Federal Energy Regulatory Commission

Office of Energy Projects
September 2011
FERC/FEIS – 0239F

# Final Environmental Impact Statement

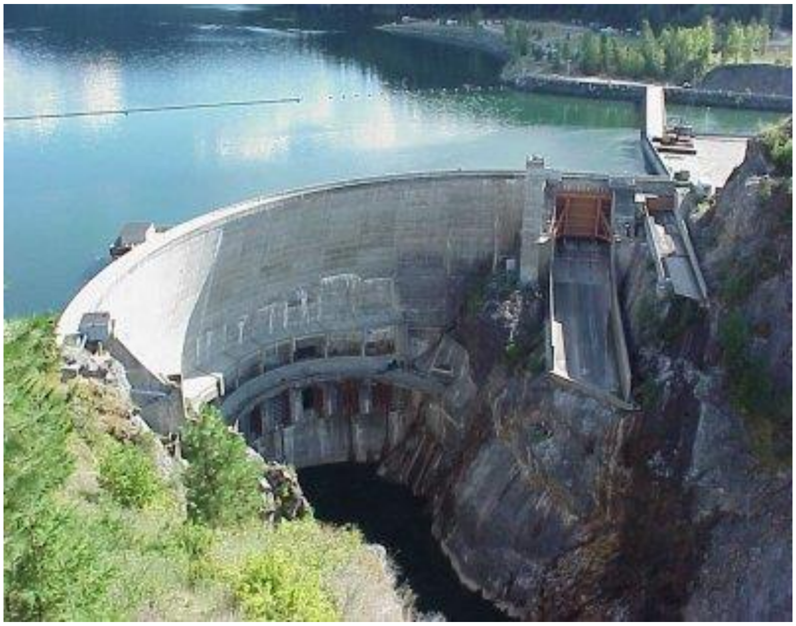
**Application for Hydropower License for the Boundary Hydroelectric Project**

**FERC Project No. 2144-038, Washington**

**And**

**Application for Surrender of Hydropower License for the Sullivan Creek Project**

**FERC Project No. 2225-015, Washington**



*Boundary Dam*

*Sullivan Lake Dam*

*Mill Pond Dam*

**Federal Energy Regulatory Commission**
**888 First Street, NE**
**Washington, DC 20426**

FERC/F-0239

# FINAL ENVIRONMENTAL IMPACT STATEMENT

Application for Hydropower License for the Boundary Hydroelectric Project
FERC Project No. 2144-038, Washington

And

Application for Surrender of Hydropower License for the Sullivan Creek Project
FERC Project No. 2225-015, Washington

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

September 2011

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

**Reference: Final Environmental Impact Statement**

Attached is the final environmental impact statement (final EIS) for the relicensing of the City of Seattle, Washington's Boundary Hydroelectric Project No. 2144-038 and the surrender of Public Utility District No. 1 of Pend Oreille County, Washington's, Sullivan Creek Project No. 2225-015. The Boundary Project is located on the Pend Oreille River in Pend Oreille County, Washington. The Sullivan Creek Project is located on Sullivan Lake, and Sullivan Creek and Outlet Creeks, tributaries to the Pend Oreille River that empty into the Boundary Project reservoir. Both projects occupy lands within the Colville National Forest.

This final EIS documents the view of governmental agencies, nongovernmental organizations, affected Indian tribes, the public, the license applicants, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations on the applicants' proposals and alternatives for relicensing the Boundary Project and surrendering the Sullivan Creek Project.

Before the Commission makes a decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. The final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about April 18, 2011.

Copies of the EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington DC 20426. The EIS also may be viewed on the Internet at http://elibrary.ferc.gov. For assistance, contact FERC Online Support at FERCOnlineSuppor@ferc.gov or toll-free at 1-866-208-3372, or for TTY, (202) 502-8659.

Attachment: Final Environmental Impact Statement

## COVER SHEET

a. Title: Application for hydropower license for the Boundary Hydroelectric Project, FERC Project No. 2144-038; and Application for surrender of license for the Sullivan Creek Project, FERC Project No. 2225-015

b. Subject: Final Environmental Impact Statement

c. Lead Agency: Federal Energy Regulatory Commission (Commission)

d. Abstract: On September 29, 2009, the City of Seattle, Washington (Seattle) filed application to relicense its 1,003-megawatt (MW) Boundary Hydroelectric Project, located on the Pend Oreille River in Pend Oreille County, Washington. The project produces an average of 3,572.8 gigawatt-hours (GWh) of energy annually. The project occupies 609.24 acres of federal lands managed by the U.S. Department of Agriculture, Forest Service (Forest Service) on the Colville National Forest, and 329.35 acres of federal lands managed by the U.S. Bureau of Land Management.

On March 29, 2010, Seattle and the Public Utility District No. 1 of Pend Oreille County (District) jointly filed an offer of settlement, consisting of two comprehensive settlement agreements, a joint explanatory statement and a request to consolidate the processing of Seattle's relicensing of the Boundary Project with the District's surrender of its license for the Sullivan Creek Project. Subsequently, on April 2, 2010, the District filed an application to surrender its license for the Sullivan Creek Project, located on Sullivan Lake and Sullivan and Outlet Creeks in Pend Oreille County, Washington. The District operates the Sullivan Creek Project as a storage facility for downstream generation; it does not generate electricity. The project occupies 522 acres of federal lands managed by the Forest Service.

The two separate, but interdependent settlement agreements detail the measures that Seattle would implement to address the effects of continued load-following operations of the Boundary Project and the District's orderly disposition of the Sullivan Creek Project. The Boundary settlement agreement includes obligations for addressing water quality issues, evaluating and providing fish passage for resident salmonids, reducing fish entrainment, improving aquatic habitat, stocking fish for recreational purposes, conserving native fish, groundwater well-decommissioning, acquiring and managing land for wildlife, and other measures for recreation and cultural resource enhancement and protection. Under the Sullivan Creek settlement agreement, the District would retain and operate under a Forest Service Special Use Authorization the Sullivan Lake dam and lake; install a

new cold-water release intake at Sullivan Lake dam; remove Mill Pond dam, restore the site and the stream channel, and conduct short-term monitoring and maintenance in accordance with its Mill Pond Decommissioning Plan to ensure the restored channel is functioning as designed. These settlement agreements, and the measures contained therein, are intended to provide significant benefits to resources within the Pend Oreille River and its tributaries, while retaining Seattle's operational flexibility and reducing costs of the Sullivan Lake Project surrender on Pend Oreille rate payers.

This final EIS assesses the effects of the approval and implementation of both settlement agreements and staff modifications to those agreements. The staff's recommendation is to relicense the Boundary Project as proposed, with certain modifications and additional measures to improve administration of the license. The staff also recommends approval of the surrender application as proposed, with certain modifications to mitigate adverse effects to cultural resources and improve Commission oversight and administration of the surrender.

e. Contact: David Turner
Federal Energy Regulatory Commission
Office of Energy Projects
888 First Street, NE
Washington, DC 20426
(202) 502-6091

f. Transmittal: This final Environmental Impact Statement (EIS) on the relicense of the Boundary Project and the surrender of the Sullivan Creek Project is being made available to the public on or about September 15, 2011, as required by the National Environmental Policy Act of 1969.[1]

[1] National Environmental Policy Act of 1969, as amended (Public Law [Pub. L.] 91-190, 42 United States Code [U.S.C.] 4321-4347, January 1, 1970.

## FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] 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)…[4]

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.[5] 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.[6]

Likewise, in considering the surrender of one of its licenses, the Commission must ensure that, in the Commission's judgment, the decision and disposition of the license will adequately protect the public interest.

---

[2] 16 U.S.C. §791(a)-825r, as amended (2006).
[3] Public Law 95-91, 91 Stat. 556 (1977).
[4] 16 U.S.C. §803(a) (2006).
[5] 16 U.S.C. §803(g) (2006).
[6] 18 C.F.R. §385.206 (2010).

**TABLE OF CONTENTS**

## LIST OF FIGURES

## LIST OF TABLES

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ac-ft | acre-feet |
| ADA | Americans with Disabilities Act |
| Advisory Council | Advisory Council on Historic Preservation |
| APE | area of potential effects |
| BIA | Bureau of Indian Affairs |
| BLM | Bureau of Land Management |
| BMP | best management practice |
| BPA | Bonneville Power Administration |
| °C | degrees Celsius |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| County | Pend Oreille County |
| Commission | Federal Energy Regulatory Commission |
| CZMA | Coastal Zone Management Act |
| District | Public Utility District No. 1 of Pend Oreille Co. |
| DO | dissolved oxygen |
| draft EIS | draft environmental impact statement |
| Ecology | Washington Department of Ecology |
| EIS | environmental impact statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| °F | degrees Fahrenheit |
| FAMP | Fish and Aquatic Habitat Management Plan |
| FERC | Federal Energy Regulatory Commission |
| final EIS | final environmental impact statement |
| Forest Service | U.S. Department of Agriculture − Forest Service |
| FPA | Federal Power Act |
| FR | Forest Road |
| ft | foot or feet |
| ft msl | feet above mean sea level |
| FWS | U.S. Department of the Interior − Fish and Wildlife Service |
| GIS | geographic information system |
| GWh | gigawatt-hour(s) (equals one million kilowatt-hours) |
| hp | horsepower |
| HPMP | Historic Properties Management Plan |
| ILP | Integrated Licensing Process |
| in. | inch |
| Interior | U.S. Department of the Interior |

| | |
|---|---|
| Kalispel Tribe | Kalispel Tribe of Indians |
| KOP | key observation point |
| kV | kilovolt(s) |
| kW | kilowatt(s) |
| kWh | kilowatt hour(s) |
| LWD | large woody debris |
| m | meter(s) |
| mg/kg | milligram(s) per kilogram |
| mg/l | milligram(s) per liter |
| ml | milliliter(s) |
| mm | millimeter(s) |
| MVA | megavolt-ampere |
| MW | megawatt |
| MWh | megawatt-hours |
| NA | not applicable |
| National Register | National Register of Historic Places |
| NEPA | National Environmental Policy Act |
| NERC | North American Electric Reliability Council |
| NHPA | National Historic Preservation Act |
| NMFS | U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service |
| NTU | nephelometric turbidity unit(s) |
| O&M | operation and maintenance |
| OHV | off-highway vehicle |
| PA | Programmatic Agreement |
| QA/QC | quality assurance / quality control |
| RRMP | Recreation Resources Management Plan |
| Seattle | City of Seattle, Seattle City Light Department |
| SHPO | State Historic Preservation Officer |
| SPCC plan | spill prevention, control, and countermeasures plan |
| TCP | Traditional Cultural Property |
| TDG | total dissolved oxygen |
| TMDL | total maximum daily load |
| TRMP | Terrestrial Resources Management Plan |
| USACE | United States Army Corps of Engineers |
| U.S.C. | United States Code |
| USGS | U.S. Geological Survey |
| Washington DFW | Washington Department of Fish and Wildlife |
| Washington DOH | Washington Department of Health |

## EXECUTIVE SUMMARY

On September 29, 2009, the City of Seattle, Washington (Seattle) filed an application to relicense its 1,003-megawatt (MW) Boundary Hydroelectric Project No. 2144, located on the Pend Oreille River in Pend Oreille County, Washington. The project produces an average of 3,572.8 gigawatt-hours (GWh) of energy annually. The project occupies about 609 acres of federal lands managed by the U.S. Forest Service (Forest Service) on the Colville National Forest, and about 329 acres of federal lands managed by the U.S. Bureau of Land Management (BLM).

On March 29, 2010, Seattle and the Public Utility District No. 1 of Pend Oreille County (District) jointly filed an offer of settlement, consisting of two comprehensive settlement agreements, a joint explanatory statement, and a request to consolidate the processing of Seattle's relicensing of the Boundary Project with the District's surrender of its license for the Sullivan Creek Project No. 2225. The agreements describe the measures that Seattle would implement to address the effects of continued load-following operations of the Boundary Project and the District's orderly disposition of the Sullivan Creek Project license.

On April 2, 2010, the District filed an application to surrender its license for the Sullivan Creek Project, including Sullivan Lake dam and Mill Pond dam. Sullivan Lake dam is located at the terminus of Sullivan Lake. The discharges from Sullivan Lake flow into Outlet Creek, which joins Sullivan Creek about one-half of a mile downstream from the dam. Mill Pond dam is located on Sullivan Creek about 1.5 miles downstream from Sullivan Lake dam. Sullivan Creek flows into the Boundary reservoir. The District operates the Sullivan Creek Project as a storage project for downstream generation in accordance with the Pacific Northwest Coordination Agreement, but not for its own production of energy. The Sullivan Creek Project occupies 522 acres of federal lands on the Colville National Forest.

Signatories to the settlement agreements include Seattle, the District, Forest Service, U.S. Fish and Wildlife Service (FWS), U.S. National Park Service, Bureau of Indian Affairs (BIA), Washington Department of Fish and Wildlife (Washington DFW), Washington Department of Ecology (Ecology), Kalispel Tribe of Indians (Kalispel Tribe), Selkirk Conservation Alliance, The Lands Council, American Whitewater, Town of Cusick, Washington, Rick Larsen, and Al Six. The settlement agreements include a suite of measures intended to significantly improve aquatic and terrestrial habitat conditions in the portion of the Pend Oreille River impounded by the Boundary Project and its tributaries, particularly Sullivan Creek, while retaining Seattle's operational flexibility and reducing costs of the Sullivan Lake Project surrender on Pend Oreille County rate payers.

Through an off-license agreement between Seattle and the District, Seattle, on behalf of the District, would remove Mill Pond dam and restore Sullivan Creek from Mill Pond dam to Outlet Creek, and share equally with the District in the cost to install a cold-water release structure at Sullivan Lake dam. Both measures are integral to the settling parties' objectives of improving aquatic habitat in Sullivan Creek, the largest tributary to the Pend Oreille River at the Boundary Project. Nonetheless, as a condition of the Federal Energy Regulatory Commission's (FERC or Commission) approval of the District's surrender, the District ultimately would be responsible for implementing these measures, which are expected to be completed within eight years of the Commission's order approving the surrender. The surrender would become effective and the Commission's oversight of the Sullivan Creek Project would cease when the Commission issues a letter stating that all of the conditions of the surrender have been fulfilled. As a component of its comprehensive Fish and Aquatic Management Plan (FAMP), Seattle would continue to monitor and maintain the restored channel through the term of the Boundary license, along with the other enhancement measures it would put in place in Sullivan Creek, to ensure the effectiveness and continued benefits to aquatic resources in the watershed.

**Public Involvement and Areas of Concern**

Before filing its license application, Seattle conducted pre-filing consultation using the integrated licensing process. Commission staff conducted scoping as part of the pre-filing process to determine what issues and alternatives should be addressed. We distributed a scoping document to interested parties on June 19, 2006, soliciting comments, recommendations, and information on the project. Based on the comments received, we issued a revised scoping document on September 28, 2006. The District consulted with various resource agencies, tribes, and non-governmental organizations to develop its surrender application and the settlement agreement.

On May 11, 2010, following the filing of Seattle's and the District's settlement agreements and motion to consolidate the proceedings, the Commission solicited scoping comments on the surrender of the Sullivan Creek Project and issued notice of a June 10, 2010, technical conference to be held in Spokane, Washington, to discuss the joint settlement agreements and the scope of issues to be addressed in a combined environmental assessment for both projects. Based on the comments received at the technical conference and in response to the Commission's July 6, 2010 *Notice of Application Ready for Environmental Analysis and Soliciting Comments, Recommendations, Preliminary Terms and Conditions, and Preliminary Fishway Prescriptions* (REA notice) for both projects (to the extent applicable), Commission staff determined that relicensing of the Boundary Project may constitute a major federal action significantly affecting the quality of the human environment. On September 16, 2010, the Commission noticed its intent to prepare an EIS; the notice was published in the Federal Register on September 22, 2010.

Commission staff issued its draft environmental impact statement (draft EIS) for the proposed relicensing of the Boundary Project and the proposed surrender of license for the Sullivan Creek Project on April 8, 2011. Staff held public meetings in Metaline Falls and Spokane, Washington on May 10 and 11, 2011 to solicit comments on the draft

EIS.  Staff requested written comments on the draft EIS be filed by May 31, 2011.  Staff received comments from U.S. Environmental Protection Agency, U.S. Department of Agriculture – Forest Service, Washington Depart of Fish and Wildlife, Seattle City Light Department, Pend Oreille County Public Utility District, Washington Department of Ecology, U.S. Department of the Interior, Kalispel Tribe of Indians, Ms. Carol Jean Merrill, Sweet Creek Ranch Residents, Mr. Larry Gragg, *et al*., and National Marine Fisheries Service.  In appendix C of this final EIS, we summarize the written and oral comments received; provide responses to those comments; and indicate, where appropriate, how we have modified the text for the final EIS.

The primary issues associated with the relicensing of the Boundary Project are the effects of reservoir fluctuations on aquatic and terrestrial habitats and the fish and wildlife they support, erosion associated with project-related operations and recreation, the influence of project operations on reservoir temperatures and total dissolved gas (TDG) levels in the tailrace, upstream fish passage, fish entrainment and mortality, improvements to recreation facilities, and protection of cultural resources.  The primary issues associated with the surrender of the Sullivan Creek Project are:  (1) erosion and sedimentation; (2) site restoration related to removal of Mill Pond dam; (3) recreational, aesthetic, and cultural effects associated with the loss of Mill Pond; and (4) Sullivan Lake operational influences on elevated water temperatures in Sullivan Creek, available aquatic habitat in Outlet and Sullivan Creeks, and kokanee spawning habitat and access to that habitat in Sullivan Lake and its tributaries.

This EIS assesses the effects of both settlement agreements, staff modifications to those agreements, and other alternatives for relicensing the Boundary Project and surrendering the license for the Sullivan Creek Project.  Those alternatives are summarized below.

**Boundary Project**

<u>Project Description</u>

The Boundary dam impounds the Pend Oreille River to create a 1,794-acre reservoir at a normal full pool elevation of 1,994 feet North American Vertical Datum (NAVD) 88.  The project directs flow from the forebay through six penstocks leading to an underground power plant containing six Francis turbine/generator units, numbered 51 through 56.  Six draft tubes discharge water from the turbines into the tailrace immediately below the dam.  When the reservoir is at full pool and inflow exceeds the hydraulic capacity of the project (56,000 cubic feet per second—cfs), flows are spilled through two spillways and six low level sluice gates.  To reduce TDG under normal, non-spill operations, Seattle voluntarily implements a practice of operating Units 55 and 56 above 125 MW and sequencing their startup and shutdown so that Units 55 and 56 are the last units to be brought on line and the first units to be shut down.  Electricity produced at the project is carried through six three-phase, 230-kilovolt (kV) transmission lines to a Bonneville Power Administration (BPA) substation immediately adjacent to the project.

The project operates in a load-following mode, generating electricity during peak-load hours from available water. The project typically begins generating in the early morning hours and continues to generate throughout the day, rising and falling in response to customer demand, with peaks experienced in the morning and evening. Power produced at the project serves the District's and Seattle's retail load, with any excess power produced sold on the secondary market.

The reservoir has an active storage of 40,843 acre-feet between elevations 1,994 feet and 1,954 feet, which are the elevation operating constraints of the current license. However, the project primarily operates between the elevations of 1,994 feet and 1,974 feet (using 27,000 acre-feet of storage), with the additional storage between 1,974 feet and 1,954 feet reserved for extreme load requirements. To improve recreation access from Memorial Day through Labor Day, Seattle voluntarily limits the forebay pool to a water surface elevation of no lower than 1,984 feet from 6:00 a.m. to 8:00 p.m. and a water surface elevation of no lower than 1,982 feet from 8:00 p.m. to 6:00 a.m.

The existing project boundary encloses about 2,720 acres that includes three project recreational facilities Seattle maintains and operates: the Forebay Recreation Area, the Tailrace Recreation Area/Machine Hall Visitor's gallery, and the Visa House.

Proposed Facilities

Seattle proposes to upgrade the turbine runners, rewind the generators, and replace the step-up transformers in Units 55 and 56 within the first four years following issuance of a new license. Seattle estimates that the upgrades would increase project generation by 39,838 MWh, but would not increase the authorized installed capacity beyond what is currently authorized. Under the settlement agreement, Seattle would continue to operate the project as it currently does. Seattle also proposes revisions to the project boundary to re-establish the buffer zone in the portion of the Boundary reservoir downstream of Metaline Falls, incorporate lands owned and managed by Seattle for the benefit of wildlife, recreation and project operations, and to include portions of some roads that are used primarily or solely for the project purposes of operation or access to project recreation facilities. Seattle's revisions would enlarge the project boundary to about 3,263 acres, 966 acres of which would be federal lands.

Proposed Environmental Measures

In accordance with the settlement agreement, and as stipulated by Forest Service's 4(e) conditions and U.S. Department of Interior's (Interior)'s section 18 prescriptions, Seattle would implement the following measures to protect, mitigate and enhance water quality, and aquatic, wildlife, recreation, and cultural resources:

- Implement a Fish and Aquatics Management Plan (FAMP), which includes the following components to improve water quality and fish habitat, provide passage of resident fish and bull trout, reduce entrainment, and foster the recovery of bull trout and conservation of native resident fishes: (A) mainstem fish community and aquatic habitat measures, (B) upstream fish passage, (C) measures to reduce project related entrainment mortality, (D) tributary non-native trout suppression and eradication, (E) tributary fish community and aquatic habitat measures, (F) Mill Pond dam site monitoring and maintenance, (G) native salmonid conservation program, (H) recreational fish stocking program, and (I) a fund for habitat improvements in tributaries to Sullivan Lake.

- Implement the following plans to improve and monitor water quality: (A) Aquatic Invasive Species Control and Prevention Plan, (B) Dissolved Oxygen Attainment Plan, (C) Fish Tissue Sampling Plan, (D) Temperature Attainment Plan, and (E) TDG Attainment Plan.

- Establish a Boundary Resource Coordinating Committee and the following work groups as needed to consult on the implementation and long-term monitoring and maintenance of environmental measures: Fish and Aquatics Work Group, Water Quality Working Group, Terrestrial Resources Work Group, Recreation Resources Work Group, and Cultural Resources Work Group.

- Implement a Terrestrial Resource Management Plan (TRMP), which consists of the following programs to improve terrestrial habitats for wildlife: (A) Erosion program, (B) Habitat Management, Enhancement, and Protection Program, (C) Integrated Weed Management Program, (D) Rare, Threatened or Endangered Plant Species Program, (E) Wildlife Program, and (F) Shoreline Management Program.

- Within 5 years of license issuance, acquire and manage approximately 158 acres, consisting of highly diverse riparian and upland habitat and about 13,022 lineal feet of varying habitats immediately adjacent to water features for the benefit of federally listed wildlife, big game, and other area wildlife.

- Implement a Recreation Resource Management Plan (RRMP), which consists of the following programs to enhance recreational opportunities: (A) Recreation Facility Capital Improvements Program, (B) Recreation Facility Operations and Maintenance Program, (C) Shoreline Dispersed Recreation Management Program, (D) Recreation Monitoring Program, (E) Travel And Public Access Management Plan, and (F) Multi-Resource Interpretation and Education Program. Capital improvements include upgrading existing project facilities, extending the boat launch and adding a vault toilet at the City of Metaline's waterfront park, adding two overlooks and a trail connecting the overlooks, and adding a Metaline Falls portage trail and boater access.

- Implement a Groundwater Monitoring Well and Road Decommissioning Plan to close groundwater monitoring wells and roads to wells no longer needed to serve project purposes.

- Implement a programmatic agreement and Historic Properties Management Plan (HPMP) to protect cultural resources.

Alternatives Considered

This EIS considers the following alternatives: (1) Seattle's proposal as outlined above, (2) Seattle's proposal with staff modifications (staff alternative), (3) the staff alternative with mandatory conditions, and (4) no-action alternative.

The staff alternative includes all of Seattle's proposed measures, except for conducting fish tissue sampling, implementing the recreational fish stocking program, and establishing a fund for habitat improvements in tributaries to Sullivan Lake. The staff alternative also includes a recommendation for Seattle to prepare and implement an operation compliance monitoring plan to document compliance with proposed reservoir limits and to modify the RRMP to include a more definitive schedule for completing the proposed capital improvement recreation projects. The staff alternative with mandatory conditions is identical to Seattle's proposal with staff's recommended operation compliance monitoring plan and modifications to the recreation plan. Under the no-action alternative, the project would continue to operate under the terms and conditions of its existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Project Effects

*Staff Alternative*

**Aquatic Resources —**Reservoir fluctuations would continue to affect the quality of aquatic habitat. Implementing the FAMP would improve aquatic habitat in the project reservoir and in its tributaries. For example, adding 1,500 cubic yards of gravel in the upper reservoir just below the District's Box Canyon (FERC Project No. 2042) dam would enhance native mountain whitefish spawning habitat; excavating a 1,800-foot-long channel would connect mainstem flow with several isolated pools in the "Cobble Sisters' area of the Boundary reservoir to reduce trapping of fish as reservoir elevations drop; adding 1,700 cubic feet of large woody debris (LWD) to tributary deltas would increase habitat complexity in these areas; and adding LWD, stabilizing channels, replacing culverts, and planting riparian vegetation in Sullivan, Linton, and Sweet Creeks and other tributaries to the reservoir would improve native salmonid habitat. Restoration and conservation of native resident fish would be promoted through the eradication of non-native trout from the tributaries and planting of native fish species raised at a new hatchery constructed, operated, and maintained by Seattle.

Further, adding a trap-and-haul facility at the Boundary Project, in conjunction with the fishways that are expected to be built within the next decade at the upstream Box Canyon Project and at the U.S. Army Corps of Engineers' Albeni Falls dam, would reconnect habitats and the migratory pathways of bull trout and other native salmonids from Boundary dam upstream to Lake Pend Oreille in Idaho. Given the complexity of flows in the tailrace, Seattle would gather additional information to appropriately site and design the facility, with installation occurring by year 14 of the license.  Measures to reduce entrainment would also benefit the fishery.

Sequencing the operation of Units 55 and 56 and structural modifications to the project would reduce TDG levels, which is expected to benefit resident fish and bull trout downstream of the project.  Implementation of the aquatic invasive species monitoring plan would help prevent zebra mussels and other invasive species from colonizing the reservoir and reducing the quality of existing habitats.  The program would also result in the removal of macrophyte beds that could entrap fish when reservoir elevations drop. Monitoring of dissolved oxygen and temperature would allow Seattle to document compliance with water quality conditions, evaluate the benefits of the tributary habitat improvement measures at reducing mainstem temperatures, and determine if other measures are needed to achieve compliance with water quality standards.

Implementation of an operation and compliance monitoring plan would provide a mechanism to document compliance with Seattle's proposed summer impoundment levels and assist the Commission in it's oversight of the license.

**Terrestrial Resources —** Reservoir fluctuations associated with load following operations would continue to influence the development, distribution, and species composition of riparian and upland habitats within and adjacent to the fluctuation zone; would continue to result in the loss of wildlife habitats through erosion; and would continue to influence habitats occupied by rare plant species.  Implementation of the TRMP would offset these effects by actively managing 749 acres of Seattle-owned lands within the project boundary for the benefit of wildlife and plant communities; monitoring and controlling noxious weeds on all project lands to protect existing habitats; monitoring populations and distribution of rare plants to determine if specific management actions are warranted; monitoring nesting bald eagles, peregrine falcons, and bank swallows to evaluate project-related recreation disturbance and to determine the need for management actions; and acquiring and managing about 158 acres of riparian and upland habitat and about 13,022 lineal feet of various habitats adjacent to stream channels to benefit federally listed species and big game.  The shoreline management program would protect terrestrial resources from shoreline land uses incompatible with management objectives.

**Threatened and Endangered Species** —The suite of proposed measures proposed in the TRMP could have long-term benefits for the grizzly bear, Canada lynx, and woodland caribou.

**Recreation Resources —** Implementation of the RRMP would enhance recreational opportunities at the project through upgrading the Vista House and Tailrace Recreation Area with accessible vault toilets and pathways, and updated signage in the Visitor's Gallery near the Tailrace Recreation Area; developing a new trailhead, trail and viewpoint at Peewee Falls and Riverside Mine Canyon; constructing a new trail connecting Peewee Falls and Riverside Mine Canyon viewpoints (Eastside Trail); developing Metaline Falls Portage Trail and boater access; extending Metaline

Waterfront Park boat launch and adding accessible parking, toilets, and paths to the park; adding, as appropriate, fire rings, picnic tables, tent pads, watercraft landing sites, bulletin boards, and primitive sanitation systems to six dispersed recreation sites. Boating would be improved in the reservoir through the control of aquatic macrophytes. Through staff's modification to the plan, these measures would be completed under a defined schedule.

**Land Use —** The proposed boundary modifications would bring in lands that are, and would continue to be, used to meet project purposes of operation and maintenance, recreation access, and wildlife management; would adjust the project boundaries to include a buffer zone consistent with Commission policies and provide greater protection of environmental resources under the new license; and would include roads used primarily or solely for project purposes. Removal of groundwater monitoring wells and spur roads used to access the wells that are no longer needed for project purposes would reduce in a small way the number of roads in the area which would benefit wildlife and conform to Forest Service land management guidelines.

**Cultural Resources —** Implementation of the HPMP would ensure protection of cultural resources.

*No Action Alternative*

Under this alternative, the project would continue to operate under the terms and conditions of the existing license, and no new environmental protection or enhancement measures would be implemented. We use this alternative to establish baseline conditions against which we evaluate the other alternatives and judge the benefits and costs that might be required under a new license.

<u>Conclusions</u>

Based on our analysis, we recommend licensing the project as proposed by Seattle with staff's modifications (i.e., staff's alternative).

In section 4.2 of the EIS, we estimate the likely cost of alternative power for each of the four alternatives identified above. Our analysis shows that during the first year of operation under the no-action alternative, project power would cost $97.2 million, or $20.20 per megawatt-hour (MWh) less than the likely alternative cost of power. Under the proposed action, project power would cost $68.7 million, or $19.24/MWh less than the likely alternative cost of power. Under the staff alternative, project power would cost $68.9 million, or $19.30/MWh less than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $68.7 million, or $19.22/MWh less than the likely alternative cost of power.

We chose the staff alternative, as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (3,612,588 MWh annually); (2) the project could save an equivalent amount of fossil-fueled generation and capacity, which may help conserve non-renewable energy resources and reduce atmospheric pollution, including greenhouse gases; (3) the recommended environmental measures proposed by Seattle, as modified by staff, would adequately protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

**Sullivan Creek Project**

Project Description

The Sullivan Creek Project was constructed in 1909 by the Inland Portland Cement Company to supply electricity to Metaline Falls. It consisted of Sullivan Lake dam, Sullivan Lake, Mill Pond dam, Mill Pond, an intake structure on Mill Pond, a wooden flume, a canal, a tunnel, and powerhouse. The project, which operated to generate power under a Forest Service permit, was decommissioned in 1956 after a portion of the project's wooden flume collapsed. The turbines were removed from the powerhouse in 1958 and the turbine bays filled with rocks and gravel; the intake on Mill Pond was removed; and the remaining facilities were abandoned in place. The Federal Power Commission (now the FERC) issued a license for the project to the District in 1958 as a storage project benefiting generation at downstream projects, with the possibility of restoring generation at the site if it were economically feasible to do so. The District did not restore the project's generating facilities during the term of the license. The District's license for the Sullivan Creek Project expired on October 1, 2008, and the project is currently under an annual license.

Sullivan Lake is fed by Harvey, Noisy, and Hall creeks; flow from Sullivan Lake discharges into Outlet Creek, which joins Sullivan Creek about one-half of a mile downstream from Sullivan Lake dam. The District maintains Sullivan Lake at full pool (elevation 2,588.66 feet) from June 1 through September for recreation. Starting on October 1, the District begins lowering Sullivan Lake to reach an elevation of 2,565 feet, typically by December 31, at which time outflow to Outlet Creek is equal to inflow. About 31,000 acre-feet of water is released to provide storage for spring run-off and downstream generation. The lake is maintained at about 2,565 feet until April 1, when the spillway gates are closed and the reservoir is slowly raised to full pool, typically by May 31. A minimum flow of 10 cfs is maintained in Outlet Creek from discharges and leakage year-round.

Mill Pond dam consists of a 134-foot-long, 55-foot-high concrete dam, with an 850-foot-long earthen dike. Mill Pond dam has an uncontrolled spillway located in the center of the dam that passes all flow captured from Sullivan Creek and Outlet Creek.

Project Proposal and Environmental Measures

The District proposes to remove Mill Pond dam, and retain and operate Sullivan Lake dam under a special use authorization (SUA) from the Forest Service. The inoperable wooden flume, canal, tunnel, and powerhouse would be left in place. Once the FERC license is terminated, which would occur following the removal of Mill Pond dam and restoration of Sullivan Creek (about 8 years after the Commission's order authorizing the surrender), the Sullivan Lake dam would come under the authority of the

Washington State Dam Safety Office and the Forest Service. The District would continue to be responsible for all dam operations and maintenance under the terms of the Forest Service special use authorization.

Within three years of the Commission's surrender order, the District would install and maintain a cold water release structure on Sullivan Lake dam to lower summer and fall temperatures in Sullivan Creek; the District would screen the intake to prevent fish entrainment. The District would increase instream flows to improve aquatic habitat and provide whitewater boating opportunities in Outlet and Sullivan Creeks; manage operations to control maximum discharge rates, up-ramping (no more than 80 cfs per day) and down-ramping rates (limited to 10 cfs per hour), and achieve temperatures in Sullivan Creek below the confluence of Outlet Creek that do not exceed 14 ºC or change average daily temperatures by more than 2 ºC when flows are less than 14 ºC to protect and improve aquatic habitat in Sullivan Creek; begin lowering Sullivan Lake the day after Labor Day (about one month sooner) to improve kokanee spawning habitat in Harvey Creek; and install gages and temperature monitoring devices to document compliance with lake elevation targets, discharge flows, ramping rates, and temperatures. To help ensure that there is adequate water to refill Sullivan Lake in the spring and provide for minimum discharge requirements, the District would maintain a minimum winter pool elevation of 2,570 (five feet higher than currently operated); then, as it does now, it would begin refilling the reservoir by April 1 to reach full pool by May 31, subject to hydrologic conditions, discharge constraints, and operating emergencies beyond the control of the licensee. During high run-off years (120% of long-term average); Sullivan Lake would be held at elevation of no higher than 2,575 feet until May 20 to facilitate mobilization of sediment at the confluence of Harvey Creek and Sullivan Lake to improve fish access in Harvey Creek (Harvey Creek bedload mobilization project). If the District releases storage from Sullivan Lake from June through September to support the Department of Ecology's Columbia River Supply Program, as proposed, it would manage the releases so as not to exceed two-times the minimum flow requirement, ensure flows are released at a steady rate, and conform to temperature and ramping rate constraints to protect aquatic habitat in Sullivan Creek.

The District would remove Mill Pond dam and restore Sullivan Creek from Mill Pond dam up to its confluence with Outlet Creek. Restoration would include stabilizing sediments left in place, revegetating the inundated area to native plant communities, controlling noxious weeds, and restoring the stream channel and adjacent uplands to a natural riverine environment consistent with the Sullivan Creek channel upstream of, and downstream from, Mill Pond. The restored stream channel, floodplain, and upland area would be designed to function up to, and including a flood event having a 100-year flood recurrence interval. The newly constructed stream channel banks would be stabilized with keyed-in logs, root wads and large boulders, and then planted with native herbaceous and woody riparian species. The District would complete a Department of Archaeology and Historic Preservation (DAHP) Level II mitigation documentation report of Mill Pond dam facilities prior to removing the dam to mitigate the long-term loss of historic structures eligible for listing on the Natural Register.

Alternatives Considered

This EIS considers the following alternatives: (1) the District's proposal, as described above, (2) the District's proposal with staff modifications (staff alternative), and (3) no-action, meaning that the project would continue to operate with no changes.

The staff alternative includes all of the District's proposed measures, except that there would not be a requirement to release flows to support Ecology's Columbia River Basin Water Supply Program as contemplated by the settlement. While we do not object to the water supply program releases so long as they conform to the discharge constraints described above, we do not contemplate the need to authorize the releases. The staff alternative also slightly modifies the characterization of Sullivan Lake operations to include specific lake elevation requirements, subject to hydrologic conditions, discharge requirements, and operating emergencies beyond the licensee's control. In addition, the staff alternative includes the following additional measures: the development of a Sullivan Lake Operation Compliance Monitoring Program; development of a more detailed revegetation plan to be filed with the final Mill Pond Decommissioning Plan; and completion of DAHP Level II mitigation documentation of all elements of the Sullivan Creek Historic District (in addition to Mill Pond dam) found on District-owned lands, within the project boundary. The Commission would retain jurisdiction over the Sullivan Creek Project until the Commission has determined that the District's work required by the Mill Pond Decommissioning Plan has been completed; however, once the Commission ends it jurisdiction over the Sullivan Creek Project, the Commission can no longer ensure that the District would operate the Sullivan Lake dam in a manner that complies with the lake level and flow requirements of the settlement.

Project Effects

*Staff Alternative*

**Aquatic Resources** — Water temperatures in Sullivan Creek would be enhanced by installing and managing discharges through the cold water release structure at Sullivan Lake dam; managed flow releases would prevent temperatures from exceeding state water quality standards and help achieve temperatures closer to those preferred by native salmonids, including bull trout. Screening the cold water release structure would reduce entrainment loss from the lake. Constraints on maximum flow discharges and ramping rates would reduce scour, prevent rapid changes in flows, reduce the potential for stranding, prevent thermal shock, and decrease energy demands on fish that occupy Outlet and Sullivan Creeks. Higher and more consistent minimum flows would increase available fish habitat, reduce adverse effects of dewatering spawning substrate, and enhance the forage base for fish. Lowering Sullivan Lake earlier in the fall would make Harvey Creek kokanee spawning beds available sooner, potentially increasing kokanee spawning success and reducing redd superimposition. The Harvey Creek bedload mobilization project may reduce sediment buildup at the head of Sullivan Lake, improving access for kokanee and cutthroat trout to habitats in Harvey Creek. Based on the draft Forest Service special use authorization conditions contained in the settlement agreement, the above benefits would likely continue after the license surrender becomes effective; however, because the Commission would no longer have any authority over the District, it could not guarantee that the measures would continue to be implemented or maintained.

An operation compliance monitoring plan would provide a mechanism to document compliance with the various flows, reservoir levels, and temperature requirements, facilitating the Commission's oversight of the operations until the surrender becomes effective.

Removing Mill Pond dam and restoring Sullivan Creek from the dam to the confluence with Outlet Creek would remove a fish passage barrier in the vicinity of the Boundary Project, providing potential access to 16 miles of spawning, rearing, overwintering, and foraging habitat. This action would also restore sediment and LWD transport to the lower portion of Sullivan Creek, increasing habitat complexity and available spawning gravels for resident trout, including bull trout. These measures would help promote recovery of bull trout in the lower Pend Oreille River.

**Terrestrial Resources** — Construction activities would result in minor, short-term disturbances of wildlife and the loss of about one-half of an acre of upland coniferous forest. Removal of Mill Pond would result in the conversion of a 63-acre lake preferred by waterfowl and other lake-oriented wildlife to a natural stream preferred by riparian obligate and dependant species. The District's Mill Pond Decommissioning Plan contained a general description of the types of plantings that would be used in different hydrologic zones around Sullivan Creek, and a commitment to control noxious weeds. Staff's recommendation to develop a detailed revegetation plan would ensure that the final Mill Pond dam removal plan contains sufficient information to ensure the efficacy of the planting program.

**Threatened and Endangered Species** — Removal of Mill Pond dam and restoration of Sullivan Creek would remove a fish passage barrier in the vicinity of the Boundary Project, providing potential access for bull trout to 16 miles of spawning, rearing, overwintering, and foraging habitat. Deconstruction activities may disturb woodland caribou, grizzly bear, and lynx, but effects would be short-term, minor and not detectable because of limited use of the area.

**Recreation** — Because Sullivan Lake would begin to be lowered about one month earlier, recreational access to Sullivan Lake would be reduced from the day after Labor Day to October 1, relative to existing operations. Effects would be minor because the drawdown would occur after the primary recreation season and because the District would repair the existing docks and ramps to ensure they continue to function under the new operations; the repairs would be made prior to implementing the new operations. Whitewater boating on Sullivan Creek would be enhanced by providing flows between

180 and 220 cubic feet per second (cfs) on at least three weekends in September or October, subject to available water; flows would be posted online one week in advance. Removal of Mill Pond would eliminate a lake fishing opportunity.

**Cultural Resources** — All cultural resources associated with the Sullivan Creek Historic District on District-owned lands within the project boundary would be properly recorded before removing Mill Pond dam and before federal oversight is terminated.

*No Action Alternative*

The District would continue to operate the Sullivan Creek Project as it does now. Mill Pond dam would not be removed. Environmental conditions would remain the same and no enhancement of environmental conditions would occur.

Conclusions

Based on our analysis, we recommend surrendering the project as proposed by the District with staff's modifications (i.e., staff's alternative).

In section 4.2 of the EIS, we compare the cost of the District's proposal with that proposed by staff. Surrendering the license as proposed by the District would cost $18,180,920 ($1,034,720 annualized over 30 years, including annual operations and maintenance). Staff's operation compliance monitoring plan would cost about $20,000 (or $1,020 annualized over 30 years) to develop and implement. DAHP Level II mitigation documentation of the remaining contributing elements to the Sullivan Lake Historic District would cost $50,000 ($2,550 annualized over 30 years). These two measures would bring the total cost for the surrender of the Sullivan Creek Project to $18,258,420 ($1,038,670 per year). Staff's revegetation plan would not increase the cost of dam removal because the District contemplated developing more detail than provided in its draft plan.

We chose the staff alternative as the preferred alternative because: (1) the District's proposal would foster the orderly disposition of the District's license; (2) removal of Mill Pond dam and restoration of Sullivan Creek would help promote the recovery of the listed bull trout and enhance conditions for native salmonids; (3) installation of the cold water intake and changes in operation of Sullivan Lake would improve aquatic habitat in Sullivan Creek and complement Seattle's and the state's efforts to reduce temperatures in the Pend Oreille River; (4) continued operation of Sullivan Lake would continue to provide for established recreation; (5) DAHP Level II mitigation documentation would mitigate adverse effects on cultural resources; (6) the proposal would restore federal lands; and (7) additional staff measures would assist the Commission with its oversight of the license until the surrender becomes effective and would further protect environmental resources.

# 1.0 INTRODUCTION

As described further below, the Commission received an application to relicense the City of Seattle's (Seattle) Boundary Hydroelectric Project No. 2144 (Boundary Project) and an application to surrender the Public Utility District No. 1 of Pend Oreille County's (District) Sullivan Creek Project No. 2225 (Sullivan Creek Project). Seattle and the District also jointly filed settlement agreements resolving issues in their respective proceedings. While these are separate actions before the Commission, the measures proposed in the interdependent settlement agreements are intended to provide significant benefits to resources within the Pend Oreille River and its tributaries, while retaining Seattle's operational flexibility for the Boundary Project and reducing costs of the Sullivan Lake Project surrender on Pend Oreille rate payers. This Environmental Impact Statement (EIS) assesses the effects of the actions associated with implementing the settlement agreements, as well as staff's modifications and recommendations related to both agreements.

## 1.1 APPLICATIONS

### 1.1.1 Boundary Hydroelectric Project License

On September 29, 2009, Seattle filed an application to relicense its 1,003.253-megawatt (MW) Boundary Hydroelectric Project, located on the Pend Oreille River in Pend Oreille County, Washington (figure 1-1). The Boundary Project is operated in a load-following mode that shapes available water to deliver power during peak-load hours. The project produces an average of 3,572.8 gigawatt-hours (GWh) of energy annually. The project currently occupies 938.59 acres of federal lands, 609.24 acres managed by the U.S. Department of Agriculture, Forest Service (Forest Service) on the Colville National Forest, and 329.35 acres managed by the U.S. Bureau of Land Management (BLM).

Seattle proposes to continue to operate the project in a load-following manner, but with formalization of currently voluntary measures, including water surface elevation restrictions from Memorial Day to Labor Day for recreation enhancement, and turbine unit sequencing to reduce total dissolved gas (TDG) production associated with non-spill operations.

The project has six turbine generating units numbered Unit 51 through 56. Seattle proposes to upgrade the turbine runners in Units 55 and 56 to increase turbine efficiency. The turbine runner upgrades would be performed concurrently with planned electrical generator rewinds and step-up transformer replacements. Seattle estimates that the project generation would increase by 39,838 MWh after completion of the upgrades. Seattle also plans to rewind the generators and replace the runners and transformers for Units 51 through 54 during the new license term; however, maintenance activities for these turbines are not anticipated to result in an increase in capacity or generation.

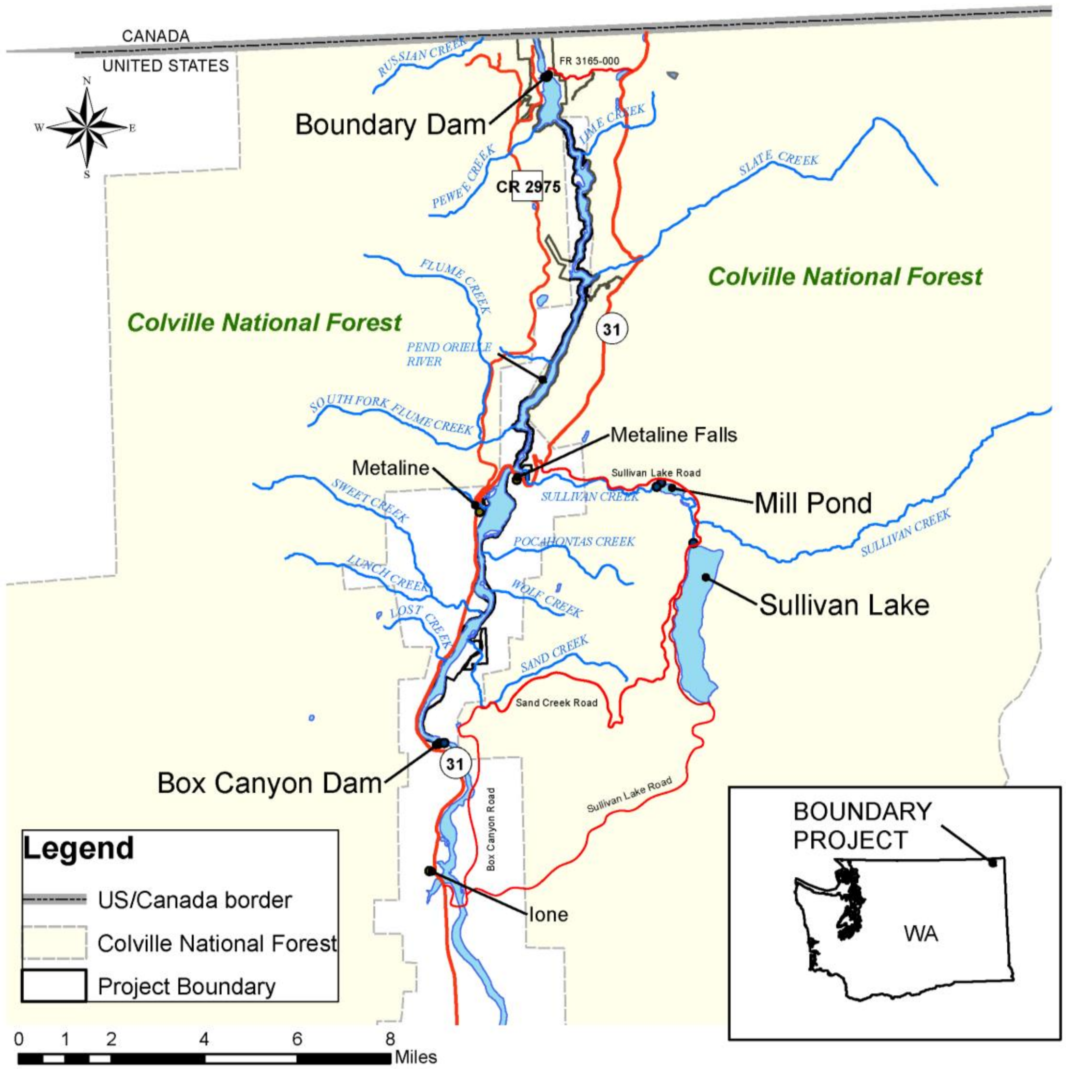



Figure 1-1. Location of the Boundary and Sullivan Creek Projects (Source: application, as modified by staff).

### 1.1.2 Surrender of Sullivan Creek Project License

On April 2, 2010, the District filed an application to surrender its license for the Sullivan Creek Project, located on Sullivan Lake, and Sullivan and Outlet Creeks in Pend Oreille County, Washington (figure 1-1). Sullivan Lake was a natural glacial lake that is fed by Harvey, Noisy, and Hall Creeks. Construction of the Sullivan Lake dam raised the natural elevation of Sullivan Lake. Outlet Creek flows from Sullivan Lake and joins Sullivan Creek approximately 0.5 miles downstream of the dam. Sullivan Creek joins the Pend Oreille River within the Boundary reservoir and is the largest tributary to the

Boundary reservoir. The Sullivan Creek Project occupies 522 acres of federal lands managed by the Forest Service.

The District obtained a license from the Federal Power Commission, the FERC's predecessor, in 1958 to operate the Sullivan Creek Project as a storage project for the benefit of generation at downstream projects. The conditions of the license included the possibility of restoring the project's generating capabilities later if it were economically feasible to do so, but it was later determined that resuming generation at the project would not be economic, and plans to rebuild the project were never implemented. The District continues to operate the Sullivan Creek Project as a storage facility for downstream generation in accordance with the Pacific Northwest Coordination Agreement. The District's license for the Sullivan Creek Project expired on October 1, 2008. It is currently operating under annual licenses.

A detailed description of the District's proposal is provided later. In brief, the District proposes to remove Mill Pond dam, and retain and operate Sullivan Lake dam under a SUA from the Forest Service. Other components of the project would be left in place after appropriate cultural resource documentation. Once the FERC license is terminated, the Sullivan Lake dam would come under the authority of the Washington State Dam Safety Office and the Forest Service for regulation of dam safety.

### 1.1.3 Boundary and Sullivan Creek Settlement Agreements

On March 29, 2010, Seattle and the District jointly filed an offer of settlement, two comprehensive settlement agreements, a joint explanatory statement, and a request to consolidate the processing of Seattle's relicensing of the Boundary Project with the District's surrender of its license for the Sullivan Creek Project. The offer consists of two separate, but interdependent settlement agreements detailing the measures that Seattle would implement to address the effects of continued load-following operations of the Boundary Project and the District's orderly disposition of the Sullivan Creek Project. The settlement agreements were reached among Seattle, the District, Forest Service, U.S. Fish and Wildlife Service (FWS), U.S. Bureau of Indian Affairs (BIA), U.S. National Park Service, Washington Department of Ecology (Ecology), Washington Department of Fish and Wildlife (Washington DFW), Selkirk Conservation Alliance, Kalispel Tribe, Town of Cusick, Washington, the Lands Council, American Whitewater, Allan Six, and Richard Larsen (Settlement Parties).

The Boundary settlement agreement includes obligations for evaluating and providing fish passage for resident salmonids, reducing fish entrainment, improving aquatic habitat, stocking fish for recreational purposes, conserving native fish, groundwater well-decommissioning, acquiring and managing land for wildlife, and other measures for recreation and cultural resource enhancement and protection.

Under the Sullivan Creek settlement agreement, the District would retain and operate under a Forest Service SUA the Sullivan Lake dam and lake; install a new cold-water release facility at Sullivan Lake dam; and remove Mill Pond dam and restore the site and downstream stream channel and conduct short-term monitoring and maintenance in accordance with its filed Mill Pond Decommissioning Plan. The Boundary and Sullivan Creek agreements are linked in that the removal of Mill Pond dam would be carried out by Seattle through an off-license, inter-local agreement with the District; both the District and Seattle would share equally the responsibility for installing cold-water release facility at Sullivan Lake dam, and Seattle would continue to monitor and maintain the restored Mill Pond dam site and stream channel following the termination of the District's license to ensure that restored stream channel is functioning as designed. Linking of these settlement agreements, and the measures contained therein, is intended to provide significant benefits to resources within the Pend Oreille River and its tributaries to the Boundary Project, while retaining Seattle's operational flexibility and reducing costs of the Sullivan Lake Project surrender on Pend Oreille rate payers. Additional detail on Seattle and the District's proposals are provided below.

## 1.2 PURPOSE AND NEED FOR POWER

### 1.2.1 Boundary Project

#### 1.2.1.1 Purpose of Action

The purpose of the action is to authorize the continue operation and production of 1,003 MW hydroelectric power. The Commission must decide whether to issue a license to Seattle for the project and what conditions should be placed in any license issued. In deciding whether to issue a license for a 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, mitigation, 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.

Issuing a new license for the Boundary Project would allow Seattle to generate electricity at the project for the term of a new license, making electric power from a renewable resource available to its customers.

This EIS assesses the environmental and economic effects associated with continued operation of the project and alternatives to proposed project. Important issues assessed in the EIS include water quality (dissolved oxygen and total dissolved gas), fish passage, fish habitat improvements, wildlife habitat enhancements, recreation facility improvements, land and shoreline management, and cultural resource protection measures. Based on the analysis, the EIS also includes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become a part of any license issued.

#### 1.2.1.2 Need for Power

The Boundary Project would provide hydroelectric generation to meet part of Washington's power requirements, resource diversity, and capacity needs. Following the proposed turbine runner upgrades in Units 55 and 56 and rewinding of the generators, the project would have an installed capacity of 1,003 MW and generate an average of approximately 3,612,588 megawatt-hours (MWh) per year.[7]

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Boundary Project is located in the Northwest subregion of the Western Electricity Coordinating Council region of the NERC. According to NERC's 2010 forecast, winter peak demands and annual energy requirements for the Northwest subregion are projected to grow at rates of 1.1 percent and 1.2 percent, respectively, from 2010 through 2019 (NERC, 2010). NERC projects resource capacity margins (generating capacity in excess of demand) will remain above the target reserve margins of 18.6 percent for summer and 20.0 percent for winter during the 10-year forecast period, including estimated new capacity additions. Over the next 10 years, the Northwest subregion estimates that 1,158 MW of future planned capacity will be brought on line.

We conclude that power from the Boundary Project would help meet a need for power in the Northwest subregion in both the short and long term. The project provides low-cost power that displaces non-renewable, fossil-fired generation and contributes to a diversified generation mix. Displacing the operation of fossil-fueled facilities may avoid some power plant emissions and creates an environmental benefit.

### 1.2.2 Sullivan Creek Project

#### 1.2.2.1 Purpose of Action

The purpose of the proposed action is the surrender of the Sullivan Creek Project license and removal of certain project facilities. The Commission must decide under what conditions the license for the Sullivan Creek Project, including the removal of project facilities, can be appropriately surrendered to ensure the protection of the natural and human environment and the restoration of occupied federal lands.

This EIS assesses the effects associated with the approval and implementation of the Sullivan Creek settlement agreement, including removing Mill Pond dam. The principal issues addressed in the EIS include erosion and sedimentation, water quantity

---

[7] The generation presented here includes the average generation based on the average gross amount of annual generation reported by Seattle to the Commission for October, 1999, through September, 2010 (3,572,750 MWh), plus the anticipated increase of 39,838 MWh from the increased efficiency to turbines 55 and 56 following their upgrades.

and quality, bull trout restoration, resident salmonid habitat improvements, recreation, and cultural and historic resource protections.

#### 1.2.2.2 Need for Action

The Sullivan Creek Project was constructed by the Inland Portland Cement Company in 1909 to provide electricity to the city of Metaline. The project operated under a Forest Service permit until it was damaged in 1956. The District subsequently acquired the project and obtained a license in 1958 to operate the Sullivan Creek Project as a storage project for the benefit of generation at downstream projects, with the possibility of restoring generation at the site. Although the District made several attempts to restore generation at the site, each attempt was abandoned because the proposals proved uneconomic. In 2003, the District informed the Commission of its intent not to seek a new license. The Commission issued a notice seeking applications from other interested entities, but no such applications were filed. On July 18, 2007, the Commission determined that a license was not required to continue to operate the project as a storage project because its effect on downstream generation was not significant,[8] but that a surrender application was required for the orderly disposition of project facilities. Thereafter, the District filed a proposal for the surrender of the license and removal of project facilities.

The District proposes to remove Mill Pond dam and restore the natural channel of Sullivan Creek previously inundated by Mill Pond to provide for fish passage and suitable fish habitat through the entire length of Sullivan Creek. The District also proposes to add a cold water release facility to Sullivan Lake dam to further enhance fish habitat downstream of the convergence of Outlet Creek and Sullivan Creek. Removal of Mill Pond dam and habitat enhancements within Sullivan Creek would enhance habitat critical to the recovery of the bull trout, as well as improve habitat conditions for resident salmonids.

## 1.3 STATUTORY REQUIREMENTS

### 1.3.1 Boundary Project

The license for the Boundary Project is subject to numerous requirements under the Federal Power Act (FPA) and other applicable statutes. Major statutory requirements are summarized in table 1-1 and described below.

---

[8] *See Public Utility District No. 1 of Pend Orielle County*. 120 FERC ¶62,045 (July 18, 2007). Also *see Public Utility District No. 1 of Pend Orielle County*. 124 FERC ¶ 61,064 (July 18, 2008); and *Public Utility District No. 1 of Pend Orielle County*. 122 FERC ¶ 61,249 (March 20, 2008) for a detailed review of the procedural history of the surrender of the license

Table 1-1. Major statutory requirements for the Boundary Hydroelectric Project.

| Requirement | Agency | Status |
|---|---|---|
| Section 18 of the FPA (fishway prescriptions) | U.S. Department of the Interior (Interior) – Fish and Wildlife Service (FWS); | FWS prescribed upstream and downstream fishway measures for bull trout, westslope cutthroat trout, and mountain whitefish and reserved its authority to prescribe fishways on September 2, 2010; it amended its prescriptions to be consistent with the Boundary settlement agreement on October 5, 2010. Interior filed modified prescriptions on August 1, 2011. |
| Section 4(e) of the FPA (land management conditions) | Forest Service | The Forest Service provided preliminary conditions on August 24, 2010. |
| Section 10(j) of the FPA | Washington Department of Fish and Wildlife (Washington DFW); FWS | Washington DFW filed section 10(j) recommendations on September 3, 2010; FWS on September 2, 2010 and amended its recommendations on October 5, 2010 to be consistent with the Boundary settlement agreement. |
| Clean Water Act water quality certification | Washington Department of Ecology (Washington Ecology) | Application for water quality certification was filed with, and received by, Washington Ecology on July 25, 2011. Certification is due by July 25, 2012. |
| Coastal Zone Management Act | Ecology | Coastal consistency review not required. |

| Requirement | Agency | Status |
|---|---|---|
| Endangered Species Act consultation | FWS | On April 11, 2011, we requested concurrence from FWS on our “not likely to adversely affect” determinations for bull trout and its critical habitat, Canada lynx, grizzly bear, gray wolf, and woodland caribou. In a letter filed June 6, 2011, FWS did not concur with the finding for bull trout. By letter dated June 8, 2011 we initiated formal consultation with FWS. |
| National Historic Preservation Act | Washington State Historic Preservation Officer (SHPO) | Commission staff will execute programmatic agreement with the SHPO requiring implementation of Historic Properties Management Plan. |
| Pacific Northwest Power Planning and Conservation Act | Northwest Power and Conservation Council | Recommendations in this EIS are consistent with the applicable provisions of the program. |

#### 1.3.1.1 Federal Power Act

**Section 18 Fishway Prescriptions**

Section 18 of the FPA provides that the Commission shall require the construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or Interior, as appropriate. On September 2, 2010, Interior timely filed preliminary fishway prescriptions for the Boundary Project. Interior amended its preliminary prescriptions on October 5, 2010, to conform them to proposed license articles 9(B) and 9(C) contained in the Boundary settlement agreement. Interior filed modified prescriptions on August 1, 2011, acknowledging that their October 5, 2010 prescriptions were unchanged and should be considered final. These conditions are described in section 2.1.2, *Seattle’s Proposal*.

Each of Interior’s filings requests that a reservation of authority to prescribe fishways for bull trout, westslope cutthroat trout, mountain whitefish, and any other fish to be managed, enhanced, protected, or restored to the Pend Oreille River Basin during the license term be included in any license issued for the project.

**Section 4(e) Conditions**

Section 4(e) of the FPA 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. The Forest Service filed 9 preliminary conditions on August 24, 2010. These conditions are described under section 2.1.2.5, *Modifications to the Seattle's Proposal—Mandatory Conditions*.

**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, and enhancement of fish and wildlife resources affected by the project, unless the Commission determines that the recommendations 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 such agency.

Washington DFW and FWS timely filed on September 3, 2010 and September 4, 2010 (amended on October 5, 2010), respectively, recommendations under section 10(j). FWS amended its recommendations on October 5, 2010 to be consistent with the terms of the Boundary settlement agreement. We summarize these recommendations in table 5-2, analyze them in the appropriate resource sections in section 3, and present our conclusions in section 5.1.2, *Comprehensive Development and Recommended Alternative*. We also discuss and address the agency recommendations in section 5.1.4, *Recommendations of Fish and Wildlife Agencies*.

#### 1.3.1.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), the Commission may not issue a license authorizing the construction or operation of a hydroelectric project unless the state water quality certifying agency has either issued a water quality certification for the project or has waived certification by failing to act within a reasonable period of time, not to exceed one year. On September 2, 2010, Seattle applied to Washington Ecology for 401 water quality certification. Ecology received the letter on September 3, 2010. On July 25, 2011, Seattle withdrew and refiled its request for certification. Ecology received the certification application on July 25, 2011. Ecology has not acted on the request. The certification is due by July 25, 2012.

#### 1.3.1.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Three wildlife species and one fish species listed as threatened or endangered under the ESA may occur in the project vicinity: Canada lynx, grizzly bear, woodland caribou, and bull trout.[9] Critical habitat has been designated for bull trout that includes project waters and tributaries to project waters. No federally listed or proposed threatened or endangered plant species are known to occur in the project vicinity. Our analyses of project effects on threatened and endangered species are presented in section 3.7, *Threatened and Endangered Species*, and our recommendations in section 5.1.2, *Comprehensive Development and Recommended Alternative*.

In the draft EIS, we concluded that relicensing of the Boundary Project may affect but is not likely to adversely affect the bull trout and its critical habitat, Canada lynx, grizzly bear, and woodland caribou. On April 11, 2011, we requested FWS' concurrence with our determinations. On June 6, 2011, FWS responded by indicating that it did not concur with our finding for bull trout. FWS cited a lack of information on the project and its effects on the species. FWS also determined that, while not having completed a thorough review of the EIS, three activities would adversely affect bull trout, including trap-and-haul operation, operation of the turbines, and fish surveys. Moreover, FWS says that it has not reviewed the draft EIS to determine whether there is sufficient information in the record to concur on staff's finding for bull trout critical habitat, Canada lynx, grizzly bear, gray wolf (which are no longer subject to section 7 consultation), and woodland caribou. FWS indicates that it will coordinate with Seattle and the District to obtain the necessary information to complete an accurate biological assessment. On June 8, 2011, we initiated formal consultation with FWS.

#### 1.3.1.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The project is not located within the boundary of a designated Coastal Zone Management Program, which includes the nine coastal counties in Washington.[10] On

---

[9] The draft EIS also considered project effects on the gray wolf. On May 5, 2011, after issuance of the draft EIS, FWS removed the Northern Rocky Mountain distinct population segment of the gray wolf, which includes eastern Washington, from the list of threatened and endangered species. Thus, consultation on the gray wolf is no longer necessary.

[10] Washington's Coastal Zone Management Program (CZMP) defines the State's coastal zone to include the 15 counties with marine shorelines: Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish,

January 13, 2011, Ecology notified Seattle that a CZMA certification will not be required for the Boundary Project (email from Marcie Mangold, Ecology to Barbara Greene, City of Seattle, Seattle City Light Department).

#### 1.3.1.5 National Historic Preservation Act

Under section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations, federal agencies must take into account the effect of any proposed undertaking on historic properties, and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on the undertaking. Historic properties are districts, sites, buildings, structures, traditional cultural properties (TCPs), and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the operation of the Boundary Hydroelectric Project. The terms of the PA would ensure that Seattle addresses any effects on historic properties identified within the project's area of potential effects through the implementation of Seattle's Historic Properties Management Plan (HPMP).

#### 1.3.1.6 Pacific Northwest Power Planning and Conservation Act

Under section 4(h) of the Pacific Northwest Power Planning and Conservation Act, the Northwest Power and Conservation Council developed the Columbia River Basin Fish and Wildlife Program to protect, mitigate, and enhance the operation of the hydroelectric projects within 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 shall take into account, to the fullest extent practicable, the program adopted under the Pacific Northwest Power Planning and Conservation Act.

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). The provisions that apply to the proposed project call for specific plans for: improving fish passage and aquatic habitat, decreasing TDG and improving water temperatures, reducing fish entrainment, building fish hatchery

---

Thurston, Wahkiakum, and Whatcom counties. The CZMP applies to activities within the 15 counties as well as activities outside these counties, which may impact Washington's coastal resources. Most, but not all, activities and development outside the coastal zone are presumed to NOT impact coastal resources (see: http://www.ecy.wa.gov/programs/sea/czm/fed-consist.html).

facilities, and acquiring and managing wildlife habitats. Our recommendations in this EIS are consistent with the applicable provisions of the program, listed above.

