tribes, SHPOs, Forest Service, and BLM, develop an implementation plan for Study 8.4.7, *Effects of Reservoir Water Level Fluctuations on Cultural Resources*, which Idaho Power deferred, in consultation with the CRWG, until the monitoring plan was implemented. File with the Commission (18S).	Staff	$0	$1,900	$1,900	Staff estimate.
Staff-CR-5	Expand monitoring program to cover all known historic properties in the project APE (20S).	Staff	$0	$185,500	$185,500	Staff estimate.
Staff-CR-6	Develop and implement a program to re-evaluate buildings and structures within the project boundary as they reach 50 years old (20S).	Staff	$0	$3,000	$3,000	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Staff-CR-7	Provision for review, and as necessary revision, of the HPMP, in consultation with the SHPOs, tribes, Forest Service and BLM every 6 years over the license term (19S).	Staff	$0	$1,700	$1,700	Staff estimate.
	Subtotal Staff Alternative (this table)		$0	$203,800	$203,800	
	Subtotal Staff Alternative (IPC table)		$77,000	$323,700	$332,100	
	Total Staff Alternative		$77,000	$527,500	$535,900	

Table I-8. Developmental analysis of new recreation measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Interior-6	Prepare a Comprehensive Recreational Plan (21S).	Interior	$70,000	$0	$7,600	Staff estimate.
FS-21	Design, construct, and maintain facility enhancements at the Hells Canyon Creek Launch Site and Visitor Center (21Sf).	FS	$275,000	$10,000	$36,100	Staff estimate.
Interior-8	Develop a Project Boat Moorage Plan (45P).	Interior	$0	$5,000	$5,000	Staff estimate.
Interior-9	Develop an enhancement plan for the BLM sites referred to as Airstrip A&B, Bob Creek section C, and Westfall (59P, 62P, and 63P)	Interior	$0	$4,600	$4,600	Staff estimate.
Interior-10	Develop an enhancement plan for the BLM Swedes Landing site (70P)	Interior	$0	$5,000	$5,000	Staff estimate.
Interior-11	Develop an enhancement plan for the BLM Spring recreation site (71P).	Interior	$0	$5,000	$5,000	Staff estimate.
Interior-12	Portion of revised Interior condition 12–Steck recreation site improved communication system (21Sb).	Interior, staff	$35,000	$0	$3,800	Staff estimate.
Interior-13	Develop an enhancement plan for the BLM site referred to as Jennifer's Alluvial Fan Site (21Sd).	Interior	$50,000	$5,000	$9,800	Staff estimate.
Interior-14	Develop an Idaho Dispersed Sites Plan (49P).	Interior	$200,000	$50,000	$69,000	Staff estimate.
Interior-15	Develop an enhancement plan for the BLM site referred to as Carter's Landing and Oxbow Boat Launch (65P and 66P).	Interior		$10,000	10,000	Staff estimate
Interior-16	Revised Interior Condition 16—develop site plan for minor improvements and monitor the need for a higher level of development at the BLM site referred to as	Interior	$50,000	$0	$4,400	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
	Oasis through the Recreation Adaptive Management Plan during the license term (21Sa).					
Interior-17	Develop an enhancement plan for the BLM site referred to as Copper Creek (57P).	Interior	$0	$5,000	$5,000	Staff estimate.
Interior-18	Develop a Low-Water Boat Launch Plan As modified by staff to lessen layers of decision-making authorities reduces the number of steps in consultation processes (70P).	Interior	$0	$5,000	$5,000	Staff estimate.
Interior-32b	As part of the warmwater fisheries plan (Interior-32a), describe relationship between the timing of reservoir level fluctuations and the ability to access and launch boats at existing Idaho Power boat ramps, and satisfy reservoir-level requirements of Baker County Settlement Agreement (7Pb)	Interior	$0	$0	$0	Unknown.
NMFS-20	Design and construct an anadromous fish interpretive display located at a mutually agreeable location near Brownlee dam (47P).	NMFS	$8,000	$500	$1,400	Staff estimate.
ODFW-79	Hells Canyon Park Consultation—ODFW (58P)	ODFW	$0	$0	$0	Staff estimate.
OPRD-2	Sediment Maintenance Plan for Farewell Bend State Park–OPRD (21Sc).	OPRD	$2,000	$4,000	$4,200	Staff estimate.
OSMB-6	I&E Plan (47P)	OSMB	$0	$0	$0	Staff estimate.
Interior-7	Implement Litter and Sanitation Plan as modified by staff to include the service schedule and include floating restrooms only where the need is confirmed through consultation (46P).	Interior	$120,000	$55,000	$66,800	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
	As part of the Recreation Plan, consult with the Corps, NPPVA, the Forest Service, and other interested parties to prepare and implement a Navigation Plan that addresses non-flow measures, including installation of additional stream gages, downstream of Hells Canyon dam (108S)	Staff	160,000	20,000	36,300	
	Subtotal Staff Alternative (this table)		$970,000	$184,100	$279,000	
	Subtotal Staff Alternative (IPC table)		$9,929,800	$358,900	$1,207,900	
	Total Staff Alternative		$10,899,800	$543,000	$1,486,900	