### 1.3.2 Sullivan Creek Project

Major regulatory and statutory requirements associated with the surrender of the Sullivan Creek Project are summarized in table 1-2 and described below.

Table 1-2. Major statutory requirements for the Sullivan Creek Project.

| Requirement | Agency | Status |
|---|---|---|
| Clean Water Act water quality certification | Washington Department of Ecology (Washington Ecology) | The District withdrew and refiled its original application for water quality certification on April 1, 2011. Certification is due by April 1, 2012. |
| Endangered Species Act consultation | U.S. Department of the Interior − Fish and Wildlife Service (FWS) | On April 11, 2011, we requested concurrence from FWS on our "not likely to adversely affect" determinations for bull trout and its critical habitat, Canada lynx, grizzly bear, gray wolf, and woodland caribou. In a letter filed June 6, 2011, FWS did not concur with the finding for bull trout. By letter dated June 8, 2011, we initiated formal consultation with FWS.. |
| Coastal Zone Management Act | Ecology | Coastal consistency review not required. |
| National Historic Preservation Act | Washington State Historic Preservation Officer (SHPO) | Commission staff will execute memorandum of agreement with the SHPO requiring implementation of a treatment plan for all contributing elements of Sullivan Creek Historic District. |

#### 1.3.2.1 Clean Water Act

If a surrender application involves an activity that may result in a discharge, the applicant must request water quality certification from the water quality certifying agency that the proposed action will comply with applicable requirements of the CWA. The

District submitted its request for certification on April 2, 2010 and Ecology received the request on April 6, 2010. On April 1, 2011, the District withdrew and resubmitted its request for certification. Ecology has not acted on the request. The certification is due by April 1, 2012.

#### 1.3.2.2 Endangered Species Act

As noted above for the Boundary Project, three wildlife species and one fish species listed as threatened or endangered under the ESA may occur in the project vicinity: Canada lynx, grizzly bear, woodland caribou, and bull trout. Critical habitat has been designated for bull trout that includes project waters and tributaries to project waters. No federally listed or proposed threatened or endangered plant species are known to occur in the project vicinity. Our analyses of the effects of the proposed surrender on threatened and endangered species are presented in section 3.7, *Threatened and Endangered Species*, and our recommendations in section 5.2.2, *Recommended Alternative*.

In the draft EIS, we concluded that the proposed actions to be taken in connection with surrendering the Sullivan Creek Project may affect, but are not likely to adversely affect, the bull trout and its critical habitat, Canada lynx, grizzly bear, and woodland caribou. On April 11, 2011, we requested FWS' concurrence with our determinations. On June 6, 2011, FWS responded by indicating that it did not concur with our finding for bull trout. FWS cited a lack of information on the project and its effects on the species. FWS also determined that, while not having completed a thorough review of the EIS, three activities would adversely affect bull trout, including trap-and-haul operation, operation of the turbines, and fish surveys.[11] Moreover, FWS says that it has not reviewed the draft EIS to determine whether there is sufficient information in the record to concur on staff's findings for bull trout critical habitat, Canada lynx, grizzly bear, gray wolf (which are no longer subject to section 7 consultation), and woodland caribou. FWS indicates that it will coordinate with Seattle and the District to obtain the necessary information to complete an accurate biological assessment. On June 8, 2011, we initiated formal consultation with FWS.

#### 1.3.2.3 Coastal Zone Management Act

As noted above for the Boundary Project, the Sullivan Creek Project is not located within the boundary of a designated Coastal Zone Management Program and actions taken in connection with surrendering the license would not directly affect resources within the boundary of a designated coastal zone. Under the terms of the settlement

---

[11] In finding that it did not concur with our not likely to adversely affect determination, FWS did not distinguish between the actions of relicensing the Boundary Project and the surrender of the Sullivan Creek Project, noting without elaboration that additional information would be needed to initiate formal consultation.

agreement and the terms of a memorandum of agreement (MOA) with Ecology's Office of the Columbia River, the District may sell or lease at least 5,000 acre-feet (ac-ft) of water from storage in Sullivan Lake for use during the summer months (June 1 to August 31) outside the Sullivan Creek drainage. This water would be used for the benefit of downstream resources all the way to the ocean. However, Ecology already considered the beneficial effects in its Columbia River Programmatic EIS[12] and Lake Roosevelt Supplemental EIS;[13] and relative to the volume of water (millions of acre-feet) considered under the Columbia River Program, the effects the District's discharges on coastal resources would be small and difficult to quantify. Therefore, we find that surrendering the project license would not affect coastal resources, and thus are not subject to Washington coastal zone program review. As a result, no consistency certification is needed.

#### 1.3.2.4 National Historic Preservation Act

To meet the requirements of section 106, the Commission intends to execute a MOA for the protection of historic properties from the effects of surrendering the license for the Sullivan Creek Project. The MOA would provide for a treatment plan to address any potential adverse effects to historic properties that might result from the license surrender.

## 1.4 PUBLIC REVIEW AND CONSULTATION

The Commission's regulations (18 CFR, sections 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license or to surrender its existing license (18 CFR 16.8). This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act, the National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

### 1.4.1 Scoping

Under the Commission's regulations, issuing a licensing decision for a hydroelectric project generally requires preparation of either an environmental assessment (EA) or an environmental impact statement (EIS), in accordance with the National Environmental Policy Act of 1969. Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed in the Commission's environmental analysis. On June 19, 2006, the Commission issued a

---

[12] The EIS can be found on Ecology's web page at: http://www.ecy.wa.gov/programs/wr/cwp/eis.html.

[13] The EIS can be found on Ecology's web page at: http://www.ecy.wa.gov/programs/wr/cwp/cr_lkroos.html.

scoping document (SD1) to interested agencies and others regarding the relicensing of Seattle's Boundary Project. The Commission issued notice of SD1 in the Federal Register on June 29, 2006. Two scoping meetings, both advertised in *The Spokesman-Review (Chronicle)-Pend Oreille*, were held on July 18 and 19, 2006, in Spokane and Metaline Falls, Washington, respectively, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, we received written comments from Ecology (filed August 29, 2006), the Selkirk Consolidated School District (September 1, 2006), FWS (September 6, 2006), Colville Confederated Tribes (September 1, 2006), and Forest Service (September 7, 2006). A revised scoping document addressing these comments was issued on September 28, 2006.

On May 11, 2010, following the filing of Seattle's and the District's settlement agreements and motion to consolidate the proceedings, the Commission solicited scoping comments on the surrender of the Sullivan Creek Project and issued notice of a June 10, 2010, technical conference to be held in Spokane, Washington, to discuss the joint settlement agreements and the scope of issues to be addressed in a combined environmental assessment for both projects. The Commission published notice of the scoping meeting and technical conference in the Federal Register on May 18, 2010, and in *The Spokesman-Review (Chronicle)-Pend Oreille.* The meeting was transcribed by a court reporter and the comments are part of the record. In addition to the oral comments, written comments were filed by Pend Oreille County on June 25, 2010, but were latter withdrawn on October 4, 2010, after reaching a off-license agreement on payments in lieu of taxes with Seattle. Comments were also filed by Ecology on June 30, 2010. This EIS addresses Ecology's comments.

Based on the comments received at the technical conference and in response to the Commission's July 6, 2010, *Notice of Application Ready for Environmental Analysis and Soliciting Comments, Recommendations, Preliminary Terms and Conditions, and Preliminary Fishway Prescriptions* (REA notice) for both projects, Commission staff has determined that relicensing of the Boundary Project may constitute a major federal action significantly affecting the quality of the human environment. On September 16, 2010, the Commission issued notice of its intent to prepare an EIS; the notice was published in the Federal Register on September 22, 2010. No additional comments were received.

### 1.4.2 Interventions

#### 1.4.2.1 Boundary Project

On October 28, 2009, the Commission issued a notice that Seattle had filed an application to relicense the Boundary Project. This notice set December 28, 2009, as the deadline for filing protests and motions to intervene. In response to the notice, the entities identified below filed motions to intervene; none filed in opposition to the project. Pend Oreille County filed a protest to relicensing the Boundary Project on

December 24, 2009, but withdrew the protest on October 4, 2010, and now supports the relicensing of the Boundary Project.

| Intervener | Date of Filing |
|---|---|
| Kalispel Tribe of Indians | January 22, 2010 |
| Public Utility District No. 1 of Pend Oreille County | January 20, 2010 |
| Pend Oreille County | December 24, 2009 |
| U.S. Department of the Interior | December 22, 2009 |
| Washington Department of Ecology | December 1, 2009 |
| Washington Department of Fish and Wildlife | November 25, 2009 |
| U.S. Forest Service | November 20, 2009 |

#### 1.4.2.2 Sullivan Creek Project

On July 6, 2010, the Commission issued a notice that the District had filed an application to surrender its license for the Sullivan Creek Project. This notice set September 6, 2010, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene; none filed in opposition to the project:

| Intervener | Date of Filing |
|---|---|
| American Whitewater | July 19, 2010 |
| Ecology | July 21, 2010 |
| Washington DFW | July 21, 2010 |
| Kalispel Tribe of Indians | July 22, 2010 |
| Seattle City Light | July 27, 2010 |
| The Lands Council | July 29, 2010 |
| Selkirk Conservation Alliance | August 3, 2010 |
| Forest Service | August 26, 2010 |
| Interior | September 1, 2010 |

### 1.4.3 Comments on the License Application

A ready for environmental analysis notice soliciting comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions for the Boundary Project was issued on July 6, 2010. The following entities filed comments: Sweet Creek residents (on August 9 and September 3, 2010), Forest Service (August 24, 2010), Interior (September 2, 2010), and Washington DFW (September 3, 2010). On October 5, 2010, Interior filed revised conditions consistent with the proposed settlement agreement. On October 19, 2010, Seattle filed reply comments to Forest Service, Interior, Washington DFW, and Sweet Creek resident’s comments.

On July 6, 2010, the Commission also issued a ready for environmental analysis notice for the surrender of the Sullivan Creek Project, soliciting comments and recommendations on the surrender. The following entities filed comments and recommendations: Forest Service (on August 26, 2010), Interior (September 2, 2010), and Washington DFW (September 3, 2010).

### 1.4.4 Settlement Agreements

As stated previously, on March 29, 2010, Seattle and the District filed settlement agreements for the relicensing of the Boundary Hydroelectric Project and the surrender of the Sullivan Creek Hydroelectric Project and a motion to consolidate the application processes. The Commission issued notice of the filing of the settlement agreements on April 1, 2010, requesting comments on the settlement agreements to be filed by April 19, 2010. Although no comments were filed in response to the notice, the settlement parties supported the settlement agreement in their comments in response to the ready for environmental analysis notice described in section 1.4.3, *Comments on the License Applications*.

### 1.4.5 Draft EIS

Commission staff issued its draft environmental impact statement (draft EIS) for the proposed relicensing of the Boundary Project and the proposed surrender of license for the Sullivan Creek Project on April 8, 2011. Staff held public meetings in Metaline Falls and Spokane, Washington on May 10 and 11, 2011, respectively, to solicit comments on the draft EIS. Staff requested written comments on the draft EIS be filed by May 31, 2011.

The following entities and individuals filed comments on the draft EIS.

| Commenting Entity | Date Filed |
|---|---|
| U.S. Environmental Protection Agency (EPA) | May 20, 2011 |
| Forest Service | May 27, 2011 |
| Washington DFW | May 27, 2011 |
| Seattle | May 27, 2011 |
| The District | May 27, 2011 |
| Ecology | May 31, 2011 |
| U.S. Department of the Interior (Interior) | May 31, 2011 |
| Kalispel Tribe | May 31, 2011 |
| Ms. Carol Jean Merrill | May 31, 2011 |
| Sweet Creek Ranch Residents (Sweet Creek residents) | June 6, 2011 |

| | |
|---|---|
| Mr. Larry Gragg, *et al*. | June 6, 2011 |
| National Marine Fisheries Service (NMFS) | June 8, 2011 |

We also received comments from several residents and agency representatives during the May 10 and 11, 2011 meetings. We summarize the substance of the comments received, provide responses to those comments, and explain how the text of the draft EIS was modified, as appropriate, to address the comments in appendix C.

## 2.0 PROPOSED ACTION AND ALTERNATIVES

### 2.1 BOUNDARY PROJECT

#### 2.1.1 No-Action Alternative

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives assessed in the EIS. Under the no-action alternative, the project would continue to operate under the current terms and conditions of its existing license. The no-action alternative also assumes continued implementation of any existing voluntary environmental measures.

##### 2.1.1.1 Existing Project Facilities

The Boundary Project includes: the 340-foot-high, 740-foot-long concrete arch Boundary dam impounding a 1,794-acre reservoir at a normal full pool elevation of 1,994 feet[14] with 40,843 acre-feet of active storage between elevations 1,994 feet and 1,954 feet; two 50-foot-wide, 45-foot-high spillways fitted with radial gates, one on each abutment; a 26-foot-wide, 9-foot-high hinged-leaf skimmer gate adjacent to the left spillway (no longer in service); seven 21-foot-high, 17-foot-wide, low-level vertical fixed-wheel sluice gates[15] in the dam; a 35-foot-wide, 57-foot-high sluice maintenance gate on the upstream face of the dam; power intake facilities excavated on the left abutment area of the dam, which consist of an approximately 800-foot-long, 300-foot-wide forebay, a trashrack structure across the entrance to the forebay, and the portal face with six 30-foot-wide, 34-foot-high horseshoe-shaped tunnels extending to intake gate chambers; six penstocks, each of which has a 165-foot-long, 24-foot-wide, 34-foot-high section at the intake to a 26-foot-diameter concrete-lined section, and a 150-foot-long, 26 to 20-foot-diameter steel-lined section; an underground power plant containing a 477-foot-long, 76-foot-wide, 172-foot-high machine hall with six Francis turbine/generator units with a total authorized generating capacity of 1,003.253 megawatts (MW); six draft tubes that discharge water from the turbines into the tailrace immediately below the dam; six horseshoe-shaped transformer bays for six three-phase, 230-kilovolt (kV) transmission lines; and appurtenant facilities.

Three Seattle-owned and -managed recreation areas are within the project boundary: the Forebay Recreation Area, the Tailrace Recreation Area/Machine Hall Visitors' Gallery, and the Vista House. The existing generating features, recreation facilities, and proposed additions to the project boundary in the vicinity of the dam and powerhouse are shown on figure 2-1.

---

[14] All elevations that refer to the Boundary Project in this document are listed as North American Vertical Datum 88 (NAVD 88) unless otherwise noted.

[15] The sluice gates have a crest elevation of 1,795.5 feet.

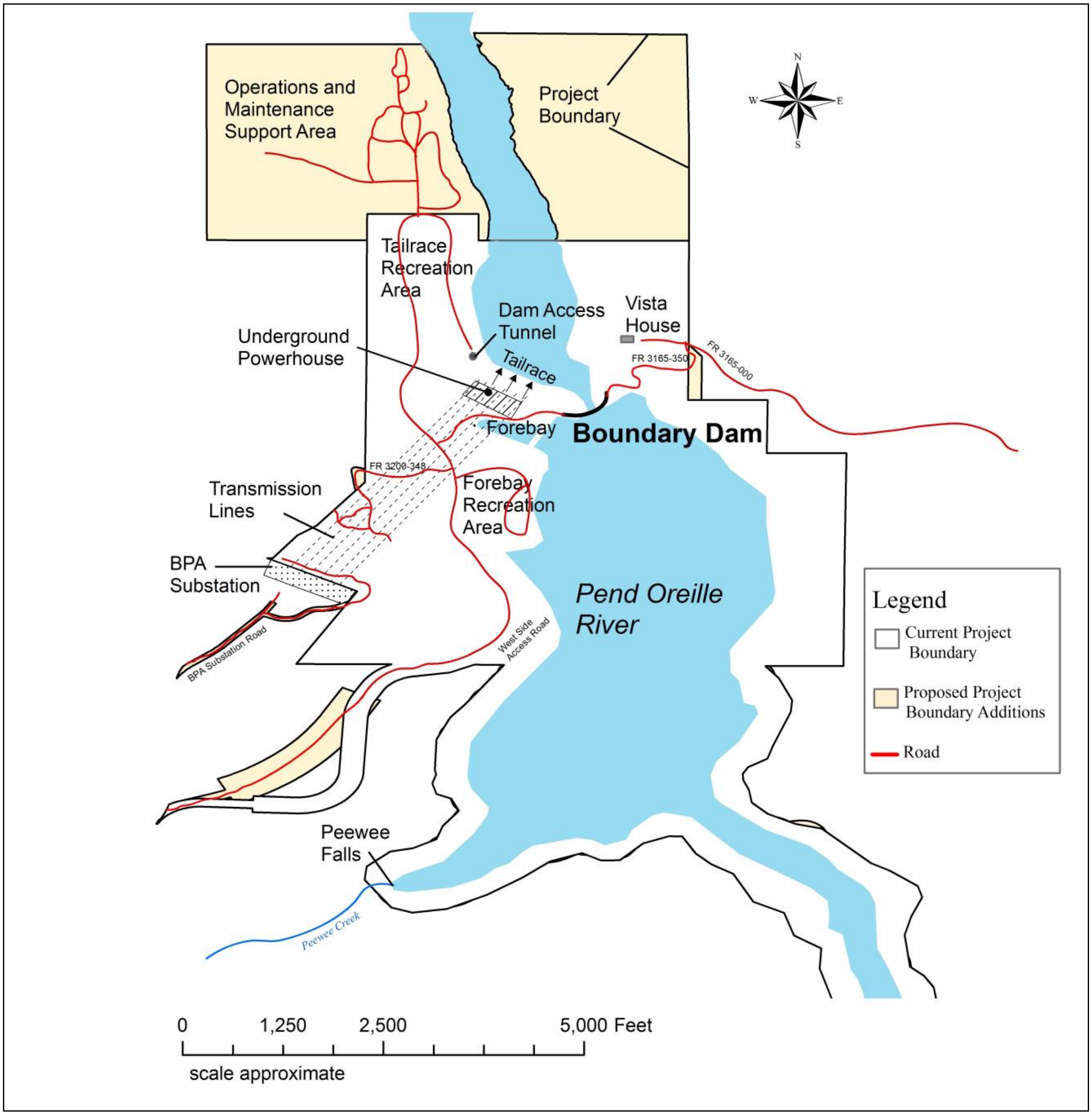



Figure 2-1. Location of existing and proposed project features in the vicinity of Boundary dam for the Boundary Hydroelectric Project, FERC No. 2144, Washington (Source: staff).

#### 2.1.1.2 Project Safety

The project has been operating for about 50 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 issued license, as appropriate. Commission staff would continue to inspect the project during the new license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

#### 2.1.1.3 Existing Project Operation

Dams within the Clark Fork-Pend Oreille River system are highly regulated with flows controlled by upstream hydroelectric and storage projects. The Boundary Project is the eighth project of eleven hydroelectric and storage projects in this river system, and is located immediately downstream of Box Canyon dam. The Boundary Project has a small active storage capacity relative to average daily river flow, and has no control or influence over the flow releases that it receives from upstream hydroelectric and storage projects. Therefore, releases from the Boundary Project for downstream users are heavily influenced by upstream project operations. The project is not operated for flood storage.

The project diverts water from the forebay through the power intake facilities excavated on the left abutment area of the dam. At the intake, flows pass into the concrete- and steel-lined penstocks, which bring the flows to the turbine/generator units in the power plant. The total hydraulic capacity of the turbine/generators is 56,000 cfs. The draft tubes discharge the water from the turbines into the tailrace immediately below the dam.

When inflows exceed the hydraulic capacity of the project and the water surface elevation is at or near the maximum surface water elevation of 1,994 feet, the spillway gates are opened until half of their discharge capacity-- about 54,000 cfs--is reached. If additional flows need to be passed through the project, the sluice gates--each with a discharge capacity of 36,000 cfs--are opened one at a time, with the gates in the center of the dam opened first to avoid eroding the abutments on either side of the dam. The total discharge capacity of the two spillways and the seven sluice gates is 360,000 cfs. The sluice gates are also available to quickly draw down the reservoir to elevation 1,974 feet if needed.

Under the current license, the project operates in a load-following mode, generating electricity during peak-load hours from available water. Through an agreement with the Bonneville Power Administration (BPA), power produced at the Boundary Project enters the grid at a BPA substation immediately adjacent to the project, and BPA provides an equivalent amount of power to Seattle, which satisfies between 35 and 45 percent of Seattle's electricity requirements. The project typically begins generating in the early morning hours and continues to generate throughout the day, rising and falling in response to customer demand, with peaks experienced in the morning and evening. The average amount of electricity generated at the project is 3,572.8 gigawatt-hours. Power produced at the project serves the Pend Oreille PUD and Seattle retail load, with any excess power produced sold on the secondary market.

The inflow to the Boundary reservoir averages 13,000 cfs in August and averages 49,700 cfs in June, with minimum and maximum inflows recorded between 6,400 cfs and 118,800 cfs, respectively. The project can operate between elevations 1,994 feet and 1,954 feet; however it primarily operates between the elevations of 1,994 feet and 1,974 feet (with a storage capacity of approximately 27,000 acre-feet), with the additional storage between 1,974 feet and 1,954 feet reserved for extreme load requirements. Any storage capacity left vacant in the reservoir is filled on a voluntary basis if there is adequate water available from upstream releases. During the summer recreation season,[16] Seattle voluntarily limits the forebay pool to a water surface elevation of no lower than 1,984 feet from 6:00 a.m. to 8:00 p.m. and a water surface elevation of no lower than 1,982 feet from 8:00 p.m. to 6:00 a.m.

Seattle makes 48,000 kilowatts of energy available to the District from the Boundary Project at cost to meet the District's load requirements of its present or potential customers. Seattle also compensates the District for encroachment of the Boundary reservoir on the tailrace of the District's Box Canyon Hydroelectric Project No. 2042.[17]

---

[16] The summer recreation season is described as running from Memorial Day weekend through Labor Day weekend.

[17] The degree of encroachment of the Boundary reservoir on the Box Canyon Project varies depending on reservoir elevations, inflow, and operation of the projects. According to the District's May 27, 2011 filing, Seattle and the District entered into an agreement on December 20, 1965, relating to encroachment compensation. Subsequently, Seattle and the District entered into the Tailwater Encroachment Losses Compensation Delivery Agreement as of October 31, 2005, to simplify the encroachment calculation methodology. According the District's filing, the agreement is to remain in effect until the earlier of (a) the date on which the operating license for the Boundary expires (including annual licenses), without renewal or extension; or (b) the license is transferred to an entity other than Seattle.

#### 2.1.1.4 Existing Project Boundary

The current project boundary, as shown in Seattle's revised exhibit K drawings, was approved in 1968 by the Federal Power Commission (FPC, now FERC),[18] The FPC established land charges based on a total of 938.59 acres of federal lands, which include 609.24 acres within the Colville National Forest and 329.35 acres of other lands of the United States in 1969.[19]

From the upstream (south) end of the project boundary, the current project boundary generally follows the ordinary high surface water elevation of the Pend Oreille River from U.S. Geological Survey (USGS) gage no. 12396500, which is approximately 1,400 feet downstream of Box Canyon dam, to immediately upstream of Metaline Falls. The project boundary is generally expanded by a 200-foot-wide horizontal buffer from the original ordinary high water surface elevation[20] from immediately upstream of Metaline Falls to about 3,000 feet upstream of the Boundary dam. At the north (downstream) end of the project boundary, beginning 3,000 feet upstream of the Boundary dam, the project boundary expands to encompass the Vista House, the tailrace recreation area, the dam and powerhouse, the forebay recreation area, the West Side Access Road, and the transmission lines leading from the powerhouse to the BPA substation.

#### 2.1.1.5 Existing Environmental Measures

As noted above, from Memorial Day to Labor Day, Seattle voluntarily restricts water surface fluctuations by maintaining water surface elevation above 1,984 from 6:00 a.m. through 8:00 p.m. from Memorial Day weekend (starting Friday evening) through Labor Day weekend (on Monday evening. At night under the voluntary summer restriction, the forebay pool elevation is maintained above elevation 1,982 feet from 8:00 p.m. through 6:00 a.m.

Seattle determined that operation of turbine Units 55 and 56 at or below 125 MWs can increase TDG in the Boundary dam tailrace during non-spill conditions. To reduce TDG under normal, non-spill operations, Seattle voluntarily implements a practice of operating these units above 125 MW and sequencing their startup and shutdown so that Units 55 and 56 are the last units to be brought on line and the first units to be shut down.

In accordance with its license (Article 51), Seattle acquired 149 acres of land adjacent to the upper reservoir, and established the Boundary Wildlife Preserve (BWP).

---

[18] 40 F.P.C. 1,515 (1968).

[19] 41 F.P.C. 577 (1969). Seattle reported in its March 2010 addendum to Exhibit A that by their calculations the current and proposed project boundary includes 920.87 and 931.36 acres, respectively.

[20] The original project boundary was established by a 200-foot buffer from the ordinary high water mark as measured in 1967.

Seattle developed a Wildlife Management Plan for the BWP, with the primary goal of protecting wetland, riparian, and slough habitats from development and to maintain populations of native terrestrial and aquatic wildlife species.

Seattle has funded the annual planting of catchable-size triploid rainbow trout in the reservoir as a voluntary measure to increase sport-fish harvest. However, this practice was discontinued after the spring 2009 planting because of Washington DFW concerns that the program may hamper native fish recovery efforts.

### 2.1.2 Seattle's Proposal

#### 2.1.2.1 Proposed Project Facilities

The project has six turbine/generator units, numbered Unit 51 through Unit 56. Seattle proposes to upgrade the turbine runners in Units 55 and 56 within the first four years following issuance of a new license. The turbine runner upgrades would increase efficiency; i.e., they would use the same flow to produce a greater amount of energy and would have a higher total generation capacity. The turbine runner efficiency upgrades would be performed concurrently with planned electrical generator rewinds and step-up transformer replacements. Seattle estimates that the project generation would increase by 39,838 MWh after completion of the upgrades. Seattle also proposes new facilities and upgrades to existing facilities, including: a new upstream fish passage trap-and-haul facility; upgrades at the existing forebay recreation area, the tailrace recreation area/Machine Hall visitors' gallery, the Vista House, and the Metaline Waterfront Park boat launch; new trailheads and trails; new portage trail and boater access near Metaline Falls; and improvements at six designated dispersed shoreline recreation site.

#### 2.1.2.2 Proposed Project Operation

Seattle proposes to continue to operate the project as it does under the current license conditions, but with the formalization of two currently voluntary operational measures described above in section 2.1.1.5, *Existing Environmental Measures*: forebay water surface elevation restrictions for summer recreation enhancement, and turbine unit sequencing to reduce TDG production during non-spill conditions.

Seattle also proposes to continue to assign 48,000 kilowatts of power to the District from the Boundary Project at the District's weekly system load factor, any part or all of which shall be available to the District at cost upon two years' notice by the District, to meet the load requirements of the present or potential customers. Seattle also proposes to continue to compensate the District for the encroachment of the Boundary reservoir on the tailrace of the District's Box Canyon Project No. 2042. These proposals do not result in environmental effects; therefore we do not analyze them further in the EIS. The applicability of the Commission's policy on issues related to power allocation to the facts of this proceeding is a matter for Commission consideration in any order acting on the license application. Likewise, the Commission's policy as it relates to encroachment is a matter for the Commission consideration in any order acting on the license application.

#### 2.1.2.3 Proposed Project Environmental Measures

Seattle proposes a comprehensive set of measures covering the full range of resources in the Pend Oreille River associated with the Boundary Project. Table 2-1 summarizes those measures proposed under the settlement agreement; details of the environmental measures are provided in section 3.0, *Environmental Analysis*, by resource area.

Table 2-1. Summary of proposed license articles (Source: Seattle 2010).

| Article | Measure | Elements |
|---|---|---|
| 1 | Operations | • From Memorial Day weekend (starting Friday evening) through Labor Day weekend (ending on Monday evening), maintain forebay water surface elevations at or above 1,984 feet NAVD 88 from 6:00 am through 8:00 pm, to facilitate recreational access and use. From 8:00 pm through 6:00 maintain forebay water surface elevations at or above 1,982 feet NAVD 88.<br>• Operate Units 55 and 56 above 125 MW and sequence their startup and shutdown so that they are the last units to be brought on line and the first units to be shut down to reduce total dissolved gas (TDG) under normal, non-spill operations. Revaluate unit sequencing following other Unit upgrades. |
| 2 | Boundary Resource Committee and Work Groups | • Establish a Boundary Resource Coordinating Committee and the following work groups as needed to meet consultation requirements: Fish and Aquatics Work Group, Water Quality Work Group (with TDG subgroup), Terrestrial Resources Work |

| Article | Measure | Elements |
|---|---|---|
| | | Group, Recreation Resources Work Group, and Cultural Resources Work Group.[21] |
| 3 | Terrestrial Resource Management Plan | • Implement the Terrestrial Resource Management Plan which consists of the following programs: (i) Erosion Program, (ii) Habitat Management, Enhancement, and Protection Program, (iii) Integrated Weed Management Program, (iv) Rare, Threatened or Endangered Plant Species Program, (v) Wildlife Program, (vi) Shoreline Management Program.. |
| 4 | Land Acquisition | • Within 5 years of license issuance acquire and manage approximately 158 acres, consisting of highly diverse riparian and upland habitat and about 13,022 lineal feet of varying habitats immediately adjacent to water features for the benefits of rare and threatened wildlife and other area wildlife. The targeted 158 acres of riparian and upland habitats and the 13,022 lineal feet of varying habitats could be provided on the same parcel of land, provided that the parcel meets the habitat criteria. |
| 5 | Recreation | • Implement the Recreation Resource Management Plan, which consists of the following programs: following programs: (i) Recreation Facility Capital Improvements Program, (ii) Recreation Facility Operations and Maintenance Program, (iii) Shoreline Dispersed Recreation Management |

[21] Seattle would convene the coordinating committee to oversee on a broad scale the integrated and efficient implementation of the various environmental measures and the work groups to further the collaboration already established during the pre-filing stages of the license application to the development, refinement, and implementation of the plans described in the settlement agreement. These actions would maintain the established processes for technical review of the various measures and ensure appropriate consultation among interested parties. Supporting the committee and work groups do not result in a direct environmental effect; therefore, we do not discuss further in the EIS. We do consider the cost of implementing this measure in section 4.2 and recommend its implementation in section 5.

| Article | Measure | Elements |
|---|---|---|
| | | Program, (iv) Recreation Monitoring Program, (v) Travel And Public Access Management Plan, and (vi) Multi-Resource Interpretation and Education Program. |
| 6 | Groundwater Well Decommissioning and Road Closure Plan | • Implement the Groundwater Monitoring Well and Road Decommissioning Plan to close groundwater wells and roads to the wells that are no longer needed for project purposes. |
| 7 | Programmatic Agreement | • Implement a programmatic agreement and Historic Properties Management Plan (HPMP) to protect cultural resources. |
| 8 | Water Quality Plans | • Implement the following plans to improve and monitor water quality: (i) Aquatic Invasive Species Control and Prevention Plan, (ii) Dissolved Oxygen Attainment Plan, (iii) Fish Tissue Sampling Plan, (iv) Temperature Attainment Plan, and (v) Total Dissolved Gas Attainment Plan. |
| 9 | Fish and Aquatic Resources | • Implement the Fish and Aquatics Management Plan (FAMP), which includes the following programs to improve fish habitat, provide passage of resident fish, and foster recovery of bull trout and native resident fishes: (A) Mainstem Fish Community and Aquatic Habitat Measures, (B) Upstream Fish Passage, (C) Reduction of Project Related Entrainment Mortality, (D) Tributary Non-native Trout Suppression and Eradication, (E) Tributary Fish Community and Aquatic Habitat Measures, (F) Mill Pond Dam Site Monitoring and Maintenance, (G) Native Salmonid Conservation Program, (H) Recreational Fish Stocking Program, |

| Article | Measure | Elements |
|---|---|---|
| | | and (I) Fund for Habitat Improvements in Tributaries to Sullivan Lake.[22] |
| 10 | Escalation | • Annually escalate all costs and funding amounts specified in the various resource plans described above beginning January 1, 2012, or in the year preceding the Commission License issuance, whichever is later. |

#### 2.1.2.4 Proposed Project Boundary Modifications

Seattle proposes to change the project boundary to refine the buffer around the lower and upper reservoir, bring lands needed for project purposes into the project boundary, and bring roads needed for project purposes into the project boundary.

Seattle proposes to expand the project boundary to include the following features: (i) the approximately 100-acre Operations and Maintenance Support Area, (ii) the 149-acre Boundary Wildlife Preserve (BWP) and adjacent 89-acre parcel (the BWP Addition); (iii) the portions of the Tailrace East (86.9 acres), Everett Creek (82.7 acres), and Sullivan Creek (17.7 acres) parcels that currently reside outside the Project boundary; and the Metaline Falls Portage Trail. Seattle also proposes to include the following roads, all of which are used exclusively or primarily for project purposes: the 0.28-mile-long portion of the West Side Access Road not already in the boundary, approximately 1.7 miles of roads within the Operations and Maintenance Support Area road network, the 0.23-mile-long Bonneville Power Administration (BPA) substation road, the 0.15-mile-long portion of the spur off of BPA substation road not already in the boundary, the 0.08-mile-long section of south end of National Forest road (FR) 6200-348 not already in the boundary, the 0.08-mile-long section of FR 3165-350 not already in the boundary, a 0.3-mile-long section of FR 3100-325, the 0.4-mile-long FR 3165-315 (for East Peewee

[22] These funds would be used to implement measures for improving connectivity in Harvey Creek, as well as reducing sediment input, increasing riparian and instream habitat complexity, streambank stabilization, and large woody debris placement in three tributaries to Harvey Creek (*see* comments filed by Interior, Washington DFW, and the Forest Service on the draft EIS).

Falls Trail and Viewpoint), a 1.07-mile-long section of FR 3100-172, and the 0.2-mile-long FR 3100-178 (for Riverside Mine Canyon Viewpoint).[23]

Seattle also proposes to revise the project boundary in the upper reservoir to match the ordinary high water line observed during the 2009 survey.[24] Seattle also proposes to align the project boundary in the vicinity of the District's Campbell Park boat ramp with the project boundary of the Box Canyon Project to eliminate an overlap of project boundaries.

In the lower reservoir, Seattle proposes to revise the project boundary to re-establish an approximate 200-foot buffer zone by extending the project boundary in areas where it is less than 180 feet from the high water level observed in 2009. The existing boundary would not be modified where it falls 180 feet or more from the observed high water line.

Staff estimates that Seattle's revisions would increase the total acreage within the project boundary by approximately 543 acres, as well as increase the amount of federal lands to about 966 acres.[25]

#### 2.1.2.5 Modifications to Seattle's Proposal—Mandatory Conditions

The following mandatory conditions would be made part of any issued license, unless modified by the conditioning agency, and are evaluated as part of Seattle's proposal. Seattle has not objected to the inclusion of any of these conditions.

---

[23] Lengths for road sections within the project boundary were obtained from the license application, Table E. 4-4 on page E-82 of the license application, or estimated by staff from the exhibit G maps filed with the Commission on March 29, 2010.

[24] The new boundaries are expressed as level foot contours between 2,004 feet and 2,007 feet except in those areas where the vegetation lines better reflect the ordinary high water level.

[25] Seattle's proposed revisions respond to concerns raised by the Forest Service. Seattle has not filed a complete set of exhibit G drawings depicting the current proposed modifications to address the Forest Service's concerns. The new acreages for the project boundary presented here are staff's estimates based on a comparison of the existing project boundary and the proposed project boundary in all areas where the boundary downstream of Metaline falls is greater than 180 feet from the project reservoir; however, we expect Seattle in the preparation of their revised exhibit G drawings to calculate the new acreages for the project boundary and federal lands within the project boundary. Until revised exhibit G drawings are filed with the total federal lands defined and approved by the Commission, federal land use charges would continue to be based on the currently approved exhibit K drawings and identified federal land acres.

**Section 18 Prescriptions**

Interior filed section 18 fishway prescriptions for fish passage identical to proposed license article 9B and 9C of the settlement agreement. Interior's fishway prescription requires Seattle to install, operate, and maintain a single upstream trap and haul fishway facility (upstream fishway or fishway) in the Boundary Project tailrace as described in Section 5.2 of the Fish and Aquatics Management Plan within 12 years of license issuance (two planning years, eight research years and two design years). The purpose of this fishway is to provide safe, timely and effective passage for bull trout, cutthroat trout, and mountain whitefish (target fish species) in the project area for the license term and any subsequent annual licenses.

Interior's section 18 prescription also includes measures to reduce project-related entrainment mortality. These include developing and implementing studies sufficient to quantify the effects of entrainment on target species (bull trout, westslope cutthroat trout and mountain whitefish) and to determine whether any population of target fish species (i.e., a unique population that constitutes a substantial percentage of fish in the project area or that has a unique evolutionary niche that requires special protection) or a substantial number of target fish are affected by project entrainment. Based on the results of these studies, Seattle would either build facilities at the project to improve survival of target species past Boundary dam, or implement appropriate non-operational measures to improve survival of target species pursuant to the provisions of this program as described in Section 5.3 of the Fish and Aquatics Management Plan. Successful implementation of this program would fully mitigate for the effects of entrainment on target species by either: (1) preventing entrainment at the project, (2) reducing entrainment at the project and mitigating for the remaining effects, or (3) fully mitigating for the effects of entrainment through other measures. Design and implementation of these entrainment reduction measures would occur in three phases: (1) an initial entrainment assessment and evaluation phase would occur from the first through the 18th year following license issuance at a cost not to exceed $23,000,000; (2) implementation of entrainment reduction measures (if needed) scheduled for the 19th through the 33rd year following license issuance at a cost not to exceed an additional $47,000,000, plus any unexpended funds from the $23,000,000 allocated during phase 1; and (3) reevaluation of entrainment related mortality and adaptive management from the 34th year following license issuance through the end of the license term with no funding limitations.

Interior also requested the Commission reserve its authority under section 18 of the FPA to prescribe fishways for bull trout, westslope cutthroat trout, mountain whitefish, and any other fish to be managed, enhanced, protected, or restored to the Pend Oreille River Basin during the term of the license.

**Section 4(e) Land Management Conditions**

The preliminary conditions provided by the Forest Service under section 4(e) of the FPA consist of one general condition (to include the license articles contained in the

Commission's Standard Form L-5 issued by Order No. 540, dated October 31, 1975) and nine specific conditions described below:

- Condition 1 stipulates that Seattle must comply with all provisions of the Boundary settlement agreement relating to: (1) all protection, mitigation and enhancement measures and other obligations identified in the settlement agreement and Exhibits which are on or affect National Forest System (NFS) lands and resources; and (2) all commitments in each and every plan referenced in the settlement agreement, and exhibits which implement activities which are on or affect NFS lands and resources; provided, however, that this Condition No. 1 excludes those measures and other obligations, and those provisions of the settlement agreement and Exhibits, relating to decommissioning of the Mill Pond dam and implementation of the cold water release from Sullivan Lake (including, the settlement agreement §§ 7.14 and 7.15, and settlement agreement Exhibit 9, (Temperature Attainment Plan)).

- Condition 2 reserves the Forest Service's authority to modify its conditions if the settlement agreement is materially modified or not adopted by the Commission, or if Seattle does not implement the conditions as required.

- Condition 3 stipulates that Seattle is to implement proposed license articles 1 through 10 of the settlement agreement.

- Condition 4 would require: (1) Forest Service approval of site-specific project designs and a authorization to proceed before implementing any ground-disturbing activities on NFS lands; (2) obtaining a special use authorization if long term occupancy of NFS lands is required for project related purposes and such occupancy is not authorized by including such lands within the FERC Project boundary; (3) Forest Service written approval prior to making changes in the location of any constructed project features or facilities on NFS lands; (4) Seattle to consult with the Forest Service to coordinate any activity with any other federally authorized uses; (5) Seattle to develop site-specific plans prior to implementing habitat and ground-disturbing activities on NFS lands that includes (i) a map depicting the location of the proposed activity and GPS coordinates, (ii) a description of the Forest Service land management area designation and applicable standards and guidelines, (iii) where required by regulatory procedures, 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, (iv) draft biological evaluations or assessments including survey data, (v) an environmental analysis of the proposed action, (vi) a Spill Prevention and Control, and Hazardous Materials Plan for hazardous materials storage, spill prevention and cleanup on NFS lands, as needed, before work commences; (6) avoidance and replacement of disturbed public land survey monuments, private property corners, and forest boundary markers; and (7) reimbursing the Forest Service for costs associated with implementation of a new license on NFS lands in accordance with a provided schedule.[26]

- Condition 5 provides that Seattle must prepare a restoration plan to restore NFS lands prior to surrendering its license.
- Condition 6 indemnifies and holds the United States harmless for any costs, damages, claims, liabilities, and judgments arising from past, present, and future acts or omissions of Seattle in connection with the use and/or occupancy of NFS lands.
- Condition 7 reserves the Forest Service's authority to require additional 4(e) conditions if the settlement is not accepted or materially modified by the Commission.
- Condition 8 authorizes Seattle to construct, reconstruct, use and maintain specific roads across NFS lands.
- Condition 9 stipulates that Seattle must relocate three specific Public Land Survey System Corners, and survey, mark and post NFS property boundaries associated with those corners in order to facilitate survey efforts and public access to NFS lands.

Conditions 2, 4, 5, 6, and 7 are standard, administrative, or legal in nature and are not specific environmental measures. Condition 4 contemplates measures for future actions that may not have been considered in this EIS.[27] We view Conditions 2, 4, 5, 6, and 7 as measures to assist in the Forest Service's administration of its lands. We therefore do not analyze these conditions in detail in the EIS.

---

[26] Condition 4 includes a reimbursement schedule for Forest Service to recover its administrative costs associated with implementing the license directly from Seattle over the license term. However, section 10(e)(1) of the Federal Power Act requires the Commission to collect from licensees annual charges to reimburse federal and state natural and cultural resource agencies their administrative costs incurred in administering their responsibilities under Part 1 of the Federal Power Act. Because the reimbursement scheme outlined in Condition 4 may be inconsistent with the Federal Power Act, staff has not included this cost in the Staff Alternative, but we have included it in the Staff Alternative with Mandatory Conditions.

[27] Implementation of condition 4 would also ensure that appropriate environmental protections are identified, as applicable, prior to implementation of the action; therefore, we have no objection to including this condition in any license issued for the project. This EIS address the measures contemplated by the applicant's proposal and recommended alternatives.

### 2.1.3 Staff Alternative

The staff alternative includes all of Seattle's proposed measures in the settlement agreement except for proposed Articles 8(iii) (conducting fish tissue sampling), 9(H) (Recreational Fish Stocking Program), and 9(I) (establishing a fund for habitat improvements in tributaries to Sullivan Lake). The staff alternative also includes a recommendation for Seattle to prepare and implement an Operation Compliance Monitoring Plan to document compliance with proposed reservoir limits, and to modify the Recreation Resources Management Plan to include a more definitive schedule for completing the capital improvement projects.

### 2.1.4 Staff Alternative with Mandatory Conditions

Because the Commission is required to include a land managing agency's section 4(e) conditions in any license issued for the project, the staff alternative with mandatory conditions includes staff-recommended measures along with the Forest Service's 4(e)conditions that we did not include in the staff alternative.

### 2.1.5 Alternatives Considered but Eliminated from Detailed Study

We considered several alternatives to the applicant's proposal, but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are: (1) issuing a non-power license; (2) federal government takeover of the project; and (3) retiring the project.

#### 2.1.5.1 Federal Government Takeover of the Project

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

#### 2.1.5.2 Issuing a Non-power License

A non-power license is a temporary license that the Commission would terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license and we have no basis for concluding that the project should no longer be used to produce power. Thus, we do not consider issuing a non-power license a realistic alternative to relicensing in this circumstance.

#### 2.1.5.3 Retiring the Boundary Project

Project retirement could be accomplished with or without dam removal. Either alterative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. No participant has suggested that dam removal would be appropriate in this case, and we have no basis for recommending it. Removal of Boundary dam would eliminate a significant portion of the City of Seattle's power supply and eliminate flat-water recreational opportunities associated with the project reservoir. Dam removal would restore fish passage for native resident fish and bull trout. However, we do not consider dam removal to be a reasonable alternative to relicensing the project with appropriate protection and enhancement measures.

The second project retirement alternative would involve retaining the dam and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. As proposed in the settlement agreement, the project would generate an estimated 3,572,750 MWh of electricity per year. Because the power supplied by the project is needed, a source of replacement power would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment to be a reasonable alternative.

## 2.2 SULLIVAN CREEK PROJECT

### 2.2.1 No-Action Alternative

The no-action alternative represents the environmental status quo, in this case the continued operation of the project under its existing license with no new environmental protection, mitigation, or enhancement measures.

#### 2.2.1.1 Existing Project Facilities

The Sullivan Creek Project works includes Sullivan Lake dam and reservoir and Mill Pond dam and reservoir. Sullivan Lake dam is a 210-foot-long, 34-foot-high concrete and earth-filed dam; with six 5-foot-wide, 4-foot-high timber crest spillway gates,[28] and three 4-foot-wide, 4-foot-high lower-level steel gates.[29] The dam impounded the existing Sullivan Lake, increasing its surface area to 1,240 acres. The Mill Pond dam consists of a 134-foot-long, 55-foot-high concrete dam, constructed 100 feet downstream

---

[28] The gates are manually operated from the walkway and can regulate the lake elevation between elevation 2,584.66 and 2,588.66 feet.

[29] The steel gates have a bottom elevation of 2,563.66 feet.

of an inundated log crib dam; with an 850-foot-long, 10-foot-high earthen dike; and the 63-acre Mill Pond.[30]

Other project works, not used for power generation since 1956, include a 0.8-mile-long Sullivan Creek diversion conduit; a 12,500-foot-long wooden flume; a 2,200-foot-long earthen canal; a 1,150-foot-long, 8-foot diameter horseshoe tunnel; and a 100-foot by 38-foot masonry brick powerhouse. The turbines were removed from the powerhouse in 1958 and the turbine bays were filled with rocks and gravel.

#### 2.2.1.2 Project Safety

The project has been operating as a storage reservoir to benefit downstream generation for about 52 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 surrender process, the Commission staff evaluates the adequacy of the existing project facilities that would be turned over to the state and Forest Service under a Forest Service SUA. Special conditions would be included in the surrender, as appropriate, to ensure that the project facilities are in good condition when turned over to the state and Forest Service.

#### 2.2.1.3 Existing Project Operation

The District operates the Sullivan Creek Project as a storage project; it releases about 31,000 acre-feet (ac-ft) of water annually in accordance with the Pacific Northwest Coordination Agreement. Sullivan Lake dam captures flows principally from Harvey Creek (figure 2-2). Water from Sullivan Lake is released through the Sullivan Lake dam, and flows into Outlet Creek. Outlet Creek converges with Sullivan Creek approximately 0.5 mile downstream of the Sullivan Lake dam. Sullivan Creek then flows into Mill Pond. Flows spill over Mill Pond dam to Sullivan Creek at the rate of inflow.

---

[30] The surface acreage of Mill Pond was reported as 80.5 acres and 63 acres in varying places in the Surrender Application and Appendices. Based on data presented in the Mill Pond Dam Decommissioning Plan, the Mill Pond Bathymetry and Sediment Evaluation Final Report, the GIS data supplied by the District, satellite imagery, and the Commission's dam safety records, the preponderance of evidence suggests that the surface area at elevation 2,505.7 feet msl (full pool) is 63 acres.

**Sullivan Creek Dam**

The District maintains Sullivan Lake at full pool (elevation 2,588.66 feet[31]), to the extent possible, during the months of May through September for recreation. Lake elevation is controlled during these months by regulating the flow through the timber crest spillway gates. Starting on October 1, the reservoir is drawn down by opening the lower-level steel gates. With all three low-level steel gates fully open, the reservoir level typically stabilizes at elevation 2,565 feet. Once the elevation level of 2,565 feet is reached, the gates remain open so that outflows from Sullivan Lake dam equal the inflows to Sullivan Lake until April 1. Beginning April 1, the elevation of the reservoir is gradually raised so that the reservoir is returned to elevation 2,588.66 feet by May 1. During dry years, the elevation level may not be achieved until after May 1. The District provides a minimum flow of 10 cfs in Outlet Creek from dam releases and groundwater seepage flow downstream of the dam.

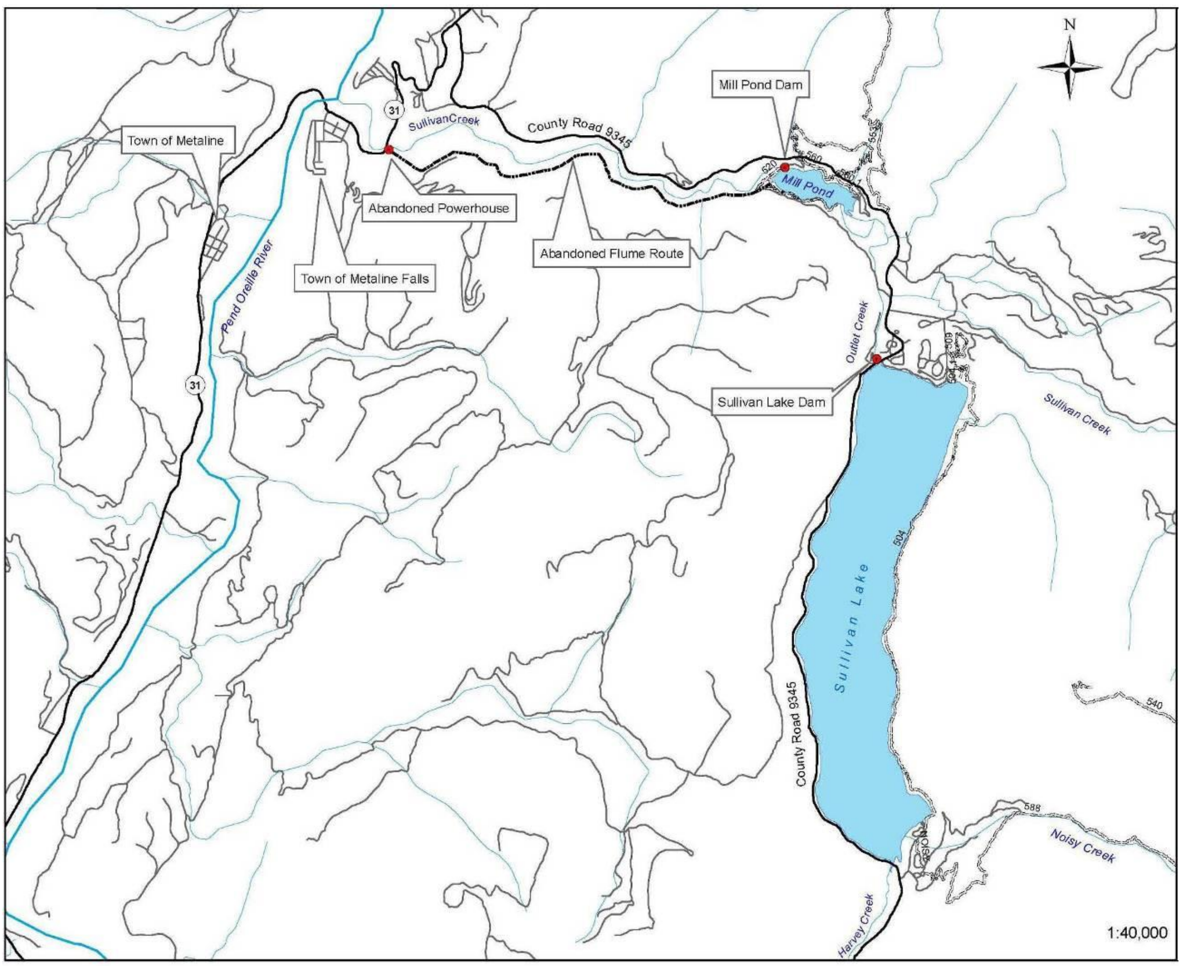



Figure 2-2. Location of project features for the Sullivan Creek Project (Source: staff).

[31] All elevations that refer to the Sullivan Lake Project are referenced to mean sea level.

### Mill Pond Dam

When originally constructed in 1909, Mill Pond was impounded by a log crib dam on Sullivan Creek and had an approximate elevation of 2,500 feet. Water from Mill Pond was diverted through a three-mile wooden flume to a powerhouse on Sullivan Creek to create electricity for the town of Metaline Falls. In 1921, a concrete dam was constructed 100 feet downstream of the log crib dam, which raised the elevation of Mill Pond to 2,520 feet. Power generation at the powerhouse was discontinued in 1958 after failure of the project's wooden flume. The District began maintaining the project in 1958 under a FERC license and purchased the project in 1959. The project has not generated power while under a Commission license.

In 1973, the dam was modified to create a new open spillway, lowering the elevation of Mill Pond to 2,505.7 feet. Mill Pond dam has an open, unregulated spillway and no storage, so flow out of the project is approximately equal to inflow and the elevation level remains constant. Outflow from Mill Pond is highest between May 1 and June 30, when inflows from Sullivan Creek are heavily influenced by snow melt runoff.

#### 2.2.1.4 Existing Project Boundary

The project boundary includes the Sullivan Lake dam and Sullivan Lake; Mill Pond dam and Mill Pond; and the former power-generating facilities, including the wooden flume, the earthen canal, the horseshoe tunnel, and the masonry brick powerhouse. The existing project boundary encompasses about 1,873 acres, of which 522 acres of land fall within the Colville National Forest. The remaining lands within the project boundary are owned by the District or are privately owned. The District does not operate or maintain any project recreation facilities. However, recreation facilities including private boat docks and various Forest Service campgrounds; boat ramps; trails; and picnic areas are found around both Sullivan Lake and Mill Pond dams.

#### 2.2.1.5 Existing Environmental Measures

As noted above, the District operates the Sullivan Lake Project to maintain Sullivan Lake at full pool for the summer recreation season and to release a minimum instream flow of 10 cfs in Outlet Creek, or inflow if less.

### 2.2.2 The District's Proposal

Under the terms of the settlement agreement, the District would continue to maintain and operate the Sullivan Lake dam and reservoir; install a cold-water release structure to improve temperatures in Sullivan Creek; modify reservoir operations to provide 5,000 ac-ft of water to downstream users on the Columbia River during June 1 to August 31; increase instream flows to improve aquatic habitat and provide whitewater boating opportunities in Outlet and Sullivan Creeks; install gages to document compliance with lake elevation targets and instream flow requirements; and remove Mill Pond dam and restore Sullivan Creek to improve aquatic habitat. The Commission would terminate the license after the installation of the cold-water release structure, removal of Mill Pond dam, and a short-term monitoring period to ensure restoration of Sullivan Creek was successful.  Sullivan Creek reservoir operations would continue pursuant to a Forest Service SUA.  Details of the above measures are summarized below.

#### 2.2.2.1 Sullivan Lake Dam—Operations and Environmental Measures

**Cold-water Release Structure**

Within three years of issuance of the order on surrender, the District would install a cold-water release facility at Sullivan Lake dam.  The facility would act as gravity-feed system to discharge cold water from the bottom of Sullivan Lake into Outlet Creek to maintain adequate instream temperatures in Outlet Creek and Sullivan Creek during warm-weather months (discussed below).  The intake for the cold water release facility would be installed at a minimum depth of 120 feet and would be fitted with fish screens. From the intake, a 4-foot-diameter high-density polyethylene (HDPE) pipe would extend between 800 and 1,000 feet along the bottom of the reservoir to immediately upstream of the existing bridge over the lake.  The pipe would be buried from the bridge to the dam. As the pipeline approaches the dam, the pipe would extend up onto the existing concrete apron upstream from the dam and connect via a bolted flange to a steel pipe section, which extends through one of the low-level outlet gates of the dam.  A control gate would be installed on the downstream end of the pipeline to control the flow released from the dam during the cold water release periods.

**Sullivan Lake Dam Operations**

The District proposes to modify the seasonal operation of Sullivan Lake to increase minimum instream flows and improve summer and fall water temperatures in Sullivan Creek.  Proposed changes are summarized below.

- Within three years of a surrender order, install a cold water release structure at the Sullivan Lake dam and fit it with fish screens to improve temperatures in Outlet and Sullivan Creeks and prevent entrainment of fish.
- Until the surrender becomes effective, manage discharges from Sullivan Lake to provide the following minimum flows in Outlet Creek (as measured by the existing gage on Outlet Creek):
  - June 1 through June 30:  30 cubic feet per second (cfs).
  - July 1 through the end of fall drawdown (when elevation of Sullivan Lake reaches  2,570 feet mean sea level—by December 31):  20 cfs.
  - From the date that Lake Sullivan reaches an elevation of 2,570 feet above mean sea level (msl) (expected January 1) until the beginning of spring filling per ordering paragraph (L) (by May 31):  outflow shall equal inflow.
  - From April 1 through May 31:  10 cfs or inflow, whichever is less.

- Until the surrender becomes effective, and prior to installing the cold water release structure, operate Sullivan Lake as follows:

*Spring Operations*: Start refilling Sullivan Lake on or before April 1 and seek to achieve and maintain a full pool elevation of 2,588.6 ft msl (as measured at Sullivan Lake dam) by May 31, subject to hydrologic conditions, water availability[32], and dam discharge flow requirements. Refilling rates would be adjusted as necessary to accommodate the Harvey Creek Bedload Mobilization activities.

*Summer Operations*: From June 1 through Labor Day of each year, the District would use its best efforts to reach and maintain Sullivan Lake at a target of elevation 2,588.6 feet (full pool) for recreation purposes

*Fall Operations*: Starting the day following Labor Day, begin drawing down Sullivan Lake in a manner that reaches the maximum flow target of 200 cfs during periods of normal or below normal precipitation and 225 cfs during periods of higher than normal precipitation as quickly as possible, given the following constraints: (1) maintain discharge flows to meet state water temperature standards (WAC 173-201A-200) and would not cause the combined waters of Outlet and Sullivan Creeks as measured at the "below confluence water temperature gage" to exceed 16 °C; (2) drawdown would strive to reach a water surface elevation of 2,577 feet by no later than November 15 and a water surface elevation of 2,570 by December 31; (3) ramp up discharge flows no more than 80 cfs per day but not to exceed a change of more than 2 °C in average daily temperature per day as measured at the below confluence water temperature gage; .and (4) maintain a down-ramping rate not exceed 10 cfs per hour.

- Until the surrender becomes effective and after installing the cold water intake, operate Sullivan Lake as follows:

*Spring Operations*: Same as described above.

*Summer Operations*: Same as above, but in addition, manage the discharges from the cold water pipe and the Sullivan Lake dam low-level outlet gates: (1) to meet state water temperature standards (WAC 173-201A-200); (2) with the goal of preventing the daily average "below confluence water temperature" from exceeding 14 °C; and (3) with the goal of preventing the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 °C, when daily average "above confluence water temperature" is less than 14 °C.

---

[32] We assume that the terms "hydrologic conditions" and "water availability" are synonymous and refer to the amount of inflow coming into Sullivan Lake on a given year.

*Fall Operations*: Starting the day following Labor Day begin, drawdown Sullivan Lake in the manner described below.

(1) Manage the discharges from the cold water pipe and the Sullivan Lake dam gates to meet state water temperature standards, with the goal of (a) preventing the daily average "below confluence water temperature" from exceeding 14 °C, and (b) preventing the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 °C, when the daily average "above confluence water temperature" is less than 14 °C. To prevent thermal shock of the downstream system, flows would be up-ramped or down-ramped to prevent waters below the confluence from changing daily average temperature more than 2 °C per day.

(2) Maintain the operation described in item (1) above until fall turnover (typically mid-October), when Sullivan Creek temperatures may fall below Outlet Creek temperatures by several degrees, and it may not be possible to maintain a 1 °C water temperature difference.

(3) Subject to the temperature constraints in item 1 above, maximize discharge flows through the cold water pipe and minimize the use of the low-level gates at the dam during fall drawdown. When low level gates are used, releases would be made from two gates simultaneously.

(4) Ramp up discharge flows no more than 80 cfs per day and down-ramp at a rate not to exceed 10 cfs per hour at the Outlet Creek gage.

(5) Manage drawdown to reach a lake water surface elevation of 2,577 feet by no later than November 15 and a 2,570 by December 31.

(6) After November 15, all releases from Sullivan Dam up to the capacity of the cold water pipe, would be made through the pipe. (7) Forecast discharge flows and post online one week in advance to support recreational use.

- When forecasts predict runoff to exceed 120 percent of the long-term average, operate Sullivan Lake to facilitate the mobilization of Harvey Creek bedload at the head of Sullivan Lake by holding Sullivan Lake level at no more than elevation 2,575 feet until May 20 of that year.
- To document compliance with the above discharge flows, ramping rates, temperature limits and lake elevations, the District would install, operate and maintain a flow gage and recording device at Sullivan dam; maintain the USGS gage on Outlet Creek if discontinued by the USGS; maintain a gage and recording device on Harvey Creek; and install, maintain, and monitor a continuous water temperature gage on Sullivan Creek at least 300 feet downstream of the confluence with Outlet Creek, and a continuous water

temperature gage on Sullivan Creek upstream of its confluence with Outlet Creek and Sullivan Creek.

- Subject to the above temperature and flow constraints, the District would manage fall drawdown to provide discharge flows between 180 and 220 cfs on at least 3 weekends in September or October to support whitewater paddling; the District would post available flows at least one week prior to their release.
- Before implementing the new operating regime, the District would repair existing docks and ramps to ensure that they would continue to function under new operations.

*Water Supply Program Flow Releases*

Under the terms of the Settlement Agreement, the District would be able to sell or lease up to 5,000 acre-feet of the usable storage in Sullivan Lake annually for use outside the Sullivan Creek drainage between June 1 and August 31, with priority given to the Columbia River Water Supply Program. This water includes all flows over the existing minimum instream flow of 10 cfs. According to the terms of the settlement agreement, for the purposes of the water supply program, the District would release water at a rate shown in table 2-2, not to exceed two times the minimum discharge flow requirement described above. Water is to be released at as steady a rate as possible, as measured by the day-to-day change in daily average cfs. The lower number represents the amount of water that can be released in dry years, and the larger number represents the amount that can be released in average and wet years. The determination of wet, average, or dry years would be made by the Resource Committee by May 20 of each year.

Table 2–2. Water Supply Program discharge flows for June through the first week in September pursuant to settlement agreement (Source: District, 2010, as modified by staff).

| **Time Frame** | **Discharge Flow (cfs)** |
|---|---|
| June Week 1 | 50-60 |
| June Week 2 | 50-60 |
| June Week 3 | 50-60 |
| June Week 4 | 50-60 |
| July Week 1 | 40-45 |
| July Week 2 | 35-40 |
| July Week 3 | 30-35 |
| July Week 4 | 30-35 |
| August Week 1 | 30-35 |
| August Week 2 | 30-35 |
| August Week 3 | 30-35 |
| August Week 4 | 30-35 |
| September Week 1 | 30-35 |

To ensure that adequate water is available in Sullivan Lake to meet the new water supply flows, the District proposes to raise the minimum elevation of Sullivan Lake from 2,565 feet to 2,570 feet from December 31 to April 1, which would decrease the amount of water required to fill the reservoir to 2,588.66 feet in the spring, and would allow more outflows to be available for downstream users.

After the settlement agreement was reached and filed with the Commission, Ecology filed on October 26, 2010, a separate Memorandum of Agreement it reached with the District to deliver 14,000 ac-ft of water to the Columbia River Basin Water Supply Program according to the schedule in table 2-3; this water includes the 5,000 ac-ft that would be provided between June and the first week in September as identified in the agreement filed with the Commission, and 9,000 ac-ft that would be provided during September. Table 2-2 shows total flows available (i.e., the flow includes the existing 10 cfs to Outlet Creek), whereas table 2-3 below reflects increased water available above the 10-cfs historic flow release in June through September. Projected late-September flows are based on model runs using the settlement agreement criteria for wet, dry and average years. All the releases to supply the flows to the Columbia River Program would be governed by the terms of the settlement agreement, including temperature constraints, minimum flow discharges,[33] and maximizing the use of the cold water intake. The delivery of water to the Columbia River program would begin only after all permitting, but before all of the construction activities are completed, provided that the provisions for interim operations are met. A tentative delivery schedule included in the memorandum of agreement is 2,500 ac-ft in 2012, 5,000 ac-ft in 2013, and 14,000 ac-ft in 2014. However, the District did not file the agreement for Commission approval or amend its license surrender application to accommodate the agreement. We analyze the effects of this agreement in the cumulative effects analysis, but do not include it as part of the District's license surrender proposal.[34]

[33] We assume that the requirement not to exceed 2.0 times the minimum discharge flow would only apply to the June through the first week in September as indicated in table 2-3.

[34] The District has not requested to amend its surrender application to include the lease or sale of the 9,000 ac-ft to the Columbia River Basin Program in September. Therefore, this EIS examines the effects of these releases, but from the perspective of an off-license agreement with Ecology.

Table 2–3. Water Supply Program discharge flows for June through September pursuant to Ecology memorandum of agreement (Source: District MOA).

| Period | Dry Year Flow Increase | | Average/Wet Year Flow Increase | | Monthly Total | |
|---|---|---|---|---|---|---|
| | cfs | ac-ft | cfs | ac-ft | Dry (ac-ft) | Wet (ac-ft) |
| June Week 1 | 40 | 560 | 50 | 700 | | |
| June Week 2 | 40 | 560 | 50 | 700 | | |
| June Week 3 | 40 | 560 | 50 | 700 | | |
| June Week 4 | 40 | 720 | 50 | 900 | 2,400 | 3,000 |
| July Week 1 | 30 | 420 | 30 | 420 | | |
| July Week 2 | 25 | 350 | 25 | 350 | | |
| July Week 3 | 20 | 280 | 20 | 280 | | |
| July Week 4 | 20 | 400 | 20 | 400 | 1,450 | 1,450 |
| August Week 1 | 20 | 280 | 20 | 280 | | |
| August Week 2 | 20 | 280 | 20 | 280 | | |
| August Week 3 | 20 | 280 | 20 | 280 | | |
| August Week 4 | 20 | 400 | 20 | 400 | 1,240 | 1,240 |
| September Week 1 | 20 | 280 | 20 | 280 | | |
| September Week 2 | 170 | 2,380 | 190 | 2,660 | | |
| September Week 3 | 210 | 2,940 | 210 | 2,940 | | |
| September Week 4 | 210 | 3,780 | 210 | 3,780 | 9,380 | 9,660 |
| Total (June – Aug) | | | | | 5,090 | 5,690 |
| Total (June – Sept) | | | | | 14,470 | 15,350 |

#### 2.2.2.2 Mill Pond Dam Removal and Restoration of Sullivan Creek

Within five years of the Commission’s order on the application to surrender the license, the District would remove Mill Pond dam and the original log-crib dam, manage sediment, restore the Sullivan Creek stream channel, implement site restoration measures for the affected area (defined as stream channel, floodplain, and upland areas from immediately downstream of Mill Pond dam to Outlet Creek), and conduct short-term monitoring and maintenance to ensure restoration was successful. Other project facilities, including the diversion conduit, wooden flume, earthen canal, and horseshoe tunnel, that were not used after the project ceased power production in 1956 would not be removed.

The District filed a draft Mill Pond Decommissioning Plan with the settlement agreement, and proposes to file a final plan within two years of the Commission’s order on surrender containing detailed engineering plans. In short, to remove Mill Pond dam and restore Sullivan Creek, the District would: install a 4-foot-diameter main siphon pipe through the dike on the west side of the dam and lower the reservoir 20 to 25 feet; install a cofferdam upstream of the log-crib dam and a decanting tower upstream of the coffer dam, with a low level pipe through the bottom of the cofferdam; drain the water in between the concrete dam, log crib dam and cofferdam areas; after the reservoir is lowered and stabilized, remove the concrete dam and log-crib dam using a crane and excavator, and dispose of concrete off-site and either use log materials for stream channel restoration or dispose of it; reconstruct the stream channel through the dam removal area; as the reservoir level drops, excavate and stabilize the streambed; and remove the cofferdam.

The District would complete DAHP Level II mitigation documentation[35] of the Mill Pond structures prior to their removal. The District would replace the existing bridge to the heritage interpretative site, if possible, or construct a new one.

To control sediment, the District would install erosion control measures, monitor them and implement corrective measures in accordance with an approved Storm Water Pollution Prevention Plan. The stream channel and floodplain restoration would require excavation and grading of about 40,000 cubic yards of material, which would be deposited and graded into defined fill areas. The remaining 360,000 to 380,000 cubic yards of sediment would be stabilized in place and planted with native herbaceous seeds and trees. The stream channel would be restored to a self-functioning system, designed to function up to a 100-year flood event.

### 2.2.3 Staff Alternative

The staff alternative includes all of the proposed surrender conditions (except the requirement to release 5,000 acre-feet to support the Columbia River Basin Program); modifies the characterization of the District's proposed Sullivan Lake operating rules to impose specific reservoir elevations, subject to hydrologic conditions, discharge flow requirements, and operating emergencies beyond the control of the licensee; and adds the development of an operation compliance monitoring plan to document compliance with Sullivan Lake operations; the development of a more detailed Mill Pond revegetation plan, and completion of a DAHP Level II mitigation documentation report of all contributing elements of the Sullivan Creek Historic District that would remain on District lands within the project boundary following the surrender. While we do not object to the District releasing storage from Sullivan Lake to support the Columbia River Basin Program, as contemplated by the settlement parties, we do not contemplate the need to authorize such releases so long as they conform to the proposed flow, temperature, and ramping rate constraints to protect aquatic habitat in Sullivan Creek (i.e., the aforementioned limitations on maximum flows and cause no other inconsistency with the requirements of any surrender approved by the Commission).

---

[35] DAHP Level II mitigation documentation has replaced Historic American Building Survey (HABS) and Historic American Engineering Record (HAER), but is essentially the same effort proposed by the District.

### 2.2.4 Alternatives Considered but Eliminated from Detailed Study

As noted above, project retirement could be accomplished with or without dam removal. Either option would involve surrender or termination of the existing license with appropriate conditions. No participant has suggested that removal of Sullivan Lake dam would be appropriate, and we have no basis for recommending it. Leaving Mill Pond dam in place would continue to provide a lake-based recreational fishery and scenic values, and the dam could continue to be used for historic purposes. However, this action would not improve bull trout passage, improve bull trout and other native resident fish habitat, restore federal lands, or be consistent with Colville National Forest land management policies. This action would require us to identify another government agency with authority to assume regulatory control and supervision of Mill Pond dam. Although the Forest Service is willing to assume control of Sullivan Lake dam, it supports the removal of Mill Pond dam. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. The project provides very little storage for power purposes, and Mill Pond is not needed for power production. We do not consider leaving Mill Pond in place to be a reasonable alternative.

## 3.0 ENVIRONMENTAL ANALYSIS

Below we analyze the effects of relicensing the Boundary Project and surrendering the license for the Sullivan Creek Project. Readers should understand that once the surrender of the license for Sullivan Creek becomes effective, the Commission would no longer maintain oversight of the District and the operations of the Sullivan Lake. Such oversight would fall to the Forest Service and the state of Washington. Because the draft conditions of the Forest Service's special use authorization are essentially identical to the Forest Service's recommendations for surrendering the project, it is reasonable to assume, and we have done so herein, that the effects of surrendering the license would continue into the foreseeable future (i.e., 30 years). Therefore the analysis does not make the distinction of the effects before or after the Commission's jurisdiction ends. Nonetheless, the Commission can not guarantee continued implementation of the measures and operations with respect to the District as recommended by the staff after the Commission's jurisdiction ends.

### 3.1 GENERAL SETTING

The Boundary Project is located in the northeast corner of Washington on the Pend Oreille River. With a total drainage area of 26,260 square miles (25,090 square miles in the United States and 1,170 square miles in Canada), the Pend Oreille River is one of the two main tributaries to the Columbia River, contributing approximately 10 percent of the Columbia River's flow on an annual basis (Muckleston 2003). The Pend Oreille River is approximately 120 miles long from its head at the outlet of Lake Pend Oreille to its confluence with the Columbia River.

The Pend Oreille River system is highly regulated, with flows controlled by dams associated with several energy production and/or storage projects. Boundary dam is one of eleven dams on the mainstem and major tributaries in the Pend Oreille River basin. The dams and corresponding locations (River Mile (RM) upstream of the Columbia River, except for Priest Lake, where RM refers to distance upstream of the Pend Oreille River) are as follows:

- Hungry Horse (South Fork Flathead River) - RM 390.3
- Kerr Project (Flathead River) - RM 318.0
- Thompson Falls (Clark Fork River) - RM 208.0
- Noxon Rapids (Clark Fork River) - RM 169.7
- Cabinet Gorge (Clark Fork River) - RM 149.9
- Priest Lake (Priest River) - RM 42.0
- Albeni Falls (Pend Oreille River) - RM 90.1
- Box Canyon (Pend Oreille River) - RM 34.5
- Boundary (Pend Oreille River) - RM 17.0

• Seven Mile (Pend Oreille River) - RM 6.0

• Waneta (Pend Oreille River) - RM 0.5

Because of the basin size and corresponding annual flow, typically no single project has an overriding influence on flows in the river. In addition to the dams listed above, the Sullivan Creek Hydroelectric Project dam and Mill Pond dam are located in the Sullivan Creek drainage, the main tributary to Boundary Reservoir. Between the outlet of Lake Pend Oreille and its confluence with the Columbia River, the Pend Oreille River is fed by numerous tributaries. The mean annual flow in the Pend Oreille River at the Boundary Project between 1913 and 2006 was 26,370 cfs. Annual runoff is produced primarily by melting snow upstream of the project, with peak flows typically occurring from April through June.

Both the Boundary and Sullivan Creek Projects are located in the Selkirk Mountains, a western extension of the Rocky Mountains. The topography surrounding the Project is relatively rugged, with nearby mountains rising more than 6,500 feet in elevation and intervening valleys ranging from approximately 2,000 to 2,400 feet. The Pend Oreille River bisects the Selkirk Mountains and cuts through the Metaline Limestone and Ledbetter Slate formations. These two formations predominate along Boundary Reservoir downstream of Metaline Falls and confine the reservoir to a narrow canyon. The adjacent area is characterized by cliffs, rock talus, and steep slopes (Seattle 2006). In contrast, the area upstream of Metaline Falls consists predominantly of unconsolidated glacial sediments and river alluvial deposits. The river channel in this area is broader and the surrounding topography more moderate (Seattle 2006).

The climate has both maritime and continental influences. The influence of the continental air masses generally results in summers that are warmer and winters that are colder than in coastal areas. The majority of precipitation in the area falls in winter and spring, with the highest totals occurring from November through January. Within the Pend Oreille River valley, mean annual precipitation is approximately 27 inches. December and January account for about 25 to 35 percent of the annual precipitation, whereas July and August account for only 6 percent. On average, approximately 30 days each year have rainfall of at least 0.1 inches and approximately 73 days each year receive at least 1.0 inch of snow. Winters are typically cold, and the snowpack normally covers all but the lowest elevations continuously from November through May (ENTRIX 2001).

Major land uses in the area include undeveloped uses (forested land, wetlands, and water bodies) as well as developed uses (timber production and residential, commercial, and industrial uses). Based on information on file with Ecology’s Water Resources Section, uses of surface and groundwater within approximately 1 mile of the Boundary Project include industrial cooling, commercial and industrial manufacturing, general domestic use, fire protection, irrigation, mining, domestic municipal, power generation, and stock watering (Ecology 2005a). Lands surrounding the Sullivan Creek

Project are predominantly National Forest and BLM lands and used for multiple use purposes.

## 3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing NEPA (50 C.F.R. 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 (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of Seattle's license application and the District's application to surrender the Sullivan Creek Project, we have identified the following resources that may be cumulatively affected by the proposed operation of the project: aquatic (including water quality and fishery resources), terrestrial, and recreation resources.

**Aquatic Resources**

Hydroelectric projects on the Pend Oreille River have resulted in the conversion of a substantial amount of lotic (river-type) habitats in the basin to lentic (lake-type) habitats, which may have led to higher summer water temperatures and changes in the structure of fish communities. The dams have also impeded sediment and large woody debris transport, which are important elements of fish habitat. The establishment of some of the reservoirs has provided environmental conditions conducive to non-native macrophyte growth, which in turn may be responsible for occasionally elevated levels of pH and decreased levels of dissolved oxygen (DO), particularly in the Pend Oreille River. Accumulation of river sediments and attached toxic compounds in the reservoirs may have degraded water quality and caused acute or chronic effects on fish and other aquatic life. The dams associated with the projects increased the number of barriers to fish movements in the basin and currently contribute to occasionally elevated levels of total dissolved gas (TDG), especially during high flow periods. Elevated levels of TDG continue downstream out of the Pend Oreille River basin and into the Columbia River at least as far downstream as Lake Roosevelt, which is formed by Grand Coulee dam (Pickett et al., 2004). Load following operations at a number of the projects on the Pend Oreille River may be causing disruption of fish spawning in shallower reservoir areas and river habitats, erosion along reservoir and river banks, and decreased abundance and diversity of macroinvertebrates. Other contributors to adverse effects on aquatic resources in the basin include introductions of non-native fish species, some urbanization, road and railroad construction, timber harvest, and mining operations.

Ecology's Columbia River Basin Water Management Program, also referred to as Columbia River Basin Water Supply Development Program, directs Ecology to aggressively pursue development of water supplies to benefit both instream and out-of-stream uses through storage, conservation, and voluntary regional water management agreements. Under the terms of the settlement agreement, the District my sell or lease up to 5,000 ac-ft of useable storage in Sullivan Lake annually for use outside the Sullivan Creek drainage between June 1 and August 31. The District would give priority to the Columbia River Basin Water Supply Program.

After the settlement agreement was reached, the District entered into a Memorandum of Agreement with Ecology to deliver 14,000 ac-ft of water to the Columbia River Basin Water Supply Program. The District's proposed operations represent a net increase in flows during the months of June through September to Sullivan Creek, the Pend Oreille River and the Columbia River compared to historic dam operations (October through December), and a shift in the hydrograph toward a more natural condition. The Columbia River Basin Water Supply Program would allocate 9,333 ac-ft of the 14,000 ac-ft for out-of-stream water right permits in Pend Oreille, Stevens, Ferry, Lincoln, Douglas, and Okanogan counties. The remaining 4,667 ac-ft would be used for instream flows and protected to the confluence of the Columbia River and the Pacific Ocean. The water supplied by the District could contribute to aquatic habitat improvements for salmon. Because of the imperfect matching of the seasonal releases with new year-round water rights permits, there could be adverse environmental effects to salmon. Ecology considered these effects in its Columbia River Programmatic EIS[36] and Lake Roosevelt Supplemental EIS;[37] and the analysis included in those documents is incorporated by reference in this EIS. The additional water rights could also result in increased growth with concomitant land use effects in the above counties. According to Ecology, projected growth has been considered by the counties in their land use planning and if conducted accordingly should not result in significant impacts; any further consideration of the cumulative effects of the Sullivan Creek water supplies toward this growth is too speculative. Ecology expects that adverse effects would be addressed as specific projects are identified and water rights permits issued by Ecology. Therefore, no additional analysis is provided in this EIS.

Moreover, authorization from the Commission is not required to sell or lease the water supply program flows as long as the releases are provided in accordance with the surrender conditions. Following the surrender of the license, the Commission could not ensure their continued release. Further, Ecology's allocation of future water rights and the subsequent effects of those actions are beyond the Commission's jurisdiction, and more appropriately considered by the state and the counties as they implement their individual projects.

---

[36] The EIS can be found on Ecology's web page at: http://www.ecy.wa.gov/programs/wr/cwp/eis.html.

[37] The EIS can be found on Ecology's web page at: http://www.ecy.wa.gov/programs/wr/cwp/cr_lkroos.html.

**Terrestrial Resources**

Regulation of flows by the Boundary Project and upstream dams causes daily and seasonal changes in surface water fluctuations that may have led to shoreline erosion, upslope bank collapse, spread of invasive species, alteration of habitats supporting threatened, endangered, and sensitive plant and animal species (including *Astragalus microcystis, Cryptogramma stelleri, Dryas drummondii, Sanicula marilandica, thalictrum dasycarpum,* and *Viola reniflora*), alteration of big game movement corridors, and alteration of riparian and wetland habitats. Boundary Project facilities and operations, mines, timber harvest, transmission line right-of-way maintenance, roads, and urban, commercial, and industrial development have collectively contributed to the loss and alteration of wildlife habitat. Seattle says that many of these non-project developments have not occurred within the project boundary, but are close enough to have an effect on resources within the project area. Upstream and upslope development, and land clearing and timber management activities, in combination with project operations, may contribute to establishment and spread of invasive species throughout the Pend Oreille River basin. Road construction, vehicular traffic, and foot traffic associated with recreational pursuits may also contribute to the degradation and loss of sensitive habitats and displacement of wildlife.

**Recreation Resources**

Fluctuations in reservoir pool levels caused by Boundary Project operations, other upstream hydroelectric and storage project operations, and natural seasonal river flow fluctuations may affect the ability of the public to access the reservoir at times. The incremental increase in the presence of human activity in the river corridor – due to project operations and associated recreation and interpretive facilities, land development in the river corridor, scenic byway and other roadway traffic, timber and mining operations, and undeveloped dispersed recreational use of the reservoir and adjoining areas – may affect the public's use and enjoyment of recreation resources in the project area.

### 3.2.1 Geographic Scope

Our geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of: (1) the proposed action's effect on the resources, and (2) contributing effects from other hydropower and non-hydropower activities within the Pend Oreille River basin. Because the proposed action would affect the resources differently, the geographic scope for each resource may vary.

We have identified the portion of the Columbia River basin upstream of Grand Coulee dam as our geographic scope of analysis for aquatic resources; however, we will particularly focus our cumulative effects analysis for aquatic resources in the Pend Oreille River basin. The Pend Oreille River basin will be our geographic scope of analysis for terrestrial resources. For recreational resources, a northwest Washington regional scope will be considered that includes the greater Spokane and Coeur d'Alene area, as well as the small communities, both Canadian and U.S., along the western portion of the International Selkirk Loop Byway.

### 3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis in the EIS will include a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of a new license for the Boundary Project, the temporal scope will look 30-50 years into the future, concentrating on the effect to the resources from reasonably foreseeable future actions. Likewise, cumulative effects for the surrender of the Sullivan Creek license will focus on the short-term when the Commission's jurisdiction ends, but will look to the extent, possible 30 years into the future, to include the term under the Forest Service SUA. The historical discussions will, by necessity, be limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present.

## 3.3 GEOLOGY AND SOILS

### 3.3.1 Affected Environment

#### 3.3.1.1 Boundary Project

The Boundary Project is located in the Selkirk Mountains within the Okanogan Highlands physiographic province. The geology of this area results from volcanism, intrusion of granitic rock, and deformation and metamorphism of accreted marine sediments (Williams et al. 1995, Alt and Hyndman 1984).

During approximately the last 20,000 to 10,000 years, continental glaciation deeply eroded the bedrock and left areas of thick glacial and postglacial sediments (Stoffel et al. 1991). Predominate geological formations in the project area are: (1) Metaline Limestone; (2) Ledbetter Slate; (3) Talus; (4) quaternary lacustrine/alluvium; and (5) quaternary glacial deposits. Fill, mining deposits, and rip rap are also located in the project area. Metaline Limestone is approximately 1,500 feet thick, forms vertical cliffs up to 500 feet high along sections of the canyon, and is resistant to erosion. Ledbetter Slate overlies the Metaline Limestone, and has variable composition and erosion qualities. Talus cones consisting of unconsolidated cobble, gravel, and sand have formed in several locations along the base of cliffs in both the Metaline Limestone and the Ledbetter Slate. Unconsolidated fine deposits are located throughout the project, such as the quaternary lacustrine/alluvium downstream of Metaline Falls and the quaternary glacial deposits upstream of Metaline Falls.

The Z Canyon Fault crosses the Pend Oreille River at the downstream toe of the spillway and offsets the Metaline Limestone and the overlying Ledbetter Slate (Seattle, 2006). The area around Boundary dam contains exposed Metaline Limestone. Between Boundary dam and Metaline Falls, the Pend Oreille River cuts through the Metaline

Limestone and Ledbetter Slate, with pockets of glacial sediments between the rock outcrops.

The upper reservoir reach of the Boundary reservoir extends from Metaline Falls to Box Canyon dam. The geology of the upper reservoir reach is predominantly unconsolidated glacial sediments and side stream and mainstem river alluvial deposits, with a few outcrops of Ledbetter Slate (Seattle, 2007). Sullivan Creek is the largest tributary that drains into the upper reservoir reach of the Boundary Reservoir, just upstream of Metaline Falls. Other tributaries that drain into the Upper Reservoir Reach include Linton Creek, Pocahontas Creek, Wolf Creek, Lunch Creek/Sweet Creek, Sand Creek, and Lost Creek.

Soils in the project vicinity are relatively undeveloped due to geologically recent volcanic and glacial activities (Seattle, 2006). Most of the sediments are silty sands and gravels in terrace deposits on both sides of the valley formed by glaciofluvial processes (associated with meltwater from retreating ice). Soils found in the broad valley bottoms are glaciolacustrine deposits (derived from lakes associated with glacial movement). Concentrations of sands and clays are scattered throughout the project vicinity (Seattle, 2006). Post-glacial sediments of any appreciable thickness primarily consist of boulders, sand, and gravel, and occur in and near the Pend Oreille River, particularly downstream of Boundary dam (NRCS, 1992).

Mining is present and contributes a small amount of erodible deposits in the project area. The Pend Oreille mine is a lead and zinc mine with surface facilities on the east side of the river approximately two miles north of Metaline Falls. Mine-related surface sediments include fine-grained sediments that are easily erodible, coarse-grained sediments that are somewhat erodible, and large, angular rock fragments that are resistant to erosion.

Bank erosion occurs on project lands upstream and downstream of the project and on non-project lands. Upstream of the project, erosion is related to erodible soils, impoundment fluctuations, trampling by people or animals, and surface runoff from non-project roads adjacent to the reservoir. Soils in the forebay reach have a high erosion potential, while soils in the canyon reach and above Metaline Falls are less prone to erosion.

#### 3.3.1.2 Sullivan Creek Project

Sullivan Lake is a natural lake formed by glacial action. The dam is located on an unconsolidated sand, gravel, and cobble moraine on the north end of the lake. The east and west sides of Sullivan Lake are characterized by steep, rocky slopes. The bedrock on the west side is Maitlen Phyllite, and on the east side the bedrock is dominated by both Maitlen Phyllite and Gypsy Quartzite. Soil series found along the sides of the reservoir are generally formed in residuum and colluvium, and include Rufus, Belzar, Rasio, Hartill, Newbell, and Inkler.

Sullivan Lake is fed by Harvey, Noisy, and Hall creeks, with Harvey Creek being the only perennial stream of the three. Harvey Creek, which enters Sullivan Lake at its southwest corner, has a history of landslides. The landslide material includes both rounded cobbles and boulders (glacial), and angular material (meta-sedimentary). These landslides have provided bedload material into Harvey Creek before it enters Sullivan Lake. Along Harvey Creek, the deposited material is coarse cobbles mixed with some sand. The deposited materials have formed a gravel bar along each side of the creek consisting of fine-textured sand and silt more than 30 inches deep.

Sullivan Lake discharges into Outlet Creek, which then converges with Sullivan Creek. It is anticipated that the outlet channel from Sullivan Lake dam consists of glacial outwash and gravel deposits. Outlet Creek flows in a channel bounded by glacial terraces, in a canyon formed by the moraine on one side and the mountain slope on the other. The geology of the mountain slope is Maitlen Phyllite; the soil formed on those slopes includes both Hartill-rock outcrop complex and Smackout loam, with glacial outwash on the east and north side of the creek.

Mill Pond is an impoundment of Sullivan Creek about 3,500 feet below the confluence of Outlet Creek and Sullivan Creek. Mill Pond has a large depositional area at the inlet end, where Sullivan Creek drops its bedload. The materials in the depositional area appear to originate from a series of landslides and road failures in the 1960s and 1970s. This 30-acre depositional area has been well vegetated with alder and brush.

Mill Pond discharges into Sullivan Creek, which flows to the Pend Oreille River. Soils in this section are Bonner silt loam and Kiehl loam, found on the low floodplain, and Newbell silt loam, Aits loam, Three-mile silt loam and Waits loam, which are found on the upland slopes. As the gradient increases, the canyon becomes incised, and the stream straightens. In this segment, the channel is bedrock controlled. The lower slopes are dominated by rock outcrops, while the upper slopes are composed of rock outcrops and glacial till deposits.

### 3.3.2 Environmental Effects

#### 3.3.2.1 Boundary Project

The greatest potential for erosion associated with the Boundary Project is from the reservoir shorelines and roads in the project area. Project-related factors affecting erosion include wave action, reservoir fluctuations, stream flow variations downstream of Boundary dam, and recreation around the reservoir. Project and non-project erosion has resulted in the loss of approximately 14 to 15 acres of land adjacent to the shoreline since project operations began 40 years ago based on historical aerial photographs and direct cross-sectional analysis.

To address project-related erosion, Seattle, in consultation with state and federal agencies, tribes, and non-government organization, proposes to implement an Erosion

Program (a component of the Terrestrial Resources Management Plan (TRMP)) to control erosion at the three recreational sites, and to monitor shoreline erosion to determine if additional measures may be warranted in the future. Seattle also proposes to bring four Seattle-owned parcels[38] into the project boundary to be managed as part of a comprehensive mitigation and enhancement package,[39] and to acquire additional property, with a target area of approximately 158 acres of riparian and upland habitat and about 13,022 lineal feet of land immediately adjacent to water features, which is defined as "perennial flat-water bodies, streams, wetlands or seeps."

Although the measures are directed at improving aquatic habitat, measures proposed by Seattle in the Fish and Aquatics Management Plan would include stream bank stabilization measures that could reduce erosion into and along the banks of Sullivan Creek, Linton Creek, and Sweet Creek, tributaries to the project reservoir.

Forest Service condition 3 stipulates that Seattle implement the Settlement Agreement license articles, including the Erosion Program, the acquisition of the additional habitat lands, and the Fish and Aquatics Management Plan. Forest Service condition 8 stipulates that Seattle is to construct, reconstruct, use, and maintain identified roads across National Forest System lands that are necessary for the operation, maintenance, and recreational use of the project. Interior and Washington DFW recommend, pursuant to section 10(j) of the FPA, that Seattle implement its proposed plans.

*Staff Analysis*

Approximately 11 miles of project roads were inventoried as part of the Erosion Study. All roads and drainage structures are generally maintained to a standard compatible with the current level of use and Forest Service management objectives, where applicable. Minor surface erosion would likely continue on unvegetated areas adjacent to project roads and facilities, but no substantial effects to high value resources were observed.

The reservoir shoreline erosion inventory, conducted as part of the Erosion Study, identified a total of 15.5 miles, or 32 percent, of the 48.8-mile long shoreline of the Boundary reservoir, as showing evidence of past or ongoing erosion. Normal project operations cause the reservoir to fluctuate between elevations 1,974 and 1,994, depending on the time of year. These fluctuations and resulting wave action work to

---

[38] The parcels to be brought into the boundary include the BWP Addition (89 acres), the portion of the Tailrace East parcel not currently included in the boundary (86.9 acres), the portion of the Everett Creek parcel not currently included in the boundary (82.7 acres), and the portion of the Sullivan Creek parcel not currently included in the boundary (17.7 acres).

[39] As described in the Habitat Management, Enhancement and Protection Program of the TRMP.

erode reservoir shorelines and mouths of stream channels. Based on Seattle's analysis, the project is responsible for 5.7 miles of the eroding length of the reservoir shoreline and a combination of project and non-project related factors is responsible for another 7.6 miles of the eroding length of the reservoir shoreline. Project operations have contributed to a loss of 14 to 15 acres of shoreline over the term of the previous license. Seattle determined that on Forest Service lands, eroding shorelines and landslides occur along 13,305 feet of shoreline (16 percent of the total length of erosion sites documented in the study), with over half of the eroding shorelines rated as having a high potential for future erosion. The sites were evaluated by the stakeholders to determine if the following resources were present at a high value: recreation use, wildlife habitat and use, presence or absence of heritage resources, rare/threatened/endangered plants, and condition of fish habitat. The Forest Service independently calculated that 24,193 total lineal feet (6.1 acres) of federal lands in the project boundary exhibit some degree of shoreline erosion.[40]

No changes in project operations are proposed that would alter existing erosion rates. However, shoreline erosion is expected to continue in some areas until the shoreline stabilizes, and in other areas may continue into the foreseeable future. How quickly that would occur is unknown, but erosion rates should be slower than historical rates.

**Erosion Program**

The Erosion Program defines two primary objectives for lands within the project boundary or affected by project operations: (1) erosion control at three recreation sites identified in the Erosion Study Final Report; and (2) long-term erosion monitoring for lands adjacent to the Boundary reservoir to determine if additional high value sites experience erosion in the future, and if so, what if any measures would be appropriate to implement.

The following three sites were identified as having important recreation resource values: (1) the Forebay Recreation Area; (2) the BLM Boundary Recreation Area; and (3) the Dispersed Recreation Day Use/Overnight Campsite on BLM-Managed Land. Seattle would implement site-specific erosion control measures at these sites, consistent with the schedule and design of recreation improvements at the sites. Erosion control at the identified recreation sites would be accomplished by a combination of biotechnical stabilization techniques, drainage swale modifications, toe protection,[41] and

---

[40] Total includes 17,132 total lineal feet (4.7 acres) of National Forest Service lands and 7,061 linear feet (1.4 acres) of BLM lands. The Forest Service seeks to mitigate for the continued effects of reservoir shoreline erosion for all of the shoreline identified as having past or ongoing erosion, regardless of the value of the resources.

[41] Toe protection refers to stabilizing the lower portion of the streambank where the weight of the bank is supported.

constructing public access to the sites. The sites would be monitored annually for three years following implementation to ensure that actions are meeting the stated objectives. The sites would continue to be monitored as part of the long-term monitoring plan, and any engineered structures would be repaired as needed to maintain the intended erosion control function.

While site-specific measures still need to be developed for each site, Seattle's proposed measures would hold the existing soil and shoreline in place, ensure that water is routed to the reservoir through a defined path to reduce erosion in non-protected areas, prevent continued degradation of the stream bank where the erosion effects from wave action and reservoir fluctuations are most likely to occur, and would minimize disturbed areas, which are more susceptible to erosion. The measures proposed in the Erosion Program would reduce erosion at the identified recreation sites.

Seattle's monitoring program would monitor and quantify the shoreline erosion rates every 10 years at 16 representative sites.[42] Every 10 years, the entire shoreline would be inspected to determine if any changes have occurred since the previous study. If erosion is shown by monitoring to be occurring at a high value resource area, Seattle and the TRWG would determine the need for and feasibility of additional mitigation.

Seattle's proposed periodic monitoring would enable it, in consultation with the TRWG, to evaluate the rate of erosion and severity of the threat to the resources and determine whether additional erosion measures would be feasible, or appropriate.

**Habitat Management, Enhancement, and Protection Program**

As part of the Habitat Management, Enhancement and Protection Program, Seattle would bring the Tailrace East parcel, the Everett Creek parcel, and the Sullivan Creek parcel into the project boundary and manage them as part of a comprehensive mitigation and enhancement package, which would include in part, monitoring for erosion as well as habitat protection. The Tailrace East parcel is located downstream of Boundary dam on the east shore of the Pend Oreille River; the Everett Creek parcel is located between Metaline Falls and the Boundary dam, adjacent to the west side of the Pend Oreille River, along Everett Creek; and the Sullivan Creek parcel is located immediately upstream of Metaline Falls on the east side of the Pend Oreille River. These lands would add approximately 11,171 lineal feet of riparian-dependent or associated habitat to the project. In addition to bringing these lands into the project boundary, Seattle has agreed to acquire about 158 acres of upland and riparian habitat and 13,022 lineal feet of varying habitats, to provide mitigation for continued shoreline erosion impacts on federal lands.

Seattle's proposed protection and management of project lands via the measures included in the Habitat Management, Enhancement and Protection Program, including

---

[42] Sites are to be identified by the Terrestrial Resources Working Group (TRWG).

the acquisition and management of about 158 acres of project habitat lands, would offset the estimated future loss of habitats from project-related effects, including erosion.[43] Because the lands that would be acquired have not yet been identified, the exact measures that would be put in place and the benefits of those measures for erosion control and mitigation are as yet unknown. The area may be miles from the project and include lands that are unaffected by project operations.

**Tributary Fish Community and Aquatic Habitat Measures**

As part of the Tributary Fish Community and Aquatic Habitat Measures (contained in the Fish and Aquatics Management Plan), Seattle proposes to implement riparian improvement along the banks of Sullivan Creek, Linton Creek, and Sweet Creek, with the objective of improving riparian functions. While the primary goal of the plan is improve habitat in these streams, the measures would also provide erosion control. Current riparian conditions in the tributaries are variable, with some portions in need of habitat improvements because they are devoid of riparian trees or brush. Stream banks with little to no vegetation do not provide the erosion control that mature riparian zones provide. Increasing the density of riparian vegetation around the stream banks of Sullivan Creek, Linton Creek, and Sweet Creek would likely result in reduced erosion losses in these streams. Seattle's proposed measure would improve over 3,000 linear feet of stream banks along Sullivan Creek, 655 linear feet along Linton Creek, and 3.3 acres of riparian land around Sweet Creek. These measures may reduce erosion in the tributaries leading to the project reservoir and provide additional habitat lost due to erosion associated with project operations.

#### 3.3.2.2 Sullivan Creek Project

The greatest potential for erosion associated with the proposed surrender is from the short-term disturbance of sediments during construction of the cold water release structure at Sullivan Creek dam, the short-term erosion potential during deconstruction activities associated with the removal of Mill Pond dam, and the longer-term mobilization and redistribution of the sediment accumulated upstream of Mill Pond dam after the dam is removed.

Under current operations, the Sullivan Creek project controls the Sullivan Lake elevation between 2,565 feet and 2,588 feet. In general, fines and topsoil that may have existed in the reservoir fluctuation zone have been eroded away, resulting in a lakeshore that is rocky and largely immune to the effects of further water erosion.

---

[43] Seattle's proposal to acquire about 158 acres of habitat and 13,022 lineal feet of varying habitats is intended to be a comprehensive package to offset all project-related effects, including erosion.

**Cold Water Release Facility at Sullivan Creek Dam**

To address aquatic habitat concerns, the District, in consultation with state and federal agencies, tribes, and non-governmental organizations, proposes to add a cold-water release facility to Sullivan Creek dam. The installation of this facility may result in a short-term disturbance of sediments around the Sullivan Lake dam. The final design plans and drawings will be developed after the issuance of any order approving the surrender of the license. The draft design plans[44] propose to elevate the intake off of the reservoir bottom to prevent transport of any sediment from the lake bottom downstream through the intake and the pipeline; and provide specific turbidity control measures based on the final construction scenario chosen.

The applicant has proposed construction scenarios that would vary in the season of construction, the final installation position of the downstream release pipe and the sediment control measures for the installation of the cold water release facility. These measures may include cofferdams and/or turbidity curtains. The exact measures proposed for reducing turbidity downstream of the construction site are not yet known.

Turbidity upstream of the dam during installation activities may be controlled by a turbidity curtain or a cofferdam. If the turbidity curtain is chosen, it would be installed around the entire installation site. Water outflow would be pumped around the dam to provide instream flows, and a small cofferdam would be constructed around the dam for the concrete work. The turbidity curtain would be left in place until sediments disturbed by the construction activities have settled out. Washington DFW provided comments to the applicant[45] stating that they are concerned with the effectiveness of the turbidity curtains, the ability of the applicant to remove all of the fish from between the turbidity curtain and the dam, and that there would be an accidental release of turbid water. Alternately, the District may use cofferdams to dewater the construction site. The cofferdam would be installed upstream of the outlet channel, then the area between the cofferdam and the dam would be dewatered, and all excavation and installation work on the pipe would be done in the dry. The water from behind the cofferdam may be pumped into settling basins to allows sediments to settle out before the water is released downstream of the construction area, or waivers may be sought to allow the water to pass without treatment.

Turbidity downstream of the dam will be influenced by the disturbance of sediments from the installation of the outlet pipe. Specific measures for controlling erosion in the construction area immediately downstream of the dam were not provided

[44] *Sullivan Lake Cold Water Intake 95% Draft Design Documentation Report*, filed with the Commission January 27, 2011.

[45] Memorandum documenting phone conference between the applicant and the WDFW on December 10, 2010, provided as part of the *Sullivan Lake Cold Water Intake 95% Draft Design Documentation Report*, filed with the Commission January 27, 2011.

in the 95% Draft Design Documentation Report. A final design plan would provide a more thorough evaluation of the alternative selected and the measures that would be put in place to control erosion and sedimentation during the construction of the cold water release structure.

**Mill Pond Dam Removal**

The District proposes to remove Mill Pond dam and restore the formerly inundated area, which will disturb sediments during deconstruction activities, mobilize sediments deposited behind the dam, and expose shoreline that could experience erosion. The District proposes the following measures for sediment and erosion control at Mill Pond: (1) draw down the reservoir behind a cofferdam at a rate that the suspension of sediments in the reservoir will be held to acceptable levels; (2) sequence the lowering of the reservoir with upstream streambed construction to minimize mobilization of sediment into the lowering reservoir; (3) prepare and implement a Storm Water Pollution Prevention Plan with measures to control erosion in the affected area, monitor the affected area for erosion, and implement corrective measures when needed; (4) when possible, work in the dry when excavating the proposed streambed and floodplain, including using bypass channels to route flow around work areas; (5) restore the Mill Pond reservoir inundated area, which shall include revegetation of the inundated area to plant communities consistent with the site and surrounding vegetation; (6) stabilize approximately 360,000 to 380,000 cubic yards of sediment left in place within the affected area; (7) deposit approximately 40,000 cubic yards of sediment material removed during site restoration in locations and at elevations to avoid mobilization and transport into the restored stream channel during flows up to, and including a flood event having a 100-year flood recurrence interval; (8) armor the bottom of the Sullivan Creek stream channel and any side channels to minimize erosion of the stream bottom; (9) implement floodplain and upland area restoration measures to prevent erosion and run-off of sediment materials into the restored stream channel during large rain events; and (10) restore the affected area, including any wetland areas receiving temporary direct impacts from equipment trampling.

The District would deposit excavated sediment materials in fills of minimum depth on terraces with low gradient slopes, away from the proposed floodplain. Fill areas would be compacted to the maximum density for geotechnical stability, yet still suitable for supporting plant growth. Erosion protection would be provided by seeding, mulch, fabric application, sediment traps, or other measures as appropriate. A second phase of revegetation would be implemented the following spring after restoration efforts are implemented.

*Staff Analysis*

**Cold Water Release Facility**

While site-specific measures for erosion control need to be developed for the project installation, the District's proposed measures would control the migration of sediments downstream that would be disturbed by the installation of the facility.

Turbidity curtains provide a physical buffer to contain the sediments within a confined area. While the efficacy of the potential curtain that would be installed is unknown, the curtain would be expected to contain the bulk of the sediments in the installation area and prevent sediments mobilized from migrating downstream. Keeping the curtain installed until the disturbed sediments have settled on the reservoir bottom would further prevent the migration of sediments downstream, protecting downstream resources.

The use of a cofferdam would block flowing water from the installation site, which would prevent disturbed sediments from being washed downstream. Pumping the water between the cofferdam and the dam into settling basins to allow suspended particles to fall out of suspension before the water is pumped downstream would protect downstream resources.

Erosion control measures downstream would need to be put in place to protect downstream resources. It is anticipated that the outlet channel consists of glacial outwash and gravel deposits. Based on historic records the depth of these deposits appears to be very deep. It is anticipated that the depth of the deposits are well below the bottom of the anticipated excavations. Final specifications should indicate measures that would be used to prevent erosion around the outlet channel.

The District's proposed measures are consistent with standard practices and should prevent any long-term erosion problems.

**Mill Pond Dam Removal**

Mill Pond dam has altered the natural sediment transport processes in Sullivan Creek by trapping all bedload material behind the dam. The amount of fine-grained sediment behind the dam at Mill Pond has an estimated volume of 465,800 cubic yards, an average depth of 4.8 feet, and a maximum depth of 12.4 feet (District, 2010). The core logs show that in most cores the upper 3.8 to 6.5 feet consist of silt, underlain by poorly graded sand, well graded sand, or gravels.

The fine-grained sediment materials present behind the dam and on the bottom of the reservoir are highly erodible. As such, the sediment would be easily mobilized into Sullivan Creek if effective control measures are not put into place. The District proposes the following measures to minimize the release of suspended sediments and prevent stream bank erosion from particle scouring: (1) draw down the reservoir at a rate that minimizes the suspension of sediments; and (2) sequence the lowering of the reservoir with upstream streambed construction to minimize mobilization of sediment into the lowering reservoir. By preventing a rapid drawdown in the reservoir, the District can also minimize diversions from the proposed stream alignment and prevent suspension of alluvial deposits upstream of Mill Pond. The McMillan report referenced in the Mill Pond Decommissioning Plan indicates that sediment would be removed from the restored stream channel using a combination of mechanical removal and natural removal, and that the final Mill Pond dam removal and channel restoration design would determine how much of the 20,000 to 40,000 cubic yards of sediment present in the restored Sullivan Creek channel would be excavated. Those sediments that are excavated would be screened, the gravels removed and redistributed within the channel confines, and the fine sediments graded into the restored upland areas. However, the sediments not excavated from the stream channel are expected to be mobilized by stream flow, with ultimate deposition in Boundary reservoir. The final design phase for the Mill Pond dam removal is expected to provide further information on sequence of steps and measures that would be applied to control erosion.

The restoration of the inundated area around Mill Pond dam would provide a defined stream channel for Sullivan Creek and stabilized stream banks that would be resistant to erosion once full stream flow is restored. The District proposes measures that would help protect project resources by minimizing sediment losses to stormwater runoff or creek flow, create a defined stream channel that would provide aquatic habitat, and create riparian habitat along stabilized stream banks. Revegetation and sediment stabilization would protect downstream resources while providing habitat.

Compacting the excavated materials on terraces above the floodplain and installing a vegetative cover would limit erosion of these sediments. The erosion protection measures that would be installed along the new habitat created by the restoration activities would limit erosion of the restored inundated area and constructed habitat until permanent vegetation cover is in place. The second phase of revegetation would ensure site stabilization and long-term successful restoration.

The District's proposal to monitor the site during dam removal, during restoration activities, and after the restoration of the free flow of Sullivan Creek through the formerly inundated area would allow the District to evaluate if additional measures are required to protect project resources.

## 3.4 WATER QUANTITY AND QUALITY

### 3.4.1 Affected Environment

#### 3.4.1.1 Boundary Project

**Water Quantity**

The portion of the Pend Oreille River basin upstream of Boundary dam has a drainage area of more than 25,200 square miles. The average flow during the period of 1987 to 2005 above the dam was 24,100 cfs (Seattle 2008). Snowmelt upstream of the project creates the majority of annual runoff, with peak flows typically occurring from April through June. The highest average flows are in June and average 49,700 cfs, while the lowest flows occur in August and average 13,000 cfs.

Because of the large volume of water flowing through the system and the limited amount of storage capacity in Boundary Reservoir, the hydraulic retention time (residence time of water) of Boundary Reservoir is very short. Maximum retention time is less than four days, but more typically retention time is less than two days (Seattle 2009).

Table 3-1 shows the average maximum, mean, and minimum flows that entered the Boundary reservoir and that were released from the project's powerhouse from 1987 to 2005. Inflow to the reservoir roughly equaled outflow from the project for all months and flows for this time period.

Table 3-1. Inflow into Boundary reservoir and releases from the project from 1987 to 2005 in cfs (Source: staff).

| | Flow into reservoir | | | Flow released from project | | | Difference | | |
|---|---|---|---|---|---|---|---|---|---|
| | Max | Mean | Min | Max | Mean | Min | Max | Mean | Min |
| Jan | 27,800 | 16,900 | 10,100 | 28,300 | 16,900 | 10,200 | 500 | 0 | 100 |
| Feb | 41,600 | 17,200 | 7,600 | 42,300 | 17,100 | 7,900 | 700 | -100 | 300 |
| Mar | 43,400 | 20,600 | 8000 | 44,400 | 20,600 | 8,600 | 1,000 | 0 | 600 |
| Apr | 54,600 | 29,000 | 11,400 | 55,700 | 29,000 | 12,000 | 1,100 | 0 | 600 |
| May | 99,000 | 43,000 | 22,500 | 99,200 | 42,400 | 22,000 | 200 | -600 | -500 |
| Jun | 118,800 | 49,700 | 15,900 | 116,200 | 49,200 | 16,100 | -2,600 | -500 | 200 |
| Jul | 39,300 | 24,900 | 11,400 | 39,100 | 24,800 | 10,700 | -200 | -100 | -700 |
| Aug | 20,800 | 13,000 | 6,400 | 20,000 | 12,600 | 6,100 | -800 | -400 | -300 |
| Sep | 21,500 | 14,600 | 8,300 | 21,200 | 14,300 | 8,200 | -300 | -300 | -100 |
| Oct | 26,300 | 21,500 | 16,300 | 26,000 | 21,300 | 16,000 | -300 | -200 | -300 |
| Nov | 28,000 | 20,700 | 15,000 | 28,600 | 20,800 | 14,800 | 600 | 100 | -200 |
| Dec | 37,500 | 18,100 | 12,000 | 37,900 | 18,100 | 12,100 | 400 | 0 | 100 |

The primary non-consumptive use of water in the project area is for hydroelectric power. Seattle holds several active water rights on file with Ecology's Water Resources Section. Seattle's water rights authorize use of Pend Oreille River water for the purpose of hydropower generation for up to 53,700 cfs at anytime and for 94,500 acre-feet annually. Seattle has applied for a water right for an additional 4,400 cfs for hydropower generation. Seattle also holds consumptive water rights on a small amount of water. These include a right of 5.34 cfs for seasonal irrigation and fire protection and 2.17 cfs for domestic supply and power plant cooling.

**Water Quality**

Water quality in the project area is largely influenced by the project's location within the highly regulated Pend Oreille-Clark Fork system. The Pend Oreille River is considered to have good water quality overall (Seattle 2009); however, Ecology has identified exceedances of temperature, TDG, and pH in the mainstem Pend Oreille River and polychlorinated biphenyls (PCBs) in fish tissue samples. Toxics and macrophyte growth have also been identified by Ecology as parameters of interest in the Pend Oreille-Clark Fork system. In addition, based on its investigation of potential contaminant sources from 21 mines and mills along the lower reach of the Pend Oreille River, EPA (2002) identified potential toxics contamination from historical mining activities as an issue in the Project vicinity.

Applicable state water quality standards for the Pend Oreille River and its tributaries are summarized in table 3-2. Water bodies in the project area that deviate from these water quality standards are identified in table 3-3.

Table 3-2. Applicable Washington surface water quality standards for designated uses in the Pend Oreille River and tributaries between the Idaho and Canada borders (Source: Seattle, 2009).

| **Parameter** | **Water Quality Standard** |
|---|---|
| Fecal Coliform | Pend Oreille River: Not to exceed a mean value of 100 colonies/100 ml with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies/100 ml |
| | Sullivan Creek (above Harvey Creek and its tributaries) and Slate Creek and its tributaries: Not to exceed a mean value of 50 colonies/100 ml with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100 colonies/100 ml |
| Dissolved Oxygen | Pend Oreille River: Levels shall exceed 8.0 mg/l |
| | Sullivan Creek (above Harvey Creek and its tributaries) and Slate Creek and its tributaries: Levels shall exceed 9.5 mg/l |
| Temperature | Pend Oreille River: Not to exceed 1-day maximum temperature (DMax) of 20.0°C due to human activities. When natural conditions exceed 1-DMax of 20.0°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed t=34/(T+9) |
| | Sullivan Creek (above Harvey Creek & its tributaries) and Slate Creek and its tributaries (Char spawning/rearing): 12°C Highest 7-day average daily maximum<br>Sullivan Creek below Sullivan dam (summer salmon habitat): 16º C Highest 7-day average daily maximum |
| Total Dissolved | Not to exceed 110 percent of saturation at any point of sample collection; this criterion shall not apply when flow exceeds the seven- |

| | |
|---|---|
| Gas | day, ten-year frequency flood (108,342 cfs). |
| pH | Within 6.5-8.5 with human caused variation within the above range of less than 0.5 units |
| Turbidity | Should not exceed either a 5 NTU increase over background when the background is 50 NTU or less; or a 10 percent increase in turbidity when the background is more than 50 NTU |

Table 3-3. Water bodies in the project area (and Box Canyon dam forebay) identified as not meeting applicable Washington water quality standards (Source: Seattle, 2009).

| **Water Body Name** | **Listing ID** | **Location Description (Township; Range; Section)** | **2008 Washington State Impaired Waters Classification[a]** |
|---|---|---|---|
| **Water Quality Parameter: Temperature** | | | |
| Pend Oreille River | 43539 | Boundary Dam tailrace (40N;43E;03) | 5 |
| Pend Oreille River | 42515 | Boundary Dam forebay (40N;43E;10) | 5 |
| Pend Oreille River | 11452 | Above Boundary Dam near Metaline Falls (39N;43E;21) | 5 |
| Pend Oreille River | 42512 | Box Canyon dam tailrace (38N;43E;19) | 5 |
| Pend Oreille River | 42513 | Box Canyon dam forebay (38N;43E;19) | 5 |
| **Water Quality Parameter: Total Dissolved Gas** | | | |
| Pend Oreille River | 42516 | Boundary Dam tailrace (40N;43E;03) | 4A |
| Pend Oreille River | 6287 | Box Canyon Dam tailrace (38N; 43E; 19) | 4A |
| **Water Quality Parameter: pH** | | | |
| Pend Oreille River | 11451 | Above Boundary Dam near Metaline Falls (39N; 43E; 21) | 5 |
| **Water Quality Parameter: PCBs (fish tissue)** | | | |
| Pend Oreille River | 52935 | Above Boundary Dam | 5 |

| | | | |
|---|---|---|---|
| | | near Metaline Falls (39N; 43E; 21) | |

[a] The state of Washington uses five water quality assessment categories. Category 1: Meets tested standards for clean water; Category 2: Waters of concern – for waters where there is some evidence of a water quality problem, but not enough for a TMDL to be required; Category 3: No data; Category 4: Polluted waters that have water quality improvement plans in place (Category 4a is for water bodies that have an approved TMDL); Category 5: Polluted waters that require a TMDL (commonly referred to as the "303(d) list"). There are numerous sites in the Project area reported in Category 1; only those waters currently (2008) listed for Category 4A or 5 are included in this table

Temperature

Temperatures in the Pend Oreille River upstream of the project area (i.e., water entering the project from Box Canyon Reservoir) at times exceed the applicable numeric water quality standard of 20 °C daily maximum temperature. Temperatures throughout the Pend Oreille River can reach 25 ºC in the summer months. Field measurements show that water temperatures are consistent along the length of Boundary Reservoir. Little vertical variation in temperatures exists, with temperatures at the deepest point in the reservoir being similar to those measured at the surface.

Several water quality studies measured water temperature in the Pend Oreille River prior to the construction of Boundary Dam in 1962. The USGS collected 58 water temperature spot measurements at an international gaging station located in Z Canyon (approximately RM 17.5) from 1952 to 1961 (Seattle, 2006). These records showed water temperatures that ranged between 0°C and 22.8°C. Temperatures exceeding 20°C were recorded in four out of eight years. Temperatures measured during the same period at another USGS gaging station at Box Canyon dam documented water temperatures that ranged from 0.5°C to 23.9°C, with spot measurements exceeding 20°C in five out of eight years. Additional pre-project data are also available for the Pend Oreille River near Ione (USGS gage #12396500) from USGS's National Water Information System (NWIS) webpage. This dataset has monthly temperature measurements between November 1959 and September 1962. Water temperatures ranged from 0.5°C to 21°C. Three out of 12 spot measurements taken between June and September exceeded the current standard of 20°C. Seattle collected bi-weekly water temperature measurements in 1962. Of the 15 spot measurements collected between June and September, four exceeded 20°C and showed a maximum value of 22.7°C. Lastly, spot measurements collected in 1963 show temperatures reaching 23.9°C in August at RM 25.5, located between Metaline and Metaline Falls. These four sets of data show that temperatures often exceeded the current water quality standard prior to construction of the project. Both Albeni Falls dam and Box Canyon dam were operational by 1952. No water temperature data collected prior to construction of these two projects was identified.

Water temperature data are also available for Boundary Reservoir since project construction (Seattle, 2006). During a bull trout field investigation study, water temperatures were measured at two locations in Boundary Reservoir from August 20 through October 27, 1996. Temperature was monitored immediately upstream of Boundary dam and in Boundary reservoir at the mouth of Slate Creek. Three thermographs were installed at each location to record temperatures at different depths. Water temperature showed a decreasing trend over the monitoring period with temperatures recorded as high as 21.5°C at the beginning of the sampling period to as low as 8.8°C at the end. These data combined with the data from the Slate Creek site show that, in general, Boundary Reservoir is isothermal both with depth and longitudinally. Variation in water temperature with depth was infrequent and minimal, generally less than 0.5°C. No differences were observed between water temperatures measured at the two stations. Data collected in 1997 for the same study had similar results with no evidence of thermal stratification and little difference in longitudinal temperature variations. The 1996 data showed diel fluctuations of less than 0.2°C.

USGS also reported daily water temperature data collected between 1999 and 2003 for Boundary Reservoir near Metaline Falls (#12398550) and Pend Oreille River at the International Boundary (#12398600) (Seattle, 2006). Similar to other water temperature data collected in the project vicinity, temperatures ranged between 0°C and 25°C at the two sites depending on the season. Temperature was consistent between the two stations. Some diel fluctuation was observed when comparing the minimum and maximum daily values. This fluctuation was on average 0.38°C, but was as great as 1.9°C. Water temperatures consistently exceeded the 20°C standard for two months in the summer.

<u>Dissolved Oxygen</u>

Dissolved oxygen in the Pend Oreille River has been found to range between 7 mg/L and 14.3 mg/L (Seattle, 2006). DO data were collected in Boundary Reservoir in 1998 and 2004, and these two studies indicated little variation in DO concentrations with depth and little variation between downstream and upstream monitoring stations.

Seattle also collected DO measurements from the reservoir in 2007 and 2008 (Seattle, 2009). Most DO measurements were at or above the 8.0 mg/L water quality standard. On occasion in July and August, DO measurements at a few sites were between 7.0 - 8.0 mg/L (most of them between 7.6 - 7.9 mg/L), mostly occurring in the lower depths of the reservoir. Monthly DO levels measured at Ecology's Metaline Falls long-term monitoring station were typically at or above 8.0 mg/L, with two recorded measurements below the water quality standard since 1996 (7.9 and 7.8 mg/L).

<u>Total Dissolved Gases</u>

Total dissolved gas is a water quality constituent of concern because past monitoring has shown that TDG measurements downstream of Boundary dam exceeded the state standard (110 percent saturation). This standard is designed for the protection of fish and other aquatic organisms. TDG in excess of 110 percent saturation has been shown to cause gas bubble trauma in fish. Symptoms of this trauma vary from blistering beneath the skin when fish are exposed to low TDG exceedances to mortality when fish are exposed to extreme exceedances. Increased levels of TDG may be caused naturally through high biological primary productivity, changes in barometric pressure or water temperatures, and waterfalls and cascades. However, monitoring data along the Pend Oreille River show that elevated TDG levels are associated with spill at hydroelectric projects. TDG supersaturation typically occurs where spill flow plunges into deep water at the base of a dam. When flow passes over the spillway, air entrained in the falling water plunges to depth, and there, under elevated hydrostatic pressure, the air (in the form of bubbles) is forced into solution at pressures up to several atmospheres. This can result in supersaturation of water with dissolved nitrogen, oxygen, and other constituents of air. Supersaturation can also be caused by the introduction of air at the turbines as water passes through the powerhouse.

Exceedances of state (Idaho and Washington) TDG standards have been measured at a number of hydropower facilities in the Pend Oreille River basin upstream of the Boundary Project (Seattle, 2009). TDG levels in the Clark Fork/Pend Oreille system at times exceed the applicable water quality standard of 110 percent saturation. TDG data have been gathered at the project since 1998; TDG levels are measured at U.S. Geological Survey (USGS) stations in the forebay (USGS Gage No. 1238550) and in the tailrace (USGS Gage No. 12398600). Exceedances of Ecology’s TDG standard typically occur during high spring flows, when flows exceed the power plant capacity of approximately 56,000 cfs and significant spill occurs. Average incoming TDG levels in the Boundary dam forebay range from 103 to 128 percent. Average tailrace TDG levels range from 106 to 131 percent, with the average TDG contributed by the Project ranging from 0 to 4 percent between the forebay and the tailrace.

Daily TDG values, estimated assuming a barometric pressure of 760 mm Hg, are presented in figure 3-1. This figure shows exceedances of the 110 percent standard in five of the six years. Over that period, TDG exceedances occurred during 5.3 percent of the total number of days monitored (primarily from April through the beginning of July).

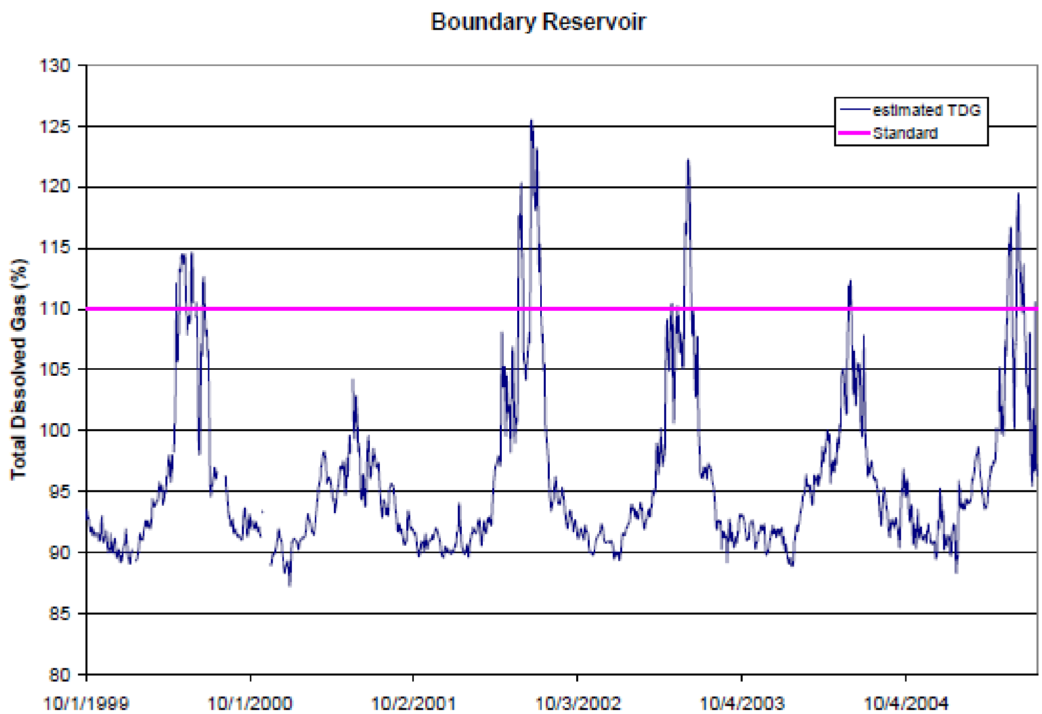



Figure 3-1. Measured TDG just downstream of Boundary dam from 1999–2005 (Gage # 12398550) (Source: Seattle, 2006).

Data collected between 1999 and 2008 indicate that when the project is spilling water, the project reduces river TDG an average of nine days per year (Seattle 2009). Data also indicate that the project adds TDG to the river an average of 7.4 days per year. On average, river flows are greater than the 7-day, 10-year (7Q10) river flow two days per year, during which time Ecology's TDG standard of 110 percent is not applicable. Table 3-4 summarizes the effects of project spill on Pend Oreille River TDG levels below the project.

Table 3-4. Boundary Project spill influence on TDG (Source: Seattle, 2009).

| Spill (CFS) | Days Per Year | % TDG Removed or Added |
|---|---|---|
| 0-5,000 | 3.7 | 7 to 5% reduced |
| 5,000-10,000 | 3.0 | 5 to 2% reduced |
| 10,000-15,000 | 2.2 | 2% reduced to pass through |
| 15,000-53,300 | 7.4 | pass through to 24% added |
| 53,000+ | 1.9 | 110% TDG standard not applicable > 7Q10 flow |

EPA approved the TDG TMDL for the Pend Oreille River in Washington in March 2008. The TMDL outlines TDG reduction goals for each hydroelectric project on the Pend Oreille River in Washington, recognizing that incoming TDG levels often exceed the 110 percent standard. There is a TMDL goal for each project to manage its spill (and reduce its contribution to TDG levels) to create TDG conditions in the downstream effectiveness monitoring location that are no worse than forebay conditions, only if conditions upstream of the dam exceed allocations and prevent meeting allocations downstream. The TMDL set the TDG allocation for the Boundary tailrace for 69 mm of mercury above saturation.

pH

An investigation of the water quality in the lower Pend Oreille River in 1962–1963 (pre-Project), found the pH to range between 7.6 and 8.2 (Seattle, 2006). The pH in the Pend Oreille River is, on average, slightly basic with peak median values occurring in July and August. Ecology has been collecting pH measurements at the Newport and Metaline stations since 1949 (WDOE, 2005a). Of the 395 readings taken at Newport during that period, 12 (3 percent) exceeded the state water quality standard of 8.5 pH units. Of the 149 readings collected at the Metaline station, 9 (6 percent) exceeded the state water quality standard of 8.5 pH units.

During 2007 and 2008 sampling, pH in the project area ranged from 7.6 to 9.1 across all monitoring stations (Seattle, 2009). No consistent longitudinal pattern was observed for pH in the reservoir, although from June through October 2007, the pH of water entering the reservoir from Box Canyon dam was higher than the pH measured in the Boundary dam forebay. pH exceeded Ecology's water quality criterion of 8.5 at several sampling stations from June through October 2007. However, as noted above, during these times the pH of water entering the project area from Box Canyon Reservoir also exceeded the 8.5 standard and was higher than the pH of the water being released from Boundary Reservoir. Monthly pH data from Ecology’s monitoring stations at Metaline Falls and Newport, Washington (the latter upstream of the project Area and Box Canyon dam) reflect a similar pH range to that observed in the project area during 2007 and 2008 (i.e., 7.0 – 9.0), with one to three exceedances of the water quality standard recorded annually since 2001 at the Metaline Falls station.

Aquatic invasive macrophytes (primarily Eurasian watermilfoil and curly pondweed) have been identified by Ecology as an impairment in Box Canyon Reservoir upstream of the project area, and dense populations of macrophytes have been found to influence pH in Box Canyon Reservoir (Seattle, 2009). In Box Canyon Reservoir, 31 percent of all measurements collected between July and November 1998, exceeded Washington water quality standards for pH. The pH of water can be raised as a result of macrophyte photosynthesis. Because reservoirs may promote macrophyte growth, Ecology identified the effects of macrophyte growth on pH in Boundary Reservoir as an area of interest. Studies in the Pend Oreille River have found that pH measurements are on average 0.4 units higher in macrophyte beds than in the main channel of the Pend Oreille River.

Aquatic Macrophytes

Dense beds of vegetation in the project area can negatively affect recreation by restricting boat traffic, and interfering with angling opportunities.  Invasive aquatic macrophytes have also been known to affect power generation by clogging intake structures.

Invasive populations of Eurasian watermilfoil and curly pondweed were surveyed by Seattle in 2007 (Seattle, 2009).  The entire project area both upstream and downstream of Boundary dam was surveyed.  Surveyors found seventy-two macrophyte beds between Boundary dam and the Box Canyon tailrace covering 223.2 acres.  Ninety percent of observed beds occurred between Metaline Falls and the Box Canyon dam, mostly near the town of Metaline.  There were no beds observed below the Boundary dam.

Invasive Invertebrates

During pre-licensing consultation, the state of Washington identified three invasive species of concern for the project area:  zebra mussel, quagga mussel, and New Zealand mudsnail.  Currently, none of these species are found in the project area.

The nearest known occurrences of zebra and quagga mussels are in Utah. However, these species have spread to many parts of the country from their introduction into the Great Lakes in the 1980s.  The most common method of dispersal into new basins is transport on recreational boats or trailers.  Once dispersed, both species have very high fecundity and can spread through a system very rapidly.  Both zebra and quagga mussels can clog water intake structures such as pipes and screens, thereby interfering with hydropower generation (Seattle, 2010).

New Zealand mudsnails are widely distributed in the western United States. First found in the Snake River in Idaho in 1987, they have spread rapidly into many stream basins.  The nearest documented occurrences to the proposed project are in the Columbia River and Kalispell Creek, Washington (Seattle, 2010) less than 50 miles from the project.  New Zealand mudsnails are a very successful invasive species due to their asexual reproduction, ability to tolerate very harsh conditions, and lack of any natural predators or parasites in the United States.  They are commonly introduced to new systems by boats and trailers that have not been thoroughly cleaned.  Resource agencies are concerned about their proliferation because their presence could adversely affect macroinvertebrate populations utilized by native trout as food.

Toxics

Due to historic mining practices in the local area, as well as throughout the Pend Oreille-Clark Fork system, toxics were identified by Ecology as a potential water quality issue in the project area.  The only recently active mine in the project vicinity is the Pend Oreille Mine, a lead and zinc mine with surface facilities located on the east side of the river approximately 2 miles north of Metaline Falls.  This mine began operation in 1952, operated intermittently until it was shut down in 1977, and was then reopened from January 2004 to January 2009. Treated water discharged from the Pend Oreille Mine into the Pend Oreille River at RM 25 is monitored by Ecology under the mine's National Pollutant Discharge Elimination System (NPDES) discharge permit.

Seattle conducted a Toxics Inventory and Screen Review for the Boundary Project vicinity (Seattle, 2006). The qualitative assessment identified 20 toxic substances with potential to be present in the project vicinity. Of those 20 toxics, 16 were determined to be of low concern and four—cadmium, lead, mercury, and PCBs—were determined to be of medium concern. The inventory and screen review identified no toxics of high concern in the project vicinity.

Based on a screening of existing information, Seattle, in consultation with resource agencies, broadened their scope to include six toxics of concern for the project area: arsenic, cadmium, lead, mercury, PCBs, and zinc. Historical and current information about these contaminants in the project area is found in table 3-5.