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Table I-9. Developmental analysis of new land use and aesthetic resources measures included in the Staff Alternative.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
ST-LM-1	Expand the HCRMP by creating the following maps: map of roads for which Idaho Power should be responsible for within the HCRMP. Maps will be made available to the public as part of the I&E program that include 1) roads and important resource areas and areas of high wildlife collisions, and 2) land and water use (72P).	Staff	$15,000	$0	$1,500	Staff estimate.
ST-LM-2	Create oversight and Resource Technical Advisory Committees (27S).	Staff	$0	$50,000	$50,000	Staff estimate.
FS-1	Coordinate with BLM and FS concerning activities on their lands (25S).	FS	$0	$1,000	$1,000	Staff estimate.
FS-2	Prepare and implement a Resource Coordination Plan as modified by staff to limit scope to Forest Service lands in the project boundary (24S).	FS	$10,000	$5,000	$6,100	Staff estimate.
Interior-1	Follow BLM requirements for Idaho Power activities on or affecting BLM-administered lands as modified by staff to limit the scope to activities on BLM land and permit more flexibility in timing (25S).	Interior	$40,000	$0	$4,400	Staff estimate.
Interior-2	Commencing five years after a new license is issued and unless otherwise provided, the Licensee shall prepare and submit an annual, written report summarizing progress on implementing articles of the license that affect recreation, cultural, aquatic, and terrestrial resources administered by BLM on BLM lands within and adjacent to the Project boundary.	Interior		$5,000	$5,000	Staff estimate.
Interior-25	Develop a Visual Resource Management Plan for project facilities to address the design, maintenance, and construction of project facilities (both existing and future facilities) in order to preserve or enhance visual resource values in the project area (22S).	Interior	$25,000	$0	$2,500	Staff estimate.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Interior-30	Modify the Project boundary to include all of the land within the Airstrip, Steck Park, Swedes Landing, and Westfall recreation sites (23S).	Interior	$10,000	$0	$1,000	Staff estimate.
ODFW-76	Develop a road management plan (81P).	ODFW	$10,000	$0	$1,100	Staff estimate.
OSMB-3	Facilitate biannual law enforcement proceedings (81P).	OSMB	$0	$5,000	$5,000	Staff estimate.
	Subtotal Staff Alternative (this table)		$110,000	$66,000	$77,600	
	Subtotal Staff Alternative (IPC table)		$840,000	$83,000	$166,800	
	Total Staff Alternative		$950,000	$149,000	$244,400	

APPENDIX J

DEVELOPMENTAL ANALYSIS OF MANDATORY MEASURES THAT ARE NOT INCLUDED IN THE STAFF ALTERNATIVE

Table J-1. Developmental analysis of new sediment transport measures specified by agencies, but not included by staff.

[Agencies did not specify any mandatory sediment transport measures that were not included by staff]

Table J-2. Developmental analysis of new water quality measures specified by agencies, but not included by staff.

[Agencies did not specify any new water quality measures that were not included by staff]

Table J-3. Developmental analysis of new operational measures specified by agencies, but not included by staff.

[Agencies did not specify any new operational measures that were not included by staff]

Table J-4. Developmental analysis of new aquatic resources measures specified by agencies, but not included by staff.

[Agencies did not specify any new aquatic resources measures that were not included by staff]

Table J-5. Developmental analysis of new hatchery measures specified by agencies, but not included by staff.

[Agencies did not specify any new hatchery measures that were not included by staff]

Table J-6. Developmental analysis of new terrestrial resources measures specified by agencies, but not included by staff.

[Agencies did not specify any new terrestrial resources measures that were not included by staff]

Table J-7. Developmental analysis of new cultural resources measures specified by agencies, but not included by staff.

[Agencies did not specify any new cultural resources measures that were not included by staff]

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Table J-8. Developmental analysis of new recreation measures specified by agencies, but not included by staff.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
FS-20	Within one year of License issuance and over the remaining term of the License, the Licensee shall perform trail maintenance for several USDA Forest Service trails.	FS		$10,000	$10,000	
Total recreation measures not included by staff			$0	$10,000	$10,000	

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Table J-9. Developmental analysis of new land use and aesthetic resources measures specified by agencies, but not included by staff.

Identifier	Measure	Entity	Capital Cost	Annualized O&M Cost	Total Annualized Cost	Comment
Interior-3	Develop an integrated Travel and Access Management Plan for BLM-administered lands affected by the project, which will be incorporated into the Comprehensive Recreation Management Plan and coordinated with the Integrated Wildlife Habitat Program and Wildlife Mitigation and Management Plan.	Interior	$50,000	$10,000	$15,100	Staff Estimate $50,000 for the plan and $10,000 per year for road maintenance in addition to IPC's proposed $30,000 per year
Interior-4	Within 5 years of license issuance or on an alternate schedule agreed to by BLM and the Licensee, the Licensee shall develop, and thereafter will begin implementation of, a Law Enforcement and Emergency Services Plan (LEESP) that includes provision for coordination and cooperative funding of law enforcement and emergency services personnel.	Interior	$50,000	$0	$5,100	Staff estimate.
Total land use measures not included by staff			$100,000	$10,000	$20,200	
Total mandatory agency measures not included by staff (all categories)			$100,000	$20,000	$30,200	

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