Table 3-5. Toxics screen and inventory qualitative assessment summary (Source: Seattle, 2006 & 2009).

| **Toxic Substance** | **Exceedance of Water Quality Standard?** | | **Exceedance of Aquatic or Human Health Guidelines?** | **Potential Mechanism for Boundary Operation to Affect Fate and Transport of the Toxic Substance?** | **Current Source in Boundary Watershed?** | **Concern** |
|---|---|---|---|---|---|---|
| | Historical (before 2000) | Current (after 2000) | | | | |
| Arsenic | No | No | No | Accumulation/ erosion | Grandview Mine, Pend Oreille Mine | Low |
| Cadmium | Yes | No | No | Accumulation/ erosion and leaching/ precipitation | Josephine Mine, Oreille Mine, Grandview Mine, Pend Oreille Mine | Medium |
| Lead | Yes | Yes | No | Accumulation/ erosion | Pend Oreille Mine, Josephine Mine, Grandview Mine | Medium |
| Mercury | No | No | | Accumulation/ bioaccumulation | Grandview Mine, Pend Oreille Mine | Medium |
| PCBs | | | Yes | Accumulation/ erosion | No | Medium |
| Zinc | Yes | Yes | No | Accumulation /erosion | Pend Oreille Mine, Josephine Mine, Grandview Mine | Low |

### 3.4.1.2 Sullivan Creek Project

**Water Quantity**

<u>Sullivan Creek and Outlet Creek</u>

The hydrology of the Sullivan Creek Project is affected by two main tributaries, Sullivan Creek and Harvey Creek (District, 2010). Sullivan Creek and Harvey Creek originate at the peaks of Salmo and Monumental Mountains at elevation 6,400 ft and 5,711 ft, respectively. Sullivan Creek drains the area east and northeast of Sullivan Lake and has a total drainage basin area of approximately 70.0 square miles. Harvey Creek drains the area to the south and southeast of Sullivan Lake and has a total drainage area of about 52 square miles.

Sullivan Lake was a natural lake prior to the construction of the Sullivan Lake dam. The lake is fed by Harvey, Noisy and Hall creeks. The Sullivan Lake dam raised the natural lake elevation by 26 feet above historical levels. Outlet Creek flows from Sullivan Lake and joins Sullivan Creek approximately 0.5 miles downstream of the dam. The confluence of the North Fork Sullivan Creek into Sullivan Creek is approximately 2,500 ft. downstream of the Mill Pond dam and adds flow to Sullivan Creek. The drainage basin of the North Fork Sullivan Creek is approximately 9.5 sq. mi. The District currently holds three water rights on Sullivan Creek. Two are for power production purposes (110 cfs and 550 cfs) and one is for municipal water supply from the North Fork Sullivan Creek for the Town of Metaline Falls (2.5 cfs).

USGS Gage #12397100, Outlet Creek Near Metaline Falls, located about 0.4 miles downstream of Sullivan Lake dam on Outlet Creek, collects stream flow data, with a period of record from 1959 to present. A USGS gage (#12396900) located on Sullivan Creek above the confluence with Outlet Creek has been discontinued but had a period of record from 1959 to 1972, and 1991 to 1995. Another USGS gage (#12398000) is located one-half mile upstream of the mouth of Sullivan Creek, with a period of record 1953-1968, and 1994 to present. Average annual flows in Sullivan and Outlet Creek are shown in figure 3-2.

Sullivan Creek flow averaged 122 cfs for the 19 years of record with a high flow of 191 cfs and a low of 53 cfs. Outlet Creek flow averaged 77 cfs for the 19 years on record with a high flow of 120 cfs and a low of 38 cfs.

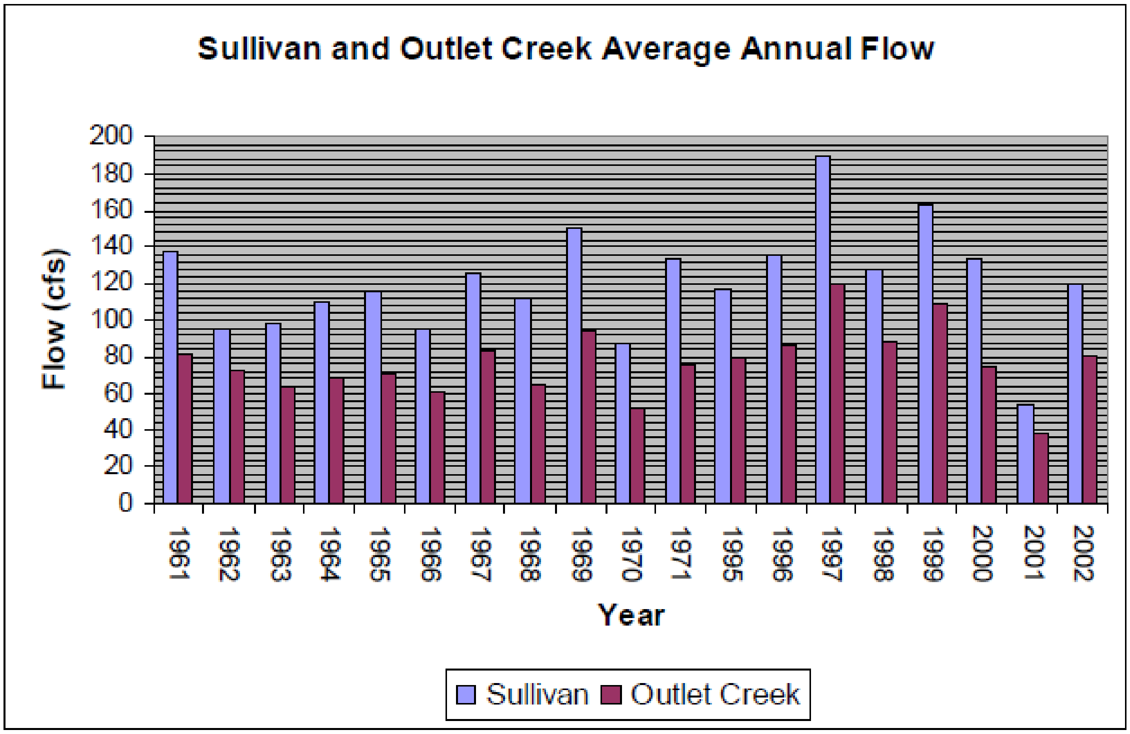



Figure 3-2. Sullivan and Outlet Creek average annual flow (Source: District, 2010).

Outlet Creek flow data are measured downstream of the dam, so they are "regulated flows," meaning they do not represent the daily inflow to the reservoir, but rather the regulated flow releases from Sullivan Lake. On an annual basis, because the reservoir portion of Sullivan Lake is brought down to elevation 2,565 feet each year and then refilled to elevation 2,588.66 feet in the spring, the total run-off in a year obtained by adding up all the daily flows for a year from Outlet Creek data is the same as the total would be if the lake were unregulated by a dam.

Sullivan Lake

Present project operations store approximately 31,000 acre-feet of water at Sullivan Lake during the summer recreation season. This water is released in October every year for the benefit of downstream power production under the Pacific Northwest Coordination Agreement.

The District's water right for 110 cfs has no minimum instream flow requirements from Sullivan Lake into Outlet Creek. Their other water right of 550 cfs requires a minimum instream flow of 10 cfs from Sullivan Lake to Outlet Creek, as recorded at the Highway 31 bridge near the old Sullivan powerhouse. The minimum flow is to be maintained from April 1 to September 30.

EES (2009b) reviewed historical water surface elevations of Sullivan Lake between 1999 and 2008; lake elevations were not available on a daily basis, but only on a somewhat periodic basis, with several days to a week between observations (980 observations over a 10 year period). During that 10-year period, hydrologic conditions caused Sullivan Lake to fill to full pool 7 out of the 10 years. The average date of reaching full pool was June 20 (with a range of June 1 to July 13). The average maximum elevation in years not filled was 2583.88 (range of 2581.76 to 2585.06).

Mill Pond

Mill Pond is formed by a man-made impoundment on Sullivan Creek. It is downstream of the confluence of Sullivan Creek and Outlet Creek. Mill Pond dam has a capacity of about 1,962 acre-ft and covers approximately 63 acres at its normal pool elevation of approximately 2,505.7 feet (District, 2010). Maximum inflows into Mill Pond typically occur in May or June, with minimum inflows occurring in September. Average monthly flow just downstream of the confluence of Sullivan Creek and Outlet Creek is approximately 200 cfs, and can vary from a low of about 62 cfs in February to about 533 cfs in June. Mill Pond has no capacity to store water, therefore its inflow and outflow are considered to be equal.

**Water Quality**

All water quality data were taken from the District's license for project surrender, unless otherwise noted.

Temperature

Washington DFW installed temperature recording devices in several locations, as described below, and collected simultaneous water temperature data in Sullivan Lake (at various levels), in Outlet Creek, Sullivan Creek above the confluence with Outlet Creek, Sullivan Creek below Outlet Creek, Mill Pond, and downstream of Mill Pond. The station in Sullivan Lake had sensors deployed at various depths, from 20 meters deep to the surface, in two meter increments. Several other stations (but not all) had duplicate instruments at the same site to insure that accurate and complete records would be recorded. The recording instruments were located as shown in table 3-6:

Table 3-6. Washington DFW Water Temperature Monitoring Stations (Source: District, 2010).

| Recorder # | Location | Date Installed | Date Removed |
|---|---|---|---|
| 1 | Sullivan Lake- with sensors at depths from 20m to the surface in 2m increments | 5/8/2009 | 11/16/09 |
| 2 | Sullivan Creek- 50m Upstream of Confluence with Outlet Creek- Unit 1 | 7/1/2009 | 11/16/09 |
| 3 | Sullivan Creek- 50m Upstream of Confluence with Outlet Creek- Unit 2 | 7/1/2009 | 11/16/09 |

| | | | |
|---|---|---|---|
| 4 | Sullivan Creek- 75m downstream of confluence with Outlet Creek- Unit 4 | 7/1/2009 | 11/16/09 |
| 5 | Sullivan Creek- 1.5 km downstream of Mill Pond Dam-Unit 5 | 7/1/2009 | 11/16/09 |
| 6 | Sullivan Creek- 1.5 km downstream of Mill Pond Dam-Unit 6 | 7/1/2009 | 11/16/09 |
| 7 | Outlet Creek-75m downstream of Dam outlet- Unit 1 | 7/1/2009 | 11/16/2009 |
| 8 | Outlet Creek-75m downstream of Dam outlet- Unit 2 | 7/1/2009 | 11/16/2009 |
| 9 | Mill Pond 15m upstream of Mill Pond Dam- Unit 1 | 7/1/2009 | 11/16/2009 |
| 10 | Mill Pond 15m upstream of Mill Pond Dam- Unit 1 | 7/1/2009 | 11/16/2009 |
| 11 | Harvey Creek- Unit 1 | 7/1/2009 | 11/16/2009 |
| 12 | Harvey Creek Unit 2 | 7/1/2009 | 11/16/2009 |

The data from these recorders consisted of 24 daily readings, taken once per hour, for the period the recorders were deployed. All temperature data for Sullivan Lake are shown in figure 3-3, while all data for Harvey, Outlet and Sullivan creeks are shown in figure 3-4.

In early May and again in mid-November, monitoring found little temperature change with depth; Sullivan Lake was basically isothermal. Temperatures from the surface to 20 meters deep ranged between about 7.5º and 5º C. This temperature profile would have remained consistent throughout the winter and spring while the lake was not stratified. Water temperatures in Sullivan Lake consistently decreased with depth most of the summer as the lake stratified. At its peak of stratification (early August), temperatures at the surface of the lake were about 24º C, while temperatures near the bottom at 20 meters deep were around 6.5º C.

Based on the temperature monitoring of Harvey, Outlet, and Sullivan creeks in 2009, Harvey Creek and Sullivan Creek (upstream of confluence) temperatures (green and dark blue lines) are the coolest of all creek waters, and are similar. Outlet Creek water temperatures are the warmest of the creeks, mainly due to release of the water warmed in Sullivan Lake. Mill Pond near its outlet has considerably warmer water than Sullivan Creek upstream of the confluence with Outlet Creek during the summer. Water temperature in the combined flow of Outlet and Sullivan Creeks increases rapidly as Sullivan Lake begins to drain in the fall. The combined Sullivan Creek and Outlet Creek waters are warmed up quickly by the warm Sullivan Lake water. This warm water is moderated by Mill Pond, however, because Mill Pond temperature does not show any jump when Sullivan Lake began to drain. Water temperature in Sullivan

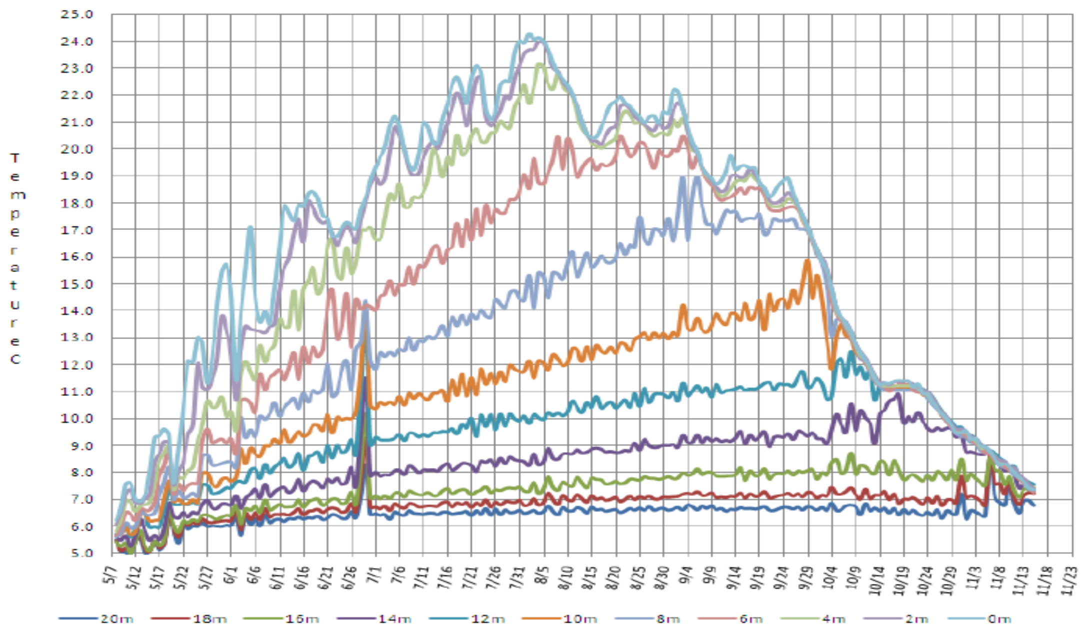



Figure 3-3. Sullivan Lake Water temperatures (C) at various depths May through November, 2009 (Source: District, 2010).

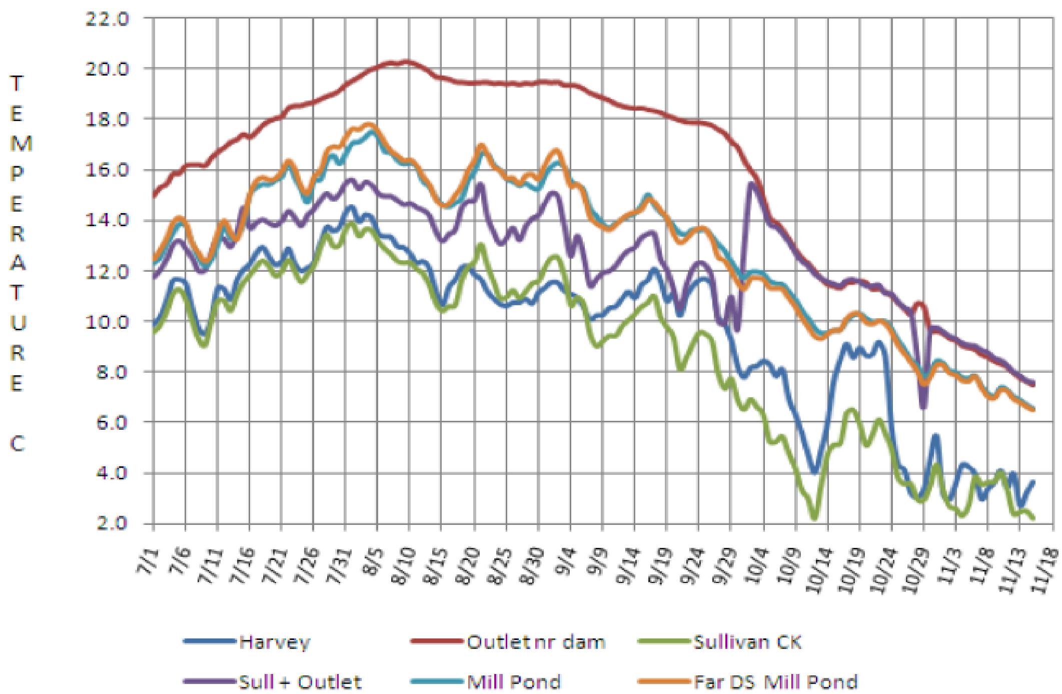



Figure 3-4. Harvey, Outlet and Sullivan Creek temperatures at various locations, July 1 to November 15, 2009 (Source: District, 2010).

Creek about 1 mile downstream of Mill Pond dam appears to be almost the same as the temperature in Mill Pond. Data gathered in 1996 for the District's license amendment process showed that 1 to 2º C of change was typical between Mill Pond and the confluence of Sullivan Creek with the Pend Oreille River (about 4 miles or 6.5 km downstream).

Other Water Quality Parameters

The District took monthly water samples in Sullivan Lake and Outlet Creek from July to November of 2009, and measured DO, pH, and turbidity. All results were within state water quality standards (table 3-2).

Sullivan Lake is not listed on the state's Clean Water Action Section 303(d) list. However, a portion of Harvey Creek, upstream of Sullivan Lake, appears on the 303d list, as does a section of Sullivan Creek upstream of its confluence with Outlet Creek and into Mill Pond. A section of the North Fork of Sullivan Creek, which enters Sullivan Creek below Mill Pond, also appears on the 303(d) list. All of these stream segments are listed as Category 5 Waters, which means they have been determined to be impaired for one or more of the water quality criteria. These criteria include fecal coliform, pH, temperature, and/or DO, depending on the reach.

## 3.4.2 Environmental Effects

### 3.4.2.1 Boundary Project

**Operation Compliance Monitoring**

Seattle's proposed operating regime is identical to the manner in which the project is currently operating (see section 2.1.2.2, *Proposed Operations*). Therefore, there would be no change in water quantity from current conditions either upstream or downstream of the project under this proposal.

Seattle's proposed operating regime contains a number of water surface elevations that must be met at certain times during the year, as well as certain times of the day during the summer recreation season. Seattle does not explain how it would monitor compliance with these operational requirements.

*Staff Analysis*

The current license does not limit daily reservoir fluctuations. However, Seattle has voluntarily done so during the summer to benefit recreation access and proposes to continue to do so over the next license. Operation compliance monitoring would assist the Commission in its administration and oversight of the license where there are such operational limits.

**Water Quality**

To address water quality concerns at the project, Seattle, in consultation with state and federal agencies, tribes, and others, developed five water quality plans:

Temperature Attainment Plan; Dissolved Oxygen Attainment Plan; Fish Tissue Sampling Plan; Total Dissolved Gas Attainment Plan; and Aquatic Invasive Species Control and Prevention Plan. Forest Service 4(e) condition 3 requires Seattle to implement each of the plans. Interior recommends their implementation pursuant to section 10(j) of the FPA. Each plan is discussed below.

Temperature Attainment Plan

The Pend Oreille River is listed on Ecology's 303(d) list as being impaired for temperature and a Total Maximum Daily Load (TMDL) is being prepared. Ecology's (2007) analysis for the Temperature TMDL indicates that areas of the Pend Oreille River in the Boundary Project area are not in compliance with the water quality standard for temperature (see table 3.2) and that, at times, the Boundary Project contributes to impaired temperature conditions.

Modeled daily maximum temperatures in the project area are within water quality standards (Seattle, 2009). Seattle's (2009) analysis found that under certain conditions, the project has a slight warming effect on surface daily maximum temperatures at the forebay, but has no effect at Metaline pool and has a cooling effect at the tailrace that is greater than the warming effect at the Boundary forebay.

Following an analysis of potential operational changes to reduce temperature effects, Seattle and stakeholders to the licensing process concluded that a suite of aquatic habitat improvement measures (contained in the Fish and Aquatic Management Plan—FAMP) in a number of tributaries to the reservoir and along the mainstem in tributary delta areas would help meet Ecology's temperature improvement goals for the Pend Oreille River. Seattle's proposed Temperature Attainment Plan summarizes the habitat measures that would be implemented as part of the FAMP (discussed later); defines a mainstem temperature monitoring plan; includes a Temperature Monitoring Quality Assurance Project Plan (QAPP); includes a provision to monitor temperature in the deltas of Sullivan, Sweet, and Linton Creeks; and provides an implementation schedule designed to achieve compliance with state water quality standards within 10 years.

Seattle's proposed monitoring program includes collecting continuous temperature data from June to September from four sites on the mainstem: Metaline pool (PRM 28.4), Slate Creek pool (PRM 22.5), Boundary dam forebay (PRM 17), and Boundary dam tailrace (PRM 16.1). Additionally, Seattle proposes to conduct continuous temperature monitoring in the deltas of Sullivan Creek, Sweet Creek, and Linton Creek from June through October annually. Seattle also proposed to monitor water and air temperatures at a single location in lower Sullivan Creek downstream of Mill Pond dam from June through October annually.

*Staff Analysis*

Seattle modeled expected temperatures if the project were to be operated under "run-of-river" conditions and at a constant forebay elevation of 1,974 during summer months. The 1,974-foot Run-of-River Condition is the most extreme variant on current operations possible given the physical constraints of the project (i.e., it maintains the forebay level as low as possible without causing cavitation damage to the units from continued operation). It therefore provides an important outer bound to compare to current operations. The 1,974-foot Run-of-River Condition was designed to evaluate whether temperature benefits would be provided by reducing the surface area of the reservoir and reducing warm water accumulation in the forebay. No significant difference between the existing condition and run-of-river operation was found for modeled surface daily maximum temperatures at Metaline pool or Boundary tailrace. The only difference between the two conditions was warming of surface daily maximum temperatures at the Boundary forebay station under run-of-river operation relative to the existing operations. The modeling results indicate that surface daily maximum temperatures in the Boundary Reservoir cannot be lowered using operational changes.

Seattle's habitat improvements in Sullivan, Linton, and Sweet creeks and in the tributary deltas on the mainstem[46] are likely to improve water temperatures for native salmonids and help achieve temperature attainment goals for the Pend Oreille River. Seattle's temperature monitoring would feed into the information on the effectiveness of the tributary enhancement measures at reducing temperatures in tributary deltas and achieving water quality standards.

Dissolved Oxygen Attainment Plan

The state of Washington's water quality criteria for the Pend Oreille River dictates that the lowest one-day minimum concentration of DO shall be 8 mg/L. This criterion was established to ensure waters can support salmonid spawning, rearing, and migration. DO monitoring conducted by Seattle in 2007 and 2008, showed that DO fell below the 8 mg/L minimum during July and August in the project area. To better define the magnitude and spatial and temporal extent of DO concentrations in the project area below 8 mg/L, Seattle proposes a 5-year DO monitoring plan to be implemented following the issuance of any new license issued by the Commission.

The DO monitoring plan would consist of monitoring at five sites in the project area, as shown in table 3-7. DO, temperature, and pH would be monitored every 15 minutes from June 15 to September 15 for each of the five years, as these are the warmest months of the year when exceedances would be most likely. DO measurements would be taken from 10, 30, 45, and 60-meter depths at each site.

---

[46] The suite of actions, as part of the FAMP, include riparian plantings, stream channel modifications, large woody debris (LWD) supplementation, bank improvements, and culvert replacements in Sullivan, Linton, and Sweet Creeks. The effects of these measures are discussed in section 3.5.2.1.

Table 3-7. Dissolved oxygen sampling sites from proposed DO monitoring plan (Source: Seattle, 2010b).

| Sample Site | Location Description |
|---|---|
| Box Canyon Tailrace | In Boundary reservoir just downstream of Box Canyon Dam |
| Metaline Old | Old Channel of Pend Oreille River across from Metaline |
| Everett Creek Island | Upstream of Everett Creek Island (below Metaline Falls) |
| Boundary Forebay | Boundary forebay |
| Boundary Tailrace | Downstream of Boundary dam |

Seattle proposes to submit a DO QAPP to Ecology within 6 months of license issuance. The QAPP would document the quality control and assurance measures that would be undertaken in the DO monitoring program. Seattle would also provide Ecology with annual reports, after license issuance, detailing the results of the annual data collection effort.

*Staff Analysis*

Although a few measured DO concentrations exceeded the state criteria in July and August, Seattle found no correlation between DO levels and water surface elevation fluctuations in Boundary reservoir related to project operation based on limited sampling. Seattle's proposed monitoring program, however, would provide a more robust dataset in which to characterize DO levels at the project under the natural range of water years and most hydraulic conditions. Monitoring would provide a means to verify that DO concentrations in Boundary Reservoir comply with Ecology standards under most conditions. Monitoring also would provide a way to detect if Seattle's proposed aquatic habitat improvement measures in the tributaries to the reservoir are having a beneficial effect on DO concentrations. If the habitat improvement measures were successful in lowering water temperatures in the reservoir, higher DO concentrations could follow, as the water's capacity to hold DO increases at lower temperatures. If it is determined that project operation is having a negative effect on DO levels in the Pend Oreille River, the monitoring program provides a mechanism to implement future measures should they be needed to improve DO levels.

Total Dissolved Gas Attainment Plan

Total dissolved gas (TDG) monitoring has shown that TDG levels downstream of Boundary dam exceed the state standard (110 percent saturation). Currently when water exits the project's sluice gates at full gate opening, the flow forms jets that result in high TDG due to plunging action of the jet into the plunge pool. Similarly, at the highest flows, flow over the spillways contributes to the energy and plunging action in the plunge pool.

In 2003, Seattle implemented voluntary operational changes to decrease TDG in the project tailrace. Turbine units 55 and 56 do not run efficiently at a capacity of less than 125 MW. To allow them to do so, Seattle utilized an air admission system, which injected air into the turbine system, resulting in increased TDG levels in the water exiting those turbines. To avoid the elevated TDG levels, Seattle stopped operating these turbines at a capacity of less than 125 MW. Additionally, Seattle changed their startup and shutdown sequences, so that these two units were the last units to be brought on line and the first units to be shutdown. This ensured that the water released from units 55 and 56 that contained high TDG levels as they started up and shut down would be mixed with water from the other four units that released water with lower TDG levels, reducing the elevated TDG levels. Seattle proposes to continue to operate in this manner under normal, non-spill operations. Seattle also proposes to upgrade the runners on units 55 and 56 within four years of license issuance which would eliminate the need for air admission[47] and likely the need to for sequencing their operations to reduce TDG levels.

Seattle filed a TDG Attainment Plan designed to attain TDG compliance with state standards at the project within 10 years of license issuance. Seattle proposes to evaluate and implement, as appropriate, the following measures: throttle sluice gates, which involves operation of sluice gates in partially open positions;[48] roughen sluice flow, which entails modification of the sluice gate outlets to add steel flip buckets on the downstream side of the sluice gates[49] to break up and spread flow; and installing a spillway flow splitter/aerator, which entails modifying the spillways to add deflectors to the end of the existing spillway structure and/or air vents to the spillway chute to aerate, break up, and spread the flow.[50] The three gate alternatives all involve spilling flow through existing outlets (the seven sluice gates and two spillway gates) into the tailwater plunge pool and rely on reduction in TDG production by spreading the flow and limiting plunging effects of the confined water jets. In 2010, Seattle would use physical and computational hydraulic models to help clarify the preferred configuration of the

---

[47] When Units 51 to 54 were upgraded with new runners, it was found that there was no longer a need to for air admission to smooth operation. It is reasonable to assume that this would be case following upgrading Units 55 and 56.

[48] Throttling the sluice gates (opening them only partially), would lower the energy of the released water.

[49] These buckets would direct the flow more horizontally than presently occurs and would also break up and spread out the jet as a spray within the plunge pool.

[50] Adding deflectors to the end of the existing spillway structure would increase the turbulence in the flow by roughening the spillway surface. Adding air vents to the spillway chute would allow for aeration of the base of the spillway jet. This would make the jet area at the impact point as large as possible, thereby, reducing the energy per unit surface area and the depth to which the jet would plunge. The air added to the flow on the spillway would assist in this process.

TDG abatement alternative or alternatives for construction in 2012, including the sequence of alternatives and their incremental plan of development. The first alternative selected for construction may consist of one of the three gate alternatives identified above, but more likely it would consist of a combination of two or more of these alternatives.

Following implementation of each set of TDG improvement measures, Seattle proposes to conduct biological sampling in the project tailrace area within two days of a spill event. Seattle would use boat electrofishing to sample along five 200-meter transects in the tailrace during each sampling period, once per year in years following installation of a new TDG abatement measure or measures. Fish captured would be examined for injury and indications of gas bubble trauma. Sampling would not be conducted during spill due to safety concerns for field crews in the tailrace.

The prioritization of evaluation of the three alternatives would be determined in the first year of plan implementation. The three alternatives would be evaluated using the following steps:

- Develop engineering plans to identify possible structural and operational improvements to meet state water quality standards.
- Identify improvement and implementation schedule.
- Implement prototype modifications.
- Monitor and test alternatives to assess success based on predicted TDG performance and dam safety goals.
- Refine ability to predict TDG performance through modeling.
- Evaluate and implement additional structural and operational measures, if necessary, until the state water quality TDG standard is met, or until all reasonable and feasible alternatives have been tested and implemented.

This evaluation would also include other factors that would be considered in the decision of which alternative to choose. These factors include (in order of importance): projected TDG reduction performance based upon testing, safety considerations, design and construction cost, constructability, flow capacity, compatibility, affect on existing project operations, prototype testability, performance based adjustability, risk of injury to fishes passing through the gates, and permitting and schedule.

Seattle proposes to submit annual reports to Ecology for review and approval in December. The reports would contain TDG monitoring data, engineering analysis and prototype design for alternatives, modeling results of predicted TDG performance of alternatives, and a schedule for the following year's activity.

*Staff Analysis*

Seattle's operational changes implemented in 2003 for its largest generating units (Unit 55 and 56) have resulted in significant improvements in TDG levels in the project tailrace (Seattle, 2009b) under normal, non-spill operations. With these changes, TDG exceeds the state standard in the tailrace for flows between about 70,000 cfs and 108,300 cfs (which correspond to spill flows of about 15,000 to 53,300 cfs). These conditions correspond to an occurrence of about 7.4 days a year based on the flow record between 1987 and 2005. Continuation of its current operations would be expected to result in similar TDG levels, if no further TDG mitigation measures were implemented. However, Seattle's proposal to upgrade the runners on Units 55 and 56 may reduce or eliminate the conditions that in the past have led to TDG production during non-spill operations.

Seattle completed a qualitative evaluation of structural TDG abatement alternatives (Seattle, 2009b) that identified three alternatives likely to reduce TDG levels. All three TDG abatement measures proposed by Seattle have the potential to reduce TDG levels of water passing through the project by spreading the flow, lowering the energy of the released water, and limiting plunging effects of the confined jets.

Given the number of potential TDG abatement alternatives involving operational changes and structural abatement alternatives, including implementing combinations of alternatives, a measured, incremental, adaptive management approach to abatement alternatives is prudent. Seattle's strategy employs a combination of engineering analysis to develop predicted improvement over current TDG conditions, followed by incremental prototype evaluations. This is an iterative process of partially developing and implementing a preferred alternative, followed by field testing to confirm that the modification has the desired TDG reduction. Preliminary results from 2009 efforts, which included baseline tests and calibration of the physical and computational hydraulic models, suggest that all three alternatives would spread spill flow and/or limit the plunging effects of spill jets for the purposes of reducing TDG concentrations downstream of the project. Nonetheless, additional physical and computational hydraulic analysis and field testing are required to select the preferred alternative or combination of alternatives.

Seattle is actively pursuing the identification of a preferred alternative and prototype development. Seattle has already completed permanent structural modifications to three of the seven sluice gates by installing stainless steel seal plates that will reduce the likelihood of damage to the project facilities during throttled flow. Testing of prototype designs has been further complicated by the fact that the sluice maintenance gate was removed for routine maintenance in 2010; it is scheduled to be reinstalled in 2011. Nonetheless, Seattle proposes to continue to evaluate the safety associated with sluice gate throttling. During the period from 2010 through 2011, Seattle would also look at the benefits of sluice gate throttling in tandem with assessing the two remaining TDG alternatives, both individually and in combination, using the physical and numerical hydraulic modeling.

Implementation of the preferred alternative would be completed within one year of license issuance. Seattle proposes to recommend a prototype design in the 2010

TDG Annual Report to Ecology and file it with the Commission in July 2011 for review and approval; submit the construction quality control inspection program (QCIP) to the Commission in early 2012 for review and approval, including obtaining other applicable permits; and, construct the prototype design in 2012 (or Year 1 of the new license) when the sluice maintenance gate is back in service. Seattle's proposed schedule would ensure that pragmatic and diligent actions are occurring to reduce adverse effects on aquatic resources downstream of the project.

Aquatic Invasive Species Control Plan.

Invasive macrophyte beds have the potential to influence localized pH levels as a result of photosynthesis. Studies in the Pend Oreille River have found that pH measurements are on average 0.4 units higher in macrophyte beds than in the main channel of the Pend Oreille River. Dense aquatic macrophyte beds can also impede boat traffic, reduce angling opportunities, and, during reservoir surface fluctuations, trap and strand fish in pools. New Zealand mudsnails are becoming an increasing ecological threat to water bodies in northeast Washington, and zebra and quagga mussels, although not present in the northwest U.S., have the potential to become a problem in northeast Washington.

*Invasive Aquatic Macrophyte Control*— Bottom barriers prevent the growth of aquatic macrophytes by compressing them and reducing or eliminating their supply of light. When properly installed, bottom barriers can eliminate up to 100 percent of aquatic macrophytes in the area covered. To control aquatic macrophytes, Seattle proposes to install bottom barriers at four locations where invasive macrophytes are abundant to reduce the risk of macrophyte-related fish stranding and trapping, benefit recreational use by creating boat lanes free of macrophytes, and reduce boat contact with invasive macrophytes to lower the risk of their dispersal to other locations (within and outside the project area). The four proposed locations are:

- Everett Island side channel- A 30-foot-wide, 650-foot-long barrier would be placed from an informal shoreline recreation site through the side channel until it joins with the Pend Oreille River main channel.
- Metaline Pool, across from the town of Metaline- A 200-foot by 100-foot barrier would be placed adjacent to the open channel in an area of dense macrophyte growth.
- Fish Stranding and Trapping Region 9- A 20-foot-wide, 700-foot-long barrier would be placed downstream of the midpoint of a side channel, adjacent to the shoreline and extending downstream through the main channel.
- Fish Stranding and Trapping Region 11- A 20-foot-wide, 400-foot-long barrier would be placed from the southern shoreline through the middle of a pool known to trap fish to the upper end of the channel that drains the pool.

Seattle proposes to evaluate the effectiveness of the bottom barriers from the first year they are installed and every year thereafter for the term of any license that may be granted. Success would be defined as a 70 percent reduction in the abundance of macrophytes and appropriate suppression so that localized pH levels improve and fish may escape to the main river channel.

Seattle also would evaluate the need for macrophyte suppression at the Forebay Recreation Area and/or the Metaline Waterfront Park boat launches, as outlined in their Recreation Resources Management Plan (RRMP). In the third year after the completion of the boat launch modifications (i.e. extending the boat launches), Seattle would begin annual surveys to determine if macrophytes have established to a degree requiring suppression. If macrophytes have become established at the Metaline Waterfront Park boat launch, suppression would be achieved through the placement of bottom barriers. If macrophytes have become established at the Forebay recreation area boat launch, suppression would be achieved through hand pulling or mechanical harvest and removal. The effectiveness of this measure would be measured annually, with success being defined as 100 percent reduction in the abundance of non-native macrophytes.

In addition to the four main target areas outlined above and at the Forebay Recreation Area and/or the Metaline Waterfront Park boat launches, Seattle proposes to suppress aquatic macrophyte growth through the deployment of bottom barriers at three additional locations that have yet to be determined. The locations would be chosen in areas where fish stranding and trapping and interference with boating are known to occur and would be chosen by the FAWG and WQWG.

Seattle proposes to meet annually with the FAWG and WQWG to assess the performance of the macrophyte suppression effort. If it is determined that macrophyte suppression could be achieved in a more effective way by changing the control technologies or their placement in the project area, Seattle and the work groups would propose changes to the program.

Seattle would submit a QAPP to Ecology within 6 months of license issuance for approval. The QAPP would document the quality control and assurance measures Seattle proposes to undertake in the macrophyte suppression program.

*Aquatic Invasive Invertebrate Monitoring and Control*—Seattle's Aquatic Invasive Species Control Plan includes a monitoring program for Zebra mussels, quagga mussels, and New Zealand mudsnails. It consists of three components:

- Substrate sampling for zebra and quagga mussels- Seattle would deploy artificial substrate samplers[51] at the Forebay Recreation Area and the Metaline Waterfront

[51] Artificial substrate samplers can consist of any number of hard surfaces that invertebrates could colonize that are deployed *in situ* for a period of time. Examples include rocks or bricks suspended in a wire basket or hardwood plates which are suspended in the water column.

Park boat launches. Seattle would consult with the WQWG, the FAWG, and the Centers for Lakes and Reservoirs at Portland State University to ensure that the proposed number of substrates, design, placement, and monitoring regime are appropriate. Artificial substrates would be deployed in April and retrieved in October of each year of license issuance. Substrates would be checked monthly for any bivalve colonization and any attached bivalves would be collected and sent to Portland State University for identification. Additionally, field crews would opportunistically inspect any hard structures in the vicinity of substrates during substrate inspection for attached bivalves. Again, any attached bivalves would be collected and sent to Portland State University for identification.

- Tow sampling for zebra and quagga mussel larvae- Seattle would conduct horizontal and vertical zooplankton tow net sampling for zebra and quagga mussel larvae. Seattle would pull a plankton net through the water horizontally at two sites above the project dam and one below for a distance of 40-100 feet at a depth of 20 feet. Seattle would also drag this same net vertically through the water column from three feet above the river bottom to the surface at the same three sites. Samples would be taken once each in June, July, and August every year for the length of any license that may be granted. After towing, the net would be thoroughly rinsed and all sample material transferred to a sampling bottle and preserved with alcohol. All samples would be shipped to a certified laboratory for analysis and determination of larvae presence or absence.
- Monitoring for New Zealand mudsnails- Seattle would conduct surveys to detect the presence of New Zealand mudsnails in the vicinities of the Forebay Recreation Area and the Metaline Waterfront Park boat launch. Surveys would take place concurrently with the zebra and quagga mussel sampling described above. During each survey, a trained field person would wade a 100-foot transect at a depth of two feet. Every ten feet, the surveyor would pick up five rocks ranging in size from 6 to 12 inches. All snails that appear to be New Zealand mudsnails would be removed and preserved in a jar with alcohol. Additionally, three grab samples would be taken from sandy/silty substrate areas near the boat launches. All snails that appear to be New Zealand mudsnails would be collected in a jar and preserved. All collected snails would be sent to a laboratory approved by Ecology for identification.

At annual meetings between the WQWG and the FAWG, participants would be able to discuss new invasive species which may be identified to be an issue and to propose monitoring. If Ecology believes that monitoring of new invasive species is warranted, Seattle proposes to do so, as long as the measures are safe, cost effective, logistically feasible, and do not have the potential to jeopardize fish and aquatic resources and water quality.

In the event of identification of new invasive species within the project area, Seattle would conduct the following response activities:

- Immediate notification to Ecology (for plants) or Washington DFW (for animals) of possible new invasive species identified during monitoring. Digital photographs would be taken and sent to Ecology or Washington DFW for assistance in identification.
- Seattle would coordinate with Ecology or Washington DFW to confirm aquatic invasive species identification.
- Seattle would immediately notify upstream (Box Canyon dam) and downstream (Seven Mile dam) operators if aquatic invasive species not previously identified in the Pend Oreille River system (e.g., zebra or quagga mussels) are found.
- If zebra or quagga mussels or New Zealand mudsnails are discovered in the project area, Seattle would evaluate potential control methods in coordination with regional invasive species control programs and in consultation with the WQWG and FAWG.
- Seattle would coordinate with Ecology and Washington DFW to develop appropriate press releases to alert the public of any new aquatic invasive species.
- Seattle would take reasonable and feasible steps, as determined in consultation with the WQWG and FAWG, to manage and/or contain the new aquatic invasive species, including providing assistance as needed for Ecology or Washington DFW site visits to confirm presence and determine extent of infestation, and coordinating with Ecology and Washington DFW to develop a further response.
- Seattle would conduct effectiveness monitoring to determine the success of aquatic invasive species management/containment actions implemented; would coordinate with the WQWG and FAWG on monitoring results; and would discuss appropriate next steps to determine long-term monitoring and reasonable and feasible control efforts in coordination with the WQWG and FAWG during the annual workgroup meeting.

Seattle would also implement an interpretation and education program aimed at recreational boaters and anglers to help control the spread of invasive aquatic invertebrates.

*Staff Analysis*

*Aquatic Macrophyte Control*—The proposed bottom barriers would cover 61, 500 square feet. The pH in these areas would be lower than current conditions because the cause (photosynthesis) of localized exceedences of pH would be eliminated. Recent pH monitoring showed that exceedences of pH were limited to areas inside of macrophtye beds and these increases did not spread to water outside of the beds (Seattle, 2009). This suggests that the proposed bottom barriers would not appreciably lower pH in the entire project area, but would improve localized pH levels in areas that provide important habitat.

Bottom barriers at the Everett Island side channel and in the Metaline pool would provide more open channels for boat traffic than under current conditions.

Under current project operations, reservoir fluctuations can result in the stranding and trapping of fish within large macrophyte beds. Fish that were able to freely move in and out of the macrophyte infested area at higher water levels find themselves unable to escape them when water levels recede. Trapped fish are subject to a lack of egress, and potentially low DO levels as a result of macrophyte respiration. Seattle's proposal to deploy bottom barriers, in up to seven areas, would create channels for fish that are occupying areas where they would become stranded under current conditions. Under Seattle's proposal, the fish would be able to escape macrophyte beds during reservoir drawdown and they would not be subject to low DO conditions.

Seattle proposes to modify both the Forebay Recreation Area and the Metaline Waterfront Park boat launches. For these boat launches to be useable, the areas need to be relatively clear of aquatic macrophytes that hinder the use of motorized boats. While they are not yet a problem, nearby macrophyte beds may eventually encroach on the launches and hinder their use. Seattle's annual surveys would provide a means to determine when macrophytes have established themselves to a degree requiring suppression.

Seattle's proposal to monitor all deployed bottom barriers monthly from the end of spring runoff until the macrophyte beds annual die-off for the term of any license granted would ensure that the deployment of bottom barriers are having the desired effect on macrophyte populations. Depending on the area, success would be defined as either 70 or 100 percent suppression of aquatic macrophyte abundance. Reductions of this magnitude would be sufficient to preserve the goals of preventing fish stranding and allowing for motorized boat usage, as well as locally improving water quality.

Techniques for controlling aquatic macrophytes are continually changing and progressing as new information develops. Annual meetings with the FAWG and the WQWG to assess the performance of the macrophyte suppression effort, would provide a forum to discuss new methods and techniques within the constraints of project operations and other aquatic measures.

*Invasive Invertebrates*—One of the keys to controlling the spread of invasive invertebrate species is early detection. Many invertebrate species display high fecundities and can rapidly colonize new areas, often out-competing native species. To detect the early presence of zebra or quagga mussels, it is necessary to understand their life-cycle. Zebra and quagga mussels reproduce through the release of gametes into the water column when water temperatures rise in the spring (USACE, 2010). Fertilization takes place in the water column when egg and sperm combine, ultimately resulting in a free floating larval form called a veliger. Veliger densities typically peak in midsummer in North America, with lower densities present in spring and autumn. Veligers are rarely found in winter. Veligers form a shell between 18 and 90 days after fertilization, eventually dropping out of the water column and settling on substrate.

Juvenile zebra and quagga mussels attach to substrate at this point (referred to as becoming sessile) where they begin filter feeding and growing towards sexual maturity.

The earliest stage where zebra and quagga mussels could be detected in the project area would be during their veliger stage. Seattle's proposal to tow a plankton net both horizontally and vertically through the water column during the summer months is intended to determine the presence or absence of the veliger stages. This proposal would utilize methods and sampling equipment approved by Washington DFW and Ecology during the time when peak presence of veligers would be expected. This sampling, along with proper identification of any collected larval bivalves, would be an efficient and effective method to detect invasive bivalves in the project area.

Because veligers can form shells and become sessile animals within 18 days of fertilization, additional sampling would be necessary to detect the presence of zebra and quagga mussels. Seattle's proposed substrate sampling for young, sessile bivalves would be an effective tool in determining their presence in the project area during later life stages. Placement of sampling substrates near boat launches would be an appropriate location as these are the areas that would likely be first colonized due to the fact that these species would likely be introduced through boats and trailers that have not been properly cleaned.

Uncleaned boats and trailers would also likely be the method of introduction for the New Zealand mudsnail, if it were to be introduced to the project area. New Zealand mudsnails have shown a capacity to withstand a very large range of environmental conditions (New Zealand Mudsnail Management and Control Plan Working Group, 2007). They can successfully colonize habitats over a wide range of depths, temperatures, flows, and disturbance patterns. Seattle proposes to conduct New Zealand mudsnail monitoring by collecting rocks from a two-foot depth every ten feet near the Forebay Recreation Area and the Metaline Waterfront Park boat launch and examining them for the presence of snails. Any snails that are suspected to be New Zealand mudsnails would be shipped to a laboratory for confirmation. This sampling strategy would be sufficient to detect the early colonization of the New Zealand mudsnail in the project area because it would focus on a habitat that the mudsnail would likely occupy early on in its development.

Seattle's proposal also includes annual meetings with the FAWG and WQWG to assess the performance of the invasive invertebrate monitoring effort. These meetings would facilitate the adaptive management aspects of the program. If it is determined that monitoring could be achieved in a more effective way by changing the sampling regime, Seattle and the work groups could propose changes to the program. This would ensure that the program continues to be effective in the future when conditions and the presence of invasive invertebrates in the project area change from current conditions.

If zebra mussels, quagga mussels, New Zealand mudsnails, or any other invasive invertebrate were to be discovered in the project during the term of any license that may be granted, Seattle proposes a protocol to respond to their colonization. This protocol would ensure that state and federal agencies, the operators of hydroelectric facilities upstream and downstream of the Boundary Project, and the public would be notified. The protocol would identify, and facilitate the deployment of possible control measures that could be used to control and possibly eradicate invasive invertebrate species. The development and deployment of these measures in consultation with the state agencies, the WQWG, and the FAWG would ensure that they would be appropriate and best suited to achieve their desired response. Seattle's proposed effectiveness monitoring of these measures would provide for adaptive management and would ensure that water quality in the project area is not affected.

Fish Tissue Sampling Plan

Due to historic mining practices in the local area, as well as throughout the Pend Oreille-Clark Fork system, toxics in fish tissues were identified as a potential water quality issue in the project area. Although a number of toxics have been found in the reservoir (see section 3.4.1.1), Ecology has focused on lead and zinc concentrations in the project area because the only recently active mine in the project vicinity is the Pend Oreille Mine, a lead and zinc mine with surface facilities located on the east side of the river approximately 2 miles north of Metaline Falls. This mine began operation in 1952, operated intermittently until it was shut down in 1977, and was then re-opened from January 2004 to January 2009. As mentioned before, Ecology monitors the discharge from this mine as part of the NPDES program.

In response, Seattle proposes to implement a Fish Tissue Sampling Plan. Seattle would collect fish tissue samples from four sites in the project area. Fish tissue collection would occur once during the first summer (July-August) following the approval of the QAPP by Ecology. One proposed site is located to represent the inflow to the reservoir, another to represent outflow from the reservoir, and the other two were selected to correspond to areas where exceedences of zinc and lead in fish tissues have been observed in the past. At each site, Seattle would collect three game fish[52] and three suckers[53] greater than seven inches in total length. All collected fish would be handled in a manner that would eliminate contamination and shipped to a Ecology-accredited laboratory for tissue analysis. Seattle would provide a report detailing the results of the tissue sampling to Ecology and Washington DOH within 90 days of receipt of data. The purpose of this information is to assist Ecology and Washington DOH in developing fish consumption advisories for those fishing in the project area.

*Staff Analysis*

Seattle conducted a toxics assessment study in 2007 and 2008 which measured the levels of six toxins of concern (arsenic, cadmium, lead, mercury, zinc, and PCBs) in

[52] Species could include smallmouth bass, largemouth bass, black crappie, pumpkinseed, or any salmonid besides bull trout.

[53] *Catostomous* spp.

water, sediment, and pore water[54] (Seattle, 2009c). Based on sampling conducted in March 2008, overall concentrations of toxics were either low or absent in media sampled from throughout the reservoir. Isolated exceedences were detected from two surface water sites for lead and from two pore water sites for zinc and lead, but these did not suggest sources originating from within the reservoir. Re-sampling in October 2008 showed that no concentrations of zinc in pore water exceeded the chronic surface water criterion, but lead in pore water samples exceeded the chronic surface water quality criterion in four of nine replicates. Linkages that would indicate within-reservoir sources for these toxics did not exist (e.g., sediment-pore water-surface water associations), and water chemistry factors that would promote transfer of these toxics into bioavailable forms were absent.

Multiple lines of evidence were examined to assess any transfer of toxics that might indicate bioavailability attributable to project operations. This information was used to evaluate potential origins, such as mobilization of toxics from reservoir banks, or movement of toxics from the permanently wetted area in a downstream direction. There were no detectable concentrations of toxics in the upper portion of the water column. This indicates that project operations are not attracting additional toxics-laden material into the reservoir because they were not found either in the active water fluctuation zone (surface to 10-foot depth) or laterally across the reservoir.

The goal of the toxics assessment was to determine whether the toxics of concern (arsenic, cadmium, lead, mercury, zinc, and PCBs) were present in the reservoir, and, if so, whether project operations increased their bioavailability. Based on the combined results of sampling conducted in November 2007 and in March and October 2008, multiple lines of evidence, including a variety of analytical techniques, indicated that project operations do not influence the bioavailability or mobility of toxics, most importantly lead and zinc.

Seattle's proposed fish tissue sampling plan would provide a mechanism to detect levels of zinc and lead in fish tissues from resident fish in the project area. However, the proposed plan would not be able to determine the source of lead or zinc in the fish tissues. Additionally, Seattle's toxics assessment showed no link between project operations and the presence or bioavailability of lead or zinc in the project area. The proposed fish tissue sampling plan would not detect a causal relationship between lead and zinc levels in resident fish tissues and project operation or existence.

[54] Pore water is the water filling the spaces between grains of sediment.

#### 3.4.2.2 Sullivan Creek Project

**Sullivan Lake Surface Elevations and Discharges**

The current FERC license contains one operational condition: the District is required to raise the level of Sullivan Lake as high as spring runoff allows, not to exceed 2,588.66 feet annually. The District must then maintain that elevation until September 20 of each year.

Under the District's proposal to surrender the Sullivan Creek license, the Sullivan Lake dam would remain in place and would be operated to provide minimum instream flows to benefit aquatic resources, maintain Sullivan Lake elevations for summer recreation, and provide storage water for downstream users. To achieve these benefits the District proposes to operate the project as detailed below.

*Interim Operations (Prior to construction of the cold water release facility)*

- Start refilling Sullivan Lake on or before April 1st and seek to achieve and maintain a full Sullivan Lake elevation of 2,588.66 feet (as measured at Sullivan Lake dam), subject to hydrologic conditions, water availability, and dam discharge flow requirements.
- During the summer period, defined as June 1 through Labor Day each year, maintain the lake level at 2588.66 ft (full pool) to protect recreation opportunities.
- Initiate drawdown the day following Labor Day each fall and in the manner described below:

1. Ramp up discharge flows no more than 80 cfs per day as measured at the Outlet Creek gage to protect aquatic resources.
2. Draw down lake water surface elevation to 2,577 feet by no later than November 15.
3. Discharge maximum flow of 200 cfs, except during periods of higher than average precipitation when the maximum flow target shall be 225 cfs.
4. Do not exceed down-ramping rates of 10 cfs per hour when changing release flows as measured at the Outlet Creek gage.
5. Draw down lake water surface elevation to 2,570.0 feet by December 31.

*Reservoir Level Operations and Requirements (once construction of the cold water release facility is complete)*

- Start refilling Sullivan Lake on or before April 1st and seek to achieve and maintain a full Sullivan Lake elevation of 2,588.66 feet (as measured at Sullivan Lake dam), subject to hydrologic conditions, water availability and dam discharge flow requirements.

- During the summer period, defined as June 1 through Labor Day each year, maintain the lake level at 2,588.66 feet (full pool).
- Initiate drawdown the day following Labor Day each fall and in the manner described below:

   1. Ramp up discharge flows no more than 80 cfs per day as measured at the Outlet Creek gage.

   2. Draw down lake water surface elevation to 2,577 feet by no later than November 15.

   3. Do not exceed down-ramping rate of 10 cfs per hour when changing release flows as measured at the Outlet Creek gage.

   4. Drawdown the lake water surface elevation to 2,570.0 feet by December 31.

*Sullivan Lake Dam Minimum Discharge Flows*

- Maintain minimum discharge flows in Outlet Creek, measured by the Outlet Creek USGS gaging station, as follows:

   1. 30 cfs from June 1 through June 30.

   2. 20 cfs from July 1 through the end of fall drawdown (when elevation reaches 2,570.0 ft).

   3. Inflow from Harvey Creek from the date Sullivan Lake reaches elevation 2,570.0 ft until the beginning of spring filling (April 1).

   4. 10 cfs or inflow, whichever is less, from April 1 through May 31.

- Comply with the Sullivan Lake water surface elevations and discharge flow requirements at all times, subject to short term deviations due to equipment failures, maintenance activities, electric and mechanical device limitations, safety inspections, testing, natural disasters (floods), and the Harvey Creek Bedload Mobilization activities.
- Use the existing USGS stream gage on Outlet Creek and install a new Sullivan Lake level recording gage at the Sullivan dam to record data to demonstrate compliance with discharge flow requirements and water surface elevations.

*Water Supply Program*

- Sell or lease up to 5,000 acre feet (AF) of the useable storage in Sullivan Lake annually for use outside the Sullivan Creek drainage between June 1 and August 31. Give priority consideration to the Columbia River Basin Water Supply Management Program.

- For the purposes of this water supply program, release water at a rate described in table 3-8, not to exceed 2.0 times the minimum discharge flow requirement. Table 3-8 shows the range of water supply discharge flows.

Table 3-8. Water Supply Discharge Flows from Sullivan Lake (Source: District, 2010).

| Period* | Discharge Flow (cfs) |
|---|---|
| June Week 1 | 50-60 |
| June Week 2 | 50-60 |
| June Week 3 | 50-60 |
| June Week 4 | 50-60 |
| July Week 1 | 40-45 |
| July Week 2 | 35-40 |
| July Week 3 | 30-35 |
| July Week 4 | 30-35 |
| Aug Week 1 | 30-35 |
| Aug Week 2 | 30-35 |
| Aug Week 3 | 30-35 |
| Aug Week 4 | 30-35 |
| Sept Week 1 | 30-35 |

* Week 1 of each calendar month begins on the first day of that month. Week 4 of each calendar month in the table above maybe longer than seven days.

The District's proposed operating regime is part of the settlement agreement filed for the Sullivan Creek Project on March 29, 2010. American Whitewater, Interior, and Washington DFW filed letters (on July 19, September 2, and September 3, 2010, respectively) stressing their support for all conditions contained in the settlement agreement. The Forest Service, in its letter filed August 24, 2010, requires that the District implement its proposed Sullivan Lake operating regime.

*Staff Analysis*

*Sullivan Lake Dam Discharge Flo*ws

Proposed annual Sullivan Lake operations would follow the same basic pattern as current operations in that Sullivan Lake would be filled and held at full pool in the summer, emptied to a target elevation in the fall, and allowed to re-fill back to full pool during the spring run-off period. Under the District's proposed operations, however, the District would provide higher minimum discharge flows from June through August, and then gradually ramp up discharges starting the day after Labor Day, instead of releasing a large quantity of water starting October 1. This operation would cause changes in the hydrology in Outlet and Sullivan Creek.

To understand the differences, we compared the proposed flows to historical monthly flows measured in Outlet Creek from 1959-2004 (USGS, 2010) (table 3-9).

The flows shown in table 3-9 represent the proposed minimum flow for each month, two times the minimum flow from June 1 through Labor Day (which is the maximum discharge flow proposed to meet water supply requirements), and the minimum flow up to the targeted flow to meet the water supply requirements and drain the reservoir in the fall months.

Table 3-9. Proposed flow releases (cfs) from Sullivan Lake compared to historical flows measured at Outlet Creek (Source: staff).

| Month | Proposed discharge flow | Historical monthly mean flow | Historical monthly minimum flow | Historical monthly maximum flow |
|---|---|---|---|---|
| Jan | Inflow | 42 | 13 | 201 |
| Feb | Inflow | 30 | 8 | 130 |
| Mar | Inflow | 32 | 2 | 323 |
| April Week 1 | 10[a] | 23 | 2 | 132 |
| April Week 2 | 10[a] | 23 | 2 | 132 |
| April Week 3 | 10[a] | 23 | 2 | 132 |
| April Week 4 | 10[a] | 23 | 2 | 132 |
| May Week 1 | 10[a] | 38 | 4 | 239 |
| May Week 2 | 10[a] | 38 | 4 | 239 |
| May Week 3 | 10[a] | 38 | 4 | 239 |
| May Week 4 | 10[a] | 38 | 4 | 239 |
| Jun Week 1 | 30-60 | 143 | 6 | 437 |
| Jun Week 2 | 30-60 | 143 | 6 | 437 |
| Jun Week 3 | 30-60 | 143 | 6 | 437 |
| Jun Week 4 | 30-60 | 143 | 6 | 437 |
| Jul Week 1 | 20-45 | 44 | 7 | 133 |
| Jul Week 2 | 20-40 | 44 | 7 | 133 |
| Jul Week 3 | 20-35 | 44 | 7 | 133 |
| Jul Week 4 | 20-35 | 44 | 7 | 133 |
| Aug Week 1 | 20-35 | 24 | 7 | 63 |
| Aug Week 2 | 20-35 | 24 | 7 | 63 |
| Aug Week 3 | 20-35 | 24 | 7 | 63 |
| Aug Week 4 | 20-35 | 24 | 7 | 63 |
| Sept Week 1 | 20-35 | 26 | 7 | 157 |
| Sept Week 2 | 20-110 | 26 | 7 | 157 |
| Sept Week 3 | 20-225 | 26 | 7 | 157 |
| Sept Week 4 | 20-225 | 26 | 7 | 157 |
| Oct Week 1 | 20-225 | 207 | 16 | 395 |
| Oct Week 2 | 20-200 | 207 | 16 | 395 |
| Oct Week 3 | 20-200 | 207 | 16 | 395 |

| | | | | |
|---|---|---|---|---|
| Oct Week 4 | 20-200 | 207 | 16 | 395 |
| Nov Week 1 | 20-140 | 203 | 18 | 343 |
| Nov Week 2 | 20-120 | 203 | 18 | 343 |
| Nov Week 3 | 20-100 | 203 | 18 | 343 |
| Nov Week 4 | 20-90 | 203 | 18 | 343 |
| Dec | inflow | 82 | 16 | 382 |

[a] The proposed discharge flow of 10 cfs in April and May is a minimum flow. Actual discharge flows typically would be higher.

As table 3-9 shows, from April 1 until Labor Day, the proposed releases to Outlet Creek essentially would be the same flow that historically has been released from the project. This would also be true for December, January, February, and March.

In the fall months, discharges would be released earlier and more gradually relative to current operations, until the reservoir reaches an elevation of 2,570 feet (target is by December 31), which is five feet higher than the current winter elevation. Until the cold water release structure is installed, the discharges would continue to be made through the low level gates. Discharges from the low level gates would be managed to reach a targeted maximum flow of 200 cfs during dry years and 225 cfs in normal and wet years. Although the purpose of this flow restriction is not clearly explained, we suspect that it is to help the District maintain the desired temperatures in Sullivan Creek. Once the cold water release facility is built, there would be no maximum flow release limit. Again, we suspect the maximum flow restriction is removed because the District would have greater control over flows and maintaining cooler temperatures in Sullivan Creek (discussed later). Regardless, proposed flows in the fall are similar to historical average annual flows from the third week of September through the final week of October; flows higher than this may still occur during wet years, but the likelihood, exact amount, duration, or timing of these flows is not known. Flows greater than 225 cfs occurred in Sullivan Creek in the fall under current operations. Nonetheless, these high flows could wash out aquatic habitat in Outlet Creek and Sullivan Creek.

As discussed in more detail in section 3.5.2.2, Aquatic Resources, *Environmental Effects- Sullivan Creek Project*, the District's operating regime also includes a number of measures that would be protective of the fishery in the project area. The District's proposal to ramp up releases by no more than 80 cfs per day should ensure that spawning areas or other useful aquatic habitats downstream of Sullivan Lake are not washed out due to high flows and that they retain their function. The proposal that down-ramping rates do not exceed 10 cfs would minimize the risk of fish stranding in Outlet Creek and Sullivan Creek due to flow reductions.

The District's ability to comply with the Sullivan Lake water surface elevations (discussed below), and minimum flow releases at all times is subject to a number of considerations, including hydrologic conditions and operating emergencies. Deviations from required flows and lake elevations would most likely be rare occurrences, such as short term deviations due to equipment failures, maintenance activities, electric and mechanical device limitations, safety inspections, testing, and natural disasters (floods). Their minimum discharge and water surface proposals are also subject to flow needs for Harvey Creek Bedload Mobilization activities. The record suggests that maintaining summer lake levels is less important than maintaining instream flows and temperatures in Sullivan Creek.

The District's proposal to use the existing USGS stream gage on Outlet Creek and to install a new Sullivan Lake level recording gage at Sullivan dam to record data would be sufficient to demonstrate compliance with any flow conditions included in any surrender order for the project.

*Water Supply Program*

The District and Ecology's Office of the Columbia River (OCR) have entered into a Memorandum of Agreement that could result in releases of water from Sullivan Lake at specific times of the year. These releases include 5,000 acre-feet of water from June to August and 9,000 acre-feet in September. Currently, this water is part of the 31,000 acre-feet released starting at the beginning of October as part of the annual lake drawdown. The 14,000 acre-feet of water that would be released from June through September would be appropriated by OCR to provide new water rights in six Washington counties.

In wet and average years, the water supply program would release 60, 45, 40, or 35 cfs from Sullivan Lake to Outlet Creek, depending on the week (table 3-8) between the start of June and the first week of September. During dry water years, these amounts would be reduced to 50, 40, 35, and 30 cfs, respectively. Under current operations, this water is released from Sullivan Lake starting at the beginning of October. Releasing this water earlier than it is currently would provide additional fish habitat above what is currently available and would benefit the fishery in Outlet Creek and Sullivan Creek during the summer months. The District's proposal to release the water at no more than two times the rate of the minimum flows and at as constant a rate as possible would provide stability to the aquatic habitat in Outlet and Sullivan creeks.

Sullivan Lake holds approximately 31,000 acre-feet of water at full pool. The release of 5,000 acre feet of water above the historic minimum flow releases of 10 cfs from Sullivan Lake during the summer season would likely have negligible effects on the fishery in Sullivan Lake and would not interfere with the management goals set by the settlement agreement parties for the lake. In addition, shifting the release of 9,000 acre-feet from after October to the month of September does not appear to be a concern for the settlement parties, and, in fact, seems to be viewed as an acceptable tradeoff between resources in Sullivan Lake versus those in Outlet and Sullivan creeks.

As noted by Ecology in a letter filed with the Commission on October 25, 2010, there is a potential for environmental effects associated with new water rights that could be granted by the state in light of the change in the timing of releases from Sullivan Lake. OCR has previously analyzed these effects it its Columbia River Programmatic Environmental Impact Statement[55] and its Lake Roosevelt Supplemental Environmental Impact Statement.[56] Both of these analyses concluded that impacts resulting from this action would not be significant, and could provide an overall public benefit. In the same letter, Ecology also noted that any new water rights granted as a result of this proposal could potentially cause environmental effects associated with increased development and growth in northeast Washington. These indirect effects certainly could occur; however, as stated by Ecology, they have been considered not only in environmental review documents prepared by OCR, but also in city and county planning documents. Therefore, we do not include a more detailed analysis of such effects in this document.

*Sullivan Lake Elevations*

During discussions about surrender of the project license, the District and the various stakeholders realized that an understanding of lake levels in Sullivan Lake was paramount in evaluating any flow release regime that could be implemented for the project. To determine what level the lake would be under a variety of water years, the District modeled the effect of its proposed minimum discharge flows and holding the reservoir at elevation 2,570 during the winter months over an 11-year time frame that included three average years, six dry years, and two wet years (District, 2010). The results of the model are shown below in figure 3-5.

[55] Available at http://www.ecy.wa.gov/programs/wr/cwp/eis.html
[56] Available at http://www.ecy.wa.gov/programs/wr/cwp/cr_lkroos.html

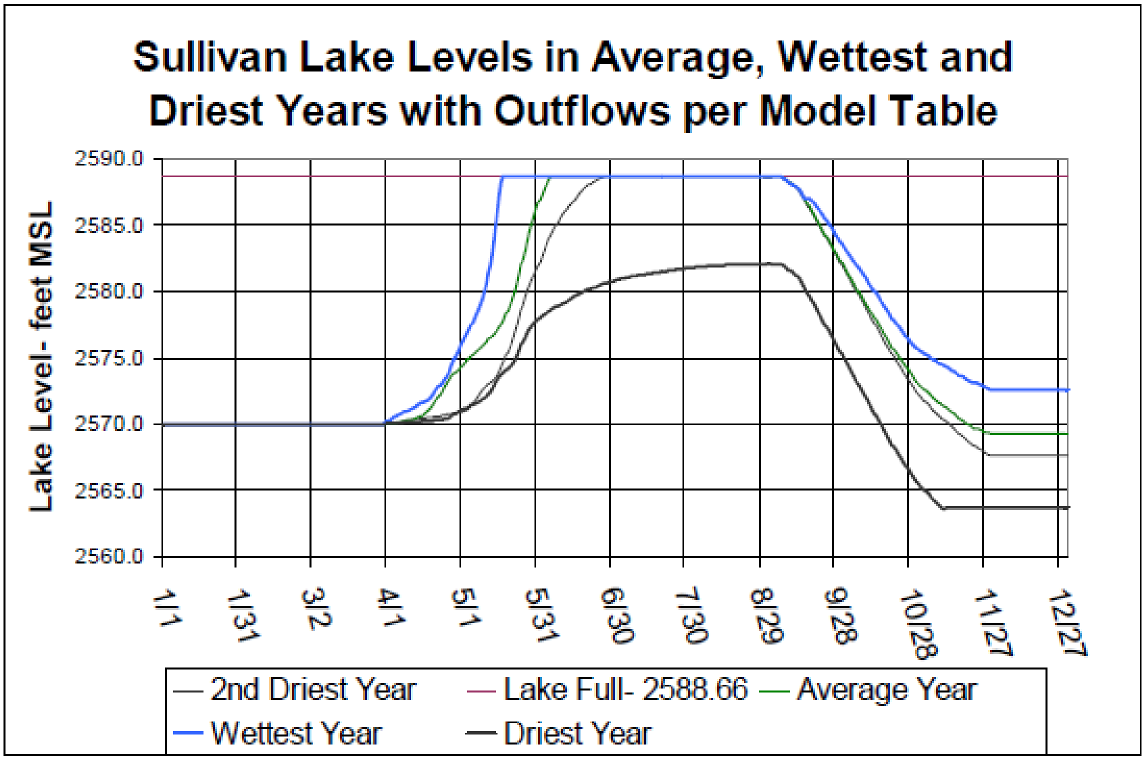



Figure 3–5. Sullivan Lake levels in average, wettest, and driest years (Source: District, 2010)

The model predicted that during an average water year, the lake level elevation of Sullivan Lake would fluctuate between 2,569 feet and 2,589 feet depending on the time of year. During the wettest water year on record, the lake level of Sullivan Lake would fluctuate between 2,570 feet and 2,589 feet depending on the time of year. During the driest water year on record, the lake level of Sullivan Lake would fluctuate between 2,563 feet and 2,582 feet depending on the time of year.

The modeling analysis also shows that under the proposed higher minimum discharge flows, the reservoir reaches full pool by June 1 in 3 out of the 11 years modeled; and it reaches full pool no later than June 28. The average date for attaining full pool is June 9. Holding the reservoir five feet higher in the winter substantially improves the District's ability to attain a full pool by June 1. The District did not model the effect of the water supply flows.

**Temperature**

The continued operation of the Sullivan Lake dam could be used to enhance stream temperatures in the project area downstream of the Sullivan Lake dam. To achieve this goal, the District proposes the following measures.

*Cold Water Release from Sullivan Lake*

- Complete construction of the cold water release facility within three years of issuance of the License Surrender Order.

*Interim Operations (Prior to construction of the cold water release facility)*

- Initiate drawdown the day following Labor Day each fall in a way that manages discharge flows to meet state water temperature standards (WAC 173-201A-200) so that the combined waters of Outlet Creek and Sullivan Creek as measured at "below confluence water temperature gage" do not exceed 16 ºC.

*Reservoir Level Operations and Requirements (once construction of the cold water release facility is complete)*

- Manage the discharges from the cold water release structure and the Sullivan Lake dam gates: (1) to meet state water temperature standards (WAC 173-201A-200); (2) with the goal of preventing the daily average "below confluence water temperature" from exceeding 14 ºC; and (3) with the goal of preventing the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 ºC, when daily average "above confluence water temperature" is less than 14 ºC.

- Initiate drawdown the day following Labor Day each fall, and in the manner described below:

1. Manage the discharges from the cold water pipe and the Sullivan Lake dam gates: (1) to meet state water temperature standards (WAC 173-201A-200); (2) with the goal of preventing the daily average "below confluence water temperature" from exceeding 14 ºC; and (3) with the goal of preventing the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 ºC, when daily average "above confluence water temperature" is less than 14 ºC.

2. Maintain the operation described in item (3) immediately above until fall turnover.

3. Maximize discharge flows through the cold water release structure and minimize the use of the low-level gates at the dam during fall drawdown.

4. After November 15, make all releases from Sullivan dam, up to the capacity of the cold water pipe, through the pipe.

5. Do not allow the daily average temperature to vary more than 2ºC per day.

*Water Supply Program*

- Manage the discharges shown in Table 3.9 above: (1) to meet state water temperature standards (WAC 173-201A-200); (2) with the goal of preventing the daily average “below confluence water temperature” from exceeding 14 ºC; and (3) with the goal of preventing the daily average “below confluence water temperature” from deviating from the daily average Sullivan Creek “above confluence water temperature” by more than 1 ºC, when daily average “above confluence water temperature” is less than 14ºC.

*Staff Analysis*

*Cold Water Release from Sullivan Lake*

The District’s proposed cold water release facility would consist of a 48-inch diameter pipe fitted with fish exclusion screens on the intake that would sit on the bottom of Sullivan Lake at a depth of 36.5 meters (about 120 feet). The pipe would be routed down the lake outlet channel to Sullivan Lake dam and then through one of the three existing low-level outlet gates at the dam.

Sullivan Lake is similar to many lakes in temperate climates in that it stratifies in the summer. As solar radiation warms the surface water, colder water sinks to the bottom of the lake because it has a higher density. This results in situation where a layer of warmer water (epilimnion) floats on top of a colder layer (hypolimnion). The District’s proposed cold water release facility would take advantage of this natural condition by withdrawing water from a depth of 36.5 meters where the water temperature would be lower than water they currently spill which is from 6 meters (19.7 feet) of depth. In 2009, Washington DFW installed temperature sensors in Sullivan Lake from the surface to a depth of 20 meters (65.6 feet), at two meter (6.6 feet) intervals, to characterize water temperatures in Sullivan Lake from May through November. Results are shown in Figure 3-6.

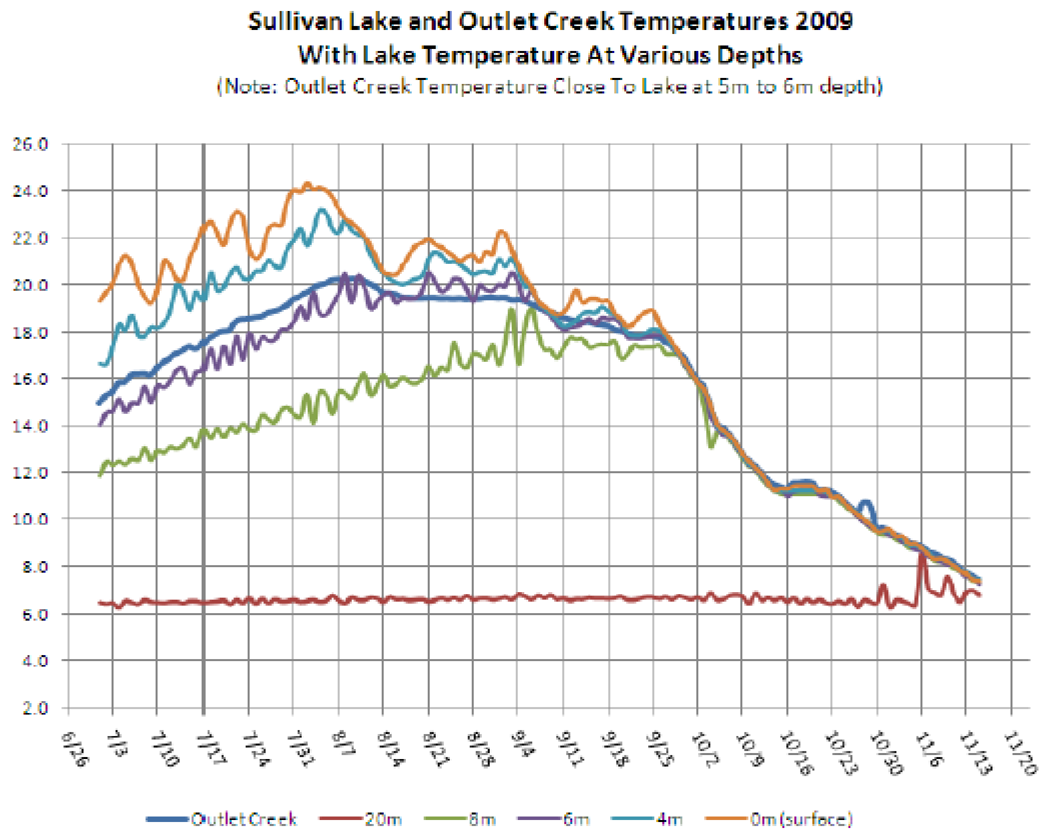



Figure 3-6. Sullivan Lake temperatures by depth in 2009 (Source: Seattle, 2010).

These data show that water temperature in Sullivan Lake at 6 meters of depth ranges from 14 ºC in June, peaking around 21 ºC in late summer, and falling back down to approximately 7º C in the late fall when the lake un-stratifies. In comparison, the temperature of water at 20 meters stayed constant just above 6 ºC for the entire time period. Water from 20 meters was between 8 ºC and 15 ºC cooler than water from 6 meters for the majority of the time period.

To further explore the effects of this proposed measure, the District under took a modeling effort to determine if these releases of colder water would noticeably reduce the water temperature below Sullivan Lake dam (District, 2010). Under current project operations, the water released from Sullivan Lake into Outlet Creek is the warmest water in the project area. Sullivan Creek upstream of the confluence with Outlet Creek tends to contain some of the coolest water in the project area, until it mixes with the warmer Outlet Creek water. This results in the temperatures in Sullivan Creek downstream of the confluence being appreciably warmer than those upstream (figure 3-7). The water released from the cold water release facility into Outlet Creek would be 8 ºC to 15 ºC cooler than what is currently released. The mixing of this water with Sullivan Creek water, which rarely exceeds 14 ºC upstream from the confluence with Outlet Creek, would result in temperatures downstream of the confluence below 14 ºC. The results of the modeling indicate that using cold water releases from approximately 20 meters of depth or deeper would improve the downstream temperature regime measurably, cooling the summer and fall water temperatures in Outlet and Sullivan creeks such that it would be possible to meet and even go below state water quality standards for temperature. The District's modeling suggests that with appropriate management of the discharge flows, the daily average temperature in Sullivan Creek downstream from its confluence with Outlet Creek should not exceed 14 ºC and the 7-day average of the daily maximum temperature should not exceed 16.0 ºC.

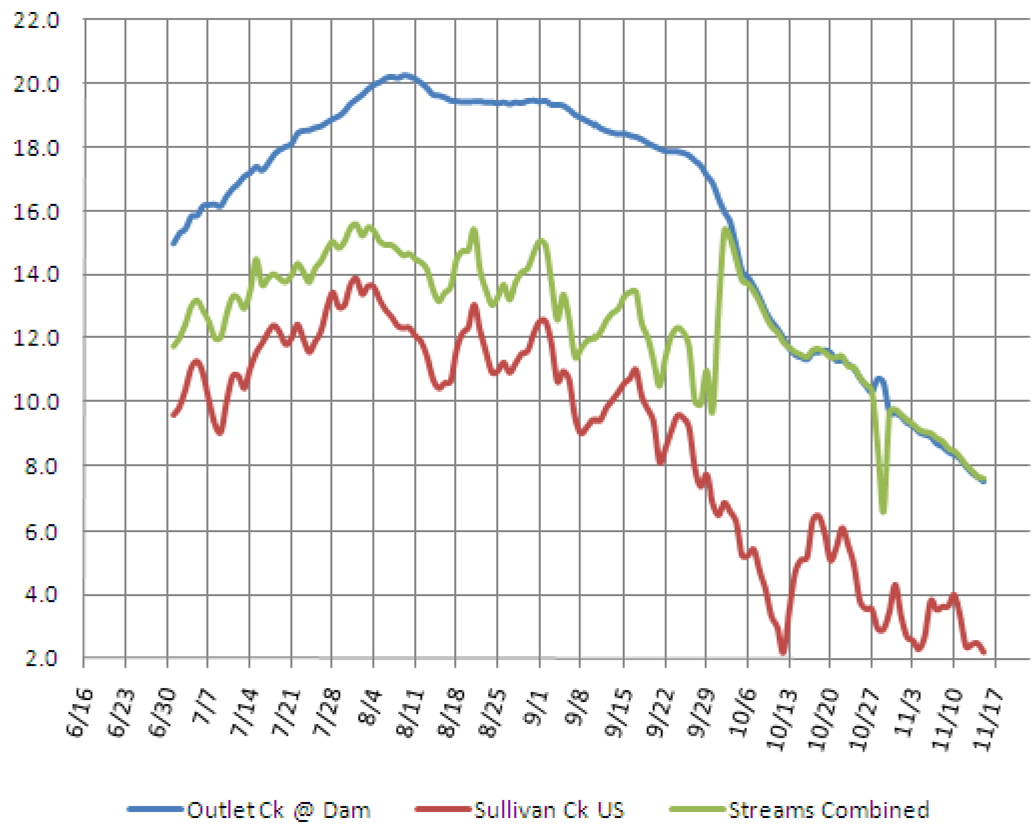



Figure 3-7. Temperatures in Outlet and Sullivan Creeks and mixed temperatures June 16 through November 17, 2009 (Source: Seattle, 2010).

To capitalize on the maximum water cooling effect that the cold water release facility could provide, it would be appropriate to release as much of the required releases from Sullivan Lake via the cold water release structure, as opposed to the low-level gates on the dam when the lake is stratified. The District's proposal would achieve this by maximizing discharge flows through the cold water release structure at all times during the fall drawdown (the day after Labor Day until November 14) when the lake is stratified for the majority of that period. The Districts modeling also shows that in an average water year about 93 percent of all flows could be released through the cold water release structure; thereby better controlling temperatures and minimizing entrainment of fish through the low level gates. However, after the lake mixes in the fall, there would likely be no additional water quality benefit because the temperature of water at 36.5 m (the cold water intake) and 6 m (the low-level gates) would be almost identical.

The District also utilized models to help determine if the facility would have negative biological effects in Sullivan Lake. The area of concern which was examined related to lake productivity. The productivity study attempted to characterize both primary and secondary productivity in Sullivan Lake and to determine if the proposed changes in releases would have an effect on them. Primary productivity is defined as the production of organic compounds through the process of photosynthesis (i.e. the growth of algae and plants in a water body). Secondary productivity is the biomass formation or energy fixation by heterotrophic organisms, such as grazers and decomposers, deriving their energy from photosynthetic plants or autotrophs (i.e. the growth of zooplankton in a water body that feed on the algal or plant material). The results of the productivity modeling effort show that Sullivan Lake has very low productivity overall. Additionally the study found that the majority of both the primary and secondary productivity of Sullivan Lake occur in the epilimnion of the lake during the months when the lake was stratified. These results support the conclusion that releasing water from hypolimnion into Outlet Creek would have no noticeable effect on lake productivity.

The construction of the cold water release facility could result in some adverse affect on water quality in Sullivan Lake. The laying of the pipe that would withdraw water from 36.5 meters would result in disturbance and stirring up of the sediment of Sullivan Lake. This disturbance would locally increase turbidity in the lake, however we expect such effects would minor in nature and short lived, as the sediment would settle fairly quickly.

*Interim Operations (Prior to construction of the cold water release facility)*

Until the cold water release structure is installed, careful management of discharge flows would be required to meet state water quality standards, and prevent dramatic changes in temperature. Ramping up flows slowly in the fall and targeting maximum flows of no more than 225 cfs in the fall should allow the District to adequately manage discharges to meet state water quality standards.

The District also proposes to manage discharges from Sullivan Lake so that average daily temperature downstream from the confluence of Outlet and Sullivan creeks would not deviate by more than 1 ºC from the average daily temperature of water upstream of the confluence when that water is less than 14 ºC. This would benefit the water quality in Sullivan Creek by ensuring that no drastic temperature shift would occur in Sullivan Creek between water above and below the confluence with Outlet Creek. The District does not propose to meet this criterion after fall turnover when Sullivan Lake un-stratifies because it would often not be possible.

During the fall drawdown, the District proposes to manage Sullivan dam discharges so that the daily average temperature would not vary more than 2º C per day. This would enhance water quality in both Outlet and Sullivan creeks in that there would be no sudden water temperature shifts over a short period of time. These shifts could occur if the project were operated such that discharges from the dam were alternated from the cold water release structure to the low-level gates in an a "one or the other" manner without a more gradual shift between the two sources. This proposal would also be beneficial in that it would help the District manage discharges from Sullivan Lake so that average daily temperature below the confluence of Outlet and Sullivan creeks would not deviate by more than 1º C from the average daily temperature of water upstream of the confluence when that water is less than 14º C. Overall, managing the project so that water temperatures are cooler, without creating any abrupt thermal changes, would be beneficial to water quality in the project area when compared to existing conditions.

*Water Supply Program*

Under the settlement agreement, the District may release water from the Sullivan Lake dam for the purposes of satisfying water use needs downstream from the project. The District would implement the same measures as it proposes for normal operation after construction of the cold water release facility. Namely, the District proposes to: (1) manage releases from Sullivan Lake after construction of the cold water release facility so that daily average temperature in Sullivan Creek downstream from its confluence with Outlet Creek would not exceed 14º C and so that the 7-day average of the daily maximum temperature would not exceed 16.0ºC; and (2) manage discharges from Sullivan Lake so that average daily temperature downstream from the confluence of Outlet and Sullivan creeks would not deviate by more than 1º C from the average daily temperature of water upstream of the confluence when that water is less than 14º C. The effects on water quality would be the same as we previously described for normal operations once the cold water facility is constructed and are discussed in the previous section.

**Mill Pond Dam Decommissioning**

As a part of the Sullivan Creek license surrender, the District filed a Mill Pond Decommissioning Plan. This plan would entail the removal of the Mill Pond dam and the associated log crib dam to return Sullivan Creek to a natural, free-flowing stream environment. This plan would be finalized after consultation with Seattle, the Kalispel Tribe, Ecology, and Forest Service and would be submitted to the Commission for approval within 24 months of license surrender order.

The District proposes to implement a dam bypass and gradual flow release approach for removal of the concrete and log-crib dams. Mill Pond would be lowered 20 to 25 feet with the water being diverted around the dam into Sullivan Creek through a siphon pipe. All dam removal work would be done in the dry, and during this time, all Sullivan Creek flow would be diverted around the construction area via the siphon pipe.

Once the concrete and the log crib dam are removed, the District would empty Mill Pond completely (approximately 15 more feet) using a decanting tower which would be built into the cofferdam. The District then proposed to restore the original channel of Sullivan Creek that is currently inundated by Mill Pond. Restoration of the original channel would be accomplished in three segments.[57] After this restoration, all Sullivan Creek flow would be retuned to its original channel.

The plan would include a number of mitigative measures to reduce the impacts of this action on water quality in the project area. They include:

- Utilize the existing stream channel alignment as the new stream channel wherever it shows on the Mill Pond bathymetry map in Reach 2, and where it is determined that the existing stream channel is in a stable condition.
- Design Reach 3 with a hydrologically connected streambed and floodplain.
- Design the bankfull channel to carry the effective discharge and highest frequency flood levels (2-year flood events). In Reach 1, where the channel is the steepest, there would be no floodplain because it is confined in bedrock. In Reaches 2 and 3, there would be a floodplain to provide riparian habitat and wood species recruitment.
- Install and anchor logs, branches and root wads (LWD) in the stream channel and floodplain to provide flow resistance under various flow conditions, habitat complexity, bank protection, sediment filtering, and mimic natural floodplain dynamics. Engineered LWD jams would be anchored in appropriate locations to provide roughness and flow dissipation.
- Place rock weir structures and appropriately-sized stream bed material in the stream channel for hydraulic stability, increased roughness, increased habitat complexity, fish passage, and to provide fish resting locations. The weirs would be used to dissipate energy and create pools. They would be spaced approximately five to seven channel widths apart to avoid backwatering effects and allow for the existence of intervening riffles or shallows between structures.

The District's proposed Mill Pond Decommissioning Plan is part of its settlement agreement filed on March 29, 2010. American Whitewater, Interior, and Washington DFW filed letters (on July 19, September 2, and September 3, 2010, respectively) stressing their support for all the conditions of the settlement agreement. The Forest

---

[57] Reach 1 would consist of the channel from just behind the current dam to approximately 300 feet downstream from the dam. Reach 2 would consist of approximately 500 feet of channel currently under the middle of Mill Pond. Reach 3 would consist of approximately 400 feet of channel just upstream of Reach 2, to nearly the current confluence of Sullivan Creek and Mill Pond.

Service, in its letter filed August 24, 2010, recommends that the District implement the proposed Mill Pond Decommissioning Plan.

*Staff Analysis*

**Water Quantity**

Under current conditions, inflow into Mill Pond roughly equals outflow. The flow and amount of water in Sullivan Creek above and below the Mill Pond dam under the District's proposal would not change from current conditions. The only difference would be that where currently Sullivan Creek contains an impoundment, the proposal would result in Sullivan Creek being returned to a natural, uninterrupted stream. Overall, hydrology in the project area would not be affected once Sullivan Creek was restored to its natural state. However, the hydrology of the project area would be affected during the process of dam removal. The District proposes to drain Mill Pond so that it may remove the dams in the dry. To achieve this dry condition, the first 20 to 25 feet of water which is currently stored in Mill Pond would be routed via a 48-inch siphon pipe around the dam and into Sullivan Creek.[58] This water from Mill Pond would be drained sometime between July and October. To understand the effects of this, we compared the proposed flows in Sullivan Creek during pond drawdown with the average flows that currently exist during that time period. Current natural inflow into Mill Pond varies by month, as shown in table 3-10.

Table 3-10. Average inflow/outflow into Mill Pond during proposed emptying timeframe (Source: District, 2010).

| **Month** | **Average Inflow/Outflow in cfs** |
|---|---|
| July | 144 |
| August | 72 |
| September | 65 |
| October | 250 |

According to the rating curve for a 48-inch siphon pipe provided as part of the Mill Pond Decommissioning Plan, the amount of extra water placed into Sullivan Creek below Mill Pond dam during the initial 20 to 25 foot drawdown would range from 200 to 87 cfs, depending on the head in the pond. At full pond (2,505 feet), the siphon would carry 200 cfs around the dam and return it to Sullivan Creek. As the pond drained, the siphon would carry approximately 4-8 cfs less for every foot of drawdown, due to decreased head. Once the pond was lowered 24 feet, the last foot would be drained at a rate of 87 cfs.

---

[58] See telephone memo of 12/15/10 between Commission staff and the District.

During a 2-year flood event, the estimated streamflow at the Mill Pond dam is approximately 986 cfs. Under the District's proposal, the maximum amount of water discharged into lower Sullivan Creek would be 450 cfs (250 cfs outflow if they started in October plus 200 cfs from the siphon). Thus, draining the Mill Pond dam during the proposed time frame would not create flooding downstream in Sullivan Creek.

The draining of Mill Pond would increase the amount of water in lower Sullivan Creek above natural levels for a period of time. This increase in flow would create more aquatic habitat than is currently available in Sullivan Creek. This would likely provide some benefit to aquatic organisms in Sullivan Creek. This benefit would be short-lived, however, as flows would return to their natural quantities upon completion of drawdown. The amount of time it would take to draw down Mill Pond this amount is not exactly known, but is likely to range from days to a few weeks.

At some point after the initial 20-25 feet drawdown of Mill Pond, both the concrete and the log-crib dams would be removed. Once this was accomplished, the District proposes to lower Mill Pond an additional 15 feet (or until the pond is fully empty) through the decanting tower that would be a part of the constructed cofferdam. The timing and amount of these emptying flows is not known, however, their effects are expected to be minor. Similar to the initial 20-25 feet draw down, the draining of the final 15 feet of water would not lead to flooding in Sullivan Creek and would provide a short-lived environmental benefit through an increase in the amount of aquatic habitat.

The District proposes to restore the natural channel of Sullivan Creek, which is currently inundated by Mill Pond, to be able to carry the amount of water that corresponds to the 2-year flood level. This measure would protect the project area from repetitive flood events, while still allowing the creek to be connected to its floodplain.

**Water Quality**

Mill Pond currently impounds water in Sullivan Creek which has a number of effects on water quality, the most notable of which is increased temperature. Impounded water is exposed to radiant heat that it would not be if were flowing down Sullivan Creek. This water absorbs the radiant heat which results in increased temperature. The water in Mill Pond is then eventually discharged to Sullivan Creek at a temperature which is higher than it would have been naturally. A recent study showed that the Mill Pond dam increased the temperature of Sullivan Creek water by 2.0 to 2.4º C (District, 2010). This increase in temperature can lead to exceedences of state water quality standards and decrease the quality of Sullivan Creek's aquatic habitat. The impoundment of Sullivan Creek water also could decrease DO levels in the stream by reducing aeration opportunities that would occur naturally.

The removal of Mill Pond dam would allow flows in Lower Sullivan Creek to pass through the former pond area without becoming impounded. This new flow regime would reduce the amount of time that radiant heat is allowed to penetrate the surface layer of water in the pond. This permanent direct effect on the flow regime of

Lower Sullivan Creek would reduce temperatures by as much as 2.4º C, potentially improving aquatic habitat. Revegetation of stream banks within the former pond reach with native riparian, wetland, and upland plant species would provide shading and cover, which would result in a cooling effect. Permanent indirect effects of temperature reduction would include the potential to attract more fish species into Sullivan Creek from Boundary Reservoir due to its colder water temperatures.

The restoration of Sullivan Creek water into its historical stream bed may increase DO levels through a return to natural flows that are not present in the impounded condition. The installation of LWD, boulders and riffles would increase aeration opportunities and cause greater amounts of oxygen to diffuse in the water column when compared to current conditions.

One of the goals of the restoration effort is to return Sullivan Creek to its natural state, which in part would include restoration of the original stream channel where possible. The District proposes a number of measures to ensure that when Sullivan Creek is restored it would function in a hydrologic manner that would replicate pre-project conditions. The proposal to ensure that Reaches 2 and 3 would be hydrologically connected to their floodplain would help to achieve this. The health of a stream is largely a function on its connectivity to its floodplain. Streams are often dependent on their floodplain for provision of nutrients and structure. When a stream overflows its channel into its floodplain and eventually recedes back, the water contains nutrients in the form of organic matter that are deposited into the stream and become an important trophic link in the system. The water can also contain woody debris, gravels, and other physical constituents of aquatic habitat that are beneficial to aquatic organisms. The District's proposal to restore the inundated Sullivan Creek channel in a manner such that it would be hydrologically connected to its floodplain would be beneficial to Sullivan Creek.

Placement of LWD and rock weirs in the restored channel would create varied flow conditions which would result in habitat complexity. Directly behind these structures, pool habitat would be created and their proposal to space out the structures would create run and riffle areas between pools. These structures would also provide erosion control and would mimic natural floodplain dynamics. Overall, these measures would help to return Sullivan Creek to a natural state and would be beneficial for the creek and the aquatic organisms that inhabit it.

### 3.4.3 Cumulative Effects

The Pend Oreille river basin contains a number of hydroelectric dams and other developments, such as mines and human settlements. Effects of these actions combined with effects from the Boundary Project likely result in negative cumulative effects on aquatic resources in the river basin. Negative aquatic effects due to cumulative actions in the basin include higher water temperatures, lower DO levels, higher TDG levels, higher pH levels, higher levels of macrophyte colonization, higher probability of invasion by aquatic invertebrates, and increased level of toxins in the water column and sediments that could be available for uptake by aquatic species.

Under Seattle's proposed action, water temperatures in the project are expected to be lower, TDG in the project tailrace would be lower, pH in localized areas would be lower, the areas of macrophyte colonization would be reduced, and the project area would be monitored for the presence of invasive aquatic invertebrates. All of these effects of the proposed action would reduce the Boundary project's cumulative effects on aquatic resources in the river basin.

Under Seattle's proposed action, there would be no change in hydrology in the project area, DO levels would not be affected, and there would be no change in the bioavailability of toxins to aquatic species. Construction of the Boundary Project likely contributed to some adverse cumulative effects on these resources, but the proposed action would not further contribute to the bioavailability and uptake of toxins.

Construction and operation of the Sullivan Creek Project likely contributed to cumulative effects in the project area. The Pend Oreille river basin contains a number of other hydroelectric dams and other developments, such as mines and human settlements. Effects of these actions, combined with effects from the Sullivan Creek Project, likely resulted in adverse cumulative effects on aquatic resources in the river basin, most notably resulting in higher water temperatures and fragmented habitat.

The District's proposed action would have a positive contribution to cumulative effects in the project area when compared to current conditions. Under the District's proposal, water temperatures in Sullivan Creek would be lower and habitat connectivity would be improved. Therefore, the effects of the proposed action would reduce the project's contribution to cumulative effects on aquatic resources in the river basin.

## 3.5 AQUATIC RESOURCES

### 3.5.1 Affected Environment

#### 3.5.1.1 Boundary Project

Boundary Reservoir has a small active storage capacity relative to mean daily river flow, and project operations, therefore, have little effect on the annual, seasonal, or monthly storage and release of water to the Pend Oreille River. Retention time of water in Boundary Reservoir averages less than 2 days; consequently, the reservoir more closely resembles a riverine system.[59] The project is operated as a daily load-following facility, which primarily affects instream flow releases on a daily or hourly basis. Water surface elevations in Boundary Reservoir fluctuate in response to inflow variation,

[59] Washington State defines lacustrine systems as those with retention times greater than 15 days (*see* WAC 173-201A).

project operations, and wind-induced waves.  Daily water surface elevation fluctuations range from 1.15 to just over 18 feet in the Boundary dam forebay, and from 0.42 to 4.8 feet in the Box Canyon dam tailrace (based on data from 1987 to 2005).

**Aquatic Habitat**

In summer, water temperatures in Boundary Reservoir often exceed 68 °F (20 ºC).  Vertical temperature profile measurements indicate that the reservoir is largely vertically mixed throughout the year, although limited surface warming occurs in the forebay during summer and early fall.  There are no substantial longitudinal trends in temperature at any time during the year.  Summer pH values at times exceed 8.5, and some spatial variability in pH occurs as a result of localized geochemistry.  DO concentrations are typically at, or above, saturation.  Turbidity, conductivity, and nutrient concentrations are low, with phosphorus and nitrogen concentration often below detection limits.  Water quality in the project area is discussed in greater detail in section 3.4.1.1, *Water Quantity and Quality, Affected Environment – Boundary Project*.

For analysis of project effects, as presented in section 3.5.2.1, we describe the aquatic resources from a geographic point 3.9 miles downstream from the Boundary dam (confluence of Red Bird Creek in Seven Mile Reservoir), upstream to the Box Canyon dam.  The project area is delineated into four distinct reaches, based on habitat characteristics that result from reservoir physiography:  the Tailrace/Seven Mile Reservoir Reach, the Forebay Reach, the Canyon Reach, and the Upper Reservoir Reach (figure 3-8).[60]

The Tailrace Reach extends from the Boundary dam downstream to the confluence with Red Bird Creek (RM 13.1 – 17.0).  At low Seven Mile Reservoir water surface elevations, riverine habitat is present in the Pend Oreille River downstream to the confluence of Red Bird Creek.  At high reservoir levels, the riverine habitat upstream of the Red Bird Creek confluence becomes reservoir habitat.  The Boundary dam tailrace area is characterized by deep pools (greater than 75 feet) in the spillway and turbine afterbays, but is generally less than 30 feet deep elsewhere.  Downstream of the spillway and afterbay pools, the tailrace is relatively swift, with cobble and boulder substrates.  Habitat diversity is provided primarily by instream boulders and alcoves along the channel margins.  Varial habitat[61] (≤ 10 feet) makes up between 12.9 and 33.3 percent of the total area of the Tailrace Reach, depending on flow.

---

**60** We describe the physical habitat conditions in these four reaches later in our discussion of the existing environment.

**61** The varial zone is the area beside a river channel that is subject to rapid wetting and drying as the flow rate changes.

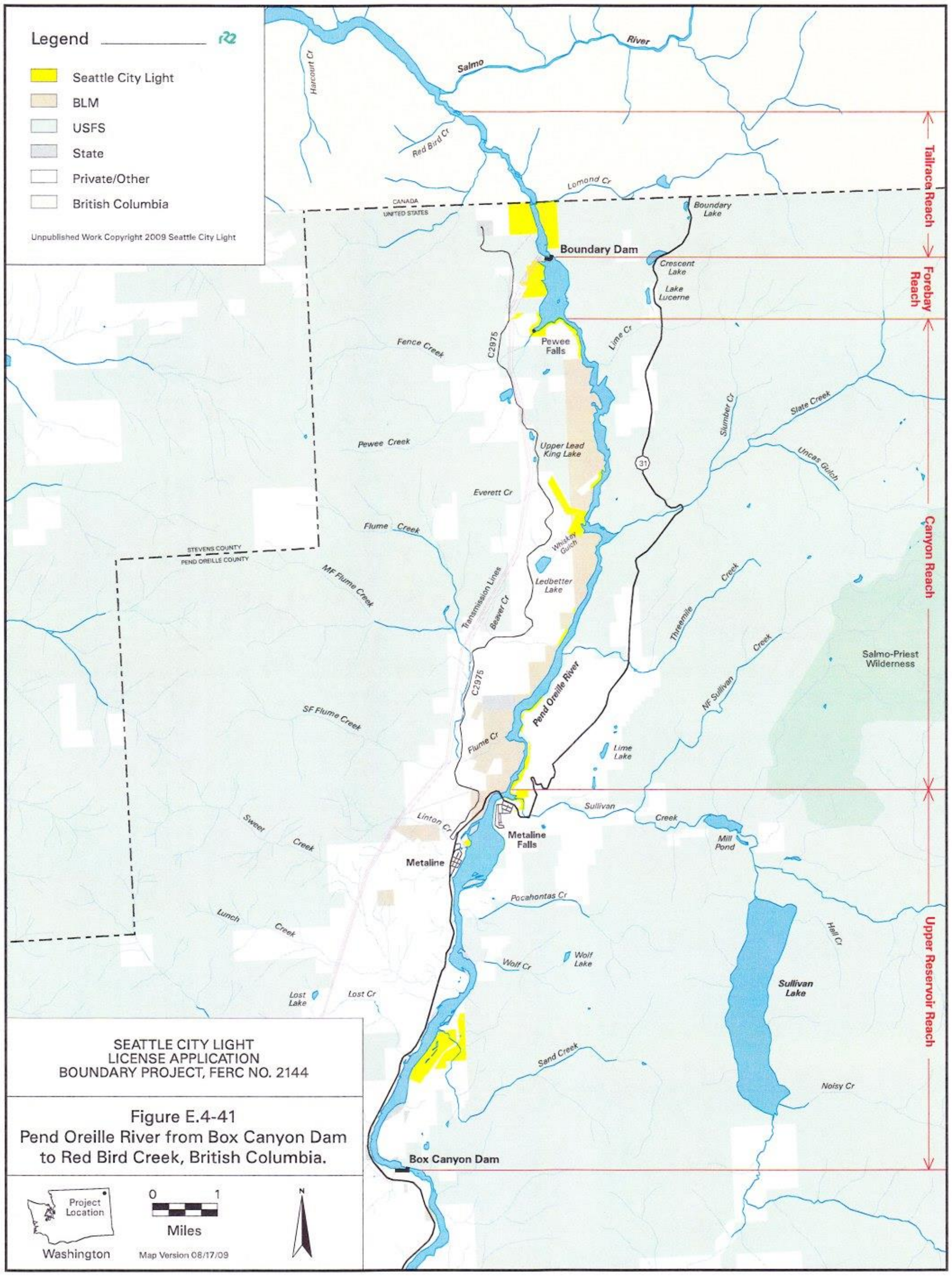



Figure 3–8. Pend Oreille River from Box Canyon dam to Red Bird Creek, British Columbia (Source: Seattle, 2010).

The Forebay Reach, which extends from the Boundary dam upstream to the lower end of Z Canyon (RM 17.0 – 18.0), is wide and deep, with steep-sided banks and water depths to about 270 feet. There is little shallow, littoral habitat in this reach. A small island near the center of this reach provides some habitat complexity, although the shores of the island are also steep. Varial zone habitat makes up between 3.4 and 4.4 percent of the total area of the Forebay Reach, depending on flow and reservoir water surface elevation. Pewee Creek drains into this section of the Boundary Reservoir at RM 17.9. The mouth of Pewee Creek is a vertical 164-foot waterfall (McLellan, 2001).

The Canyon Reach, which extends from the downstream end of Z Canyon to Metaline Falls (RM 18.0 – 26.8), is predominantly narrow, with steep rock walls. A few large embayment and backwater channels provide localized shallow habitats with aquatic macrophyte beds, and areas of rock outcroppings provide habitat complexity. Downstream of Slate Creek, the canyon is more constricted, and water depths exceed 100 feet, whereas depths upstream of Slate Creek are typically 80 to 100 feet. Varial zone habitat makes up between 6.4 and 8.4 percent of the total area of the Canyon Reach, depending on flow and reservoir water surface elevation. In addition to Slate Creek, there are six other tributaries that drain into the Canyon Reach, including Lime Creek (RM 19.0), Everett Creek (RM 21.9), Whiskey Gulch (RM 21.9), Beaver Creek (RM 24.3; west side), Threemile Creek (RM 24.3; east side), and Flume Creek (RM 25.8). The upstream end of the Canyon Reach is inundated by Boundary Reservoir when flows/water surface elevations are high.

Slate Creek has four main tributaries and two forks: Slumber Creek,[62] Uncas Gulch,[63] Styx Creek,[64] and North and South Fork Slate creeks. Westslope cutthroat and eastern brook trout are found in Slumber, Styx, and South Fork Slate creeks, as well as Uncas Gulch (Forest Service, 1998a). Slumber Creek supports a self-sustaining population of brook trout.

---

**62** Slumber Creek runs through a steep-sided valley and has an average channel gradient ranging from 3 to 4 percent (Forest Service, 1998a). Channel sinuosity is low, and instream cover consists primarily of large wood. Dominant substrates types include sand, gravel, and cobble, and substrate embeddedness is greater than 35 percent.

**63** Uncas Gulch is contained in a steep-sided valley, and the channel has an average gradient ranging from 4 to 6 percent (Forest Service, 1998a). Channel sinuosity is generally low, and instream cover consists primarily of large wood. Dominant substrate includes sand, gravel, and cobble, and substrate embeddedness is less than 35 percent.

**64** Styx Creek flows through a moderately steep-sided valley, and has an average channel gradient ranging from 3 to 6 percent (Forest Service, 1998a). Channel sinuosity is generally low, and instream cover consists mainly of large wood. Dominant substrate includes sand, gravel, and cobble, and substrate embeddedness is less than 35 percent.

The Upper Reservoir Reach, which extends from Metaline Falls to the Box Canyon dam (RM 26.8 – 34.5), is relatively wide and shallow, with a combination of silt, sand, and hard substrates, and water depths typically ranging from 10 to 25 feet. Habitat diversity is provided primarily by islands, back channels, and near-shore aquatic vegetation. Varial zone habitat makes up between 14.8 and 52.5 percent of the total area of the Upper Reservoir Reach, depending on flow and reservoir water surface elevation. Sullivan Creek, the largest tributary that drains into Boundary Reservoir, is located in this reach just upstream of Metaline Falls at RM 26.9. Other tributaries that drain into the Upper Reservoir Reach include Linton Creek (RM 28.1), Pocahontas Creek (RM 29.4), Wolf Creek (RM 30.3), Lunch Creek/Sweet Creek (RM 30.9), Sand Creek (RM 31.7), and Lost Creek (RM 32.2).

There are many named and unnamed tributaries that flow into Sullivan Creek, not including water that enters Sullivan Creek from Sullivan Lake via Outlet Creek. The named tributaries include Cascade, Copper, Deemer, Fireline, Gypsy, Johns, Kinyon, Leola, Lookout, Mankato, North Fork Sullivan, Pass, Rainy, Stony, Thor, Thunder, and Totem creeks. According to Forest Service (1996), the fish-bearing drainages include Cooper, Deemer, Fireline, Gypsy, Kinyon, Leola, Mankato, North Fork Sullivan, and Stony creeks. Westslope cutthroat trout are known to occur in all fish bearing drainages, except Cooper, Fireline, and Stony creeks. Eastern brook trout and brown trout, both introduced species, occur in many locations in the Sullivan Creek watershed, and rainbow trout are thought to occur mostly in the mainstem of Sullivan Creek.

Habitat conditions vary among Sullivan Creek's tributaries. Cascade, Copper, Kinyon, Rainy, and Totem creeks have the V-shape that is characteristic of a history of debris torrents, and Cascade, Kinyon, and Totem creeks have landslide deposits at their mouths (Forest Service, 1996). At the time of the Sullivan Creek watershed assessment (Forest Service, 1996), riparian management objectives, with the exception of water temperature, were not being met in Deemer, Kinyon, Leola, and Stony creeks. As the result of historic timber harvest, Leola and Deemer creeks did not meet INFISH[65] guidelines for LWD and bankfull width-depth ratio objectives. In addition, dispersed recreation had adverse affects ("heavy" to "extreme" ratings under the "impact of previous use" characterization) at some locations on Deemer Creek. The North Fork Sullivan Creek dam, located 0.25 miles upstream of the creek's mouth, is a barrier to upstream fish passage.

---

[65] INFISH. 1995. Inland native fish strategy: Interim strategies for managing fish-producing watersheds in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada. U.S. Department of Agriculture, Forest Service: Intermountain, Northern, and Pacific Northwest Regions.

### Fish Communities

At least 28 species of fish occur in the Project area (table 3-11). Table 3-12 provides a summary of the periodicity, life history, and spawning and rearing habitat for fish species in the project area. No anadromous fish are found in Boundary Reservoir or the tailrace. Some fish species found in the reservoir may have adfluvial life histories. Fish abundance and species diversity in Boundary Reservoir differ from that found in the reservoir's tributaries, and densities of all fish species are low in the deep water of the reservoir, most of which occurs in the Forebay and Canyon reaches.

Table 3-11. Species composition, distribution, and abundance of fish within Seven Mile and Boundary reservoirs (Source: Seattle, 2009).

| | | | Boundary Reservoir | | |
|---|---|---|---|---|---|
| **Species** | **Type** | **Seven Mile to Boundary** | **Forebay Reach** | **Canyon Reach** | **Upper Reach** |
| Longnose sucker | Native nonsport | O | O | O | C |
| Bridgelip sucker | Native nonsport | P | N | N | N |
| Largescale sucker | Native nonsport | A | A | A | A |
| Brown bullhead | Non-native sport | N | O | P | C |
| Pumpkinseed | Non-native sport | O | C | C | A |
| Smallmouth bass | Non-native sport | A | A | A | A |
| Largemouth bass | Non-native sport | P | O | O | O |
| Black crappie | Non-native sport | O | O | O | C |
| Sculpin spp. | Native nonsport | P | P | P | O |
| Peamouth | Native nonsport | A | A | A | A |
| Northern pikeminnow | Native sport | A | A | A | A |
| Longnose dace | Native nonsport | P | N | N | N |
| Redside shiner | Native nonsport | A | C | A | C |
| Tench | Non-native, nonsport | P | O | C | C |
| Northern pike | Non-native sport | O | N | N | O |
| Burbot | Native sport | P | O | O | O |
| Yellow perch | Non-native sport | O | A | A | A |
| Walleye | Non-native sport | O | O | O | O |
| Cutthroat trout | Native sport | O | O | O | O |
| Redband trout | Native sport | O | P | P | P |
| Hatchery rainbow trout | Non-native sport | C | C | C | C |
| Kokanee | Non-native sport | O | O | O | O |
| Mountain whitefish | Native sport | C | O | O | C |

| | | Boundary Reservoir | | | |
|---|---|---|---|---|---|
| **Species** | **Type** | **Seven Mile to Boundary** | **Forebay Reach** | **Canyon Reach** | **Upper Reach** |
| Lake whitefish | Native sport | N | N | O | N |
| Brown trout | Non-native sport | O | O | O | O |
| Bull trout | Native sport RTE | O | P | P | P |
| Eastern brook trout | Non-native sport | O | O | O | O |
| Lake trout | Non-native sport | O | O | O | O |

Abundance Codes: A = abundant, C = common, O = occasional, P = present, status unknown, N = not recorded in past or present studies (likely absent or rare).

Fish sampling by several entities (Forest Service, 1998a, b; R2 Resource Consultants, 1998a); McLellan, 2001; and Seattle 2009d) provide the following general characterizations of fish communities in Boundary Reservoir. The Forebay Reach fish community is dominated by largescale suckers, northern pikeminnow, peamouth, yellow perch, and smallmouth bass. Hatchery-reared rainbow trout, cutthroat trout, burbot, walleye also exist in this reach. Rainbow trout, yellow perch, smallmouth bass, and largescale sucker are relatively abundant in the Forebay Reach varial zone, and smallmouth bass, lake trout, rainbow trout, and largescale sucker are also captured in open waters of the Forebay Reach.

The Canyon Reach is dominated by minnows and suckers, including northern pikeminnow, largescale sucker, redside shiner, and peamouth. Mountain whitefish is occasionally observed, and hatchery-reared rainbow trout is commonly observed. Yellow perch, pumpkinseed, suckers, and northern pikeminnow are abundant in the varial zone, and tench have been captured in the varial zone. Similar to the Forebay Reach, smallmouth bass, lake trout, largescale suckers, and rainbow trout have been captured in open waters of the Canyon Reach.

Table 3–12. Periodicity, life history, and spawning and rearing habitat of fish species in the Boundary Project area (Source: Seattle, 2009).

| Species | Spawning Habitat | Spawn Period (month/day) | Time to Hatch or Emergence (days) | Optimal/Max Spawning Temperature | Juvenile Rearing Habitat | Optimal/Max Rearing Temperature | Typical Lifespan (yr) | Max Size (inches) |
|---|---|---|---|---|---|---|---|---|
| Native Species | | | | | | | | |
| Longnose sucker | rivers: swift riffles, gravel substrates | 4/15 – 7/15 (peak from 4/30 – 6/24) | 8 at 59 °F; 11 at 50 °F; 1-2 weeks before emergence | 41 – 48 °F | lakes & streams; weedy shallows by day, deeper offshore by night | Max: 80.6 °F | 8 – 19 | 20.2 |
| Largescale sucker | riverine; pool tailouts with fine gravel and sand substrate; occasionally along shoreline of lakes | 4/10 – 7/15 (peak from 4/30 – 6/24) | 14 | 46 – 55 °F | lakes & streams; weedy shallows by day, deeper offshore by night | Max: 85 °F | 8 – 15 | 22.2 |
| Sculpin spp. | under rocks | mottled: Feb. – June slimy: spring | mottled: 20 – 30 at 50 °F slimy: 28 at 46 °F | 41 - 50 °F | lakes & streams; benthic; rubble, gravel, or rocky substrates | 55 – 65 °F/ 70 °F | 4- 5 | mottled: 5 slimy: 2-3 |
| Peamouth | streams and shorelines with gravel or rubble substrate | May – June | 7 – 8 at 54 °F | 54 - 59 °F | lakes & streams; young very shallow during spring to fall; over-winter in deep water | | 13 | 11.1 |

| Species | Spawning Habitat | Spawn Period (month/day) | Time to Hatch or Emergence (days) | Optimal/Max Spawning Temperature | Juvenile Rearing Habitat | Optimal/Max Rearing Temperature | Typical Lifespan (yr) | Max Size (inches) |
|---|---|---|---|---|---|---|---|---|
| Redside shiner | gravel stream bottoms or vegetation along lake shorelines | April – July | 3-7 at 70 - 73 °F | 58 - 64 °F | Rivers & lakes, slow to moderate current; aquatic vegetation; in stratified waters at depth during summer; over-winter in deep water | Summer 55 - 68 °F/ 75 °F | 4 – 5 | 5.7 |
| Northern pikeminnow | broadcast spawn over gravel, cobble, rubble in streams & lakes | May – June | 7 at 65 °F; free swimming in 14 | 57 - 65 °F | lakes & streams, slow to moderate currents; shallows or surface of pelagic zone in summer; benthic during winter; YOY mud to rubble substrate then move to vegetated areas | 68 - 73 °F | 10 + | 22.9 |
| Westslope cutthroat trout | riverine; redds dug in gravel substrates found in pool tailouts | 3/15 – 6/15 (peak from 4/1 – 5/31 | 49 – 63 | 50 °F/ 43 - 63 °F | Resident: stream pools, gravel, rubble, boulder, overhead cover.<br><br>Adfluvial: same as resident for 1 to 4 yr; older fish lake habitats | 60 °F/70 °F | 4 -5 | 12.6 in Box Canyon<br><br>10.9 in Pend Oreille tributaries |
| Redband trout | rivers; redds in gravel, pool tailouts | 3/1 – 6/30 (peak from 4/1 – 5/31) | 50 at 50 °F | 36 - 68 °F | lakes & streams | < 70 °F/ 32 - 80 °F | 6 | 22.2 |

| Species | Spawning Habitat | Spawn Period (month/day) | Time to Hatch or Emergence (days) | Optimal/Max Spawning Temperature | Juvenile Rearing Habitat | Optimal/Max Rearing Temperature | Typical Lifespan (yr) | Max Size (inches) |
|---|---|---|---|---|---|---|---|---|
| Mountain whitefish | gravel; riffles and runs in streams; shoals along lake shorelines | 10/15 – 1/15 (peak from 11/1 – 12/31) | 30 at 48 °F | 40 - 45 °F | riffles in summer, large pools or runs in winter in streams; gravel bars at mouths of tributaries for Box Canyon | 48 – 52 °F | 8 | 17.1 in Box Canyon |
| Bull trout | riverine; redds in gravel, pool tailouts | 9/15 – 12/30 (peak from 10/1 – 11/30) | 165 – 235 | 35.6 – 39.2 °F | small fish - benthic with cover; large fish – large pools and lakes | < 59 °F | 5 – 7 | Resident: 6-12<br><br>Adfluvial: 23.8 |
| Burbot | lakes & rivers under ice; 1-9 ft of water, over sand and gravel | winter – early spring | 71 at 34 °F<br>28–35 at 39 °F<br>30 at 43 °F | 33 - 35 °F | shallows and stream channels | | up to 15 | 45 |
| Non-Native species | | | | | | | | |
| Brown bullhead | lake shallows, depression in mud or sand near aquatic vegetation or woody debris | April to June | 5 at 77 °F;<br>7 at 69 °F | 70 °F | shallow vegetation; benthic; lakes, ponds, sluggish areas of streams | | 5 | 12 -14 |
| Pumpkinseed | lake shallows, | 5/15 – 6/31 (peak from | 3 at 82 °F | 60 °F | clear water; dense vegetation; sloughs, | > 70 °F | 6 | 5 |

| Species | Spawning Habitat | Spawn Period (month/day) | Time to Hatch or Emergence (days) | Optimal/Max Spawning Temperature | Juvenile Rearing Habitat | Optimal/Max Rearing Temperature | Typical Lifespan (yr) | Max Size (inches) |
|---|---|---|---|---|---|---|---|---|
| | depression in gravel, mud, or sand near aquatic vegetation | 6/15 – 7/31) | | | backwaters, slow moving rivers | | | |
| Smallmouth bass | lakes shallows, depressions | 5/15 – 7/31 (peak from 6/1 – 7/15) | 4 – 10 | 55 – 65 °F | clear streams and lakes; coarse substrate, boulders and rocky reefs | 70 – 80 °F | 10 | 17 - 19 |
| Largemouth bass | lakes; sand, gravel, rubble 1-4 ft deep, max 8 ft deep | 5/15 – 7/31 (peak from 6/1 – 7/15) | 3 – 7 | 60 – 65 °F | shallow vegetation and woody debris; lakes and backwaters of rivers | 68 °F/75 °F | 8 | 17.2 |
| Black crappie | lakes; shallow depressions in mud, < 8 ft | 5/15 – 8/31 (peak from 6/15 – 7/31) | 2 – 3 at 65 °F | 58 – 64 °F | clear water; dense vegetation; large streams, lakes and reservoirs; sand, muck or organic | | 8 | 8.4 |
| Yellow Perch | lakes; egg mass laid on vegetation, submerged brush, or sand, gravel, or rubble | 3/15 – 5/31 (peak from 4/5 – 5/15) | 8 – 10 | 45 – 52 °F | lakes with vegetation; clear water | 70 °F | 8 | 8.3 |

| Species | Spawning Habitat | Spawn Period (month/day) | Time to Hatch or Emergence (days) | Optimal/Max Spawning Temperature | Juvenile Rearing Habitat | Optimal/Max Rearing Temperature | Typical Lifespan (yr) | Max Size (inches) |
|---|---|---|---|---|---|---|---|---|
| Walleye | 2 – 30 feet, shoreline areas, shoals | March – May | 14 at 46 °F | 43 – 48 °F | associated with cover in depths < 50 ft | 54 – 84 °F | 7 – 10 | 30 |
| Northern Pike | vegetated littoral areas | April – May | 31 at 42 °F | 40 – 59 °F | vegetated littoral areas | | 10 -12 | 59 |
| Rainbow trout | rivers; redds in gravel, pool tailouts | February – June | 50 at 50 °F | 36 – 68 °F | lakes & streams | < 70 °F/ 32 – 80 °F | 6 | 22.2 |
| Brown trout | rivers; redds in gravel, pool tailouts | October – December | 50 at 50 °F | 45 – 55 °F | lakes & streams | 65 – 75 °F/ 81 °F | 9 in Box Canyon; 5 in Pend Oreille tribs. | 20.4 in Box Canyon; 13.6 in Pend Oreille tribs. |
| Eastern brook trout | rivers; redds in gravel, pool tailouts | August – December | 144 at 35 °F | 40 – 50 °F | spring fed headwater ponds and streams | 55 - 66 °F/ < 77.5 °F | 3 | 7.1 |
| Kokanee | riverine; redds in gravel, pool tailouts | September – December | 56 – 84 | 41 – 55 °F | lake pelagic zone | 50 °F | 4 | 16.7 – 17.7 |
| Lake trout | lakes; gravel, boulders, rubble on clean shoals | October – December | 105 – 147 at 32.5–33.8 °F | 48 – 57 °F | lakes 60 – 300 ft deep | 50 °F | 10 – 17 | 26.9 – 35.5 |

Fish species diversity is higher in the Upper Reservoir Reach than downstream from Metaline Falls, as the result of increased habitat diversity. The fish community in the Upper Reservoir Reach is dominated by minnows, suckers, tench, and smallmouth bass; brown bullhead is common and burbot is occasionally observed in this reach. In addition, yellow perch, mountain whitefish, and pumpkinseed can be found in this reach, and non-native northern pike and walleye are captured in this reach with increasing frequency. The varial zone in the Upper Reservoir Reach provides extensive, gently sloping to flat off-channel and slough habitat, often with dense aquatic macrophyte beds in the summer. These areas provide important spawning and young-of-the-year (YOY) fish rearing habitat for a variety of species. YOY sunfish, minnows, perch, and suckers are locally abundant. The presence of suckers and sunfish in the varial zone increases in summer, likely due to increased water temperatures. YOY mountain whitefish have been observed in the varial zone during May and June, and adult whitefish are found in the varial zone in November (likely due to spawning). Northern pikeminnow and peamouth are present in the open water of the Upper Reservoir Reach.

As discussed in section 3.4.1.1, *Water Quantity and Quality, Affected Environment – Boundary Project*, summer water temperatures in Boundary Reservoir at times exceed 68 °F (20 ºC), which is too warm to provide optimum summer habitat for trout species (i.e., generally less than 60.8 °F (16 ºC) (Bjornn and Reiser, 1991). Triploid rainbow trout planted by Seattle[66] are by far the most numerous trout species present in Boundary Reservoir, accounting for 64 to 90 percent of the salmonid observations during relicensing surveys, depending on the reach. Wild rainbow trout (redband and hatchery origin) and brown trout are the next most common trout species in the reservoir, and cutthroat trout are uncommonly observed in the reservoir. No cutthroat trout, bull trout, or rainbow trout spawning, and no bull trout rearing, occurs in the reservoir. Cutthroat and rainbow trout YOY are captured exclusively in tributary streams near their confluences with the reservoir, whereas mountain whitefish, smallmouth bass, and cyprinid species YOY inhabit the reservoir. Although not abundant, trout species in the reservoir show a summertime preference for habitat in tributary deltas, because the relatively low temperatures of the tributary inflows provide thermal refugia from warmer water in the mainstem reservoir (Seattle, 2009b).

The larger tributaries to Boundary Reservoir contain a variety of fish species, and most salmonids in the vicinity of the project occur in the tributaries. The dominant sport fish in the tributaries are westslope cutthroat trout, eastern brook trout, rainbow

---

**66** The Washington DFW no longer provides permits for triploid rainbow trout stocking into Boundary Reservoir due to concern over potential competition with native salmonids, low catch rates, poor salmonid habitat conditions, and low survival and retention in the reservoir.

trout, and to a lesser extent brown trout and mountain whitefish. Bull trout, kokanee, and burbot have been found in Sullivan Creek.

The fish community in the Tailrace Reach is dominated by minnows and suckers, including northern pikeminnow, largescale sucker, redside shiner, and peamouth. Smallmouth bass are the most abundant sport fish. Mountain whitefish and both wild and hatchery-reared rainbow trout are common in the reach. Walleye, a non-native species, was caught in the Tailrace Reach in 2007. Data collected in 2007 – 08 indicate that little trout spawning occurs in the project tailrace (Seattle, 2009b). Suckers, smallmouth bass, and triploid rainbow trout accounted for nearly 85 percent of the varial zone catch in 2007 – 08 sampling. Fish abundance in the varial zone is highest in July. Suckers and triploid rainbow trout dominated the open water catch. Large northern pikeminnow are commonly encountered in the deep waters of the spillway pools and afterbay. Walleye are occasionally found at depths of 10 to 20 feet. Aside from suckers and northern pikeminnow, no YOY have been caught in the Tailrace Reach, due to the fact that highly variable and often swift flows over coarse substrates likely limit the spawning habitat for many species in the reach.

**Physical Habitat**

Physical habitat varies by reach in Boundary Reservoir, but the project area provides limited habitat for adult and juvenile salmonids. The Forebay Reach has little shallow, littoral habitat. Habitat complexity is provided by a single island. The Canyon Reach has a few embayment and backwater channels that provide localized shallow habitat with macrophyte beds, and areas of rock outcroppings provide some habitat complexity. The Upper Reservoir Reach exhibits the greatest amount of physical habitat of the reservoir reaches, with habitat diversity provided by islands, back channels, and near-shore aquatic vegetation.

Large wood debris (LWD) was mapped along the Boundary Reservoir shoreline in 2007. The mapping showed that LWD is distributed in concentrated areas throughout the reservoir (table 3-13). Abundance is greatest in the Canyon Reach, followed by the Upper Reservoir Reach. The Forebay Reach has very little LWD.

Table 3–13. Large woody debris in the Boundary reservoir by reach (Source: Seattle, 2009).

| | | **Large Wood** | |
|---|---|---|---|
| **Reach** | **Reach Length (miles)** | **Total Count (no./mile)** | **Total Volume ($ft^3$/mile)** |
| Forebay | 1.0 | 80 | 2.881 |
| Canyon | 8.9 | 118 | 4,706 |
| Upper Reservoir | 7.6 | 53 | 2,881 |

Macrophyte beds are much less extensive downstream from Metaline Falls (18.6 acres) than in the Upper Reservoir Reach (137.6 acres). Eurasian watermilfoil and coontail are the dominant plant species found in Boundary Reservoir (table 3-14. Macrophytes can provide habitat and food for benthic macroinvertebrates and fish (Engel, 1995), particularly spawning fish, fry, and juveniles.

Table 3–14. Macrophyte beds in Boundary reservoir (Source: Seattle, 2009)

| **Reach** | **Number of Macrophyte Beds** | **Macrophyte Bed Size Range (acres)** |
|---|---|---|
| Forebay | 12 | 0.001 - 8.4 |
| Canyon | 27 | 0.001 – 7.9 |
| Upper Reservoir | 33 | 0.02 – 61.7 |
| Tailrace | 0 | 0 |

Many Boundary Reservoir tributaries have natural upstream fish migration barriers close to the reservoir (Seattle, 2006). Some tributaries have no potential adfluvial habitat, whereas Sullivan Creek has nearly 22,000 linear feet of adfluvial habitat.

Physical habitat at the mouths of the tributaries varies by tributary. A detailed characterization of the tributary deltas in Boundary Reservoir can by found in Seattle (2009a), and is summarized in section 3.7.1.1, *Threatened and Endangered Species, Affected Environment – Boundary Project*. For tributaries where flow was present at the mouth during September, stream temperatures ranged from 46.4 – 59 °F (8 – 15 ºC), and flows ranged from 0.001 – 40.5 cfs (40.5 cfs in Sullivan Creek).

**Seasonality of Fish Distribution and Abundance**

Fish use of the shallow near-shore margins and off-channel areas of Boundary Reservoir is low during February through early May, compared to the summer months. From June through August, there is an increase in the relative abundances of juvenile suckers and minnows in near-shore areas. Large numbers of YOY fish are present in the Upper Reservoir Reach during this period, and small YOY fish, swim-up fry, and larval fish are found near the shorelines throughout the Canyon and Forebay reaches (Seattle, 2009b).

Wild rainbow trout capture rates are highest during the early spring and late fall, likely related to reduced water temperatures. Adult walleye are found in the Tailrace Reach primarily during April, when the species would be expected to spawn. The catch rate of adult smallmouth bass also increased during the spawning period of May and June in the Upper Reservoir Reach.

### Target Fish Species

The following species were identified as important species relative to potential project effects:

- Target Species
  - bull trout[67]
  - westslope cutthroat trout
  - mountain whitefish
- Species of Interest
  - smallmouth bass
  - minnows, suckers, and perch fry and juveniles

*Westslope Cutthroat Trout* – Westslope cutthroat trout are found in Boundary Reservoir, but their abundance is low. In contrast, cutthroat trout are found in nearly all of the larger tributaries that drain into Boundary Reservoir, the major exception being Flume Creek (Forest Service, 2005). Genetically pure strains are known to occur in North Fork Sullivan Creek (upstream of the town of Metaline Falls water supply diversion dam) and Harvey Creek (upstream of Sullivan Lake) (Small and Von Bargen, 2008), as well as in Sweet, Slate, and Peewee creeks. FWS (1999) indicates that cutthroat trout are usually found in the cooler, upper reaches of the tributaries, but suggested this was due to competition with other trout species (e.g., rainbow and brook trout).

Of the cutthroat trout captured or observed in or adjacent to Boundary Reservoir during 2007 – 08, the majority were observed in the lower reaches or deltas of tributaries to the reservoir. During the spring and summer, cutthroat trout are more frequently found in the Box Canyon tailrace (spring primarily) and in association with stream mouths, including Sweet, Sullivan, and Russian (in Canada) Creeks, potentially using these areas for feeding or as thermal refugia. During the winter, cutthroat trout use the Boundary tailrace and the area immediately downstream from the Box Canyon tailrace.

*Mountain Whitefish* – Mountain whitefish are the most frequently observed or captured native salmonid in Boundary Reservoir, but represent less than 1 percent of the fish community in the project area. Tributary surveys indicate that mountain whitefish are only present in Sullivan and Sweet creeks (McLellan, 2001; R2 Resource Consultants, 1998a; Seattle, 2009b). Most of the mountain whitefish population in the project area resides in the Upper Reservoir Reach.

---

**67** We discuss bull trout in section 3.7, *Threatened and Endangered Species, Affected Environment*.

Adult whitefish in spawning condition occur in the 1–mile reach downstream from the Box Canyon dam, and eggs have been collected on egg mats in the reach. Mature whitefish have also been observed in the Boundary dam tailrace. Whitefish eggs have been collected on egg mats at the mouth of Sullivan Creek. Biotelemetry studies show that mountain whitefish use habitat in the Boundary and Box Canyon tailraces during the spring through fall period, then move to deeper water areas downstream of the tailraces to overwinter.

*Smallmouth Bass* – Smallmouth bass is a non-native species that has become a popular sport fish in Boundary Reservoir. Largemouth bass are also present, but in much lower abundance. Smallmouth bass generally have a small home range during most of the year, but may move distances up to about 1 mile (Todd and Rabeni, 1989; Wydoski and Whitney, 2003).

Smallmouth bass occupy all reservoir reaches, but are most abundant in the Upper Reservoir Reach, least abundant in the Forebay Reach, and of intermediate abundance in the Canyon Reach. Smallmouth bass are most frequently found in the Box Canyon tailrace, near Sand, Sweet, and Pocahontas creeks, and in the Boundary Forebay Reach throughout the year. However, during spring and summer, they are widely distributed throughout Boundary Reservoir. Smallmouth bass feed over a large range of depths, and during high flow conditions, bass are routinely found in shallow water, inundated creek deltas, and inundated terrestrial habitat.

*Minnows, Suckers, and Perch* – Minnows are sufficiently abundant in Boundary Reservoir to be important prey for predatory fish; northern pikeminnow and peamouth being the most abundant (6.3 and 7.3 percent of the catch, respectively). Suckers (28.1 percent of the catch) and yellow perch (13.3 percent of the catch) also are available in sufficient abundance to be important prey species. Non-salmonid fry are observed beginning in July along the reservoir shoreline, and in backwaters and trapping pools.

**Recreational fishery**

Access to Boundary Reservoir for recreational fishery occurs primarily from three boat ramps: one each at the Forebay Recreation Area, in Metaline, and near the Box Canyon dam. Creel surveys in 1997 indicated the Upper Reservoir Reach is the most heavily fished area of the reservoir (R2 Resource Consultants, 1998a). Northern pikeminnow and rainbow trout are the two most commonly caught sport fish during the summer recreation season, although rainbow trout are caught at a much lower frequency than pikeminnow. Rainbow trout and smallmouth bass are the most commonly targeted species by anglers.

**Reservoir Productivity**

Productivity in Boundary Reservoir is low. Phosphorous and nitrogen concentrations are low throughout the year, with soluble reactive phosphorous and total kjeldahl nitrogen often below detection limits. Nitrogen-phosphorus rations indicate that the reservoir is phosphorus limited. Phytoplankton chlorophyll *a* concentrations (at times < 2.8 µg/l) also indicate that the system is oligotrophic. The zooplankton community is limited by food availability in the project area. Because zooplankton densities are low, McLellan (2001) suggests that benthic macroinvertebrates are likely the primary food source for many fish in Boundary Reservoir.

#### 3.5.1.2 Sullivan Creek Project

**Habitat**

As part of the 1994 license amendment, the District undertook an instream flow study that evaluated the effects of the proposed Sullivan Creek Project, at that time, on salmonid fisheries within the proposed diversion reach. Additional information was collected and analyzed in 1996. This data, which included water temperature, substrate, and spawn timing, is presented in FERC (1998), and summarized in sections 3.4.1.2, *Water Quantity and Quality*, *Affected Environment – Sullivan Creek Surrender* and 3.7.1.2, *Threatened and Endangered Species, Affected Environment – Sullivan Creek Surrender*.

Previous evaluation of project effects on fishery resources emphasized resident fish species, because no anadromous fish are able to reach the project area due to many impassable dams in the Columbia and Pend Oreille River systems. The waters of lower Harvey Creek, which is the largest tributary flowing into Sullivan Lake, transitions from surface to subsurface flows in most years during late summer through the winter. This area blocks upstream passage of fish from Sullivan Lake to over 95 percent of the aquatic habitat in Harvey Creek and downstream access to Sullivan Lake and beyond during this same period.

Spawning habitat in Harvey Creek is limited, in relation to the escapement in all of the study years. Individual redds are rarely observed, which indicates super-imposition, and the amount and effect on egg survival likely varies with differences in escapement. Dead eggs were observed during the spawning period in all years, with substantially more dead eggs in 2004 when escapement was highest. This said, it is reasonable to conclude that redd super-imposition occurs in Harvey Creek, since escapement exceeds available habitat (McLellan, 2009).

In the 500-foot reach from the non-operational powerhouse, upstream to the natural falls in the lower canyon (see discussion in section 3.7.1.2, *Threatened and Endangered Species, Affected Environment – Sullivan Creek Surrender*, little spawning habitat for any species exists (Powers, 2008). Pools available in this reach would still be available after surrender of the Sullivan Creek Project license, and would provide holding areas for any fish that might migrate up Sullivan Creek to escape warm temperatures in the Pend Oreille River.

### Fish Resources

Information on fish species composition and distribution in the project area was obtained through agency consultation, agency document review, and field studies. The fish species present, or potentially present, downstream from Sullivan Lake in Outlet and Sullivan Creeks include bull trout, brook trout, brown trout, kokanee, rainbow trout, westslope cutthroat trout, mountain whitefish, tiger trout, burbot, and pygmy whitefish.

The most abundant salmonid species downstream from Mill Pond is resident rainbow trout. Brown trout are known to exist in, and above, Sullivan Lake,[68] and brook trout exist throughout the drainage. Westslope cutthroat trout have been observed in lower Sullivan Creek, downstream from the Mill Pond dam. Although data on population size and density was not collected, the abundance of trout species appears to be relatively low.

According to the Washington DFW, the kokanee population in Sullivan Lake is being considered as a potential brood source for stocking several lakes in eastern Washington. Sullivan Lake has a self-sustaining population of kokanee that was first introduced in 1913 (Nine and Scholz, 2005). Kokanee were planted with regularity until the mid-1940s, but Sullivan Lake has only received three plants since then (1976, 2003, and 2004). The fish survey by Nine and Scholz (2005) found that the fish assemblage of Sullivan Lake, in addition to kokanee, includes speckled dace, redside shiner, tench, longnose sucker, westslope cutthroat trout, rainbow trout, brown trout, mountain whitefish, pygmy whitefish, burbot, and slimy sculpin. With the exception of kokanee, salmonids occur in low densities.

Sullivan Lake has three tributaries; Harvey, Hall, and Noisy creeks. These tributaries drain a total of about 32,769 acres. Sullivan Lake dam is a barrier to fish moving upstream in the system, which limits Harvey Creek and Sullivan Lake's other tributaries to resident fish production (i.e., these streams provide no habitat for adfluvial fish populations in the Pend Oreille River). Hall Creek is not fish bearing. Noisy Creek is intermittent in certain locations and is occupied by a very small population of westslope cutthroat trout. Hall and Noisy creeks are small streams that are not used by kokanee. However, significant spawning of kokanee occurs in limited areas of Harvey Creek, and redd superimposition likely occurs in the creek, because escapement exceeds available habitat (McLellan, 2009). In addition to kokanee, cutthroat trout and mountain whitefish, both native salmonids, use Harvey Creek. Harvey Creek is considered high priority habitat for cutthroat trout.

Sullivan Lake has a long stocking history of rainbow and cutthroat trout by the Washington DFW; however, regular stocking was discontinued in the early 1990s. According to Washington DFW hatchery planting records, 29 releases of hatchery

---

[68] The Washington State record brown trout was taken from Sullivan Lake.

rainbow and westslope cutthroat trout have occurred since 1981.[69] There are no records of trout releases into Sullivan Creek during this same period.

**License Surrender Studies**

As part of its preparation of a license surrender application for the Sullivan Creek Project, the District undertook several studies to help define the existing environmental conditions in the Sullivan Creek drainage. The District also summarized fisheries data provided by the Forest Service. The studies included: (1) a fish-barrier assessment; (2) a Harvey Creek habitat survey; (3) an entrainment investigation and fish presence study; (4) a Sullivan Creek instream flow study; (5) a lake fertilization review; (6) a species review of water temperature requirements; and (7) a bull trout spawning and incubation analysis. The information derived from these efforts is described in detail in section 3.7.1.2, *Threatened and Endangered Species, Affected Environment – Sullivan Creek Surrender*.

#### 3.5.1.3 Bull Trout and Habitat

Bull trout (*Salvelinus confluentus*) was listed as threatened under the ESA on June 10, 1998 (68 FR 31647-31674). Boundary Reservoir, Sullivan Creek for most of its length, and Slate Creek were designated as critical habitat for bull trout on October 18, 2010 (75 FR 63898-64070). In addition, POSRT (2005) identified several Sullivan Creek tributaries (i.e., Deemer, Gypsy, Leola and some of its tributaries, North Fork Sullivan, Outlet, and Pass Creeks), as well as Harvey Creek and some of its tributaries, as containing bull trout habitat.

Large bull trout are known to migrate up tributary streams from the Pend Oreille River when temperatures increase in the main river (FWS, 2002).[70] Bull trout have been observed in lower Sullivan Creek. In addition, bull trout have been observed at the mouth of Slate Creek (Andonaegui, 2003), but there are no documented observations of bull trout farther upstream in Slate Creek or its tributaries. Bull trout, as well as the effects of relicensing the Boundary Project and surrendering the Sullivan Creek license, are described in section 3.7, *Threatened and Endangered Species*.

### 3.5.2 Environmental Effects

#### 3.5.2.1 Boundary Project

The Boundary Project is operated in a load-following mode that shapes available water to deliver power during peak-load hours and reduces generation during off-peak hours. Daily water surface elevation fluctuations range from 1.15 feet to 18.02 feet in

[69] From 1981 through 1986, plantings of 292,946 and 282,883 rainbow trout and westslope cutthroat trout, respectively, occurred in Sullivan Lake.

[70] In September 1994, a dead adult female bull trout was found in Sullivan Creek downstream from the Mill Pond dam (FWS, 2002).

the forebay, and from 0.42 feet to 4.80 feet in the Box Canyon dam tailrace. The normal maximum reservoir water surface varies from elevation 1,994 feet at the forebay to 1,999 feet at the Box Canyon tailrace. The Boundary Reservoir has a small active storage capacity (about 40,843 acre-feet) relative to mean daily flow; retention time of water in reservoir averages less than 2 days. The project is operated within the maximum drawdown of 40 vertical feet of active storage authorized under the current license. From Labor Day weekend to Memorial Day weekend, the project is operated with forebay water surface elevations generally fluctuating within 20 feet of full pool (1,994 feet to 1,974 feet) and only occasionally below 1,974 feet. The magnitude of water surface elevation fluctuations in the Boundary forebay are replicated up through the base of the hydraulic control at Metaline Falls. Metaline Falls attenuates or dampens water surface elevation fluctuations for the upper reservoir area, upstream of Metaline Falls.

Seattle maintains the summer forebay water surface elevations to facilitate recreational access and use. From Memorial Day weekend through Labor Day weekend, forebay water surface elevations are maintained at or above 1,984 feet from 6:00 am through 8:00 pm. During nighttime hours, forebay water surface elevations are maintained at or above elevation 1,982 feet.

Under the settlement, Seattle proposes to formalize what are currently voluntary summertime forebay water surface elevation restrictions, as described above. Seattle also proposes a suite of non-operational measures related to fish and aquatic resources that are described in subsequent portions of this section. The Washington DFW, Interior (on behalf of FWS, BIA, and the Park Service), and the Forest Service recommend that Seattle implement its proposed operational and non-operational environmental enhancements measures, as described herein.

**Project Effects on Mainstem Reservoir Habitats**

Aquatic biota and habitats immediately upstream and downstream of the Boundary dam are influenced by project operations,[71] hydrologic conditions, and releases from upstream hydroelectric and water storage projects. The effects of project operations on aquatic habitat were assessed using a Physical Habitat Model to generate indices reflecting habitat conditions within Boundary Reservoir, the Boundary dam tailrace, and select tributary deltas.

Seattle developed a suite of models and analyses to support the evaluation of existing conditions and alternative operations. These models and analyses included the Scenario Tool, Hydraulic Routing Model (HRM), mainstem habitat model, trapping and

---

[71] The varial zone is defined as the area of the channel alternately inundated (wetted) and dewatered (dried) by water surface elevation fluctuations. The upper limit of the analysis was the top of the varial zone, and the lower limit extended to 50 feet below the lowest typical extent of the euphotic zone.

stranding models, a mainstem sediment transport model, and tributary delta habitat models (*see* Mainstem Aquatic Habitat Modeling Report, Study No. 7; Seattle, 2009a). The Scenario Tool optimized project energy production using historic hydrologic data and resource criteria input to provide a consistent foundation for the comparison of resource effects or benefits. Use of the Scenario Tool provided the mechanism to develop information (i.e., water surface elevation and flows) that was used as input to the HRM. The HRM was used to translate hourly changes in forebay water surface elevations to locations upstream of, and downstream from, the Boundary dam. The HRM computes water surface elevations, average velocities, and timing of water surface fluctuations at locations throughout Boundary Reservoir and the Boundary dam tailrace.

The mainstem habitat model used water surface elevations and average velocities from the HRM, along with specific velocity measurements within habitat cells at various habitat transects, to determine depths and velocities for each habitat cell for each hour of simulated operation. In addition to depth and velocity, substrate and cover were incorporated into the habitat model and compared to Habitat Suitability Indices/Criteria for life stages and fish species of interest (native salmonids, smallmouth bass, and forage species) and other aquatic organisms (macrophytes, periphyton, and benthic macroinvertebrates. The integration of hydraulic, channel morphology and biological response data was used to calculate the relative amount of potential habitat (weighted useable area; WUA) at each transect for life stages and species of interest for each hour of simulated project operation. The mainstem habitat model was also used to track the effect of fluctuating water surface elevations on potential mountain whitefish and smallmouth bass spawning areas to evaluate which cells of potential spawning habitat remain inundated through the subsequent incubation period.

The mainstem habitat model was applied to the four mainstem reaches in the project area. The four reaches are briefly described below.

<u>Tailrace Reach</u> – The 3.1-mile-long Tailrace Reach is situated downstream from the Boundary dam, extending into Canada to the confluence with Redbird Creek. The reservoir behind Seven Mile dam in Canada, at times, inundates the entire reach to the base of the Boundary dam, depending on its forebay elevation. This creates complex hydraulic conditions in the Tailrace Reach, and the reach can exhibit both reservoir-like and riverine-like conditions depending on the releases from the Boundary dam and the forebay elevation of Seven Mile dam.

<u>Forebay Reach</u> – The Forebay Reach is the most lacustrine of the four reaches. Depths reach 270 feet, and because the channel is wide (nearly 2,000 feet) average water velocities are generally a few tenths of a foot per second or less, except during high flows. Shallow water habitat (0 to 20 feet at median pool and flow) is 2,553 x $10^4$ $ft^2$, about 4 percent of the shallow water habitat in Boundary Reservoir. Shallow water habitat generally occurs as a narrow strip along the edge of the reservoir, equivalent to an average of 204 feet (about 10 percent) of the overall wetted width of the Forebay

Reach. The low water velocities and lack of shallow habitat in the Forebay Reach are conducive to a fish community dominated by suckers, yellow perch, triploid rainbow trout, and northern pikeminnow.

Canyon Reach – The Canyon Reach is generally reservoir-like, but because it is much narrower than the Forebay Reach, velocities are higher, especially near the upstream end of the reach. The steep canyon walls in this reach limit the amount of shallow water habitat. Within the 8.8-mile length of the Canyon Reach, there are 302 x $10^4$ $ft^2$ (average width of 68 feet) of shallow water habitat at the median pool and flow condition, which is about one-third of the values for the Forebay and Tailrace reaches and about one-tenth of the Upper Reservoir Reach value.

Upper Reservoir Reach –The Upper Reservoir Reach is the most riverine of all the reaches and at times experiences little influence from project operations on hydraulic conditions and resulting habitat indices. The gradient is relatively low in the downstream 4 miles of the reach, but then increases farther upstream. The different gradients in the Upper Reservoir Reach are reflected in the hydraulics. The lowest mean channel velocities occur in the wide section adjacent to the Town of Metaline, where they range from about 0.5 to 1 fps at the median flow of 19,500 cfs. For most of the remainder of the reach, the velocities at the median flow vary between 1 to 3 fps, depending on the location and forebay elevation. In the uppermost mile of the reach, the steepest section, the velocities range between about 2 and 5 fps.

Aquatic habitat modeling of the four reaches was supported by field studies of fish, macrophyte, periphyton, and benthic macroinvertebrates. The Upper Reservoir Reach generally has a higher diversity and abundance of these fauna because it contains more shallow and complex habitat, a wider variety of substrate types, and isles affected by fluctuations in water surface elevation.[72] In contrast, the Canyon and Forebay reaches are deep, with narrow strips of shallow water habitat adjacent to the shorelines, relatively coarse substrates, and fluctuations in water surface elevation that occur frequently and can be substantially larger than those in the Upper Reservoir Reach.

Mountain whitefish fry and adult WUA in the Upper Reservoir Reach is higher than in any of the other three reaches for all hydrologic conditions.[73] The Canyon Reach affords smallmouth bass a variety of habitat conditions in the form of boulders, bedrock ledges, and attendant velocity shear conditions. The amount of WUA for forage fish is fairly low in the Forebay and Canyon reaches as a result of the scarcity of

---

**72** The Upper Reservoir Reach provides nearly 80 percent of the macrophyte WUA, about 65 percent of the periphyton WUA, and just over 70 percent of the benthic macroinvertebrate WUA available within the four reaches.

**73** The Upper Reservoir Reach provides more than 60 percent of the mountain whitefish WUA in the project area.

shallow depths and low water velocities preferred by the smaller fish. Habitat in the Tailrace Reach is similar to the upper 1 miles of the Upper Reservoir Reach (i.e., Box Canyon tailrace), except that that tailrace habitat is more affected by fluctuations in water surface elevations resulting from the operation of Boundary dam and BC Hydro's downstream Seven Mile dam.

WUA values for adult cutthroat trout in the Upper Reservoir Reach are similar to the Canyon Reach, totaling over 75 percent of the available WUA for the species in the project area. The individual estimates of WUA for the two reaches are about 3 times higher than in the Tailrace and Forebay reaches. Similar to the Canyon Reach, the Upper Reservoir Reach has tributaries that appear to provide a source of cutthroat trout production, as evidence by the capture of juvenile cutthroat trout moving downstream in Sweet and Sand creeks. However, as is the case elsewhere in the project area, few native trout have been observed using mainstem Upper Reservoir Reach habitats, which could be due, at least in part, to the high water temperatures that typically occur during the summer months in the mainstem Pend Oreille River.

The Upper Reservoir Reach is the most physically diverse reach within the project area. This reach has over 86 percent of the shallow water habitat in the Boundary Reservoir. Within this 7.7-mile reach, variable habitat conditions are provided by several islands, back channels, and near-shore aquatic vegetation. Many of the off-channel areas away from the mainstem currents contain widespread and seasonally dense concentrations of submerged aquatic vegetation. These areas serve as both spawning and rearing habitat for various fish species present in the reach. Near-shore areas within the more confined, steeper portions of the reach provide gravel and cobble bed habitats, often in conjunction with velocities that are more representative of riverine systems supportive of native salmonids. The shallow water zone is quite extensive under most flow conditions.

The Upper Reservoir Reach provides substantial spawning habitat for a variety of fish species, including mountain whitefish and smallmouth bass. The spawning index for mountain whitefish is similar for all three representative years, with the highest value of 343 feet for the wet year and the lowest value of 259 feet for the dry year.[74] In contrast, the spawning index for smallmouth bass exhibits a higher degree of variability, with a high of 24 feet for the dry year and a low of 13 feet for the average year.[75] Spawning smallmouth bass, as well as other centrarchids, has been documented

---

**74** The small range is the result of similar water level fluctuations that occur during the potential spawning and incubation period for mountain whitefish, which occurs during the late fall and winter.

**75** The smallmouth bass spawning and incubation period typically carries into the spring freshet. The higher index value for a dry year reflects the lack of increased water surface elevations associated with periods of runoff. During the wet and average years, potential spawning nests are exposed when the high flows recede.

in off-channel areas or on the downstream ends of cobble bars in the Upper Reservoir Reach during the spring and summer months. In addition, mountain whitefish are known to spawn in the upper 0.5 mile of the Upper Reservoir Reach downstream from the Box Canyon dam and in the vicinity of Sullivan Creek.

Due to the presence of low-gradient bars and side channels, Boundary Project operations have the greatest stranding and trapping effect in the Upper Reservoir Reach.[76] The Upper Reservoir Reach also has about 90 percent of the submerged aquatic macrophyte cover, which increases the potential for stranding and trapping of juvenile fish. Trapping indices are substantially higher during dry years when load-following operations increase the frequency and magnitude of pool level fluctuations. Field studies conducted in 2007 and 2008 confirm that the Upper Reservoir Reach poses the greatest risk of trapping and stranding in the project area. Large numbers of minnow fry were observed stranded during major down-ramping events during the summer. Because of their habitat preferences, smallmouth bass and northern pikeminnow are the sport fish species most at risk of trapping and stranding in the Upper Reservoir Reach (*see* table 3.5-2). Few fish were observed in areas prone to trapping and stranding during the winter months.

The results of aquatic habitat modeling are best used as a relative index of potentially suitable fish habitat. Abundance of native salmonids and other target species in the project area are limited by factors other than microhabitat variables (*see* Exhibit E of the License Application, Section 4.5.3.2.1). For example, during an average year, there is about 33 percent more WUA for adult cutthroat trout in Boundary Reservoir ($3{,}257 \times 10^4$ $ft^2$) than WUA for adult smallmouth bass ($2{,}489 \times 10^4$ $ft^2$). However, smallmouth bass represented about 10.5 percent of the fish community during surveys conducted in 2007 and 2008, while cutthroat trout represented less than 0.1 percent.

**Project Effects on Tributary Delta Habitats**

Tributary deltas are transition areas between the tributaries and reservoir that provide a variety of ecological functions. Fish may congregate at the tributary confluence to feed on organisms transported in the tributary flow, may use the deltas as temperature refugia, or may stage in delta habitats prior to spawning. Because of the nature of the processes that form the tributary deltas, much of a delta's surface lies within the range of elevations that are subjected to water level fluctuations resulting from project operations. Our analysis of project effects on tributary delta habitats focuses on the distribution and quality of physical habitat conditions (e.g., water depth, cover) and the presence and persistence of thermal plumes at the seven largest tributary

---

**76** The three reaches in the project area downstream from Metaline Falls (i.e., Canyon, Forebay, and Tailrace reaches) account for approximately 23 percent of the total Trapping or Stranding Index area, indicating the relatively high importance of the Upper Reservoir Reach with regard to the risk of trapping.

deltas (*see* Sediment Transport and Boundary Reservoir Tributary Delta Habitat Report, Study No. 8; Seattle, 2009a).[77]

Physical habitat modeling of major tributary deltas translated hourly fluctuations in Boundary Reservoir water surface elevations from the hydraulic routing model into estimates of a habitat quality rating (HQR) for native salmonids. The HQR model was applied to three historical river flow conditions to evaluate representative tributary delta habitat for wet, dry, and average years.

The HQR (measured in $ft^2$) was calculated as the product of the areas of lacustrine and riverine habitat and weighted by their respective riverine or lacustrine Habitat Suitability Index (HSI) scores. HSI values were calculated for individual representative tributary delta areas for three life stages (i.e., adult, juvenile, and fry) of native salmonids using the species-habitat relationships developed for cutthroat trout by Hickman and Raleigh (1982). The riverine HSI model uses three or four of the following parameters, depending on life stage: thalweg depth, percent cover, percent cobble/boulder substrate, percent pool, pool quality (size and depth), and percent fines. The lacustrine HSI model relies on three water quality parameters: water temperature, DO, and pH. Details of the HQR modeling are provided in the *Sediment Transport and Boundary Reservoir Tributary Delta Habitats Final Report* (Seattle, 2009a).

The effect of historic project operations on tributary delta habitat quality varied in relation to whether the delta was located upstream or downstream of the Metaline Falls hydraulic control (table 3-15). Below Metaline Falls, the Slate and Flume Creek tributary deltas experience the full range of water level fluctuations associated with load-following operations, and consequently exhibited low HSI scores. The five tributary deltas upstream from the Metaline Falls hydraulic control do not experience the full range of water surface elevation fluctuations associated with project operations, and had high HSI scores. The Pocahontas and Sand creek deltas were rated as unsuitable during some periods because of their dry channel beds (and associated zero depth of thalweg).

Table 3–15. List of tributaries, their calculated habitat suitability indices, and their relative ranking for salmonid adult, juvenile, and fry life stages in the tributary delta areas of Boundary Reservoir, as derived from the Hickman and Raleigh (1982) riverine model (Source: Seattle, 2009).

| **Tributary Name** | **Adult Salmonid** | | **Juvenile Salmonid** | | **Salmonid Fry** | |
|---|---|---|---|---|---|---|
| | **HSI** | **Rank** | **HSI** | **Rank** | **HSI** | **Rank** |
| Slate Cr. | 0.924 | 1 | 0.923 | 1 | 0.877 | 1 |

[77] Based on a screening process that included both desktop GIS and field assessments, delta habitat modeling was done for those tributary deltas with substantial potential for salmonid habitat, including Slate, Flume, Sullivan, Linton, Pocahontas, Sweet, and Sand creeks.

| | | | | | | |
|---|---|---|---|---|---|---|
| Flume Cr. | 0.820 | 3 | 0.900 | 2 | 0.739 | 2 |
| Sullivan Cr. (low flow) | 0.703 | 4 | 0.340 | 6 | 0.340 | 6 |
| Sullivan Cr. (regulated flow) | 0.840 | 2 | 0.823 | 3 | 0.673 | 3 |
| Linton Cr. | 0.300 | 5 | 0.300 | 7 | 0.000 | 8 |
| Pocahontas Cr. (dry) | 0.000 | 9 | 0.000 | 9 | 0.000 | 8 |
| Pocahontas Cr. (low flow) | 0.100 | 6 | 0.300 | 7 | 0.589 | 5 |
| Sweet Cr. | 0.100 | 6 | 0.577 | 5 | 0.600 | 4 |
| Sand Cr. (dry) | 0.000 | 9 | 0.000 | 9 | 0.000 | 8 |
| Sand Cr. (low flow) | 0.100 | 6 | 0.703 | 4 | 0.160 | 7 |

Note: HSI – Habitat Suitability Index, 0 indicates unsuitable habitat and 1 indicates optimal habitat

The Hickman and Raleigh (1982) lacustrine model for salmonid habitat in the shallow water areas of the deltas during periods of inundation suggests a range of habitat quality throughout the year (table 3-16). The model results are driven primarily by the variability in average monthly water temperature (range 34.2 to 72.7 ºF) (1.2 to 22.6 ºC). During the month with the greatest average water temperature (August), the HSI was zero (unsuitable habitat) because the water temperature (72.7 ºF) exceeds the maximum suitable temperature (71.6 ºF, 22 ºC). Conversely, in May and October, when the average monthly water temperature is between 52.7 and 59.0 ºF (11.5 and 15 ºC), pH becomes the limiting factor and the HSI approaches 0.90. As temperature fluctuates between the unsuitable values in August[78] and the near optimal values in May, June, and October, the HSI values change accordingly.

Table 3–16. Boundary Reservoir average monthly temperatures, their associated suitability, and final reservoir Habitat Suitability Index using Hickman and Raleigh's (1982) lacustrine model (Source: Seattle, 2009; modified by Staff).

| | **Temperature (ºF)** | | |
|---|---|---|---|
| **Month** | **Value** | **Suitability** | **HSI** |
| January | 34.2 | 0.15 | 0.15 |

[78] Because of the influence of the potential presence of thermal plumes at the tributary mouths, the suitability for a portion of the lacustrine area may be greater than 0 during times when water temperatures are unsuitable for salmonids. The HSI models, however, do not reflect these small-scale thermal characteristics.

| | | | |
|---|---|---|---|
| February | 35.4 | 0.24 | 0.24 |
| March | 39.0 | 0.48 | 0.67 |
| April | 45.5 | 0.83 | 0.81 |
| May | 53.1 | 1.00 | 0.86 |
| June | 59.5 | 0.99 | 0.86 |
| July | 70.3 | 0.16 | 0.16 |
| August | 72.7 | 0.00 | 0.00 |
| September | 66.0 | 0.66 | 0.75 |
| October | 55.4 | 1.00 | 0.86 |
| November | 44.1 | 0.77 | 0.79 |
| December | 36.3 | 0.30 | 0.30 |

A number of patterns are apparent from the results of the HQR modeling. These are described as follows.

1. Each of the modeled tributary deltas has minimum lacustrine HQRs of 0 because water temperatures during August are considered unsuitable.
2. Average lacustrine HQR values increased from dry, to average, to wet hydrologic conditions, although differences among years were small for Flume and Slate Creeks.
3. Under the modeled historic conditions, the lacustrine HQR results followed the same general temporal pattern for all tributaries, which is a function of water temperature.[79] Under the proposed operations for any new license, we would expect that the trends would be similar to the historic conditions.
4. The Sullivan Creek delta supplies substantially more lacustrine and riverine habitat than any of the other tributaries, with average HQRs of 20.4 x $10^4$ $ft^2$ and 2.0 x $10^4$ $ft^2$ for lacustrine and riverine juvenile habitat, respectively. For all tributaries, average lacustrine HQR values are about an order of magnitude or higher than riverine HQR values.[80]

[79] In the months of April and October, when temperature is within the optimal range, the HQR values peak. Between these two maximums, HQR values rise and fall as water temperatures warm (prior to April), become unsuitably hot (August), and then cool (after October).

[80] From highest to lowest, the ranking of tributaries based on lacustrine HQR values is as follows: Sullivan, Flume, Slate, Sand, Sweet, Linton, and Pocahontas creeks. From highest to lowest, the ranking of tributaries based on riverine HQR values is as follows: Sullivan, Sweet, Slate, and Sand creeks. Flume, Linton, and Pocahontas creeks have negligible suitability, with riverine HQR values all less than 600 $ft^2$. (*see* figure 3-11)

Physical habitat conditions in the inundated portion of the deltas are of low quality; however, salmonids from the reservoir seek out the cold-water inflow from the tributaries. Thermal plumes at the tributary deltas provide refugia during the summer when mainstem water temperatures rise above the levels suitable for salmonids. Thermographs installed along the thalweg of the stream channels flowing across the seven tributary deltas indicate that thermal plumes persist throughout the rising and falling of the pool levels.[81] The thermographs at all seven tributary deltas show a gradient in temperature progressing from the warmer mainstem water to cooler water across the delta to the coldest water in the upstream tributary inflow. Project operations that maintain low reservoir water surface elevations would expose riverine habitat area on the tributary deltas. The quality of this riverine habitat in the delta is lower than riverine habitat in the tributary channels upstream of the deltas. The lower habitat quality of the delta channels is due to the lack of stable bedforms, small substrate particle sizes, sparse cover (e.g., boulders, LWD), few pools, and shallow channel depths.

Fish passage can become an issue at tributary deltas if the mainstem water surface exposes the steep leading edge or face of the delta deposits, referred to as the foreset slope. On this slope, fish passage can be jeopardized because water drains into the loose delta sediment deposits, the stream becomes too steep and/or shallow, or the stream divides into multiple small channels that become impassable. Within the tributary deltas, no barriers exists that would affect fish passage to upstream tributaries. Even where potential barriers exist (e.g., the Pocahontas Creek foreset slope), they are not exposed for a long enough duration (typically, no longer than a single day) to substantially affect upstream fish movement.

**Project Effects on LWD Recruitment and Transport**

LWD can be an important component of aquatic habitat in both riverine and reservoir habitats (Bjornn and Reiser, 1991; Northcote and Atagi, 1997). LWD provides habitat complexity, cover, and substrate for fish and macroinvertebrates. As LWD decomposes, it may also provide nutrients to the water column and sediments (Harmon *et al*, 1986). LWD in reservoirs can be divided into three categories, each with distinct biological functions, based upon location: (1) submerged LWD; (2) floating LWD; and (3) shoreline LWD.

---

**81** The thermal plume mapping and the analysis of the results indicate that at all the tributary deltas except Slate Creek, the size of the thermal plume at the tributary delta increases with an increase in mainstem water surface elevation adjacent to the tributary delta. In addition, over the long term, lower mainstem water surface elevations is expected to result in smaller average thermal plume areas than higher mainstem water surface elevation.

No generally recognized criteria for LWD size and distribution in Pacific Northwest reservoirs are available. Nevertheless, LWD that remains in place on the shoreline has the potential to create water velocity breaks, fish cover, complex habitat structure, and surface area for the production of periphyton and macroinvertebrates that prefer woody substrate over rock substrate.

The project affects the abundance, distribution, and quality of LWD as a component of aquatic habitat within the reservoir and downstream of the project. Water surface elevation fluctuations in Boundary Reservoir may affect wood recruitment indirectly by affecting the development of riparian trees adjacent to the varial zone, or fluctuation zone. Wood recruitment mechanisms adjacent to lakes or reservoirs are primarily windthrow, senescence, or mass wasting events. Recruitment may also occur by transport from tributaries or passage over the Box Canyon dam during periods of spill, but the size of most of the tributaries draining to Boundary Reservoir is too small to transport large wood pieces that could provide substantial habitat structure. LWD that collects in the Boundary Forebay is currently removed from the river and used as firewood, sold as commercial timber, or disposed of in other ways.

Based on data collected in 2007 and 2008, high flow events are important for the redistribution of LWD in the Pend Oreille River, and tend to increase the amount of LWD collected at the project's trashrack. If LWD is delivered to Boundary Reservoir from tributaries or Box Canyon Reservoir, a portion could eventually become stranded on the floodplain or gravel bars and, when inundated during high pool conditions, serve as littoral habitat for aquatic invertebrates and fish. As reservoir levels recede, some of the non-anchored pieces could float off of these areas and into the main portion of the reservoir.

Reservoir fluctuations can affect the portion of time that a given piece of LWD provides habitat. LWD that is stranded on mid-channel bars or along the shoreline during peak runoff periods may be at elevations above the water surface during other parts of the year. Other pieces of LWD may be located within the varial zone affected by project operations and may intermittently provide aquatic habitat.

Removal of LWD at the Boundary Forebay trashrack results in the potential depletion of shoreline wood farther downstream in the Boundary tailrace or within Seven Mile or Waneta Reservoirs. Similarly, removal of LWD at the Albeni Falls and Box Canyon dams depletes the amount that enters Boundary Reservoir.

According to LWD mapping at the project, LWD in the largest diameter category (i.e., greater than 32 inches) is extremely rare (about 0.4 percent if the numerical total and 1.3 percent of the volume) and LWD in the largest length category is numerically low (399 pieces, 26 percent of total) but provides the most wood volume (40,717 cubic feet, 64 percent of total). Records of LWD removal at the Boundary dam indicate the proportion of wood in the largest length and diameter categories transported during

2007 and 2008 is also very low, so its removal reduces the amount of a limited resource that could potentially benefit aquatic habitat in the Pend Oreille River.[82]

Mass wasting events along the reservoir shoreline can result in the recruitment of new LWD to the system. However, areas with chronic erosion problems do not provide an environment conducive to the growth of new trees. Within the project area, 132 erosion sites along 15.5 miles of reservoir shoreline were inventoried using GIS and aerial photos (LWD Management Study; Seattle, 2009a). Trees and LWD were observed at only a few locations. Consequently, little high value potential LWD is available for recruitment and project-related mass wasting along the reservoir shoreline would likely have a minor effect on LWD that could contribute to aquatic habitat in the reservoir or downstream.

**Project Effects on Aquatic Productivity in Boundary Reservoir**

The physical characteristics and chemical constituents of the water, such as water temperature, DO, pH, and nutrients (nitrogenous and phosphorus compounds), in Boundary Reservoir can affect fish and aquatic productivity. For example, water temperatures in Boundary Reservoir are cold in the winter and warm in the summer. The wide range of temperatures in the reservoir tends to limit the productivity of both cold water fish (e.g., trout) and warm water fish (e.g. pumpkinseed), which prefer summer temperatures less than 65º F and greater than 75 ºF, respectively (Holton 1990). Cool water fish species, such as smallmouth bass, that prefer intermediate temperatures and tolerate relatively wide extremes are not limited by the temperatures present in Boundary Reservoir.

DO is strongly influenced by, and inversely related to, water temperature and can be affected by plant[83] and animal respiration and the amount of mixing in the water column. DO monitoring conducted in 2007 and 2008 indicates that Boundary Reservoir is generally above the state standard of 8.0 mg/L. However, several exceedances were recorded for July and August of 2008 within deeper portions of the Canyon and Forebay reaches, and at a shallow water site near the Town of Metaline. In addition, data showed that DO decreased about 1.0 mg/L from the surface to the deepest measurement between July and October 2008, and these decreases were more prevalent at the Forebay Reach.

---

**82** 164 pieces of LWD greater than 12 inches in diameter were removed at the Boundary dam during 2008, which is about 29 percent of the LWD standing crop of those size categories that was counted along the shoreline during 2007.

**83** Macrophyte beds can have a localized diurnal effect on DO levels as a result of photosynthesis and respiration. During periods of high photosynthesis/respiration, monitoring demonstrates that DO levels at night frequently drop below 8 mg/L in the macrophyte bed, with the lowest DO concentration being 2.7 mg/L (Seattle, 2009a).

DO levels less than 8 mg/L in the Boundary Reservoir could adversely affect pelagic and demersal fish species living in deeper waters during the late summer. EPA (1986) reports that DO levels less than 8 mg/L for salmonids, other than embryos, results in some level of impairment, with severe impairment occurring below 4 mg/L and the limit to avoid acute mortality at 3 mg/L. Levels are somewhat lower for non-salmonids, with impairment starting at levels less than 6.5 to 6.0 mg/L and acute levels occurring below 3 to 4 mg/L for early life stages and older fish, respectively. Monitoring data suggest that, at times and locations, DO levels may result in temporary stress to fish and invertebrates in Boundary Reservoir. Some fish may be able to avoid stressful conditions by moving to more suitable conditions, for example from the interior of a macrophyte bed to its edge, but such movements, particularly for young-of-the-year fish, may also expose them to predators that typically inhabit areas outside of or at the fringe of macrophyte beds.

Primary production in the form of macrophytes can be important to the aquatic ecosystem by providing food, substrate, cover, and habitat structure. However, the vast majority of macrophytes in Boundary Reservoir are fast-growing non-native species, primarily Eurasian watermilfoil and curly pondweed, which tend to out-compete native macrophyte species. Many of the fish species that inhabit Boundary Reservoir use macrophyte beds during one or more of their life history stages, but these are primarily the non-salmonid or non-native fish species.

Macrophytes can be affected by water surface elevation during spring and fluctuations in water surface due to project operations. Pool elevations during early spring control macrophyte bed distribution. If young plants are exposed to air for more than 72 hours, they are likely to die (Seattle, 2009c). In contrast, if water levels rise, young plants that colonize lower elevations may receive insufficient light for adequate growth. These effects are related more to the magnitude of the spring runoff than to project operations. Exposure to air during hot summer periods may also affect macrophytes; however established macrophytes are relatively hardy during these periods and the short dewatering periods associated with project operations appear to have little effect on them. Project-related effects on macrophytes are expected to be less in the Upper Reservoir Reach than in the Canyon and Forebay Reaches, owing to the affect of the channel constriction at Metaline Falls.

Periphyton and benthic macroinvertebrates require appropriate substrate for production. Periphyton biomass is primarily controlled by nutrient availability and secondarily by light levels, while macroinvertebrates biomass is controlled by food availability (periphyton production). Fluctuations in reservoir water surface elevation affect periphyton and macroinvertebrate production through desiccation, influencing light penetration, and substrate availability. Repeated exposure to air and inundation associated with changes in water surface elevation result in alternating periods of impaired conditions and recovery/recolonization. The decline in suitability of habitat for periphyton and macroinvertebrate communities occurs rapidly and at about the same rate during desiccation periods, with nearly all periphyton and macroinvertebrate habitat becoming unsuitable in about 24 hours. Habitat suitability curves developed for the habitat model suggest that suitability remains relatively high (0.8 or greater) for desiccation periods of 10 hours or less. The time required for complete recovery of periphyton and macroinvertebrate communities is also about the same, or 56 days, but the rate of periphyton recovery is initially somewhat higher than for macroinvertebrates (Seattle, 2009a). In either case, rates of decline in habitat suitability are substantially higher than rates of recovery. Thus, project operations that frequently dewater shallow areas of the reservoir reduce the potential for periphyton and the macroinvertebrate community to achieve maximum biomass.

**Project Effects on Fish Entrainment and Habitat Connectivity**

Fish Entrainment and Mortality – The Boundary dam is situated in a narrow canyon at RM 17.0 on the Pend Oreille River. Although anadromous fish no longer have access to the Pend Oreille River, potential injury or mortality of fish that may be entrained in project facilities, and potential fish connectivity between habitats upstream of, and downstream from, the Boundary dam, were identified as issues.

There are three pathways through which fish pass downstream of the Boundary dam: turbines, spillways, and, possibly, sluiceways. The likelihood that fish would pass through one of these pathways is related to the percentage of the river flow moving through a given pathway, the relative depth of the pathway entrance, the time of year, and the habitat use and periodicity of particular fish species that places them in the vicinity of the pathways and at risk of entrainment. The risk of injury or mortality associated with each pathway is a function of fish occurrence in the vicinity of the pathway and hydraulic conditions experienced by the fish during passage and upon reintroduction to the tailrace.

Fish experience injury or mortality when exposed to a variety of hydraulic or physical conditions when passing through hydroelectric facilities. These include: (1) physically contacting solid structures at high velocity (strike); (2) exposure to shearing water velocities; (3) grinding between moving and stationary mechanical components of a turbine; (4) exposure to turbulent conditions that can result in disorientation of the fish and, as a result, a greater risk of predation; (5) exposure to cavitation from the rapid formation and collapse of small air bubbles at extremely high water velocities; (6) exposure to rapid pressure changes that can result in bursting of the swim bladder or blood embolisms; and (7) exposure to supersaturated TDG levels. Each of these mechanisms was considered in the evaluation of entrainment mortality rates at the Boundary dam.

When inflow to the project is less than the total powerhouse capacity (approximately 56,000 cfs), the project is operated as a load-following facility. Because of the large total powerhouse capacity relative to normal flows in the Pend Oreille River, spill generally occurs only during spring runoff. During the period 1987 through 2006, spill conditions averaged 578 hours a year. Infrequent spill conditions results in turbine passage being the primary pathway for fish to move downstream through the project.

Seattle conducted hydroacoustic and fyke net sampling at the Boundary dam to estimate the number, size, species, and timing of fish that may be entrained within the project turbine intakes and spillways (*see* Fish Entrainment and Habitat Connectivity Report, Study No. 12; Seattle, 2009c). Hydroacoustic target entrainment data were collected and analyzed using split-beam target tracking techniques, and fyke nets were deployed in the Unit 54 draft tube gatewell downstream of the turbine unit. Results of the two techniques were combined using statistical methods derived by Dr. John Skalski at the University of Washington. The hydroacoustic sampling, which provided a continuous measure of relative entrainment at all operating turbines and spill gates, was used to scale the fish entrainment rates measured by the fyke net sampling at Unit 54. A total of 54,597 ±5,176 fish (90 percent confidence interval) was estimated to have been entrained through all operating turbines and spill gates at the project over the one-year period between March 2008 and February 2009. Suckers, pumpkinseed, and yellow perch dominated the fyke net catch in the draft tube of turbine Unit 54.

Under the settlement, Seattle developed estimated mortality rates for fish passing through the turbines and spillways at the Boundary dam. Based on a review of available literature and office-based, turbine survival modeling,[84] fish passage mortality through the existing turbines at the Boundary dam was estimated to vary with the turbine units and fish size.[85] In general, smaller fish are expected to have the lowest turbine mortality (5% to 15%), while turbine mortality is expected to increase with fish size (i.e., 23% to 65% for larger fish) (table 3-17).

Table 3–17. Estimated mortality through the Boundary Project turbines, based on a predictive equation developed by the U.S. Department of Energy's Advanced Hydro Turbine System Program (Source: Seattle, 2009).

| | **Percent Mortality by Fish Length** | | |
|---|---|---|---|
| **Turbine Units** | **3.9 inches** | **9.8 inches** | **23.6 inches** |
| 51 – 54 | 6 - 15 | 13 – 33 | 26 – 65 |

**84** Seattle used a predictive equation for mortality through Francis turbines developed by Franke *et al*. (1997) to estimate the likely mortality rate for fish passing through the turbines at the project.

**85** The analysis considered three sizes of salmonids: 3.9 inches to represent juveniles; 9.8 inches to represent moderate-sized adult trout and whitefish; and 23.6 inches to represent large trout. One consideration with respect to fish size is that the trashrack bars have a spacing of 5.5 inches, and the mortality analysis assumes that this spacing would not physically preclude any of the target sizes of fish from being entrained in the turbine flow.

| | | | |
|---|---|---|---|
| 55 and 56 | 5 – 12 | 11 - 28 | 23 - 59 |

The Boundary dam has two spillways, one on either side of the main arch dam section. The spillway chutes do not extend to the tailwater; consequently, water is released into open air and plunges into a pool in the tailrace. Of the seven potentially damaging conditions listed above, the two that are major considerations associated with spill flow are shear and strike.[86]

The greatest effect on fish passing through spill is expected to occur upon entrance of the plunging flow into the tailrace. Based on the height of the spillways above the tailrace (155 to 170 feet from the point of flow release from the spillway chute to the plunge pool, depending upon tailwater level), the velocity of the plunging flow immediately downstream of the Boundary dam is estimated to exceed 100 fps upon impact with the tailrace plunge pool.

We reviewed the results of studies conducted at other dams concerning the effects of shear forces on fish. Based on that review, we determined that at low spill flow rates there would be near 100 percent mortality of fish that plunged onto rock instead of falling into the open water of the Boundary tailrace. At spill rates where the flow directly reaches the tailrace pool, the mortality rate will depend on the size of fish and whether the fish remains entrained in the flow jet or freefalls in the air before reaching the tailrace pool (R2 Resource Consultants 2006). Estimated mortality ranges for spillway downstream passage routes are shown in table 3-18.

Table 3–18. Estimated mortality of fish using spillway and sluiceway downstream passage routes (Source: Seattle, 2009).

| | **Range of Estimated Mortality by Fish Length** | | |
|---|---|---|---|
| **Passage Routes** | **3.9 inches** | **9.8 inches** | **23.6 inches** |
| Spillways | 40 – 80 percent | 35 – 65 percent | 20 – 50 percent |
| Sluiceways | 40 – 70 percent | 25 -55 percent | 10 – 40 percent |

As proposed in the settlement, Seattle would evaluate and implement, as appropriate, measures designed to attain TDG compliance at the project, including: (1) throttle sluice gates, which involves operation of sluice gates in partially open positions; (2) roughen sluice flow, which entails modification of the sluice gate outlets to break up

[86] Damaging shear occurs when the plunging spill flow enters the tailrace and there is a substantial difference in velocities where the two flows come together. Strike can occur if the spill flow comes in contact at high velocity with projections within the spillway chute, or with rock along the bank or the bottom of the plunge pool.

and spread flow; and (3) spillway flow splitter/aerator, which entails modifying the spillways to aerate, break up, and spread flow. The three gate alternatives all involve spilling flow through existing outlets into the tailwater plunge pool and rely on reducing TDG production by spreading the flow and limiting plunging effects of the confined water jets.

Each of the proposed measures may have both beneficial and adverse effects on fish. The beneficial effects would involve achieving a higher likelihood of attaining TDG compliance levels in the Boundary dam tailrace, with a concomitant reduction in potential gas bubble trauma in fish. Nonetheless, the measures could also result in increased injury or mortality to fish entrained through the spillways or sluiceways[87] due to the increased risk of fish strikes on the added roughening elements. Spreading the flow and reducing the size of water jets could be beneficial for small fish and adversely affect large fish upon contact with the tailrace water surface. Small fish (about 4 inches) that leave a water jet and free fall to the tailrace should survive at a higher rate than small fish that experience strong shear forces while plunging in a water jet. In contrast, large fish (about 24 inches) have low survival if they leave a water jet. There is substantial uncertainty regarding the magnitude of both the potential beneficial and adverse effects of the proposed TDG measures, which leads to uncertainty regarding the overall net effect to fish.

Habitat Connectivity – Habitat fragmentation has been cited as an important concern to the maintenance and recovery of bull trout and Westslope cutthroat trout populations (69 FR 59996; USFWS, 1999; Rieman and McIntyre, 1993; Rieman *et al.*, 1997; McIntyre and Rieman, 1995). The available survey information reviewed by Rieman *et al*. (1997) and McIntyre and Rieman (1995) indicates that in most regions bull trout and Westslope cutthroat trout distribution is discontinuous or patchy. A variety of biological and anthropogenic factors has been suggested as contributing to the patchy distribution of bull trout and Westslope cutthroat trout. The most important of these are the species' narrow habitat requirements, habitat degradation, exotic fish introductions, and passage barriers (Rieman and McIntyre, 1993; McIntyre and Rieman, 1995).

Passage barriers are clearly an isolating mechanism for local populations. Types of barriers include waterfalls, landslides, water withdrawals, road crossings, and dams. A local population that lives above a barrier can only contribute individuals (and their genes) in a downstream direction. If a local population upstream of a passage barrier is extirpated, there is virtually no opportunity for the local population to become re-established in the near future, unless other local populations are present farther upstream or there is human intervention. The likelihood of re-establishing local populations is

---

**87** The depth of the sluiceways likely makes them a route through which few fish would pass.

greatly enhanced if upstream populations include migratory life history forms, which are more likely to disperse. Nelson *et al*. (2002) suggested that the loss of the migratory form in some areas increases the risk that local populations could go extinct.

Passage barriers may isolate local populations, but they can also prevent the spread of non-native species such as brook trout, which are also considered a threat to native salmonids (Andonaegui, 2003). Most of the tributaries to Boundary Reservoir and the Pend Oreille River have been stocked with non-native salmonid species such as brook trout, brown trout, and rainbow trout. In addition, populations of cool-water fish species such as smallmouth bass, walleye, and northern pike, which are highly predatory, have become established in Boundary Reservoir and could compete with large bull trout or cutthroat trout for prey or could forage on fry and juvenile trout.

Currently none of the hydroelectric projects on the Pend Oreille River, including the Boundary dam, has upstream or downstream passage facilities. Consequently, any potential gene flow by native salmonids can only occur in a downstream direction by fish that survive entrainment and successfully reproduce in non-natal streams.

**Tributary Habitat Productivity**

Tributary streams are a source of nutrients, sediment, LWD, and water. In addition, they support biological processes by potentially providing spawning, rearing, and over-wintering habitat to resident fish residing in the tributaries year-round, as well as to adfluvial fish that may migrate between the reservoir and tributary streams during their life cycle. As such, some fish species found in Boundary Reservoir are directly dependent upon tributary productivity for a part of their life cycle. In addition, some predatory fish species living in the reservoir, such as smallmouth bass or northern pike, may partially rely on tributary productivity for forage fish that either actively emigrate from tributaries or are flushed out during high flow periods.

At a broad scale, Boundary Reservoir tributaries provide a relatively small amount of habitat for salmonid populations that exhibit either adfluvial or fluvial life history traits compared to tributaries to other reservoirs in the region, such as the Priest River and the Salmo River. Sullivan Creek is the third largest tributary draining into the Pend Oreille River, but at 143 $mi^2$ is substantially smaller than the Priest River drainage at 979 $mi^2$ and Salmo River drainage at 502 $mi^2$. The relatively small watershed sizes (except Sullivan Creek), presence of natural barriers, high stream gradients, and basin hydrology in these tributaries all contribute to the limited amount of habitat available for salmonid populations. Nevertheless, salmonid populations reside in the majority of Boundary Reservoir tributaries.

A number of physical and biological factors are important to explaining the generally low production of native salmonids in the region, such as habitat degradation, fish passage barriers, and competition with non-native species of fish (Andonaegui, 2003). The presence of brook trout is considered a threat to native salmonids as a result of interbreeding and competition for habitat and food resources (Andonaegui, 2003). In addition, other non-native salmonids (e.g., brown and rainbow trout; kokanee) have a documented presence in one or more tributaries to Boundary Reservoir.

The project does not affect any limiting physical factors in the tributaries (see Exhibit E of License Application, pp. 216 – 218; Seattle, 2009). However, there could potentially be indirect biological effects on native salmonid life stages that exhibit an adfluvial life history pattern and use Boundary Reservoir during a portion of their lives. Potential adverse effects include (a) fishing pressure on out-migrant and non-native fish species such as smallmouth bass, northern pike, and northern pikeminnow, (b) entrainment past the Boundary dam and potential mortality, and (c) exposure to warm mainstem summer water temperatures. The magnitude of these potential ecological interactions is difficult to determine; however, genetic information does indicate that tributaries supply at least some of the native salmonids inhabiting Boundary Reservoir.

*Staff's Analysis of Proposed and Recommended Environmental Measures*

The Fish and Aquatics Management Plan (FAMP) establishes the goals, program objectives, tasks, and schedule for implementing the non-operational aquatic enhancement measures proposed by Seattle in the settlement. The FAMP provides information about how Seattle would implement the proposed enhancement measures, conduct monitoring, and report on the progress of their implementation. Information regarding the estimated costs for implementing the measures is provided in section 4.1.3, *Development Analysis, Cost of Environmental Measures*.

The aquatic enhancement measures, as described in the FAMP filed on March 29, 2010, are an integrated package of non-operational mainstem and tributary measures designed to benefit native salmonid populations and their habitat.[88] The FAMP is divided into the following elements:

- Mainstem Fish Community and Aquatic Habitat Measures (proposed License Article 9(A))
    - gravel augmentation downstream from the Box Canyon dam
    - channel modifications of mainstream trapping pools at RM 30.3
    - mainstem LWD placement at tributary deltas

[88] The settlement parties agree that changes to Boundary Project operations would be costly and provide limited improvement in reservoir habitat conditions. In addition, warm summer water temperatures, low primary productivity, and the presence of non-native predatory sport fish would limit the ability of changes in project operation to facilitate the restoration of native salmonid populations. Therefore, the majority of measures included in the FAMP are focused in the tributaries where opportunities to protect and recover native fishes have the greatest likelihood of success.

    - Boundary Reservoir fish community monitoring and evaluation of salmonid predation at select tributary deltas

- Upstream Fish Passage (proposed License Article 9(B))
- Reduction of Project-Related Entrainment Mortality (proposed License Article 9(C))
- Tributary Non-Native Trout Suppression and Eradication (License Article 9(D))
- Tributary Fish Community and Aquatic Habitat Measures (proposed License Article 9(E))
    - riparian improvement and stream channel enhancement in Sullivan Creek from RM 0.30 to RM 0.54
    - stream and riparian improvements in Sullivan Creek from RM 2.3 to RM 3.0, and North Fork Sullivan Creek
    - LWD placement and road improvements in Sullivan Creek and selected tributaries upstream of the confluence with Outlet Creek
    - culvert replacements and LWD placement in tributaries to Boundary Reservoir
    - riparian planting, culvert replacement, and channel reconstruction in Linton Creek from RM 0.00 to RM 0.24
    - riparian and channel improvements in Sweet Creek from RM 0.0 to RM 0.6
    - habitat improvements in Tier-2 tributaries to Boundary Reservoir
    - closure and restoration of Sullivan Creek dispersed recreation sites
- Mill Pond Dam Site Monitoring and Maintenance (proposed License Article 9(F))
- Native Salmonid Conservation Program (proposed License Article 9(G))
- Recreational Fish Stocking Program (proposed License Article 9(H))

In addition to the measures that Seattle includes in its proposed FAMP, Seattle also proposes, under the settlement, to establish a $2.5 million fund to help pay for activities to enhance habitat conditions in Harvey, Noisy, and Jungle creeks that flow into Sullivan Lake. The fund would be administered by the Fish and Aquatics Working Group (FAWG).

<u>Mainstem Aquatic Habitat Measures</u> – Relicensing studies indicate that production of native salmonids in Boundary reservoir is limited by warm water temperatures during the summer, low primary and secondary productivity, and the presence of non-native predatory sport fish species (Seattle, 2009a). Non-native predators of particular concern include smallmouth and largemouth bass, walleye and a

small, but expanding population of northern pike. Because of the limitations in Boundary reservoir and the low likelihood that operational measures could improve environmental conditions sufficiently to address the continuing effects of the project on aquatic resources, Seattle proposes to implement a variety of restoration and enhancement measures, primarily in tributaries to Boundary Reservoir. However, pre-licensing studies did identify several non-operational measures to benefit mainstem habitats.

Mountain whitefish are a native salmonid species thought to spawn in the Upper Reservoir Reach, immediately downstream from the Box Canyon dam. Gravid and milt-flowing mountain whitefish were captured by boat electrofishing during surveys in the Upper Reservoir Reach and egg mats were used to successfully collect several eggs believed to be mountain whitefish. The area immediately downstream from the Box Canyon dam has water depths and velocities appropriate for use by spawning whitefish, but much of the substrate is larger than the gravel size preferred by the species. Seattle proposes to place 1,500 $yd^3$ of gravel among boulder groupings near suspected mountain whitefish spawning areas.[89] This would increase the amount and quality of potential spawning habitat for mountain whitefish in this area.

Project operations can cause pool levels to rise and fall on a daily basis, causing fish to become stranded or trapped as pool levels decline. Depressions and pools along the shoreline may become exposed as pool levels drop causing juvenile fish to become trapped and subject to injury and mortality. During the wet, average and dry modeled hydrologic years, 90 percent of exposed trapping area within the project area occurs in the Upper Reservoir Reach. While nearly all of the trapped fish observed during 2007 and 2008 were suckers, perch, or smallmouth bass fry, these trapping mechanisms could also potentially adversely affect native salmonids if they are present in the trapping areas when water surface elevations decline.

The area referred to as the "Cobble Sisters" at RM 30.3 within the Upper Reservoir Reach is an area with a high occurrence of trapping. The pools and depressions at the site are the result of aggregate mining that occurred prior to completion of the project and represent about 21 percent of the trapping area within the upper reservoir. The excavated depressions have persisted since construction of the project, which suggests that the area is geomorphically stable. Seattle's proposal to excavate a channel connecting the pools with the mainstem flow would reduce the incidence of fish becoming trapped or stranded in isolated pools at the site.

---

[89] Placement of gravel in the headwaters of the Boundary Reservoir to enhance spawning habitat for mountain whitefish would constitute a discharge to waters of the United States. Seattle would be required to obtain a dredge and fill permit under section 404 of the CWA for the activity prior to placement of the gravel.

The tributary deltas are important transition zones between mainstem and tributary habitats and coldwater tributary plumes that offer thermal refugia to native salmonids during warm summer months. The tributary deltas are characterized as containing poor habitat features due to the lack of stable bedforms, small substrate particle sizes, sparse cover (e.g., boulders, LWD) and few pools. To address these limitations for the delta areas, Seattle proposes to place and maintain LWD jams within the thalweg in the upper delta regions of four tributaries to Boundary Reservoir, including the delta regions of Sullivan and Slate creeks. This proposal would enhance tributary delta habitat by providing additional cover for salmonids holding in the coldwater refugia at tributary mouths.

Both salmonids and predatory sport fish have been observed holding at the confluence of tributaries to Boundary Reservoir, and the influence of introduced sport fish predators on salmonid populations is unclear. Seattle proposes to conduct fish community surveys in Boundary Reservoir to monitor changes in salmonid and predatory sport fish population abundance and size structure.[90] Seattle also proposes to conduct a study to evaluate predation on out-migrating native salmonids at select tributary deltas.[91] Monitoring and evaluation of salmonid and predatory sport fish populations would help guide future native salmonid recovery efforts.

Upstream Fish Passage – The Boundary dam was built without fish passage facilities because downstream power and water storage projects, such as Grand Coulee and Chief Joseph dams, blocked anadromous fish migrations to the Upper Columbia Basin. Without upstream fish passage facilities, any potential gene flow by native salmonids can only occur in a downstream direction by fish that survive entrainment. However, declines in populations of native salmonids have increased attention on protecting resident fish movements. The FWS Bull Trout Draft Recovery Plan, for example, calls for upstream passage at the Corps' Albeni Falls dam, the District's Box Canyon dam, and Seattle's Boundary dam. The District is currently planning to construct upstream fish passage facilities at its Box Canyon dam, targeting upstream passage of bull trout, westslope cutthroat trout, and mountain whitefish.

As part of relicensing activities, Seattle and a team of fish passage experts evaluated options for bypassing upstream migrating fish around the Boundary dam (McMillen, 2009). As part of the settlement, Seattle proposes to address upstream fish passage with a traditional trap and haul fishway based on NMFS criteria. A trap and haul facility would be appropriate in this case due to comparatively low population sizes

---

**90** The goal of the mainstem reservoir fish community monitoring is to provide federal, state, and tribal agencies with demographic and population information on fish species inhabiting the Project area to inform future management decisions.

**91** The objective of the study would be to quantify the proportion of outmigrating native salmonids that are being consumed by predatory fish within selected tributary deltas.

of native salmonids and physical site constraints in the tailrace. While agreement has been reached on the preferred alternative, there is uncertainty regarding an appropriate site within the tailrace for the fixed trap-and-haul facility. In addition, because of the low numbers of native salmonids captured or observed in the Boundary dam tailrace, there is little direct information regarding movement patterns of bull trout, cutthroat trout, or mountain whitefish in the Boundary tailrace.

Consistent with the settlement, the process for developing the trap and haul fishway includes a 2-year study design and planning effort and an 8-year research and development phase to evaluate site specific conditions and biological traits of the target species in the project area. Details of the research and development phase would be confirmed after license issuance in consultation with the FAWG, but a conceptual plan was developed that includes multi-year biotelemetry studies and attraction flow tests in multiple tailrace locations (*see* tables 2.2-1 and 2.2-2 in the FAMP filed March 29, 2010).

Because few target fish were captured in the tailrace during pre-licensing studies, Seattle proposes to evaluate fishway attraction effectiveness using target species from upstream sources or that demonstrate upstream migration behavior. For instance, Seattle, in consultation with the FAWG and appropriate agencies, may collect bull trout from Lake Pend Oreille, insert radio and/or acoustic tags, release the fish into the Boundary tailrace, and use micro-telemetry studies of those fish to identify an effective fishway entrance location and design.

Seattle proposes to use a proven technology, such as trap-and-haul, for upstream fish passage facilities at the project. Providing fish passage at the Boundary dam would eliminate a substantial barrier to fish movement in the Pend Oreille River. In fact, with the fish passage measures planned for the upstream Box Canyon and Albeni Falls dams, adding fish passage at the Boundary dam would re-establish a migration corridor that would be accessible to native salmonids, including bull trout, westslope cutthroat trout, and mountain whitefish, from Lake Pend Oreille, downstream to Boundary dam. In addition, any uninjured fish entrained over or through the Boundary dam and generating units would have an avenue to move back upstream.

The proposed research and development activities would allow Seattle and the resource agencies to evaluate site-specific conditions and the behavioral traits of the target species. This information would help support the design of a fish passage program that complements native salmonid recovery efforts in the Pend Oreille River Basin. The post-construction monitoring component would help inform decisions regarding the effectiveness of the facilities and the need for modifications to the passage facilities.

Finally, installing fish passage facilities at the Boundary dam would be consistent with FWS' draft recovery plan for bull trout (FWS, 2002). Provision of fish passage at the Boundary dam, as well as at Albeni Falls and Box Canyon dams, is a primary recovery measure of the plan.

Fish Entrainment and Mortality – The Boundary dam was built without entrainment reduction facilities. As fish pass downstream through the Boundary dam facilities, they are exposed to potential injury and mortality, with the level of mortality depending on the pathway, flow rate, and size of fish. A total of about 55,000 fish was estimated to have been entrained through all project turbines and spill gates over a one-year period (Seattle, 2009a). Suckers, pumpkinseed, and yellow perch dominated the catch in fyke nets installed in the draft tube of turbine Unit 54. Although native salmonids were not captured as part of the netting effort, downstream movement of native salmonids is evidenced by the capture of two bull trout in the Boundary tailrace.[92] Although the number of native salmonids entrained through the Boundary dam may be small, the influence of entrainment on recovery of native salmonid populations is uncertain.

As part of relicensing activities, a team of fish passage experts evaluated alternative entrainment reduction concepts for the Boundary dam, including fixed full flow screens, modular inclined screens, and floating or fixed surface collectors (McMillen, 2009). The results of the evaluation determined that a floating surface collector concept would provide the most flexibility and potentially the highest incremental increase in fish protection. The estimated incremental increase in survival was 0 to 2 percent for 4-inch fish, -1 to 9 percent for 10-inch fish, and 8 to 21 percent for 24-inch fish. Since little is known about the migration depth of native species, the efficacy of a floating surface collector concept to reduce entrainment is uncertain.

Due to uncertainty regarding the effects of entrainment on target fish populations, and uncertainty regarding the efficacy of available entrainment reduction options, Seattle proposes to implement an Entrainment Reduction Program, which would include an evaluation phase to assess the effects of project entrainment on target species. During Years 1-18, Seattle would develop and implement studies (*see* Tables 2.2-3 and 2.2-4 in the FAMP filed March 29, 2010) sufficient to quantify the effects of entrainment on target species and to determine whether any population of target fish species (i.e., a unique population that constitutes a substantial percentage of fish in the project area or that has a unique evolutionary niche that requires special protection) or a substantial number of target fish are affected by project entrainment.

---

[92] The fish were identified through genetic analysis as originating upstream in the Lake Pend Oreille basin.

Successful implementation of the Entrainment Reduction Program[93] would reduce the effects of entrainment on target species (e.g., bull trout, westslope cutthroat trout, and mountain whitefish), as well as potentially other species by either: (1) preventing entrainment at the project; (2) reducing entrainment at the project and addressing the remaining effects through other means; or (3) fully addressing the effects of entrainment through other measures. The decision as to whether entrainment is best addressed through options 1, 2 or 3, as defined above, would be made by the FAWG, based on site specific information developed under this program.[94] Seattle would work collaboratively with the FAWG in all aspects of this program.

The Boundary Project currently entrains individual fish through its generating units and spillways, and direct mortality associated with entrainment is high (*see* Fish Entrainment and Habitat Connectivity Study, Study No. 12 Final Report; Seattle, 2009a). The existing level of entrainment and mortality, if it continues, would likely reduce the benefits of fish production gained from the additional habitat provided by passage of native salmonids upstream of the Box Canyon dam.

Seattle's proposal to implement a fish entrainment reduction program at the project would reduce entrainment, injury, and mortality of fish during any downstream movement through the project area. The proposed studies/evaluation component would help to define the extent to which entrainment is occurring at the project and to ensure that the measures ultimately implemented are commensurate with project effects. Seattle's proposed evaluation phase would last 18 years. The length of this phase reflects the uncertainty concerning the level of entrainment for bull trout, cutthroat trout, and whitefish that is occurring, and would be warranted under these circumstances.

Tributary Aquatic Habitat Enhancements – As we noted above, much of the FAMP is focused on improving Boundary tributary habitat. As part of developing the FAMP, Seattle categorized tributaries flowing into Boundary Reservoir according to habitat availability for native salmonids and the potential opportunity to improve

---

**93** The minimum survival threshold is 60 percent, based on site conditions and best available technology. If survival of target species passing through the Boundary dam is less than 60 percent, Seattle would construct a facility to increase survival. The facility would be designed to improve survival of target species to more than 60 percent. Monitoring of the facility would confirm whether 60 percent survival has been achieved, or if additional modifications are needed to achieve 60 percent survival.

**94** Seattle proposes to implement an 18-year Fish Behavior and Population Study to help define factors that complement or hinder native salmonid recovery. The information obtained from this effort, which would include the effects of dam survival on native salmonid populations and the success of tributary enhancements, would help guide Seattle's implementation of its entrainment reduction program (e.g., the decision to implement non-operational measures versus construct protection and passage facilities at the Boundary Project).

conditions through habitat enhancement (*see* Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats, Study No. 14; Seattle, 2009a). Twenty-eight tributaries were categorized as primary, secondary, or excluded according to the extent to which habitat improvements would likely benefit native salmonids. The majority of tributary treatments are directed at primary or secondary reaches (i.e., Tier-1) that provide the greatest potential to influence native fish resources. In addition, Seattle proposes to implement measures to improve aquatic habitat conditions in low priority tributaries (i.e., Tier-2). The over-riding criterion is that the Tier-2 tributary must have, or potentially have, useable native salmonid habitat that could be effectively improved through habitat improvement or protection.

Most of the tributaries to Boundary Reservoir have been stocked with non-native salmonids such as brook trout, brown trout, and hatchery rainbow trout from out-of-basin stocks. The presence of non-native trout, especially brook trout, is a serious threat to native salmonids, as a result of interbreeding (with bull and westslope cutthroat trout) and competition for habitat and food resources. FWS (1999) states, in its status review, that westslope cutthroat trout are usually found in the cooler upper extents of tributaries.[95] In addition, habitat in the tributary reaches has been degraded by blocking culverts, roads constructed in riparian zones, and past logging practices which reduced LWD recruitment. To address the aforementioned issues, Seattle proposes to implement biological and habitat treatments in tributaries to Boundary Reservoir to benefit native salmonids, followed by monitoring and adaptive management to increase performance of the measures.

The objective of the tributary aquatic habitat program is to establish self-sustaining, naturally reproducing stocks of native salmonids and provide access to, and improve, habitat conditions in tributaries draining to Boundary Reservoir to offset an estimated 304 acres of reservoir habitat affected by the Boundary Project. Fish population and habitat condition goals are needed to guide these restoration efforts. To this end, prior to implementing any tributary enhancements, Seattle proposes to develop a Tributary Management Plan that includes a schedule and scope of activities for each tributary to ensure that enhancements are complementary to the population and habitat goals. For instance, removal of culverts that block tributary access might be delayed until after brook trout suppression efforts to reduce the risk of brook trout recolonization. Biological enhancements would include suppression or eradication of non-native fish in tributary reaches and selected lakes draining to Boundary Reservoir.[96]

---

**95** FWS suggests that this distribution pattern is more likely driven by competition from other trout such as rainbow trout and brook trout that are less tolerant of cooler, higher gradient streams, rather than a preference for that habitat type.

**96** Backpack electrofishing would be the technique used to capture non-native fish (primarily brook trout) during suppression efforts. Eradication of non-native fish would involve multiple applications of an approved fish toxicant in select water bodies.

The proposed habitat enhancements would consist of a variety of measures designed in response to the site-specific conditions. Removal or replacement of blocked culverts would restore access to habitats that is not otherwise available during low-flow conditions. Riparian plantings and streamside road improvements would benefit tributary habitat conditions by reducing fine sediment runoff, increase shade and canopy cover to reduce water temperatures, and increase the long-term recruitment of LWD to the streams. Where possible, easements would be purchased to reduce development and other effects to the riparian areas and provide long-term protection to native salmonid habitat.

Logjams and LWD pieces would be placed to increase channel complexity, retain gravel, and support pool formation. In general, as aquatic habitat increases (creating areas of different velocities and depths), fish populations increase (Heede and Rine, 1990). Stream complexity creates both low velocity areas where young fish can incubate and rear and high velocity areas that provide feeding stations and holding areas for larger fish. The addition of certain types of cover (e.g., extra depth, preferred substrates, woody debris, etc.) would likely make some areas in the tributaries suitable for fish that would not otherwise be used (Bjornn and Reiser, 1991).

For native salmonids using the tributaries, Seattle's proposed habitat enhancements would create slow velocity and deep pool habitats suitable for all life stages. Salmonid fry prefer the margins of pools created by the instream enhancement structures, if adequate cover exists for escape from predators. Side-channel habitats, created with cover for predator avoidance, are preferred by juvenile salmonids. The creation of large complex pools with abundant cover are preferred by adults (for holding before spawning and summer habitat), and by rearing juveniles. Adult trout would use the deep, low-velocity pools created by instream structures as over-wintering habitat. Gravels introduced as part of the gravel augmentation program would be used by salmonids during the spawning periods.

Suppressing or eradicating non-native fish from tributary reaches and implementing habitat enhancements would facilitate the recovery of native fish populations if there is sufficient recruitment of native salmonids. Out-planting of early life stages of native salmonids (*see* native fish conservation measures discussion below) could support a rapid population response to biological and habitat improvements in the tributaries.

Shirley and Wilhelm Botzheim and the Sweet Creek Ranch Residents, in letters filed August 9 and September 3, 2010, respectively, expressed concern with Seattle's proposed measures for Sweet Creek. These entities question the benefits to be derived from the measures, and indicate that they have no intention of selling any of their property to facilitate the proposed improvements. These entities also seek clarification regarding the specific activities that would be associated with the work.

The proposed FAMP includes conceptual plans for the habitat improvements to be made on Sweet Creek. The general plans include: (1) riparian buffer protection and plantings,[97] (2) large woody debris placement,[98] and (3) culvert improvements for Highway 31.[99] The overall goal of these improvements for Sweet Creek is to restore the creek to as natural condition as possible, including improving overall water quality in the creek and providing habitat for native salmonids. However, the FAMP recognizes the existing uses of the creek (e.g., use as a clean water supply for the residents). In addition, Seattle makes it clear in the FAMP that implementation of the riparian protection portion of the Sweet Creek improvements would depend upon the willingness of current landowners to either sell a portion of their property or enter into protective easement agreements, and that if the landowners do not cooperate the long-term protections planned for the creek would not be implemented. Based on this, it seems that the FAMP accommodates the residents' concerns regarding activities on their property.

The Sweet Creek residents ask what specific activities would be associated with the work. The questions about the exact nature of the proposed work are difficult to answer at this time. While the FAMP outlines a conceptual plan for the improvements to Sweet Creek, which is sufficient for our NEPA review and analysis, the project-specific detail would be designed post-filing, as part of the tributary-specific plans that are developed.

Mill Pond Site Monitoring and Maintenance – Mill Pond, located at RM 3.9 on Sullivan Creek, is a complete barrier to the upstream movement of resident fish (Seattle, 2009a). The impoundment has altered natural stream processes in Sullivan Creek by interrupting the downstream transport of all bedload material and some LWD. The Mill Pond impoundment has also slowed water velocities and increased summer water temperatures in lower Sullivan Creek.

As discussed in section 3.5.2.2, *Aquatic Resources, Environmental Effects – Sullivan Creek Project*, the District, as part of its surrender application for the Sullivan Creek Project, proposes to remove the Mill Pond dam and restore the site to a natural functioning stream system.[100] The Mill Pond Decommissioning Plan, filed by the

---

**97** The objective of this component is to provide long-term protection for the relatively intact riparian zone of Sweet Creek downstream from the Highway 31 culvert (approximately 11.8 acres within a 100-foot buffer on either side of Sweet Creek from RM 0.0 to RM 0.5, the location of the Highway 31 culvert.

**98** The objective of this component is to increase channel complexity and gravel retention through placement of LWD from RM 0.0 to RM 0.6. The presence of eroding stream banks would be considered during the design of this component.

**99** The objective of this component is to improve upstream fish passage at the culvert located at RM 0.5 under Highway 31.

**100** New stream channel banks would be stabilized with keyed-in logs with root wads and large boulders, and then planted with native herbaceous and woody riparian species.

District with its surrender application describes the decommissioning work to be performed at the Mill Pond dam site. In general, the Mill Pond Decommissioning Plan covers removal and restoration work that would be completed within 5 years of the Commission issuing a surrender order for the Sullivan Creek Project.

Upon the Commission determining that the District's work required by the Mill Pond Decommissioning Plan has been completed, and the Commission terminates its jurisdiction over the Sullivan Creek Project, Seattle, proposes, as a component of the FAMP, to monitor and maintain the Mill Pond site to ensure that the habitat enhancements continue to function over time.

Seattle's proposal has merit in this instance. Sullivan Creek is the largest tributary flowing into Boundary Reservoir and provides the most significant amount of habitat for native salmonids in the project area. Under the FAMP, Seattle proposes riparian and stream channel enhancements for Sullivan Creek from RM 0.3 to 0.54, RM 2.3 to 3.0, and upstream of the confluence with Outlet Creek at RM 5.3, as well as the North Fork Sullivan Creek, which flows into Sullivan Creek downstream from the Mill Pond dam site. These enhancement projects would involve on-going monitoring and maintenance to ensure they continue to function as designed. The Mill Pond dam site is situated between RM 3.9 and RM 5.3, amongst the other areas to be monitored by Seattle. Improvements to the aquatic habitat at all of these sites are inter-dependant.[101]

Therefore, we have no objection to monitoring the habitat enhancements made to Sullivan Creek, including those made to the Mill Pond dam reach. Monitoring Sullivan Creek habitat improvements, as part of an integrated program, would ensure that desired benefits continue to accrue over time and that additional measures, if needed, are implemented in a timely manner. In addition, monitoring and maintaining the Mill Pond site, along with the other areas of Sullivan Creek, would further the goals of enhancing habitat in, and restoring native fish populations to, Sullivan Creek. This is consistent with the goals of the FAMP, as well as the resource agencies' fishery restoration goals for the Pend Oreille River system.

Native Salmonid Conservation Program – As part of its native salmonid conservation program, Seattle proposes to fund the design, construction, operation and maintenance of a native fish conservation facility for the production of native salmonids to supplement tributaries draining into Boundary Reservoir. The facility would be designed to produce eyed eggs, fry, and fingerlings,[102] as well as support multiple age class broodstock. In addition, the facility would be designed to simultaneously propagate two species of fish and several life stages, including but not limited to

[101] For example, unstable substrates in one area could lead to deposition of sediments downstream and render ineffective the downstream habitat improvements.

[102] The primary distribution of fish is expected to be fingerlings, but may include stream-side incubators or artificial redds to minimize potential domestication.

westslope cutthroat trout and bull trout. Selection of species, stocks, and life stages to be produced would be determined in consultation with the FAWG. Locally adapted, multiple age class broodstock would be used to maintain long-term fitness traits,[103] and the facility would be operated to minimize genetic divergence from local, naturally spawning stocks. Annual production would be commensurate with the need to out-plant fish in tributaries draining into Boundary Reservoir.

Seattle, in consultation with the FAWG, the Forest Service, and Ecology, would establish measurable goals for the conservation program by (a) determining appropriate tributary target fish populations, and (b) establishing self-sustaining native stocks of fish. The optimal outplanting strategies for achieving the desired goals would be identified based on monitoring and evaluating multiple outplanting strategies that consider appropriate fish sizes, outplanting densities, frequency, and timing. Finally, as part of the program, Seattle would monitor the initial success of outplanted native salmonids and conduct periodic monitoring until population goals are achieved.

Outplanting of native salmonids produced from an approved facility would, if done correctly and in consultation with the FAWG, the Forest Service, and Ecology, compliment brook trout suppression and habitat improvement activities in the tributaries. Native fish propagation and outplanting also would facilitate rapid recruitment and colonization of underutilized tributary habitats or currently unoccupied habitat. For example, artificial propagation of bull trout could be used to seed currently unoccupied habitat and facilitate the recovery of the species (*see* Assessment of Factors Affecting Aquatic Productivity in Tributary Habitats, Study No. 14: Seattle, 2009a; FWS 2002).

<u>Recreational Fish Stocking Program</u> – Boundary Project operations affect mainstem and tributary delta habitats, and cause loss of fish through entrainment and increased predation on salmonids associated with the reservoir environment (Seattle, 2009a). Since 2001, Seattle has voluntarily stocked sterile rainbow trout in the Boundary Reservoir to increase recreational fish opportunities. As of 2010, Seattle discontinued stocking triploid trout in Boundary Reservoir since the Washington DFW no longer permits the activity, citing concerns regarding potential competition with native trout and poor trout habitat conditions in the reservoir.

As part of an ongoing Washington DFW program, fry and fingerling trout are routinely stocked in Washington lakes during the spring and fall where they grow on natural food until the following spring when they are large enough to be harvested. Where fry survival is low, or where there is intense fishing pressure, catchable size trout, 8 inches or larger, are stocked to improve recreational opportunities. In addition

---

**103** Design considerations for outdoor rearing facilities would consist of a naturalized, sinuous channel lined with cobble and gravel substrate similar to Boundary drainages, feeding system, natural shading, and instream woody habitat.

to fertile rainbow and cutthroat trout, sterile and hybrid trout are sometimes planted in select lakes. If provided with an abundant food supply, sterile triploid and hybrid trout have the potential to quickly grow to trophy size. Sterile trout are also planted in areas where natural reproduction could adversely affect native species.

As an element of the FAMP, Seattle proposes to stock trout in 18 lakes within a 15-mile area around the project. Trout species stocked in these lakes may consist of westslope cutthroat, rainbow, rainbow triploid, or tiger trout, and may include fall fry, fingerlings, spring fry and catchable-size fish. These fish would be produced annually and planted by the Washington DFW. However, fish may be obtained from a commercial production facility if fish are unavailable from the Washington DFW. About 11,678 pounds of fish would be stocked annually. In addition, Seattle proposes to monitor and evaluate lakes receiving the stocked fish. The number, size, and species of fish to be stocked in the selected lakes each year may be modified in response to the information developed through annual monitoring.

This measure would provide recreational fishing opportunities in the region, in lieu of recreation angling opportunities in Boundary Reservoir. In addition, stocking non-native trout in nearby lakes would offset the effects associated with the tributary restoration program on reduced recreational fish opportunities in Boundary tributary streams. The stocking program is expected to (a) reduce recreational fishing pressure on the Boundary Reservoir and tributary streams, and (b) gain local citizen and landowner support for the tributary restoration effort.

Habitat Improvement Fund for Sullivan Lake Tributaries – Sullivan Lake supports a naturally reproducing population of kokanee that provides recreational angling opportunities of regional significant. In addition, the Sullivan Lake dam is a barrier to fish movement in Sullivan Creek, blocking access to fish habitat in Sullivan Lake and its tributaries. As part of its settlement, Seattle proposes to establish a $2.5 million fund that would be used to improve habitat in select Sullivan Lake tributaries. As we indicated in section 3.7.2.1, *Threatened and Endangered Species, Environmental Effects – Boundary Project*, improving habitat in Harvey, Noisy, and Jungle creeks would benefit native fish populations in the Sullivan Lake watershed, including kokanee, cutthroat trout, and bull trout (should they become established in the watershed). Enhancing the tributary habitat would also likely improve the forage base for native fishes. The habitat improvements in these tributaries would provide little, if any, benefit to resources affected by the continued operation of the Boundary Project and would serve no project purpose.

#### 3.5.2.2 Sullivan Creek Project

As part of the Sullivan Creek settlement, the District is proposing measures that are designed to provide substantial resource benefits. For example, removal of the Mill Pond dam would remove a barrier to fish movement on a tributary to Boundary Reservoir, providing potential access to 16 miles of spawning, rearing, overwintering, and foraging habitat. In addition, Mill Pond dam removal and the additional stream restoration activities proposed by the District would return Sullivan Creek to a naturally functioning stream environment in the reach that is currently inundated by Mill Pond.

The Sullivan Lake dam and associated lake would remain in place to continue to provide significant recreational opportunities, which include camping, boating, fishing, and swimming (see section 3.8, *Recreation, Land Use, and Aesthetic Resources*). However, the District's proposed measures that would improve the temperature regime in the Sullivan Creek watershed include: installing a cold-water release structure for Sullivan Lake, increasing minimum flow releases from the Sullivan Lake dam, and modifying the operating regime in the summer and fall. The operational changes, which we discuss in greater detail below, are expected to (a) improve fish habitat conditions (primarily native salmonids) in Sullivan Creek (below its confluence with Outlet Creek), and (b) provide cooler water flowing into the Pend Oreille River.

We describe, individually, the District's proposed measures and discuss associated effects in the paragraphs that follow.

**Settlement Condition No. 4 – Mill Pond Decommissioning and Removal**

Mill Pond, which is located at RM 3.5 on Sullivan Creek, was created when a log-crib dam was constructed in 1909. The current dam, an un-gated concrete structure situated immediately downstream from the log crib dam, was built in 1921. In 1956, the associated powerhouse was shut down because of maintenance problems with the wooden flume that conveyed water from the Mill Pond to the powerhouse.

Sullivan Creek flows into the reach of the Pend Oreille River impounded by Boundary reservoir immediately north of Metaline Falls. The Sullivan Creek watershed contains some of the best remaining spawning and rearing habitat for salmonids (native and non-native) in the lower Pend Oreille River (Forest Service, 2004). Within the Sullivan Creek watershed, the Mill Pond dam is a complete barrier to the upstream movement of resident fish (Seattle, 2009a). The dam also restricts downstream passage of fish, the movement of other aquatic organisms, and downstream transport of sediment and woody material in the system (Forest Service, 1997).

Bull trout, westslope cutthroat trout, white sturgeon, mountain whitefish, northern pike-minnow, peamouth, redside shiner, sucker, sculpin, and dace species are native to the Pend Oreille River system. Many of these species either have adfluvial life histories or are most likely resident within tributaries to Boundary Reservoir. As we observe in section 3.7.1, *Threatened and Endangered Species, Affected Environment*, bull trout are present in low numbers in the reach of the Pend Oreille River between the Albeni Falls and Boundary dams. Large bull trout are present within the Boundary Reservoir, including lower Sullivan Creek. Bull trout are also found in tributaries to Box Canyon Reservoir, and all life forms are present upstream of Albeni Falls dam.

Mill Pond is 63 acres in size. Past land management activities resulted in excessive sediment transport from the upper watershed (Wasson, Forest Service, Pers.

Comm., 1999; cited by Forest Service in its letter filed August 24, 2010, providing surrender conditions for the Sullivan Creek Project), with subsequent deposition of coarse particles within the transition zone and finer clays and silts into the lacustrine zone of Mill Pond. As noted by the Forest Service, the depositional area is about 1,500 feet long, about 500 feet wide, and covers about 30 acres.

Sullivan Creek is the primary source of water flowing into Mill Pond. The Mill Pond dam has altered the natural sediment transport processes in Sullivan Creek by trapping incoming bedload material behind the dam (Forest Service, 1997). This has created a condition where Sullivan Creek downstream of the Mill Pond dam is sediment depleted. Thus, the sediment transport capacity exceeds the sediment supply in the reach downstream from the dam, which has resulted in a lack of appropriately-sized spawning gravel for resident trout populations and extensive armoring of the bed surface.

Water temperature data (R2 Resource Consultants, 1998a) demonstrates the warming effect of the Mill Pond dam on water released from Sullivan Lake and flowing towards the mouth of Sullivan Creek. During the summer months, water temperatures can exceed 60.8 °F, with the Mill Pond dam increasing water temperature by about 3.6 to 4.3 °F (Doug Robison, Washington DFW, pers. Comm., 2009; cited by Forest Service in its letter filed August 24, 2010, providing surrender conditions for the Sullivan Creek Project).

To address the aforementioned effects, the District proposes, as part of the Sullivan Creek settlement, to remove the Mill Pond dam and return that reach of Sullivan Creek to a free-flowing stretch of river. Once the dam has been removed and site restored, the District would monitor the restoration work until the Commission's jurisdiction ends. The resource agencies and Forest Service, who are signatories to the settlement, recommend the dam be removed and the creek restoration efforts.

*Staff Analysis*

The Code of Federal Regulations (18 CFR 6.2, Surrender of License) states that where project works have been constructed on lands of the United States, the licensee is required to restore the lands to a conditions satisfactory to the Department having supervision over such lands, which in this instance is Forest Service. The Colville National Forest Plan, as amended by INFISH, requires that hydroelectric projects maintain or restore riparian habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities, favorable channel conditions, and fish passage. The removal of the Mill Pond dam would meet these requirements.

Recent actions at other projects on the Pend Oreille River would lead to fish passage being provided at the Box Canyon and probably at Albeni Falls dams, both located upstream of the Boundary Project and Sullivan Creek. These actions would re-establish the historic migration corridor for migratory species in the lower Pend Oreille

River, and fully reconnect habitat in the river from Boundary dam upstream to Lake Pend Oreille in Idaho. These actions, combined with removal of the Mill Pond dam, would enable fish species, including bull trout, to more easily re-colonize habitat and fully express migratory life history strategies that rely on tributaries, such as Sullivan Creek, for spawning and rearing.

The District proposes to monitor the reach of Sullivan Creek restored after the Mill Pond dam is removed. Rehabilitation and monitoring of, and adaptively managing the restoration activities on, Sullivan Creek in the area of the Mill Pond would provide the District, resource agencies, and Forest Service the necessary tools to make decisions regarding the structural and functional needs of aquatic and riparian dependent community species.

Finally, the Colville National Forest Plan, as amended, stipulates that projects and facilities on Forest Service lands comply with state water quality standards, as well as maintain favorable habitat for fish reproduction and growth. The removal of the Mill Pond dam would address these stipulations by contributing to the reduction of summer water temperatures in lower Sullivan creek, and restoring the natural movement of bedload material and passage of large woody debris downstream from the Mill Pond dam site. This would have the effect of increasing the aquatic habitat complexity and improving the spawning, rearing, and foraging habitat of Sullivan Creek downstream from the dam site.

**Settlement Condition No. 5 – Cold Water Release Facility**

Sullivan Lake is a natural lake that was increased in size by the construction of the Sullivan Lake dam. Currently, the project stores and releases about 31,000 acre-feet of water annually from Sullivan Lake for downstream generation purposes. Sullivan Lake covers 1,240 acres, and is maintained to the extent possible, at a constant elevation of 2,588.66 feet during the months of May through September. Beginning in October, the lake is drawn down to provide storage for spring runoff.

Although water temperature data is not available for the original lake, the Sullivan Lake dam has likely altered the original temperature regime by increasing the amount of lake surface area with relatively shallow depths. This created a situation where summer water temperatures in Sullivan Lake are above Washington State water quality standards in the upper 25 feet of the water column during portions of July and August (Nine and Scholz, 2005). Currently, water released from Sullivan Lake is drawn from this warmer epilimnion layer of the lake. Thus, the water released from the lake into Outlet Creek and lower Sullivan Creek during the July/August time period is marginal for some life stages of salmonids, particularly native salmonids.

To address the temperature effects associated with water released from Sullivan Lake, the District proposes, as part of the Sullivan Creek settlement, to construct a coldwater release facility at Sullivan Lake.[104] The facility would consist of a gravity water supply pipe, 48 inches in diameter, with fish screens at the intake and using an existing low-level outlet gate at the Sullivan Creek dam. The resource agencies and Forest Service, who are signatories to the settlement, recommend this coldwater release facility be constructed.

*Staff Analysis*

As we previously mentioned, the Colville National Forest Plan requires compliance with water quality standards, as well as maintenance or restoration of favorable habitat conditions for fish reproduction and growth. The District's proposal to construct and operate a coldwater release facility (siphon) would help meet this requirement. Releasing cold water from Sullivan Lake, particularly during July and August, would enhance the quantity and quality of habitat available for fish using Sullivan Creek.

The migratory corridor for a number of native fish species, including bull trout, is being re-established in the lower Pend Oreille River. Constructing a coldwater release facility, when coupled with the removal of the Mill Pond dam, would enable fish species, including the migratory bull trout, to use Sullivan Creek and Outlet Creek for spawning, incubation, and rearing.

As part of the Sullivan Creek settlement, the District proposes to screen the coldwater intake pipe, in accordance with NMFS' design criteria of 0.4 fps approach velocity, and manage lake discharge flows to minimize the use of the low level outlet gates in the dam. Screening of the coldwater release facility would help prevent entrainment of fish. This measure, coupled with the intake screen, would help protect the fisheries of Sullivan Lake.

The proposed coldwater release facility would allow the District to initiate its fall drawdown earlier, improving water temperatures in Outlet and Sullivan creeks in late summer in the process. This earlier drawdown would expose Harvey Creek spawning areas substantially earlier, which would enhance spawning success of kokanee and other fish species that use the creek. Redd superimposition would be reduced.

**Settlement Condition No. 6 – Reservoir Level Operations**

**Settlement Condition No. 10 – Water supply Program**

Sullivan Lake is currently maintained at a constant elevation of 2,588.66 feet, to the extent possible, during the months of May through September. This is done

---

[104] The District would be responsible for constructing the facility pursuant to the Sullivan Creek settlement. However, Seattle, as part of a separate, off-license, agreement between the District and Seattle, would be responsible for 50 percent of the funding for the actual design, permitting, and construction costs, as well as operation and maintenance costs.

primarily to accommodate recreation use. During the summer months, when the gates are closed (typically from April 1 through September 30), a minimum of 10 cfs is released from Sullivan Lake. Beginning in October, the lake is drawn down about 25 feet during the winter months to provide downstream benefits and to provide storage for spring runoff.

The District currently releases 31,000 acre-feet of the usable storage in Sullivan Lake annually for use for power production downstream. This water is released starting the first week in October each year. Releases continue until late December or early January, at which time equilibrium of inflow and outflow is again normally reached. The District is compensated for these releases through the Pacific Northwest Coordination Agreement.

An annual drawdown in the fall and winter has the potential to expose substrate that may be important habitat for macroinvertebrates and mussels, contributing to desiccation and freezing. Extreme fluctuations have the potential to affect fish habitat and behavior by creating an unstable environment where temporary loss of habitat can occur. In addition, the success of species which spawn in the littoral zone could be reduced by extreme fluctuations where nests and rearing grounds are subjected to dewatering.[105] For example, where water levels fluctuate on an irregular or un-natural basis, nest failure can be more likely to occur especially if nests are constructed during periods of extended high water levels and then the water levels are suddenly dropped.

*Staff Analysis*

The process of selling water for power production results in the manipulation of lake levels, which affects habitat within and adjacent to the lake. The existing lake level management regime affects the productivity of the lake habitat by preventing the establishment of a riparian and littoral zone around Sullivan Lake. This management regime also (a) accelerates the draining of nutrients out of the lake during fall plankton production, (b) removes fish from the lake via entrainment through the dam spillway, and (c) causes habitat degradation in Outlet and lower Sullivan Creeks due to increased water temperatures.[106]

In addition, the existing lake level regime limits the use of littoral zone habitat around Sullivan Lake, as well as hinders fish movement into, and out of, the lake's

---

**105** Kokanee, which is a nest building species, is an important component of the Sullivan Lake's fishery, and the Washington DFW is considering this population as a potential brood source for stocking several lakes in eastern Washington.

**106** The issues of nutrients, fish entrainment, and water temperatures in Outlet and Sullivan creeks have either been addressed previously in this section or in section 3.4.2.2, *Water Quantity and Quality, Environmental Effects – Sullivan Creek Surrender*.

tributaries (*see* Harvey Creek Bedload Project discussion below).[107] To address these effects, the District proposes, as part of the Sullivan Creek settlement, to change its operation of Sullivan Lake. The resource agencies and the Forest Service, who are signatories to the settlement, recommend these changes.

The changes in how Sullivan Lake is operated include higher lake levels and increased minimum flows downstream (we address the minimum flows in a subsequent discussion). The specific changes can generally be described as:

- increasing instream flow releases on a year-round basis;
- raising the winter lake level by 5 feet to elevation 2,570.0 feet to help ensure that Sullivan Lake fills more often in the spring;
- managing the rate of Sullivan Lake filling in the spring and drawdown in the fall to enhance the environment and for recreation;
- start refilling Sullivan Lake on or before April 1 and continue until an elevation of 2,588.66 feet is reached, and maintain Sullivan Lake at that elevation through Labor Day, subject to hydrologic conditions, water availability, and dam discharge flow requirements; and
- drafting a specified amount of water (5,000 acre-feet) during the period of June through Labor Day.

As discussed in greater detail below and in section 3.7.2.2, *Threatened and Endangered Species, Environmental Effects – Sullivan Creek Surrender*, the increase in minimum flows would improve water quality and, thereby, enhance aquatic habitat in Outlet and Sullivan Creeks.

The District's proposed changes in how Sullivan Lake is managed likely would have a number of important benefits for the fish populations residing in the lake. First, raising the winter pool elevation by 5 feet would make it more likely that Sullivan Lake will fill to an elevation of 2,588.66 feet. This would enhance littoral zone habitat around the lake and potentially improve spawning and rearing conditions in those areas. Second, releasing cold, less-productive water earlier in the year (i.e., during the summer) is expected to improve overall productivity by retaining more nutrients in the lake. Third, kokanee and mountain whitefish spawn in the fall; whitefish typically in October and November, and kokanee from early August through December. Both species spawn over gravel in free-flowing bodies of water or along a lake's shoreline. Given these are self-sustaining populations, they likely have adapted to the existing water management regime. Nonetheless, the District's proposed changes in how it manages Sullivan Lake water levels would provide greater stability to shoreline habitats that may be used for spawning and rearing in the fall, and, thereby, improve spawning

---

[107] As described in our discussion of Settlement Condition No. 8, access to habitat in Harvey Creek is blocked during low-flow periods.

success for fish that use those areas. Fourth, more stable, and higher, lake levels should improve riparian and littoral zone habitat conditions. Finally, the proposed changes would improve access to important tributary habitat.

**Settlement Condition No. 7 – Sullivan Lake Dam Minimum Discharge Flows**

The magnitude of instream flows in Outlet and Sullivan creeks would affect aquatic resources by influencing water temperature, water quality, the amount of wetted space for aquatic macroinvertebrates, and the amount of habitat within the water column suitable for various species and life stages of fish. Adequate instream flows are needed to protect aquatic resources in Outlet and Sullivan creeks.

Currently, the gates at the Sullivan Lake dam are fully opened during the first week of October, and flows in Outlet and lower Sullivan Creeks are substantially increased for about 3 months for power generation purposes downstream from the Sullivan Creek Project. With these releases, flows downstream from Sullivan Lake in Outlet Creek increase and then decrease dramatically. For example, average flows in Outlet Creek from 1960 to 1989 increased from an average of 28 to 212 cfs during maximum release periods and then dropped back to 30 cfs in January when the releases are finished. Similarly, average flows in lower Sullivan Creek from 1960 to 1968 went from 84 to 292 cfs and then back down to 90 cfs in January (District, 1994).

The relatively rapid increase and decrease in flows in these creeks can: (a) disturb habitat; (b) flush fry and juveniles out of their habitat; and (c) affect spawning success through the dewatering of spawning habitat when flows return to the more natural regime where outflow is approximately equal to inflow. In addition, rapid changes in stream discharge can lead to: (a) fish stranding and mortality;[108] (b) loss of food resources; and (c) behavior responses that can reduce survival or growth (Hunter, 1992).

To address the effects associated with current flow releases, the District proposes, as part of the Sullivan Creek settlement, to change the flow release schedule for Sullivan Lake, by increasing year-round flows. The resource agencies and the Forest Service, who are signatories to the settlement, recommend these changes.

*Staff Analysis*

The Colville National Forest Plan, as amended, requires compliance with state water quality standards, as well as maintenance and restoration of favorable habitat

---

[108] Eighty-seven percent of Sullivan Creek downstream from the Mill Pond dam is relatively confined and high gradient, with few, or no, major slide channels or gravel bars (FERC, 1998). Very little potential stranding habitat appears to exist in this reach. Therefore, a given reduction in stage over time in Sullivan Creek is less likely to strand aquatic organisms than that same rate of reduction would have in a river with side channels, low gradient gravel bars, and potholes.

conditions for fish reproduction and growth. Implementing a pre-set, more natural, schedule of flow releases from Sullivan Lake, as proposed by the District, would meet the Plan's requirements.

The proposed increase in the flows discharged from Sullivan Lake would address the existing, on-going, effects associated with the substantial instream flow fluctuations in Outlet and lower Sullivan Creeks. During the time periods of early summer, and from early fall through winter, water would be released on a schedule with set minimum flows. The higher flows would improve aquatic habitat by making available more habitat and improving water quality (especially in the summer) (*see* flow analysis in FERC (1998) and section 3.7.2.2, *Threatened and Endangered Species, Environmental Effects – Sullivan Creek Surrender*)

The maintenance of consistent instream flows, with gradual increases and decreases during periods of up- and down-ramping, would reduce potential adverse affects to fish and habitat including: (a) minimizing any decrease in fall and winter salmonid spawning success due to dewatering of spawning substrate; and (b) reducing effects on food sources in the creek(s). This change would address the provision of the Colville National Forest Plan to "eliminate adverse effects on native fish associated with habitat manipulation" and "require instream flows and habitat conditions for hydroelectric and other surface water development proposals that maintain or restore… favorable channel conditions, … reproduction and growth." In addition, the proposed higher instream flows during the fall would reduce any adverse effects to critical spawning and rearing habitat for bull trout in lower Sullivan Creek due to the current flow regime (*see* section 3.7.2.2, *Threatened and Endangered Species, Environmental Effects – Sullivan Creek Surrender*).

**Settlement Condition No. 8 – Limitations to Sullivan Lake Surface Elevations and Discharge Flows**

The District proposes to comply with the Sullivan Lake water surface elevations and discharge flow requirements at all times, to which the resource agencies and the Forest Service agree, subject to short term deviations due to equipment failures maintenance activities, electric and mechanical device limitations, safety inspections, testing, natural disasters, and the Harvey Creek Bedload Mobilization activities. In addition, the District proposes to use the existing USGS stream gage on Outlet Creek and install a new Sullivan Lake level recording gage at the Sullivan Lake dam to demonstrate compliance with discharge flow requirements. These measures, as proposed by the District, would provide a mechanism and the data necessary for the District to demonstrate that the required lake level operation and instream flow releases are occurring. However, the parties to the settlement should understand that once the Commission ends it jurisdiction over the Sullivan Creek Project, the Commission can no longer ensure that the District operates the Sullivan Lake dam in a manner that complies with the lake level and flow requirements of the settlement.

**Settlement Condition No. 9 – Harvey Creek Bedload Mobilization Project**

Sullivan Lake is a high elevation, deep (mean and maximum depths of 190 and 331 feet, respectively) lake. It has two main inlets, which are its only fish-bearing tributaries; Harvey and Noisy creeks. Portions of both streams frequently become intermittent during base-flow periods. Noisy Creek is a small watershed containing about 1.25 miles of suitable fish habitat located in the lower reaches of the creek. Harvey Creek contains about 17 miles of spawning and rearing habitat for species that need to move out of the lake to fulfill part of their lifecycle.

Under existing conditions, access to upstream habitat in Harvey Creek is blocked during low-flow periods due to excessive accumulation of bedload deposits in the vicinity of Harvey Creek's confluence with Sullivan Lake. The sediment berm is an unnatural artifact of the management of water volumes and depths in the lake. As previously described, lake levels are kept artificially high in the spring, as water is stored for later release. The movement of bedload being transported down Harvey Creek during spring run-off is interrupted by the high lake level during the end of May. When bedload enters the high water and slow water velocity, it is deposited onsite rather than being carried farther down into the lake. Later in the year, as the lake level recedes, this bedload forms the berm that blocks fish access to habitats in the Harvey Creek. Lack of access to a majority of the suitable habitat in the creek by fall and winter spawners, such as kokanee, brown trout, and mountain and pygmy whitefish, limits their productions.

To address the effects associated with excess sediment at the mouth of Harvey Creek, the District proposes, as part of the Sullivan Creek settlement, to implement a program to mobilize the sediment and flush it into the lake (i.e., the Harvey Creek Bedload Mobilization Project). Briefly, the program would consist of: (a) consultation with the Resource Committee[109] regarding available regional flow projections, snow pack data and run-off forecasts by April 1; (b) holding Sullivan Lake at no more than elevation 2,575.0 feet until May 20, if, by April 20, the Resource Committee determines this appropriate; (c) monitoring flows in Harvey Creek to determine when refilling can resume at its normal rate; (d) meeting of the Resource Committee after July 1 to determine the effectiveness of the lake-level hold down; and (e) the installation of a new gage on Harvey Creek. The resource agencies and the Forest Service, who are signatories to the settlement, recommend these changes.

---

[109] Membership on the Resource Committee consists of representatives from Seattle, the District, Forest Service, FWS, BIA, Washington DFW, Ecology, the Kalispel Tribe, the Lands Council, the Selkirk Conservation Alliance, American Whitewater, Rick Larson, and Al Six.

*Staff Analysis*

The Colville National Forest Plan, as amended, stipulates that hydropower projects maintain or restore riparian habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities, favorable channel conditions, and fish passage. The change in lake-level operations, established by the proposed settlement, would address the myriad of provisions outlined in the Plan.

During the time period from late summer through winter, upstream fish passage beyond the first 500 feet of the creek is blocked, due to the aggradation of bedload material. This is the result of existing operations which maintain unnaturally high lake levels in the spring.

The lower lake levels provided by the settlement during the peak flow period in the spring would allow Harvey Creek to move its bedload out from the current area of aggradation farther into the lake where it would not restrict access to habitat in Harvey Creek. These operations would create favorable channel conditions and improve access to approximately 17 miles of spawning and rearing habitat in Harvey Creek for fall and winter spawning native salmonids which need to migrate to, and from, Sullivan Lake to fulfill parts of this lifecycle. The change to lower lake levels in the spring would also provide additional spawning and rearing habitat in lower Harvey Creek which is currently inundated during a portion of the year.

#### 3.5.2.3 Cumulative Effects

The Boundary Project is the third of five hydroelectric projects on the Pend Oreille River between Lake Pend Oreille and the Columbia River. The existing project contributes to the following cumulative effects: (a) lack of habitat connectivity for native salmonids; (b) disruption of sediment transport; and (c) disruption of LWD transport.

**Habitat Connectivity**

Currently, none of the five dams on the Pend Oreille River has upstream or downstream fish passage or screening facilities. Consequently, all fish entrained over or through the projects are at risk or injury or mortality. Because the level of mortality at each of the dams is unknown, the cumulative level of injury or mortality for fish that pass multiple projects is also unknown. However, some fish do survive passage, as evidenced by the capture and release of healthy fish in the Boundary dam tailrace that had been tagged upstream of the dam. In addition, genetic analysis of tissue from two bull trout captured in the Boundary Tailrace Reach indicates that these fish were derived from populations in tributaries to Lake Pend Oreille and survived passage at the Albeni Falls, Box Canyon, and Boundary dams. Status reviews for bull trout (Rieman and McIntyre, 1993) and westslope cutthroat trout (McIntyre and Rieman, 1995) identify the lack of habitat connectivity (i.e., upstream and downstream fish passage) as an important factor contributing to the patchy distribution and low viability of these species in the Pend Oreille River.

As discussed in this document, Seattle proposes to implement upstream fish passage measures and a fish entrainment reduction program that would address the project's contribution to cumulative effects on native salmonids related to habitat connectivity. During the term of any new license issued for the Boundary Project, Seattle would install, operate, maintain, and monitor an upstream trap-and-haul fish passage facility in the project's tailrace. Seattle would also implement a program over the new license term to address the effects of entrainment on bull trout, westslope cutthroat trout, and mountain white fish by either (a) preventing entrainment at the project, (b) reducing entrainment at the project and mitigating for the remaining effects, or (c) fully mitigating for the effects of entrainment through other measures.

As part of its settlement for the Sullivan Creek Project, the District proposes to remove the Mill Pond dam, manage sediment in Sullivan Creek and Harvey Creek (a tributary to Sullivan Lake, implement site restoration measures at the Mill Pond dam site, and install a cold water release facility in Sullivan Lake. These measures, taken together, would increase the extent of habitat connectivity for native salmonids, as well as improve water quality and aquatic habitat in Sullivan Creek, the largest tributary flowing into Boundary Reservoir.

**Sediment Transport**

The Pend Oreille River between the Boundary and Box Canyon dams has two distinct segments in terms of sediment transport. The section from the Boundary dam upstream to Metaline Falls is a depositional area created by project-related inundation. Upstream of Metaline Falls, the Pend Oreille River is at times influenced by a backwater effect from the Boundary dam, but it is often characterized by riverine conditions, particularly when forebay water surface elevations are low or inflows to the project from Box Canyon Reservoir are high.

The operation of the Box Canyon dam limits the supply of bed material to the Upper Reservoir Reach to periods when flows exceed 80,000 cfs. At flows above 80,000 cfs, the leaves at the Box Canyon dam are opened, and bed material (primarily coarse gravel) stored behind the dam moves into Boundary Reservoir. The Box Canyon Project can, at times, reduce the coarse sediment supply to Boundary Reservoir if peak flows do not reach 80,000 cfs for an extended period.

The effect of project operations on sediment transport in the reservoir is negligible. The project ceases to operate in a load following mode when flows into the reservoir exceed power plant capacity (about 56,000 cfs). In general, most sediment is transported by flows approaching, or greater than, the "channel forming" flow (i.e., the estimated 2-year recurrence interval peak flow magnitude is 85,800 – 107,000 cfs), on which the project has little effects.

The cumulative effect of the dams is to disrupt the transport of coarse sediment, resulting in conditions in the Boundary dam tailrace that are depleted of gravel suitable for spawning by some fish species. Of the native salmonids in the project area, mountain whitefish are known to spawn in the 1-mile reach downstream of the Box Canyon dam and stage in the Boundary dam tailrace prior to spawning farther downstream in Seven Mile Reservoir. In both of these areas, mountain whitefish spawning habitat could be adversely affected by the disruption of gravel-sized particles suitable for spawning. To address this issue, Seattle proposes to deposit 1,500 $yd^3$ of screened gravel between RM 29.1 and the Box Canyon dam to increase potential mountain whitefish spawning habitat, thereby lessening the Boundary Project's contribution to any cumulative effects related to sediment transport.[110]

**Woody Debris Transport**

LWD is collected in the forebays of all dams on the Pend Oreille River to protect project facilities. The effect of this removal on the LWD budget of the river has not been quantified, but there is a cumulative loss of LWD that would otherwise provide aquatic habitat along the shoreline or at islands and cobble bars. As part of its settlement, Seattle proposes to place and maintain LWD jams in the delta regions of Sullivan, Sweet, Slate, and Linton creeks to provide cover for salmonids occupying coldwater refugia at the mouths of these tributaries. LWD jams would be located in the upper ends of tributary deltas to minimize use by non-salmonids. This measure would, to some extent, offset any project effects resulting from disruption of LWD transport.

**Sullivan Lake Fishery Enhancement Fund**

The District entered into an off-license Memorandum of Agreement (Fish MOA; *see* Attachment 3 to the settlement) with the Washington DFW to provide the Washington DFW funds to mitigate for fish entrainment and loss of productivity in Sullivan Lake. The funds provided in the Fish MOA would be used to address fishery resources management by the Washington DFW in Sullivan Lake and its associated tributaries, including developing a fisheries management plan and purchasing necessary equipment to carry out Washington DFW's responsibilities. However, this measure, while having merit if the funds are used in a manner that improves fish populations and aquatic habitat, lacks specificity. Therefore, it is impossible for us to evaluate how the funds would benefit aquatic biota in the Sullivan Creek drainage in any meaningful and measurable way.

---

[110] Up to 25 percent of the gravel would be replenished every 5 years. To increase gravel retention, Seattle proposes to install up to 189 tons of 3- to 4-foot-diameter boulders in weirs or other structures, and up to 25 percent of the boulders would be replenished every 10 years as needed to maintain gravel retention.

## 3.6 TERRESTRIAL RESOURCES

### 3.6.1 Affected Environment

#### 3.6.1.1 Boundary Project

The influence of the maritime climate on the dominant vegetation types in the Selkirk Mountains is profound and likely exceeds the influence of geology and soils in most parts of the eastern Okanogan Highlands (Philip and Durke 1972). Vegetation zones, or climax vegetation, in the Project area include the Douglas-fir/Grand Fir Zone on drier sites and the Western Hemlock/Cedar Zone on more mesic sites (Williams et al. 1995). Forest communities in the Pend Oreille River valley, including the project area, are characterized by a higher diversity of tree species than other regions in Washington. These species include: Douglas-fir, lodgepole pine, western hemlock, Ponderosa pine, western red-cedar, trembling aspen, grand fir, black cottonwood, western larch, paper birch, and western white pine.

Most of the land within the project area has been logged or burned within the last 80 years, and the forested slopes adjacent to the reservoir are dominated by second-growth Douglas-fir and western larch. Mixed stands of western red-cedar and western hemlock occur in ravines and other shaded, moist areas. Riparian and wetland communities are uncommon, particularly downstream of Metaline Falls, where they occur only in sheltered coves and at the mouths of the few tributary streams in this reach. One of the largest and most diverse wetland/riparian communities in the project area occurs on the Boundary Wildlife Preserve.

**Vegetation Cover Types**

Seattle mapped vegetation cover types found on lands between Highway 31 (on the east side of the reservoir) and County Road 2975 (on the west side of the reservoir) from Boundary dam to Metaline Falls; and the area between Highway 31 (on the west side of the reservoir) and 0.25 mile east of the reservoir shoreline from Metaline Falls to the Box Canyon dam tailrace. This includes lands within the project boundary as well as lands outside the project boundary and unaffected by project operations. Seattle mapped 28 different cover types, broadly grouped as upland (899.2 acres) and riparian/wetland (2698.2 acres) cover types.

The upland cover types were subdivided into developed/disturbed cover types (i.e. agricultural, pasture, mining, recreation, etc.), totaling 117.5 acres. Forested uplands accounted for the majority of the upland habitats (612.9 acres), moist mixed conifer forest being the most abundant cover type, occupying 566 acres. The forestlands vary in forest cover and species composition as a result of timber harvest and forest fires that have occurred over the past 100 years. Deciduous hardwood species such as paper birch, aspen, and Douglas maple are relatively more abundant in open conifer stands, along forest edges, and disturbed locations. Non-forested uplands (meadow, grassland, and shrub habitats) and sparsely vegetated uplands (eroded and bedrock outcrops) accounted for 18.4 and 143.4 acres, respectively.

Riparian and wetland habitats were subdivided into lacustrine/littoral, palustrine wetlands, and riverine/riparian cover types. Lacustrine/littoral cover types cover about 1,650 acres in the project area. Littoral emergent wetlands are wetland areas that are inundated or have a very high water table when the forebay elevation is at 1,994 feet. Littoral emergent wetlands cover approximately 15 acres along the reservoir, primarily upstream of Metaline Falls. Palustrine wetlands are often fed by groundwater seepage, in contrast to the littoral emergent wetlands, which are almost exclusively supported by shallow groundwater associated with the reservoir. Palustrine wetland habitats (87.2 acres) were divided into aquatic bed, emergent wetland, scrub-shrub, and palustrine forested wetland habitats. Several palustrine emergent wetlands along the reservoir have very low species diversity and are dominated by dense swards of reed canary grass. Overall, species diversity is high in the palustrine emergent wetlands, with more than 150 taxa recorded during surveys conducted in 2005 (Seattle 2006). Palustrine forested wetlands occur primarily at the Boundary Wildlife Preserve, where open stands of mature black cottonwood grow on the broad floodplain. The main side channel in the terrace receives backwater during floods. In years with high spring runoff, all but the highest elevations on the floodplain are inundated.

The five cover types associated with riverine/riparian habitats include riverine, unconsolidated bottom, riverine unconsolidated shoreline, riparian grass, riparian shrub, and riparian deciduous tree (total of 61.9 acres). The mouth of Sullivan Creek is an exceptional area with extensive stands of riparian vegetation and alluvial features. Substantial amounts of riparian shrub and riparian deciduous tree cover types also occur in the upper portion of Peewee Creek where it crosses the BPA transmission line ROW. Small amounts of riparian vegetation are associated with the mouths of several other tributary streams, including Slate, Lime, Sand, Lost, Lunch, and Linton creeks.

Riverine/riparian cover types along the Pend Oreille River downstream of Boundary dam include the river itself, alluvial sediments (riverine unconsolidated bottom cover type), and the coarse, rocky shoreline (riverine unconsolidated shoreline cover type). The associated riparian vegetation consists primarily of small stands of coyote willow on islands, gravel bars, and at the upper margins of the shoreline corridor.

There are only 1.7 acres of riparian shrub and palustrine scrub-shrub in the lower reservoir because of the steep slopes, rocky terrain, and lack of suitable sediments. Riparian vegetation in the lower reservoir is limited to the few areas with moderate slopes or coves with suitable substrate conditions. Shoreline vegetation associated with managed reservoir systems can be minimal and fragmented (Nilsson and Keddy 1988), but natural physical and ecological processes (e.g., topographic variation, moisture gradients, and wildfire) also create fragmented landscapes (Saunders et al. 1991).

**Weeds**

Weeds are defined as terrestrial plant species that have been classified as noxious weeds by the Washington State Noxious Weed Control Board. In Washington, noxious weeds are defined as non-native plants that result in economic losses and adverse effects on the State's agricultural, natural, and human resources (Washington Weed Law, Chapter 17.10 Revised Code of Washington [RCW]).

Weeds are classified as follows (State NWCB 2009; RCW 17.10.010(2)):

- **Class A Weeds -** Non-native species with a limited distribution in the state. Eradication is required by state law.
- **Class B Weeds -** Non-native species established in some regions of Washington, but of limited distribution or not present in other regions of the state. Because of differences in distribution, treatment of Class B weeds varies between regions of the state. In regions where a Class B species is unrecorded or of limited distribution, prevention of seed production is required. In these areas, the weed is a "Class B designate," meaning it is designated for control by state law. In regions where a Class B species is already abundant or widespread, control is a local option. In these areas, the weed is a "Class B" with the chief goals of containment, gradual reduction, and prevention of further spread.
- **Class C Weeds -** Non-native species that are already widely established in Washington or of special concern to the state's agricultural industry. Counties may enforce control if locally desired, or choose simply to provide education or technical consultation to county residents.

Studies conducted during relicensing in 2005, 2007, and 2008, and earlier by the Pend Oreille County NWCB, documented a total of 20 terrestrial noxious weed species in and near the Project area, five classified as Class B-designate, nine Class B, and six Class C (Seattle 2006, 2009). No Class A species were found. Infestations of one or more of the Class B-designate species were mapped in six different locations. In general, the number of noxious weed species found in and near the project area is low compared to many other locations in eastern Washington, but the Class B and Class C weed species that do occur are widespread and pervasive (Seattle 2006).

In uplands, weeds are more prevalent along roads and disturbed areas. Common upland weed species include Dalmatian toadflax, cheatgrass, common tansy, common St. John's-wort, spotted knapweed, and meadow hawkweed. Weeds occur along most of the reservoir shoreline, but are especially common in the more sheltered backwaters of the upper reservoir. Ruderal weedy species dominate the sheltered areas because of their ability to tolerate daily changes in moisture compared to native plants. Common weeds in the reservoir fluctuation zone include St. John's wort, yellow flag, common tansy, oxeye daisy, Canada thistle, reed canarygrass, lanceleaf plantain, and white sweetclover. Most of these species also dominate the island complex between project

RMs 28.5 and 29.0, while all the other islands in the upper reservoir are covered in reed canarygrass. Some of the densest weed infestations consist of reed canarygrass occurring in palustrine wetlands, such as those observed in the Boundary Wildlife Preserve and other alluvial habitats along the upper reservoir. Reed canarygrass is also the dominant groundcover in willow stands along Sullivan Creek that are not influenced by the reservoir.

**Rare, Threatened, and Endangered Plant Species**

Surveys conducted during relicensing studies in 2007 documented 15 vascular Rare, Threatened, and Endangered (RTE) plant species in the project area. These species occurred in 206 polygons or subpopulations, which were combined into 53 populations.[111] Since the completion of the plant surveys, two species (*Thalictrum dasycarpum* and *Impatiens aurella*) have been removed from the Washington Natural Heritage Program (WNHP), which will likely affect their status on the federal agencies' lists when these are updated. None are listed under the Endangered Species Act.

The 2007 survey results suggest that four RTE plants are locally abundant: yellow mountain-avens, lest bladdery milk-vetch, orange balsam, and purple meadowrue. Yellow mountain avens is a predominant component of the vegetation growing on the limestone rock faces and cliffs along the lower reservoir. Least bladdery milk-vetch is relatively common on cobble bars, islands and steep eroding slopes. Large populations of purple meadowrue were observed in a variety of habitats and several large populations of orange balsam were observed in palustrine forested wetlands. Other RTE species, including hair-like sedge, adder's tongue, northern blue-eyed grass, and Steeler's rock-brake, are relatively rare, with either few populations and/or populations with few individuals.

Of the 206 RTE documented plant subpopulations, 105 (51 percent) were located in the fluctuation zone. These subpopulations represent 10 RTE plant species. Noxious weeds were also commonly associated with RTE populations. Erosion was also associated with some of the plant subpopulations.

**Wildlife Resources**

Of the total 308 terrestrial vertebrate wildlife species that potentially occur in the project area, 152 species were confirmed during relicensing studies (Seattle 2006; Seattle 2009a). The remaining 156 species may occur in the project area based on range, habitat requirements, and migration patterns. The following sections provide a summary of the wildlife documented within the project area by major groups of terrestrial vertebrates (i.e., mammals, birds, reptiles and amphibians).

[111] A list of the RTE populations can be found in table 5.4-1 of the TRMP.

Mammals

Twenty-six mammal species were confirmed to occur within the project area during the 2007/2008 field season. White-tailed deer, mule deer, and elk are the most common large game mammals and are of particular interest because of their overlapping wildlife, cultural, recreational, and commercial values. Deer are estimated at 4.1 to 4.9 animals per square mile in the project area. The Selkirk elk herd (about 1,450 individuals) occupies lands east of the Pend Oreille River, with some members of the herd commonly found in the project area (Seattle 2009a). Because the Selkirk herd has expanded its range without any corresponding population increase (*see* Big Game Study Final Report Seattle 2009a), it is hypothesized that winter range may be limiting the size of the elk population

The extent and distribution of big game hiding and thermal cover and forage habitats in the project area are strongly influenced by the age of the conifer forest stands and topography (*see* Big Game Study Final Report, Seattle 2009a). More than one-third of the 1,563-acre primary study area for the Big Game Study does not provide habitat for deer or elk because of steep slopes or lack of vegetation. This particularly true in the lower reservoir, where cliffs, rock outcrops, and slopes are effectively too steep for big game use. This is especially true along the Canyon Reach, which extends from Metaline Falls to the downstream end of Z Canyon (Project RM 26.8 to 18.0), where the average slope is greater than 100 percent. This steep terrain forces big game to follow topographic features, such as drainages, to access the reservoir. A number of big game trails and crossing sites have been mapped in the lower reservoir. The topography of the upper reservoir is less steep, and big game movement in this reach appears more diffuse.

Though less common than deer and elk, moose are also frequently observed in the project area and are thought to be increasing in abundance locally (*see* Big Game Study Final Report, Seattle 2009a). Big-horn sheep and mountain goat are known to occur more than one mile away from the reservoir, with only rare sightings in the project area. Woodland caribou are a high elevation species and may enter the project area occasionally; however, they have not been documented recently (Seattle 2006; *see* RTE Wildlife Study Final Report, Seattle 2009a). Mountain lion, bobcat and black bear are common carnivores that may occur anywhere in the project area.

Bats are commonly observed in the project area, likely due to the extensive mines, mine adits, suitable forest habitat, natural caves, and large area of foraging habitat over the reservoir (*see* Bat Study Final Report, Seattle 2009a). Potential bat roosting habitat was investigated for 24 mines, seven caves, and one bridge in the project area, and for several project-related structures, including the portals at the dam. Some roosting activity was documented at four mine locations and three shoreline caves (mostly California and Yuma myotis), and individual bats were observed in the visitor's tunnel north portal and inside the employee's tunnel (*see* Bat Study Final Report, Seattle 2009a). Ten species of bats were recorded foraging in the study area, including four rare, threatened or endangered species. Large numbers of bats were frequently observed foraging over the reservoir. These bats apparently roost outside of the project area, because few bat roosting sites were documented in the study area. Some roost sites are also potential hibernacula or maternal colony habitat, but low winter temperatures inside potential sites and low numbers of animals recorded outside of potential hibernacula suggest that surveyed sites are not suitable for maternal colonies or winter roosts (*see* Bat Study Final Report, Seattle 2009a).

<u>Birds</u>

One hundred and fourteen bird species were confirmed in the project area during field reconnaissance in 2005 and more detailed field investigations in 2007 and 2008. Another 113 species potentially occur in the project area (Seattle 2006; Seattle 2009a). The Forest Service regional species list identifies 185 bird species as resident to northeastern Washington, although some of these are quite rare (Forest Service et al. 2001).

Twenty species of waterfowl and 20 species of waterbirds (*see* Waterfowl/Waterbird Study Final Report, Seattle 2009a) were observed in the project area. Canada geese are the most common nesting waterfowl that occur in the project area. This species nests primarily on islands in the upper reservoir; only seven of 44 nests found in 2007 were in the lower reservoir. Most of the Canada goose nest production occurs on a large island at project RM 27.7.

The project area potentially supports 12 hawk and eagle species, four falcon species, and 13 owl species. The two most commonly observed raptors—bald eagles and ospreys—nest in the project area.

Riparian areas characterized by a mix of deciduous woodlands, shrublands, grasslands, and wetlands support the greatest number of bird species in the project area. Sullivan Creek and the BWP represent excellent passerine bird habitat, indicated by the large numbers of species found at these sites. Additionally, several colonies of swallows are found in the project vicinity. A large colony of cliff swallows and at least two bank swallow colonies occupy the cliffs surrounding Boundary reservoir (Seattle 2006; *see* RTE Wildlife Study Final Report, Seattle 2009a).

<u>Reptiles and Amphibians</u>

Records from the Colville National Forest (CNF) document the presence of western toads, Columbia spotted frog, long-toed salamanders, bullfrogs, Pacific tree frogs, painted turtles, western terrestrial garter snakes common garter snakes, and rubber boas in the Sullivan Lake Range District (Hallock 2003). Four amphibian and four reptile species were confirmed in the project area: the western toad, bullfrog, Pacific treefrog, Columbia spotted frog, painted turtle, northern alligator lizard, western terrestrial garter snake, and common garter snake (RTE Wildlife Study Final Report, Seattle 2009a). No use of the project reservoir by amphibians was documented (*see* RTE Wildlife Study Final Report, Seattle 2009a).

### Rare, Threatened and Endangered Wildlife

Seattle's surveys documented presence and absence and limiting factors for wildlife species in the project area. Forty-three rare, threatened, and endangered wildlife species were identified as potentially occurring in the project area; this includes state-listed species and Forest Service/BLM management indicator species. Of those, 20 species were documented in the project area and another four species likely occur in the area only as migrants. RTE species observed in the project vicinity include two amphibian, 12 bird, and six mammal species, four of which are bats (Seattle 2009a). Species listed under the Endangered Species Act are discussed in section 3.7.

The two RTE amphibian species documented in the project area were the western toad and Columbia spotted frog. Two incidental sightings of western toads were recorded near the forebay boat ramp. Columbia spotted frogs appear to be confined to wetland and seep areas downstream of the dam. No evidence of breeding by western toads or Columbia spotted frogs was recorded in the project area.

The project reservoir and shorelines provide habitat for bald eagles, osprey, great blue herons, beavers, migrating common loons, and eared and western grebes. Great blue herons are regularly observed along the reservoir; although there are no known rookeries in the project area, individual nests may occur. A heron nest was observed in the forest at the mouth of Sullivan Creek in 2009. There were three active bald eagle territories in the project area in 2005: across the reservoir from the Box Canyon Resort, near Sand Creek, and on Everett Island. Only the Everett Island nest was confirmed to fledge eaglets (two) in 2005 (Seattle 2006). In 2007, four eagle nesting territories were occupied in the project area, but only the three territories upstream of Metaline Falls were active, collectively producing at least five fledglings. The Everett Island nesting territory was occupied at various times by two adults and two juveniles. Although the nest tree was used as a roost by these eagles, no evidence of breeding was observed at the Everett Island site in 2007. In 2008, the same three territories in the upper reservoir were occupied. The Sand Creek pair failed to nest, whereas the Metaline and Box Canyon nests fledged two eaglets each. Eagles were documented on several occasions along the lower reservoir on what appeared to be two territories (near Everett Island and Slate Creek), but active nests were not found. It is possible that nesting occurred outside of the project area.

Several cave features (including natural caves and mining adits) are used by bats. The Townsend's big-eared bat roosts within the project area, and the long-legged myotis, western small-footed myotis, and long-eared myotis forage within the project area (Seattle 2009a).

A pair of peregrine falcons were observed by Settle's study teams in 2007 and 2008; Washington DFW confirmed nesting at Washington Rock in 2009. Pileated woodpeckers are widely distributed throughout the project area and a northern goshawk was recorded at Slate Creek, where there is a patch of late-seral conifer forest.

#### 3.6.1.2 Sullivan Creek Project

**Vegetation Cover Types**

The District reported vegetation cover types in the Sullivan Creek Project area as consisting of agriculture (175 acres), forest land in various serial stages (2,340 acres), and wetlands (35 acres). The forested riparian zone along Sullivan Creek is narrow due to steep banks and incised channel segments.

Upland vegetation is mostly second growth forest, with western larch, Douglas fir, western hemlock, grand fir and western red cedar the dominant overstory trees. Deciduous species occur in disturbed openings and in the narrow riparian zone along Sullivan Creek and its tributaries. White birch, black cottonwood, trembling aspen, and Douglas maple are common species. Understory plants are generally sparse, but include oceanspray, wild rose, willow, serviceberry, and a variety of grasses and forbs in shrub and grassy meadows in forest openings.

A more detailed review of vegetation associated with Mill Pond, Outlet Creek, and Sullivan Creek was completed by McMillen (2010). McMillen (2010) divided the cover types into coniferous forest, shrub and grass meadows, lacustrine/littoral, wetland, riverine/riparian, and disturbed/developed cover types. Species composition for the forested and grass meadows was similar to that reported above. Lacustrine/littoral habitats associated with Mill Pond and the confluence of Sullivan Creek and the Boundary reservoir consisted of rock bottom (around the concrete Mill Pond dam), unconsolidated bottom, aquatic bed, rocky shore, unconsolidated shore and emergent Species found in the shallow water areas of Mill Pond include Eurasian water milfoil, coonwort, and elodea. The littoral zone includes unconsolidated shoreline, emergent, and rocky shoreline. Species found on finer texture soils include yellow flag, forget-me-not, and water pygmyweed.

No wetlands were reported for the Sullivan Lake. The only wetland reported to be associated with Mill Pond is considered to be a properly functioning high quality riparian-wetland community at the head of Mill Pond. The alluvium at the outfall of the creek into the pond has be deposited and reworked over 100 years. Beavers are well established and confound any certainty about the hydrologic connectivity of the pond and wetland. The resource agencies believe the wetland is more likely to be hydrologically connected to Sullivan Creek during the majority of the year than Mill Pond (McMillan 2010).

The wetlands associated with lower Sullivan Creek are riverine that become flooded during elevated flows. These wetlands are predominately scrub-shrub and emergent; scrub wetlands are dominated by Sitka alder, with lesser amounts of red-osier dogwood, common snowberry and buffaloberry. Species found in the emergent wetlands include self heal, purple meadowrue, hairy sedge, reed canarygrass, and common dogbane.

### Weeds

Weed species described above the Boundary Project are also expected to be found in disturbed areas surrounding Sullivan Lake and Mill Pond. Knapweeds and hawkweeds are the most prevalent species around Mill Pond.

### Rare, Threatened and Endangered Plants

No federally listed threatened or endangered plants are known to occur in the Sullivan Creek Project area. However, little is known about the number, distribution, and condition of sensitive species in the area. Based on distribution and habitat requirements, the Forest Service identified 45 sensitive species that may occur in the area. Of these, only yellow sedge and bronze sedge are known to occur in the area, and from only one site.

### Wildlife

Given the proximity of the two projects and similar habitats, wildlife species expected to occur in the Sullivan Creek Project area are expected to be the generally same as those described for the Boundary Project above. Species documented occurring at the Sullivan Project include bald eagle, gray wolf, grizzly bear, caribou (sporadic sightings in the vicinity), lynx, common loon, eared grebe, Townsend’s big-eared bat, elk, mule and white-tailed deer, pileated woodpecker, and beaver.

Sullivan Lake and Mill Pond support several pairs of breeding ducks and grebes each year. Mill Pond tends to support a greater diversity of species and produce more broods than Sullivan Lake, presumably because Mill Pond has greater amounts of aquatic and emergent vegetation, shallow water areas, and areas of dense cover along its shoreline. Each year a few pairs of Harlequin ducks nest on Harvey Creek and Sullivan Creek above Mill Pond. Various neo-tropical migrant songbirds are associated with riparian shrub habitats found on the margins of Mill Pond.

### Rare, Threatened and Endangered Wildlife

Federal listed species are discussed in section 3.7. Forest Service and state listed species known or expected to occur in the Sullivan Creek Project area include: bald eagle, common loon, northern leopard frog, eared grebe, Townsend’s big-eared bat, wolverine, great gray owl, sandhill crane, peregrine falcon, Pacific fisher, and harlequin duck.

Typically a few bald eagles (1 to 5) are observed at the mouth of Harvey Creek form about mid-November through December, when kokanee are spawning in the creek. One or two birds are also occasionally seen on Outlet Creek during this period. Eagles are occasionally seen foraging on Mill Pond during the summer. Eagles attempted to nest in a snag located on Outlet Creek, about 100 yards below Sullivan Lake dam, in 2003 and 2004 species, but abandoned the nest both years. The nest site has been inactive since then.

Common loons occasionally use Sullivan Lake and Mill Pond as resting and foraging sited during migrations.  There are no known records of loons nesting on either water body.  In the spring when nesting is initiated, there is little vegetative cover near the water on Sullivan Lake within which to conceal a nest.

## 3.6.2 Environmental Effects

### 3.6.2.1 Boundary Project

Project operations have the potential to affect botanical and wildlife resources through the following mechanisms:  water surface elevation fluctuations, erosion, project maintenance activities, project-related weed infestations, and project-related recreation.  Seattle, in consultation with state and federal agencies, tribes, and non-governmental organization, developed a Terrestrial Resources Management Plan (TRMP) intended to provide for the protection, management, and enhancement of terrestrial resources occurring within the project boundary or affected by project-related operations and recreation.  Seattle also proposes to acquire within five years of license issuance and manage about 158 acres of riparian and upland habitat and about 13,022 lineal feet of varying habitats immediate adjacent to water features.

Although the Tributary Fish Community and Aquatic Habitat Measures (contained in the FAMP) proposed by Seattle are intended to address fishery resources affected by project operations, implementation of the proposed riparian and channel improvements in Sullivan, Linton, and Sweet Creeks and other tributaries to the reservoir would also affect wildlife.  Similarly, recreation improvements and road closures proposed by Seattle could affect wildlife.

Forest Service Condition 3 requires the implementation of the TRMP and the acquisition of the additional habitat lands; Interior and Washington DFW recommend implementing the TRMP and acquisition of the lands under section 10(j) of the FPA.  Forest Service Conditions 3 also requires implementing the Tributary Fish Community and Aquatic Habitat Measures and Interior and Washington DFW recommend its implementation under section 10(j).

**Terrestrial Resources Management Plan**

The TRMP establishes goals, measurable program objectives, tasks, and schedule for implementing the terrestrial resource protection, mitigation, and enhancement measures on about 1,911.4 acres of land (either currently contained within or proposed for inclusion into the project boundary) owned by Seattle, Forest Service, and BLM; the TRMP would also guide the development of specific habitat protection and enhancement measures on the additional 158 acres of riparian and upland habitat that Seattle would acquire in the future.  These lands are grouped into Project Habitat Lands (PHL—lands owned by Seattle that would be managed to benefit terrestrial plant and wildlife communities unless other management considerations/constraints are identified); Seattle Project Facility Lands (lands that support project facilities and operations, including the dam, power plant, warehouses, and approximately 3,000 feet of transmission line right-of-way (ROW), as well as project recreation facilities and project roads); other Seattle-Owned Lands (lands owned by Seattle, including small parcels, steep cliffs, or talus slopes that generally provide less habitat value than the PHLs), and Federal Lands (lands managed by the Forest Service and BLM).[112] Management of Federal Lands is and would continue to be the responsibility of the federal agencies, but Seattle would coordinate with these entities regarding weed and erosion control/monitoring and rare plant and wildlife surveys and other cooperative management actions.

The TRMP defines three primary goals for the above lands: (1) foster biodiversity, ecosystem function, and habitat connectivity within the project area; (2) manage project-related recreation and other human uses in a manner that is compatible with maintaining biodiversity, ecosystem function, and habitat connectivity; and (3) avoid, minimize, or mitigate effects on wildlife and habitat from ongoing project-related operations and maintenance and recreation. The TRMP consists of six resource management programs designed to achieve these goals: (1) Erosion, (2) Habitat Management, Enhancement, and Protection, (3) Integrated Weed Management, (4) Rare, Threatened and Endangered Plant Species, (5) Wildlife, and (6) Shoreline Management. The TRMP also describes actions Seattle would implement to improve employee awareness of environmental programs and best management practices it would implement to ensure maintenance of project facilities are conducted in a manner that minimizes adverse effects on terrestrial resources. The erosion program is described in section 3.2 and the shoreline management program is described in section 3.8.2.1. We analyze the effects of the remaining programs below.

<u>Habitat Management, Enhancement, and Protection Program, and Acquisition of Additional PHL Lands</u>

Approximately 749 acres of Seattle-owned land would be managed for the benefit of wildlife and plant communities. Key elements of the Habitat Protection, Enhancement, and Management Program include active management and enhancement of project habitat lands (PHLs), and passive management to protect the existing habitat values on PHLs and to allow the natural maturation of the relatively young mixed conifer stands. Habitat management and enhancement measures are parcel-specific and include the following: motorized vehicle access control; a wetland/riparian habitat enhancement feasibility assessment; riparian habitat management and enhancement; forest and other upland habitat management; island and shoreline access control; future

[112] The Forest Service and BLM manage approximately 606 and 314 acres of land, respectively; within the project boundary. Most of the federal ownership is located north of Metaline Falls and has a long history of being managed for timber production, mining, and resource protection.

measures for about 158 acres of PHLs that are to be acquired; and adaptive management to address changing needs to achieve the management objectives.

The 158 acres of riparian and upland habitats and 13,022 lineal feet of varying habitats immediately adjacent to water features that Seattle would acquire would be located between the near ridgelines east and west of the project. The eastern boundary roughly aligns with Boundary Ridge, Crowell Mountain, and Sand Creek Mountain and the ridge between Boundary Reservoir and Sullivan Lake. On the west side, the boundary follows a line connecting Frisco, Abercrombie, Litton, and Baldy Mountains. Seattle would apply, in consultation with the TRWG, the following objectives to identify and prioritize acquisition of the properties: (1) acquire property with high habitat diversity located immediately adjacent to or containing perennial water and secure from disturbance via open roads or towns, and/or a natural community that is relatively scarce or dwindling in the watershed, which has unique landscape or habitat elements; (2) acquire large blocks of habitat that are contiguous with other protected parcels of land, form a strong corridor link or are connected by a viable corridor to protected land; and (3) acquire property with habitats that benefit threatened and endangered species, big game, waterfowl, upland game birds (grouse and turkey), amphibians, aquatic furbearers, and neotropical migrant birds.

The Forest Service, Interior, and Washington DFW assert that these collective measures are needed to compensate for the continuing inundation of 158 acres of riparian and upland habitats within the reservoir fluctuation zone (elevation 1954 to 1994) and the loss of 6.1 acres and 24,193 lineal feet shoreline habitats from shoreline erosion. While Seattle disputes the acreage of affected lands and to some extent the degree of the project-related effect,[113] it has agreed to acquire and manage about 158

---

[113] Both Seattle and the Forest Service estimated the acreage and types of habitats that might develop if the project were operated at lower reservoir levels based on extrapolations from existing habitats adjacent to the reservoir. Seattle estimated the types of riparian vegetation and the types of habitats important to big game species that would develop over time between elevation 1,974 and 1,994 because these represent typical reservoir fluctuations. However, the Forest Service considered elevations between 1,954 and 1,994 because the project is authorized to lower the reservoir to levels as low as 1,954. The Forest Service estimates that 158 acres of riparian, conifer, herbaceous (forage), rock, talus, and cliffs would continue to be inundated over the course of the next license. Seattle estimates that 48.6 acres of habitats of value to mule deer would develop in the lower reservoir, 41.6 acres of habitats of value to white-tailed deer would develop in the lower reservoir, and 21.6 acres of habitats important to big-game species would develop in the upper reservoir. In a separate study, Seattle calculates that an additional 8.8 acres of riparian habitat would be gained if the project was operated at elevation 1,974.

acres and about 13,022 lineal feet of varying habitats to address all documented project-related effects on terrestrial resources.[114]

*Staff Analysis*

Fluctuations in water surface elevations affect the establishment and composition of the riparian vegetation community, which in turns affects its use and value to wildlife. This effect is more pronounced along the lower reservoir than the upper reservoir.

The project is allowed to operate between reservoir elevations of 1954 and 1994, a 40-foot elevation difference. However, operations typically result in reservoir elevations between 1,974 and 1,994 (a 20 foot fluctuation), depending on the time of year. While Seattle can use the additional storage below 1,974 during extreme energy loads or draw down the reservoir for maintenance, this occurs infrequently.[115] Seattle reports that between 1987 and 2005 (the period represented by the available hydrologic record) the reservoir was drawn down below the 1,974 foot elevation less than 0.25 percent of the time (about 17.5 days) and below 1,964 less than 0.02 percent of the time (equivalent to 1.5 days).

Because of the hydraulic control at Metaline Falls, there is a distinct difference in the magnitude of water surface elevation fluctuations in the upper reservoir (upstream of Metaline Falls) and the lower reservoir (downstream of Metaline Falls). Project-related water surface elevation fluctuations are attenuated by Metaline Falls; when forebay elevation fluctuations are in the range of 5 to 20 feet, corresponding elevation changes in the upper reservoir are only 3 to 4 feet, depending on inflow and forebay elevation.

Existing vegetation communities along the project reservoir reflect the current operating regime and historic land practices. Because proposed project operations would be the same over the next license, riparian vegetation and shoreline habitat would continue to be subject to similar reservoir fluctuations. Consequently, little change in these communities would be expected over the course of the next license. That is, habitats within the fluctuation zone in the lower reservoir which are generally devoid of vegetation, consist mostly of steep, rocky cliffs and slopes, and are of limited value to wildlife, particularly big game species, would be expected to continue to exhibit those

---

As stated in section 2, the baseline against which alternatives are compared is existing operations, which we do. We also evaluate the benefits of acquiring the habitats as a proposed enhancement measure that would benefit resources affected by the project.

[114] The targeted 158 acres of riparian and upland habitats and the 13,022 lineal feet of varying habitats immediately adjacent to water features could be provided on the same parcel of land, provided that the parcel meets the habitat criteria.

[115] Continually operating the project at a forebay elevation below 1974 can cause cavitation damage to the units.

traits over the next license. Likewise; lands below elevation 1,974 are essentially consistently inundated and thus devoid of terrestrial vegetation and would continue to be devoid of vegetation over the next license.

Erosion associated with water surface elevation fluctuations in the lower reservoir contributes to the reduction of the amount of fine sediment along the shoreline affecting the ability of riparian vegetation to colonize these areas. However, riparian and palustrine wetlands in the lower reservoir are naturally sparse and disconnected because of the rock cliffs and talus slopes that occur in this area. Because of the steep rocky terrain, habitats in this reach are of limited value to big game and other wildlife. This condition would continue over the next license.

Unlike the lower reservoir, flood scour is the primary factor affecting the occurrence and distribution of shoreline vegetation in the upper reservoir (*see* Riparian Study Final Report, Seattle 2009a). Daily water surface elevation fluctuations can promote cottonwood seed germination at inappropriate elevations, or produce river stage declines that are too rapid for cottonwood seedlings to establish (Mahoney and Rood 1998). However, the majority of cottonwood stands in the project area are located in the upper reservoir, and project-related water surface elevation fluctuations do not appear to be adversely affecting these stands. On the Boundary Wildlife Preserve, periodic flooding of backwater channels is likely a factor in maintaining cottonwood stands and some level of recruitment in this area. Seedlings or saplings were found in 79 percent of the acreage supporting mature cottonwood trees, suggesting that this species is reproducing and establishing. There was only one riparian stand (at the mouth of Sullivan Creek) where erosion was a management concern, but seasonal flood-related scouring was determined to be the primary source of the erosion at this site, and daily water surface elevation fluctuation a secondary source. Reservoir fluctuations in the upper reservoir do not appear to be significantly reducing wildlife habitats; and would not be expected to do so in the future due to the similarity of continued project operations.

Approximately 14 to 15 acres of land adjacent to the shoreline have been lost over the past 40 years due to project-related erosion (Erosion Study Final Report, Seattle 2009a). Upland coniferous forest is a common habitat type in the project area and is the habitat most affected by erosion. Thus, loss of such habitat will have a relatively minor adverse effect over the term of the new license on any species that use this habitat. A small portion (an estimated 10 percent) of the 15 acres of erosion projected over the next license period would occur in riparian habitat, based on the analysis of past erosion. Continued effects on this habitat would have a corresponding effect on wildlife that use these areas.

Management of riparian and upland habitats on project lands and other Seattle-owned lands adjacent to the project over the course of the last license has been primarily one of preservation, with some control of recreational pursuits that could harm wildlife habitats in the Boundary Wildlife Preserve. The measures proposed within the TRMP would improve habitat conditions over most project lands by controlling recreational vehicle access where needed to prevent damage to valuable wetland and riparian communities,[116] creating openings and forage for big game, enhancing wetland habitats associated with several ponds within project boundary (if feasible), enhancing riparian areas associated with the Boundary Wildlife Preserve, Everett Creek and Tailrace Recreation Area through native vegetation plantings, improving upland habitats via measures to increase habitat diversity (e.g., creating small openings in the canopy to increase the amount of herbaceous vegetation and deciduous trees and shrubs), protecting Canada goose nesting sites on Metaline and Rat Islands by installing signs prohibiting access during the Canada goose nesting season from March 15 through May 15, and educating the public about sensitive resources that could be damaged from camping outside of designated use areas by installing signs at specified locations along the reservoir. Measures would be monitored to determine their effectiveness in achieving stated objectives, and the TRMP revised as needed to reflect any new or revised management actions.

The acquisition and management of about 158 acres of project habitat lands could further benefit wildlife resources, some of which may also use project lands. Given the priorities for selecting the habitat lands, it appears that Seattle and other interested stakeholders are targeting species that have large home ranges and would benefit from seclusion from human disturbance (such as elk, mule and white-tailed deer, grizzly bear, woodland caribou, lynx, and gray wolf). As noted in section 3.7, *Threatened and Endangered Species*, use of the project area by grizzly bear, woodland caribou, lynx and gray wolf is limited and used primarily as a travel corridor. However, some localized and temporary disturbance associated with project operation and maintenance, project-related recreation, and implementation of proposed conservation measures may occur. Acquisition and management of the lands proposed by Seattle would off-set these minor effects. Further, as noted above, there is limited wintering habitat in the project area for big game, particularly along the lower portion of the reservoir. Accessible winter range is limited in northern Pend Oreille County and snow depths restrict elk movements and often limit use to open clear-cuts and shrub forage to areas below 3,500 feet elevation (Washington DFW 2001). Seattle is proposing habitat improvements that would improve winter forage for big game on project lands, but there are limited opportunities within the project boundary. Further, recreational pursuits (snowmobiling, boating, hunting, etc.,) on project lands may further limit the use of these areas.

---

[116] ORV and snowmobile use at the Boundary Wildlife Preserve was documented several times during 2005 and 2007 field studies. This recreation use has harmed wetland and riparian vegetation by creating ruts and erosion patches primarily within areas dominated by reed canarygrass. The impacts from ORV use are currently minor although it represents a potential ongoing and future threat to sensitive riparian and wetland vegetation at the Boundary Wildlife Preserve.

The Selkirk elk herd represents an important resource that provides significant recreational, aesthetic, cultural and economic benefit to Washington citizens and to the Native American people of the area (Washington DFW 2001). Although significant strides have been made in the county to benefit this herd (Washington 2010) and the habitat improvements proposed by Seattle on project lands would add to those benefits, the acquisition and management of additional lands could further state management objectives for the herd.

Given that project reservoir fluctuations would continue to preclude the development of riparian and upland vegetation habitats within the fluctuation zone, project-related erosion would continue to remove available habitats, disturbance from project-related recreation could limit use of project habitat lands, and that some important habitats (i.e., wintering habitats for big game) are in limited supply, acquisition and management of additional lands by Seattle could improve conditions for the species discussed above and promote the recovery of listed species.

The area from which these lands would be acquired includes lands within a few miles of the project, but are unaffected by the operation of the project; thus, the habitats and the resources they support may bear no relationship to the project. Adhering to the criteria identified in the settlement agreement would help ensure a connection to resources affected by the project. However, until the lands are identified, there is little information on the record to determine exactly what those benefits would be, if there are lands of the quality and quantity sought that could be acquired and at what cost, or the relationship of the lands and resources to the project.

Integrated Weed Management

Noxious weeds and other invasive plant species can negatively affect native plant communities and wildlife, as well as recreation, aesthetics, cultural values, and economic resources. Several federal, state, and county policies and regulations have been developed to address concerns about the spread of weeds, and to guide management of weeds on private and public lands. Landowners in the state of Washington are required by state law and various county ordinances to take steps to control the spread of certain specified noxious weeds on their property.

A number of project-related factors may influence the establishment and spread of noxious weeds, but it is difficult to quantify the effect: reservoir fluctuations may create conditions that are better tolerated by invasive species; vehicle traffic may be aiding the dispersal of weeds along project roads, although the level of project-related road traffic versus non-project-related use is unknown; and recreation users may also be a factor in dispersal of terrestrial and aquatic weeds.

To control the spread of noxious weeds on project lands, Seattle proposes to develop and implement, as a component of the TRMP, an Integrated Weed Management Program (IWMP) that includes monitoring, control, suppression, and containment of terrestrial noxious weed species in order to maintain or achieve diverse and naturally functioning plant communities in the project area. Aquatic weeds are not included in the IWMP but are addressed under the Aquatic Invasive Species Control and Prevention Plan.

Specifically, the plan includes: (1) conduct within one year of license issuance an initial inventory to update information regarding the locations of existing weed infestations and then re-inventory every three years to identify areas where new weeds or new infestations have become established: (2) develop and implement within three years of license issuance an integrated program to minimize the establishment of noxious weeds in the project area and along roads and in recreation areas covered by the TRMP; and (3) develop site-specific treatment plans to eradicate, suppress, or contain infestations of Class A and Class B-designate weed species on Seattle lands within the project boundary and along roads and at recreation areas covered by the TRMP, and on federal lands within the reservoir fluctuation zone, and initiate and monitor the effectiveness of control measures within three years of license issuance..

The Forest Service Condition 3 requires development and implementation of IWMP and Interior and Washington DFW recommend its implementation under section 10(j) of the FPA.

*Staff Analysis*

Prevention of introduction and spread of weeds relies on early detection, effective treatment, on-going education of land managers and the public about weed issues, and proper planning and management of ground disturbing activities. Monitoring existing weed populations and patrols to identify new infestations are essential to evaluate the success of the steps being taken to control and prevent the spread of weeds.

Control and effectiveness monitoring tasks defined in the IWMP would focus on the noxious weed species that are required for land owner control, i.e., Class A and Class B-designate species. It would also include diffuse knapweed and yellow flag iris which are Class B and C species, respectively, but are not yet well established around Boundary reservoir. There is no single treatment method for effectively controlling weeds. Treatment methods proposed in the plan include manual, mechanical, cultural, chemical, and biological techniques. Any use of herbicides and pesticides would be limited; screened based on toxicity to birds and bees, aquatic toxicity, mobility, persistence, neurotoxicity, endocrine disruption, reproductive effects and carcinogenicity; and applied in accordance with specified labels. Effective control may require integrating several treatment methods depending on the species, the characteristics and location of the infestation, and site objectives for the infestation. Site objectives can range from complete eradication, to containing the spread of the species, to suppressing the population.

Seattle's IWMP would likely help control existing weed populations and prevent the introduction and spread of weeds in the project area. The adaptive nature of the plan would enable the plan to be responsive to changing conditions such as changes in weed status, occurrence, or distribution.

Rare, Threatened and Endangered Plant Species Program

The 2007 survey identified several factors that may be affecting populations of rare vascular plants:  reservoir fluctuations, competition with noxious weeds, erosion, recreation, and project maintenance.  Because the results were based on one year of survey, stakeholders felt that additional monitoring was needed to document population trends.

Seattle, in consultation with relicensing participants, agreed to develop a RET program as an integral part of the TRMP that includes:

- qualitative surveys to evaluate distribution and population trends for widespread RTE species in the project area;
- censuses to monitor trends of discrete RTE plant populations that could be significantly affected by disturbance because of their rarity and limited distribution in the project area;
- sampling to assess the distribution and density of invasive, non-native plant species; and
- surveys in areas that are significantly affected by a natural disaster, such as a large-scale wildfire.

Specifically, Seattle would (1) conduct qualitative surveys within two years of license issuance and then once every six years thereafter to evaluate the distribution and population trends for widespread RTE plant species in the project area; (2) conduct a census within two years of license issuance and then every three years thereafter to evaluate the distribution and population trends for RTE plant species with limited distribution in the project area; (3) conduct an extensive survey following a catastrophic event in the project area to determine effects on RTE plants and identify appropriate restoration measures; (4) update the project database following each survey or census and coordinate with TRWG to ensure that RTE plant data are current; and (5) use the findings from RTE plant species monitoring surveys and censuses to inform project-related recreation management, with the goal of protecting RTE plant populations.

The Forest Service requires the development of the RTE program, and Interior and Washington DFW recommend its development pursuant to section 10(j) of the FPA.

*Staff Analysis*

Ten RTE plant species, representing about half of the RTE subpopulations are located in the project’s typical fluctuation zone.  The presence and persistence of these species in the fluctuation zone suggests that they are adapted to variable hydrological conditions, including those conditions created by existing project operations.

Regardless, although some plants, especially annual species, might not be killed directly, prolonged inundation during critical flowering and fruiting times could pose a threat to the reproductive success of some individual plants during some years. It is difficult to assess the potential RTE plant habitat that has been affected by project-related water surface elevation fluctuations, but it is likely that these fluctuations have, and will continue to have, some limiting effect on the distribution of RTE plant species over the term of the new license.

The most significant potential effect to RTE plant populations in the project area appears to be competition with weeds, especially in the fluctuation zone, where many populations of RTE plants occur. The influence of existing project operations on the establishment, persistence, and spread of weeds is unknown, as is whether RTE plant population sizes are increasing, decreasing, or remaining constant.

As noted by the Forest Service, the overall effect of recreation on RTE plant populations is low. A total of 29 plant sites are in the vicinity of recreation sites, but the effect of project related recreation on RTE plants at these sites appears to be low. Most recreation use occurs in areas that do not support RTE plant populations or the recreation sites are large enough that the use is fairly diffuse.

Similarly, project maintenance activities do not appear to adversely affect RTE plants because few RTE plants occur near project facilities. Although project maintenance activities occur near some RTE sites, no effects were observed.

Seattle's proposed RTE plant monitoring program would achieve the objectives of the settlement parties, would help identify when additional protection or restoration measures related to project operation, maintenance, and recreation are needed, and would help ensure that populations of these rare plant communities will continue to thrive on project lands.

<u>Wildlife Program</u>

The TRWG identified three wildlife species that they believed would potentially benefit from long-term monitoring: bald eagle, peregrine falcon, and bank swallow. Seattle developed and proposes to implement a Wildlife Program that includes the following:

- annual bald eagle nest monitoring surveys;
- management plans for bald eagle nests affected by project-related activities;
- surveys for peregrine falcon and bank swallows; and
- document wildlife observations in the project area.

Specifically, Seattle would (1) monitor bald eagle nesting sites annually by conducting two bald eagle nest surveys, one early in the season (April) and one late (June) of each year to determine occupancy of known nest sites and report the results to

Washington DFW; (2) prepare and implement within three years of license issuance management plans for bald eagle nest sites documented within the project boundary; (3) monitor peregrine falcon breeding at identified cliff locations and bank swallow colonies along and immediately adjacent to the reservoir shoreline. For bank swallows, Seattle would conduct one nest survey annually during the breeding season (late May or early June); for peregrine falcons, Seattle would survey the following sites up to two times between April 15 and May 15 to determine occupancy (only one survey will be needed if occupancy is determined during the first survey): Washington Rock (known eyrie) and the cliffs along the reservoir 0.5-1 mile north of Washington Rock; the cliffs along the "Narrows" in the Canyon Reach near the BLM campground; Boundary tailrace; east cliff face, Boundary tailrace, west cliff face; and the cliffs along the reservoir 0.5-1 mile north of Washington Rock. If any occupancy is determined, Seattle would monitor each occupied site up to two times between June 10 and July 10 to determine nest success/productivity.

The Forest Service Condition 3 requires implementation of the Wildlife Program as mitigation for project-related recreational disturbance and to meet Forest Service management directions of preventing authorized actions from causing a species to move toward listing and to maintain viable populations in the area. Washington DFW and Interior also recommend implementation of the program pursuant to section 10(j) of the FPA.

*Staff Analysis*

Certain types of recreational activities (e.g., motorized boating, ORV use, and shooting guns) in the vicinity of bald eagle nests have the potential to adversely affect breeding behavior and nest success. The FWS (2007) has developed guidelines for managing disturbance around active eagle nests. These guidelines recommend restricting ORV use, loud boats, and camping activity within 330 feet of active bald eagle nests, especially during critical periods.

Eagle response to recreationists is apparently dependent on site conditions, level of acclimation, age of the bird, season, and other factors (Knight and Gutzwiller 1995). According to the Seattle Audubon Society (2008), there were more than 550 active bald eagle nests in Washington in 2008. Many productive nesting territories are in urban settings and along lakes and other water bodies, such as Hood Canal and the San Juan Islands, which are used extensively for recreational boating. Therefore, threats to eagles from boat noise or other recreational activities must be evaluated in the context of the susceptibility of the specific breeding pair to disturbance at different times of the nesting cycle. The most critical periods relative to eagle nest disturbance are the initial nest-building, egg-laying, and incubation periods. In the project area, this period runs from January to April, when there is little boat or camping activity on the reservoir. At the Boundary Wildlife Preserve, snowmobile activity may occur during these months and may pose a threat to the Sand Creek nest territory (although the nest is more than 800 feet north of the BWP. In addition, erosion may undercut a tree used for nesting along Sand Creek; however, they have nested in two other trees in the Boundary Wildlife Preserve in the past and other suitable trees are available. Proposed monitoring and management plans would help determine if management actions are warranted to protect the bald eagle.

Seattle did not identify any project-related effects to the pair of peregrine falcons that nest on Washington Rock, located high above the project reservoir and outside the project area and near Metaline Falls. However, peregrine falcons are likely to forage on birds and waterfowl over the reservoir and shorelines, and therefore may be susceptible to disturbance from recreational boating or other recreational pursuits in the Canyon Reach and tailrace recreational areas. Annual monitoring would help to determine if these birds are successfully expanding their distribution and if management actions to minimize recreational disturbances are needed.

Two colonies of bank swallows are located along the project reservoir. These colonies appear to benefit from erosion processes. However, they too forage over the reservoir. While recreational pursuits do not appear to be affecting these colonies, additional monitoring would help to determine if management actions are warranted.

**Tributary Fish Community and Aquatic Habitat Measures, Recreation Measures, and Road Closures**

Over the course of the license, Seattle proposes to implement a number of tributary enhancements to improve spawning, rearing, and foraging for native salmonids. These activities would consist of placing large woody debris and boulders in streams, replacing culverts that are barriers to fish migration, and planting native riparian tree species to stabilize bank slopes and increase overhead shade. Actions would occur in Sullivan Creek, Outlet Creek, Linton Creek, Sweet Creek, and other lesser tributaries as identified.

Seattle also proposes to implement a number of recreational improvements, such creating trails, extending boat launches, etc. (discussed in greater detail in section 3.9). Seattle also proposes to close portions of several roads no longer needed to monitor wells.

The above activities would increase human activity and noise in the area of the actions, potentially result in some vegetation disturbance, and result in soil disturbance that could foster the spread of weeds. Wildlife could be temporally displaced and their behavior altered during the construction periods. Vegetation and erosion effects are expected to be minor, short-term, and localized and controlled through appropriate best management practices. Over the long-term, wildlife associated with riparian habitats would likely benefit from the riparian habitat improvements and from the road closures.

**Mill Pond Dam Site Monitoring and Maintenance**

Following the removal of the Mill Pond dam and stream channel restoration efforts by the District (discussed further below), Seattle would, in conjunction with its other monitoring efforts defined in the FAMP, monitor and maintain the Mill Pond dam site.  This would entail monitoring the site to asses stream channel, floodplain, and upslope conditions to determine if any structure or plantings fall below the success levels established during implementation planning, which as proposed by the District is 80 percent survival of planted trees and 50 percent canopy cover of shrubs.  Seattle proposes to develop detailed plans and protocols for monitoring and maintenance in consultation with the Fish and Aquatic Working Group and subject to approval by the Forest Service and Ecology.  Seattle would conduct monitoring at the site in years 2, 4, 6, and 10 following the end of the Commission's jurisdiction over the District's Sullivan Creek license and at eight-year intervals for the remainder of its license.

Forest Service 4(e) conditions would require Seattle to monitor Mill Pond site. Interior and Washington DFW recommend pursuant to section 10(j) that Seattle monitor the site.

*Staff Analysis*

Seattle is proposing a suite of measures to re-establish and enhance aquatic habitats in Sullivan Creek above and below Mill Pond.  Establishment of native vegetation and a functioning stream channel at the Mill Pond site is critical to achieving the settling parties' goals for the Sullivan Creek system.  Assuming the surrender becomes effective within eight years of the Commission's order approving the surrender (i.e., five years to complete dam removal and 3 years of monitoring), Seattle's monitoring program would begin to provide information in years 10, 14, 16, 18, and every eight years thereafter for the life of the license.  Seattle's proposed monitoring would extend from the point after the period of most rapid change and stabilization of the system, well into the period when the vegetation community is developing its more defining characteristics.  Seattle's monitoring program would help determine if additional measures are needed to ensure the effectiveness of its enhancement measures However, specific monitoring criteria still need to be developed.

#### 3.6.2.2 Sullivan Creek Project

Activities associated with the surrender of the Sullivan Creek Project have the potential to affect botanical and wildlife resources through the following mechanisms: changes in the operation of Sullivan Lake, disturbance associated with the installation of the Sullivan Lake cold water release structure, changes in habitat and species composition associated with the removal of Mill Pond and the restoration of Sullivan Creek, disturbances associated with construction activities associated with dam removal and site restoration, and erosion.

The District filed a draft Mill Pond decommission plan that generally describes the measures it would implement to limit adverse effects on surrounding vegetation and wildlife and to restore Sullivan Creek following removal of Mill Pond dam.  This includes minimizing the area of disturbance, using best management practices to control erosion, revegetating with native species, controlling noxious weed establishment, and monitoring for three years to ensure 80 percent survival of trees and 50 percent canopy cover of native species 3 years after planting. The District would file a final plan once detailed engineering design is completed.

The Forest Service and Washington DFW recommend the removal of Mill Pond. No other specific recommendations were filed.

Below we discuss potential effects associated with future operations of Sullivan Lake and removal of Mill Pond dam.

**Cold Water Intake on Sullivan Lake and Sullivan Lake Operations**

Human activity and noise would increase during the installation of the cold water intake, which could displace wildlife from the construction area and disrupt their normal behavioral patterns. The increased noise and human disturbance would be short-term and localized to the area near the Sullivan Lake dam, where some level of human use is already occurring due to maintenance activities of the dam and road use.

Sullivan Lake operations following the surrender of the license would be similar to current operations in that summer lake elevations would remain the same. The fall drawdown period would begin about one month earlier, immediately after Labor Day weekend instead of October 1, and winter lake elevations would be held five feet higher (2,570 as opposed to 2,565). During years when higher than average runoff is expected, lake levels would be held down a little longer (May 20) to move bedload in Harvey Creek. No direct effects on wildlife or vegetation would be expected from these operational changes. The operational changes are proposed, in part, to improve kokanee spawning and lake productivity. If successful, wildlife (e.g. bald eagles) may indirectly benefit from an increase in available forage and their use of Sullivan Lake may increase.

Minimum discharge flows from Sullivan Lake would also increase. Riparian vegetation associated with Outlet and Sullivan Creek would likely benefit from the increase in available water. The degree of benefit would depend on the stream reach, with the greatest benefit occurring in the less incised segments of the streams.

**Mill Pond Dam Removal and Restoration of Sullivan Creek**

The District proposes to remove Mill Pond dam and restore Sullivan Creek from the dam to the confluence with Outlet Creek. The 63-acre pond and Sullivan Creek upstream to the confluence with Outlet Creek would be stabilized and planted with native vegetation. About 0.5 acres of upland coniferous forest would be permanently removed for construction access and the proposed siphon pipe over the existing dike. Portions of the wetland at the head of Mill Pond would likely be disturbed during grading to restore the stream channel. The 0.25-mile reach of lower Sullivan Creek above Mill Pond will be stabilized to prevent erosion. Riparian vegetation within this reach would receive temporary and some permanent effects from trampling and clearing for construction access. Once construction is complete, disturbed areas would be planted with native vegetation, limiting long-term disturbance effects.

The draft Mill Pond decommissioning plan contains a generalized approach for establishing native vegetation in upland areas and in riparian areas. Four planting zones are identified based on hydrology: riparian zone (edge of stream channel up to 5-year flood), wet zone (wetland area near inlet with Sullivan Creek and from stream channel up to 2-year flood), upland zone (above 5-year flood), and sediment depositional zone (areas above the 100-year flood elevation where sediment removed from the channel would be placed in compacted layers). Species composition, planting methods (i.e., hydroseeding, live stakes), and desired functions (e.g., stabilizing soils, habitat) are described generally for each zone. The District would monitor the site for three years following completion of dam removal to ensure 80 percent survival of trees and 50 percent canopy cover of native species. The District's proposed time frames are consistent with generally accepted practices for ensuring site stabilization and successful establishment of vegetation (FISRWG, 1998).

The District's approach would likely establish a functioning, viable stream channel and riparian zone valued by wildlife. However, more details, based on site-specific conditions are needed to fully evaluate the efficacy of the proposed plans. Such details would include (1) site preparation and design details; (2) detailed provisions for site stabilization; (3) a description of plant species to be used and where they would be planted, the source of plant materials, planting densities and methods, and fertilization and irrigation requirements; (4) a description of methods to control noxious weeds for 3 years after dam removal; (5) a description of a 3-year monitoring program, including the proposed performance standards and success criteria, of 80 percent survival of trees and shrubs and 50 percent canopy cover of native species after 3 years from the date of planting; (6) procedures to be implemented if monitoring reveals that establishment of vegetation is not successful or areas of erosion are identified, including the need for additional monitoring; and (7) an implementation schedule.

Removal of Mill Pond would eliminate the lacustrine/littoral habitats and any wetlands along the edge of Mill Pond; the lake bed and stream channel would be converted to upland and riparian habitats. The wetland complexes along lower Sullivan Creek and at its confluence with the Boundary Reservoir would not be affected because the hydrology pattern would remain constant during construction and restoration efforts. The lake bed and stream channel would be restored and planted with native upland and riparian species. Monitoring would be conducted both to ensure that the restored stream channel and wetland are functioning as intended.

Soil disturbance from construction activities could create conditions favoring colonization by noxious weeds. In addition, Sullivan Creek could transport weed seeds downstream to Mill Pond, affecting the quality of the restored stream channel and associated uplands. Noxious weeds in the construction area would be sprayed or removed prior to construction. The District would also apply best management practices to control the spread and growth of noxious weeds. The District would develop a noxious weed control plan that would cover pre-, during, and post-construction time periods (McMillan 2010). This plan should be filed with the Commission.

No rare, threatened, or endangered plant species have been identified in the Mill Pond area; however a site survey has not been completed. The District would conduct a survey prior to construction, and if any such plants are found, efforts would be made to minimize adverse effects (McMillan 2010).

Increased human activity and noise would be likely to disturb and displace wildlife. Most large animals, such elk, deer, wolf, etc., will avoid the Mill Pond construction area for the duration of the construction period. Mill Pond dam is proposed to be removed and the site restored within five years of the Commission's surrender order. The most significant disturbance would occur for only a portion of that period. McMillen (2010) expects that the surround conifer stands and intervening topography will limit noise from heavy equipment, pumps, and motors to about 0.25 miles. Small and medium sized animals would also be temporarily displaced during construction, or may be lost by direct mortality or from lost habitats.

Some changes in wildlife species composition and use of the Mill Pond site would also be likely following removal of the pond. Species favoring lake habitats, such as loons, waterfowl, ducks and bats, would be replaced with species favoring stream riparian habitats, such as harlequin ducks. Wildlife using habitats in the lower Sullivan Creek are not expected to be affected by removal of Mill Pond because the hydrology would remain the same during construction.

Any rare, threatened, or endangered species in the project area would likely be affected as described generally above for wildlife. If any such wildlife species are found to be dependant on the habitats associated with Mill Pond, the District proposes to relocate, if possible, these species prior to construction (McMillen 2010). The District would also use best management practices, noise reducing equipment, and restrict construction times to avoid direct or indirect effects on RTE species (McMillen 2010).

#### 3.6.2.3 Cumulative Effects

The effect of relicensing the Boundary Project and the surrender of the Sullivan Creek Project on wildlife and wildlife habitats is expected to be beneficial. A number of variables contribute to dispersal of weeds in the vicinity of both projects and the larger Pend Oreille watershed, which include ground-disturbing activities, aquatic and terrestrial recreation, road use, and the presence and operation of hydroelectric facilities. It is likely that weed populations in the watershed are increasing due to continued influence by these activities and construction activities associated with both projects could contribute to their spread. However, use of appropriate control measures and implementation of Seattle's integrated weed program would minimize these effects and is consistent with Pend Oreille County objectives of controlling the spread of noxious weeds.

Although minor effects to individual RTE plants were identified in the Boundary Project vicinity, no effects were noted on a population level. Human activities in the watershed are likely having continued effects on RTE plants and wildlife through habitat loss and degradation, but the Boundary Project does not appear to be cumulatively contributing to these effects. Some RTE habitat loss could result in the counties where additional development occurs from the additional water supplied by the District to Ecology's Columbia River program, but these effects would accounted for at the project specific level, as indicated in Ecology's EISs.

Cumulative effects to riparian habitat in the watershed occur from shoreline development, habitat degradation, operation of hydroelectric facilities, road building and associated slope stabilization, shoreline erosion, and alteration of the sediment load of the river by dams. Upland vegetation is similarly affected by development and corresponding habitat removal and degradation. Erosion of up to an estimated 15 acres of upland habitat over the course of the new license would cumulatively contribute, albeit slightly, to effects on botanical resources in the watershed. Land clearing activity in the basin is likely to continue to affect the distribution of weeds and rare plants and have continued effects on the extent, distribution, and composition of vegetation communities, including riparian habitat. Land clearing can be caused by timber operations, residential and commercial construction, and mining.

Seattle's TRMP establishes management goals for all Seattle-owned lands and describes protection, enhancement, and monitoring efforts designed to benefit botanical resources on lands within the Project boundary. These efforts would reduce cumulative effects on botanical resources in the basin by decreasing the contribution of project-related factors.

Boundary Project operations contribute to minor, long-term cumulative adverse effects on shoreline vegetation, which have a corresponding effect on the ability of the watershed to support certain wildlife species. However, on a basin-wide and cumulative scale these effects are insignificant. Vegetation loss and modification from development, road building and maintenance, recreation, and operation of hydroelectric facilities in the basin cumulatively affect the distribution and quality of shoreline habitat for wildlife. Land clearing in the basin from residential and commercial development, timber harvest, and mining are likely to continue to cumulatively affect wildlife habitat. The Boundary Project also has a minor adverse effect on wildlife use of land within the project boundary because of associated roads and shoreline recreation. The Boundary Project's contribution to cumulative effects related to wildlife disturbance is insignificant. The removal of Mill Pond dam and the restoration of Sullivan Creek would improve habitat in the basin.

## 3.7 THREATENED AND ENDANGERED SPECIES

Three wildlife species and one fish species listed as threatened or endangered under the ESA may occur in the vicinity of both the Boundary and Sullivan Creek

Projects: Canada lynx, grizzly bear, woodland caribou, and bull trout.  On May 5, 2011, the gray wolf in eastern Washington was removed from the FWS's list of threatened and endangered species.  Therefore it is not subject to the protection of the Endangered Species Act.  Nonetheless, given the interest in this species and because the analysis is still accurate, we left the analysis of project effects on the gray wolf in this section.  No federally listed or proposed threatened or endangered plant species are known to occur in the vicinity of the projects.  (letter from Preston Sleeger, Regional Environmental Officer, FWS to Kimberly Bose, Secretary, FERC, dated October 4, 2010).

### 3.7.1 Affected Environment

#### 3.7.1.1 Action Area

For the bull trout, the Action Area extends from the Canada border, which is about 1 mile downstream from the Boundary dam in the Seven Mile Reservoir, upstream to the headwaters of the Boundary Project located just downstream from the Box Canyon dam.  The Action Area also includes all tributaries that flow into Boundary Reservoir, including Sullivan Creek.

For terrestrial threatened and endangered species, the Action Area includes the entire area within the FERC Project boundary and lands proposed for inclusion within the project boundary as described in the TRMP (project area).

#### 3.7.1.2 Bull Trout

In section 7.3.1 of the Boundary and Sullivan Creek settlements, the FWS indicates that it anticipates that the measures in the respective settlements would be adequate to:  (a) avoid a jeopardy finding for bull trout; (b) avoid a finding of destruction or adverse modification of designated or proposed critical habitat for bull trout; and (c) minimize incidental take of bull trout.  Due to the operational provisions of the settlements (i.e., instream flows and impoundment fluctuations), as well as the proposal to surrender the Sullivan Creek license and remove the Mill Pond dam, we consider the effects of the aforementioned actions on the bull trout inhabiting the Pend Oreille River and its tributaries.

**Ecology and Life History**

Bull trout are members of the char subgroup of the salmon family, which also includes the Dolly varden, lake trout, and Arctic char.  They can grow to more than 20 pounds in lake environments, while bull trout that live in streams rarely exceed 4 pounds.

Bull trout reach sexual maturity at 5 to 6 years of age during spawning migrations to their natal streams (Scholz *et al.*, 2005).  Bull trout are iteroparous and repeat spawning annually or in alternate years.  They spawn in the fall after temperatures drop below 48° F (8.9 ºC).  In the Salmo River, which has its confluence with the Pend Oreille River at RM 12.7 (about 4.3 miles downstream from the

Boundary dam), bull trout spawning migrations begin in June through early August, spawning peaks during early September, and post-spawning migration to overwintering habitat is completed by the end of November (Baxter and Nellestijn, 2000; DuPont *et al.*, 2007). Few bull trout from the Salmo River are known to enter Seven Mile Reservoir. However, one Salmo River bull trout was captured, and another detected via telemetry, in the Boundary dam tailrace in 2008, suggesting that some remnant of an adfluvial life history pattern may still be present in the population.

Bull trout spawn in streams with cold, unpolluted water, clean gravel and cobble substrate, and gentle stream slopes. Bull trout spawning sites are characterized by low-gradient, uniform flow, and gravel substrate between 0.2 - 2.0 inches in diameter (Wydoski and Whitney, 2003; Fraley and Shepard, 1989). Groundwater influence and proximity to cover are also reported as important factors in spawning site selection (Fraley and Shepard 1989). Studies conducted throughout the species' range indicate that spawning occurs in water from 0.75 to 2.0 feet deep (Wydoski and Whitney, 2003; Fraley and Shepard, 1989) and often occurs in reaches fed by streams or near other sources of cold groundwater (Pratt, 1992).

Bull trout require a long period of time from egg deposition until emergence (4-5 months). Rieman and McIntyre (1993) indicate that optimum incubation temperatures are between 35.6 and 39.2 °F (2 and 4 ºC) . The alevins remain in the streambed, absorbing the yolk sac, for an additional 65 to 90 days after hatching (Pratt, 1992). Emergence from the streambed occurs in late winter/early spring (Pratt, 1992). High levels of fine sediment in spawning substrates reduce embryo survival, but the extent to which this affects bull trout populations is not entirely known (Rieman and McIntyre, 1993). Long winter incubation periods for native char embryos and alevins make them particularly vulnerable to increases in fine sediments (FWS, 1998).

Some bull trout may live near areas where they were hatched. Others migrate from streams to lakes, reservoirs (or, in the case of coastal populations, salt water). Scholz *et al.* (2005) summarized the available information on juvenile bull trout migratory behavior. They concluded that most migratory bull trout outmigrate from tributaries at age 2 to 3 and at a size of 6.7 - 11.8 inches. Juvenile outmigration from tributaries to Lake Pend Oreille peaks during May, but information from other areas (i.e., Flathead River, Metolius River, Mill Creek) shows that some juveniles also outmigrate in early to late summer.

Migratory bull trout attain a greater size than resident stream fish. However, lakes and reservoirs are not good spawning habitat, so migratory bull trout may swim considerable distances to spawn when habitat conditions allow. Bull trout typically occur in steeper gradient, more upstream reaches than other salmonid species.[117] Adult bull trout have a greater ability to navigate waterfalls and cascades that impede the upstream migration of many other salmonid species. Rather than exhibiting unusual leaping abilities, bull trout have been observed to seek out channel margins and bypass falls during high flow events or to burrow through logjams to ascend to upstream reaches. Bull trout can also exhibit a patchy distribution, where they are found in only some tributaries or reaches within a watershed (Watson and Hillman, 1997; Baxter, 1995).

Small bull trout eat terrestrial and aquatic insects but shift to preying on other fish as they grow larger. Large bull trout are primarily fish predators. Bull trout evolved with whitefish, sculpins and other trout and use all of them as food sources.

**Distribution**

Historically bull trout occurred throughout the Columbia River Basin, east to western Montana, south to the Jarbidge River in northern Nevada, the Klamath Basin in Oregon, the McCloud River in California and north to Alberta, British Columbia, and possibly southeastern Alaska. Today bull trout are found primarily in upper tributary streams and several lake and reservoir systems; they have been eliminated from the main stems of most large rivers. The main populations remaining in the lower 48 states are in Montana, Idaho, Oregon and Washington with a small population in northern Nevada. Bull trout are now extinct in northern California.

Gilbert and Evermann (1894) observed that bull trout were "abundant in the Pend Oreille River" during their surveys in the late 1800s. Smith (2000), in his ethnography of the Kalispel Tribe, noted that "char" (presumably bull trout) were a component of the Tribe's subsistence along with other resident fish (suckers, trout, chub, and whitefish) and salmon captured near the Salmo River and Kettle Falls. However, there are currently no bull trout spawning populations in the Action Area (Pend Oreille river mile [RM] 17.0 to RM 34.5) and tributaries, although individual bull trout are occasionally observed (*see* table 2.3-3 in Seattle's March 2010 Draft Biological Assessment).[118]

---

[117] Bull trout may occur in greater densities in these higher gradient reaches to avoid higher water temperatures in downstream reaches, and possibly because of an inability to compete effectively with other salmonid species (Stolz and Schnell, 1991).

[118] Bull trout have been found and/or observed: (1) within lower Sullivan Creek (McLellan, 2001; Seattle, 2009b); (2) within or near the mouth of Sweet Creek (Lembcke, 2001; McLellan, 2001); (3) in the Boundary dam tailrace; (4) in the Canyon Reach of the Boundary Reservoir (drop-down from Lake Pend Oreille); and (5) in the Boundary Reservoir near the mouth of Slate Creek, which is thought to provide a coldwater refuge for bull trout in the reservoir during the summer months. *See* McLellan (2001), Seattle (2009b), Lembcke (2001), CES (1996a), R2 Resource Consultants (1998a), Forest Service (1995), and FERC (2004).

Bull trout in the Action Area are within the Pend Oreille Core Area of the Northeast Washington Unit (NWU) of the Columbia River Distinct Population Segment (DPS), an area that includes the Boundary and Sullivan Creek projects. The available information suggests there are two, and perhaps four, populations of bull trout in tributaries to the Pend Oreille River, but only LeClerc Creek, a tributary to Box Canyon Reservoir, is within the Pend Oreille Core Area. The Salmo River, which is located in British Columbia at RM 12.7, and the Priest River at RM 95.2 are both known to sustain reproducing bull trout populations. LeClerc Creek is suspected of having a small self-reproducing population of bull trout, but its status is unknown (Scholz *et al*., 2005). Five juvenile bull trout have been observed in Nine Mile Creek, which drains into Seven Mile Reservoir in British Columbia, but additional monitoring is needed to determine if a self-reproducing population is present there. The Salmo River and Nine Mile Creek are located downstream and the Priest River is located upstream of the core area.

Tributaries with particular pertinence to bull trout that drain into Boundary Reservoir include Sullivan Creek (RM 27.9), Slate Creek (RM 23.1), and Sweet Creek (RM 32.0). There are also 12 other named tributaries and 13 unnamed tributaries that drain into the Boundary Reservoir. A detailed compilation of existing information on habitat conditions in tributaries draining to Boundary Reservoir can be found in Seattle (2009a). Adfluvial fish habitat is very limited in tributaries to Boundary Reservoir because of stream size and the presence of natural passage barriers at or near the mouths of the tributaries (*see* table 2.3-2 in Seattle's March 2010 Draft Biological Assessment).

Sullivan Creek is the largest tributary, with a drainage area of 142.5 square miles ($m^2$). Two potential natural fish barriers occur at RM 0.60 and RM 0.65 on lower Sullivan Creek.[119] In addition, Mill Pond dam, located 3.94 miles from the mouth of Sullivan Creek, is not equipped with fish passage facilities and is a complete barrier to upstream fish passage, as is the dam at the outlet of Sullivan Lake on Outlet Creek. Slate Creek has a drainage area of about 32.3 square miles and includes about 3,474 linear feet of adfluvial habitat downstream of a waterfall 19.7 feet in height (McLellan, 2001). The Sweet Creek\Lunch Creek drainage has an area of about 11.1 square miles and a series of three waterfalls that limit potential adfluvial habitat to about 2,659 feet.

Currently, adfluvial bull trout may use the Pend Oreille River on a seasonal basis, as water temperatures are too high during summer for continuous use (*see* Figure

[119] Surveys of these two potential barriers found that (a) while the barriers would be extremely difficult to ascend, passage at certain flows could not be ruled out (CES, 1996a), and (b) bull trout 18 inches or larger could pass the falls under low flows (99 cfs) (Powers, 2008). Turbulence makes passage difficult at flows higher than 300 to 500 cfs.

2.3-1 in Seattle's March 2010 Draft Biological Assessment).[120] Seasonal use of the Pend Oreille River by bull trout is evident from the studies completed by DuPont *et al*. (2007), DuPont and Horner (2003), Geist *et al*. (2004), and Scholz *et al*. (2005), but use patterns throughout the year are not known, particularly in Boundary Reservoir, where few bull trout have been observed and only a single observation from July 2009 is available from a radio-tracked individual. Observations of bull trout near Albeni Falls dam (Geist *et al*., 2004; Dupont and Horner, 2003), cutthroat trout, mountain whitefish, and triploid rainbow trout in Boundary Reservoir (Seattle, 2009b), and brown trout in Box Canyon Reservoir (Garrett and Bennett, 1995) suggest that salmonids use thermal refugia when mainstem river temperatures begin to exceed 64.4 °F (18 ºC). Few bull trout currently use the mainstem Pend Oreille River downstream of Albeni Falls for rearing.

**Threats**

Bull trout are vulnerable to many of the same threats that have reduced salmon populations in the Snake River Basin. Due to their life history requirements, bull trout are more sensitive to increased water temperatures, poor water quality, and low-flow conditions than many other salmonids. In addition, past and continuing land management activities have degraded stream habitat. In Washington State, the Washington DFW lists the following factors as limiting for bull trout: stream temperatures that exceed the normal spawning and incubation temperature range, lack of spawning and rearing habitat, and a high percentage of fine sediment in spawning gravels (Washington DFW, 1998). Because of their close association with the bottom, native char, including bull trout, are sensitive to changes in the streambed (Fraley and Shepard, 1989; FWS, 1998). In many watersheds, remaining bull trout are small, resident fish isolated in headwater streams.

Bull trout readily interbreed with non-native brook trout, which results in the production of infertile hybrids, thus reducing the potential ecological fitness of bull trout. Brook trout may also exclude bull trout from suitable habitat (FWS, 1998). Dams and other in-stream structures also affect bull trout by blocking migration routes, altering water temperatures and killing fish as they pass through and over dams, or are trapped in irrigation and other diversion structures. Finally, bull trout are easily caught by anglers, making them highly susceptible to fishing pressure. Any increase in the accessibility of a population to fishing pressure may negatively affect that population (Fraley and Shepard, 1989; FWS, 1998).

---

[120] The range of water temperature recorded at 15-minute intervals between May 2007 and September 2008 was 37.9 -77.4 °F (3.3 – 25.2 ºC) and averaged 57.0 °F (13.9 ºC). Water temperatures in the Action Area exceed 68.0 °F (20 ºC ) every year and at times exceed 75.2 °F (24 ºC). Temperatures in excess of 68.0 °F commonly occur during the months of July through September (Seattle, 2009a).

### Current Status

Bull trout was listed as federally threatened on June 6, 1998 (63 FR 31647-31674). FWS originally designated critical habitat for the bull trout October 6, 2004 (69 FR 59995-60076), and revised the critical habitat designation on September 26, 2005 (70 FR 56211-56311) and on October 18, 2010 (75 FR 63897-64070).

The NWU Recovery Team for bull trout designated the Pend Oreille River and its tributaries from the Albeni Falls dam to the U.S.-Canada border as a core area. In developing recovery criteria for the species, the NWU Recovery Team used professional judgment, knowledge of the NWU, and guidance from Rieman and McIntyre (1993) and Rieman and Allendorf (2001). Rieman and McIntyre (1993) indicate that fish in core areas with less than five interconnected local populations are at increased risk of extirpation, while fish in core areas with five to 10 local populations are at intermediate risk, and those with more than 10 local populations are at diminished risk. Rieman and Allendorf (2001) indicate that local effective population sizes of more than 50 adults and core area effective populations greater than 1,000 adults minimize adverse genetic effects to the population.

There is at most one tributary (LeClerc Creek) within the Pend Oreille River Core Area that may have some bull trout reproduction. However, nine tributaries were identified by the NWU Recovery Team as having the potential to sustain local bull trout populations. These tributaries were assigned numeric recovery goals for adult migratory fish with an overall core area recovery goal of 1,575 – 2,625 fish. Two of these tributaries, Slate and Sullivan creeks, drain into Boundary Reservoir, and have goals of 25 - 75 fish and 600 - 850 fish, respectively. The remaining seven (i.e., Cedar Creek; Ruby Creek, LeClerc Creek, Mill Creek, Tacoma Creek, Calispell Creek, and Indian Creek) drain into Box Canyon Reservoir. Of the Box Canyon tributaries, LeClerc Creek has the largest goal of 400 to 500 adult fish. Currently, detailed population and habitat information is lacking to determine which tributaries to include as local populations (FWS, 2002). In addition, there is no specific plan for establishing bull trout populations where they currently are now. However, the NWU Recovery Team suggests that artificial propagation might be needed to achieve recovery within 25 years.

The NWU Recovery Team states that recovery in the NWU is contingent upon reconnecting the Pend Oreille River with the Lower Clark Fork River Subunit that lies upstream of the Pend Oreille Core Area and the Albeni Falls dam (RM 86.9). The Albeni Falls dam impounds the upper 18 miles of the Pend Oreille River and portions of Lake Pend Oreille, the Priest River, and the Clark Fork River (to Cabinet Gorge dam). The Priest River is located about 5 miles upstream of the Albeni Falls dam. FWS' Biological Opinion (FWS, 2000) concluded that completion of the Albeni Falls dam was responsible for the "abrupt decline" of bull trout in the Pend Oreille River.

In the 2005 final rule designating critical habitat for bull trout, FWS identified short sections of lower Slate Creek and Sullivan Creek as critical habitat. All impoundments behind dams that have a primary purpose of providing flood control, energy production, or water supply for human consumption were excluded from designation as critical habitat. Consequently, Boundary Reservoir was not considered critical habitat for bull trout. FWS' revised final rule designating critical habitat for bull trout, however, does include Boundary Reservoir, Sullivan Creek, Sweet Creek downstream of the impassable falls at RM 0.60, and Slate Creek downstream of the impassable chutes and falls at RM 0.65 as critical habitat.

**Existing Conditions**

The Boundary Project is located on the Pend Oreille River in northeastern Washington, one of eleven hydroelectric and storage projects within the Clark Fork-Pend Oreille River basin. The dam is located at RM 17.0 on the Pend Oreille River. The upstream end of the Boundary Reservoir is located immediately downstream of the Box Canyon dam, at RM 34.5. The Sullivan Creek Project is located on Sullivan Creek, a tributary of the Pend Oreille River that enters Boundary Reservoir just upstream of Metaline Falls, about 10 miles upstream of the Boundary dam.[121]

The Pend Oreille River, which has a total drainage of 26,260 $mi^2$, is one of the two main tributaries to the Columbia River, contributing about 10 percent of the Columbia River's flow on an annual basis (Muckleston, 2003). On average, the 120-mile-long Pend Oreille River gains about 1,300 cfs between the upstream Albeni Falls dam (the outlet for Lake Pend Oreille) and the Boundary dam, with about 18 percent of that inflow coming from Sullivan Creek.[122] The average annual flow is 26,370 cfs (Seattle, 2008a). Annual runoff is primarily from melting snow upstream of the project, with peak flows typically occurring from April through June.

The Pend Oreille River passes through a bedrock-controlled constriction located at Metaline Falls (el. 1,970.6 feet),[123] which is a geological feature that divides the Boundary Reservoir into two distinct reaches: an upstream reach that extends from the

---

[121] As originally constructed, the Sullivan Creek Project consisted of the Sullivan Lake dam and reservoir, the Sullivan Creek diversion dam and conduit, the Mill Pond dam and reservoir, a conduit, penstock, powerhouse, and transmission facilities. The Mill Pond dam is located at RM 3.5 on Sullivan Creek. The project currently is operated to store and release about 31,000 acre-feet of water annually.

[122] Flows in lower Sullivan Creek are primarily a function of two tributaries that combine to form Sullivan Creek: Harvey Creek that contributes flow to Sullivan Lake; and Sullivan Creek. The average annual flow for Sullivan Creek is 122 cfs, and the average annual flow for Outlet Creek (the outlet of Sullivan Lake that joins Sullivan Creek) is 73 cfs. The average annual flow for Sullivan Creek downstream from the Mill Pond dam is about 210 cfs.

[123] The Boundary Project can operate within a range 20 feet, between the elevations of 1994.0 to 1974.0 feet.

Box Canyon dam to Metaline Falls and a downstream reach that extends from Metaline Falls to the Boundary dam. Gradient and depth of the upstream reach, ranging from 10-25 feet, are much less than those of the downstream reach.

As explained in section 3.5.1.1, *Aquatic Resources, Affected Environment – Boundary Reservoir*, the Boundary Reservoir has been delineated into four reaches based on habitat characteristics: the Forebay Reach (RM 17.0 – 18.0), the Canyon Reach (RM 18.0 – 26.8), the Upper Reservoir Reach (RM 26.8 – 34.5), and the Tailrace/Seven Mile Reservoir Reach (RM 13.9 – 17.0). Summer water temperatures in Boundary Reservoir at times exceed 68 °F, which is too warm to provide optimum summer habitat for native trout species (i.e., generally less than 61°F (16.1 ºC); Bjornn and Reiser, 1991). Phosphorous and nitrogen concentrations are low throughout the year, and phytoplankton chlorophyll *a* concentrations (at times < 2.8 μg/l) indicate that the system is oligotrophic.

The highest water temperature recorded in Sullivan Lake by the District in 2009 was 70.7 °F (21.5 ºC), which exceeds Washington's standard of 63.5 °F (17.5 ºC ) for salmonid rearing and migration (*see* section 3.4.1.2, *Water Quantity and Quality, Affected Environment – Sullivan Creek Surrender*). Nonetheless, temperature does not appear to limit fish production in Sullivan Lake, since average temperatures fall within the range of preferred temperatures for salmonids (50 to 68 °F, 10 to 20 ºC). Water temperatures in Outlet Creek were similar to those at about the top 16 feet in the lake. The Mill Pond dam has a warming effect on water released from Sullivan Lake, increasing temperatures by about 2 degrees, except during the fall release of water from Sullivan Lake. DO does not appear to limit fish production in Sullivan Lake, as DO levels averaged 9.0 mg/L in the epilimnion, well within the range for normal physiological functions of salmonids (Bjornn and Reiser, 1991). DO never dropped below 7.2 mg/L. However, DO in Outlet Creek was substantially lower, averaging 5.2 mg/l. As for its productivity, Sullivan Lake is classified as an oligotrophic system, averaging 0.007 mg/l of phosphorus.

At least 28 species of fish occur in the Action Area (Seattle, 2009b). Although anadromous fish are not found in Boundary Reservoir, some fish species (especially bull trout) potentially found in the reservoir can have adfluvial life histories. Bull trout are rarely captured in the project area. Mountain whitefish are known to occur in the Upper Reservoir Reach and the Tailrace Reach. A variety of other native and non-native species occur in Boundary Reservoir, including largescale sucker, northern pikeminnow, peamouth, yellow perch, and smallmouth bass, hatchery-reared rainbow trout, cutthroat trout, redside shiner, and minnows. The most abundant species that inhabits Sullivan Creek below the Mill Pond is rainbow trout, though a few cutthroat trout have been observed in this area as well. Brown trout and brook trout occur throughout the Sullivan Creek drainage, and Sullivan Lake has a healthy, self-sustaining population of kokanee.

<u>Reservoir and Delta Habitat</u>

*Spawning and Incubation* – Bull trout are not known to spawn in Boundary Reservoir, the project tailrace, or tributary deltas that could be affected by project operations. Scholz *et al*. (2005) describe bull trout spawning habitat as small tributaries with sufficient cover and upwelling. Consequently, it is not anticipated that bull trout would spawn in Boundary Reservoir.

*Sub-Adult Rearing* – Juvenile bull trout typically rear in natal streams for two to three years and outmigrate at a length of about 6.7 - 11.8 inches (Scholz *et al*., 2005). To assess mainstem juvenile bull trout habitat availability, juveniles were considered to be 2.2 - 5.9 inches in length, and adults were larger. Juvenile bull trout of this size would generally remain in tributaries rather than migrating to the mainstem Pend Oreille River. Nevertheless, potential juvenile bull trout habitat in Boundary Reservoir was assessed.

Aquatic habitat modeling was used to provide an index of the amount of physical habitat that might be available to bull trout based on the suitability of available water depths, water velocities, and substrate types under existing conditions.**[124]** For comparability between reaches, the index calculated was weighted useable area (WUA) per foot of river reach. The model showed that during average flow years the Forebay and Canyon reaches have a relatively low density ($35 ft^2$ or less of monthly minimum WUA) of potentially suitable habitat for bull trout juveniles, particularly during the fall and spring months when water surface elevations fluctuate more frequently and over a greater range than during summer (figure 3-9). Monthly minimum WUA density was slightly higher for the Tailrace Reach (36 to 45 $ft^2$ WUA) and substantially higher for the Upper Reservoir Reach (60 to 158 $ft^2$ WUA). Because of its greater length, the Upper Reservoir Reach provides the most available potential habitat for juvenile bull trout.

*Adult Habitat* – Adult bull trout (assumed > 6 inches) habitat suitability has a broader range than that of juveniles. The Aquatic Habitat Model indicated that about three times the density of WUA was available for adult bull trout than for juvenile bull trout under existing conditions, primarily as a result of the higher suitability of deeper and faster water. For an average flow year, the density of WUA was similar for the Upper Reservoir, Canyon, and Tailrace reaches between November and March at about 100 to 160 $ft^2$ of WUA (figure 3-10). In contrast, the Forebay Reach was substantially higher at about 300 $ft^2$ of WUA throughout the year. Between April and October the Upper Reservoir WUA density was more similar to the Forebay Reach.

*Delta Habitat* – Tributary deltas are transition areas between the tributaries and reservoir that, depending upon their physical characteristics, provide a variety of ecological functions. Fish may congregate at the tributary confluence to feed on aquatic

---

**[124]** Habitat Suitability Index (HSI) information for sub-adult and adult bull trout is summarized in Seattle's March 2010 Draft Biological Assessment, pages 18-20.

organisms transported downstream in the tributary flow, may use the deltas as temperature refugia, or may stage in delta habitats prior to spawning runs. Fry and juvenile fish may rear in complex habitats associated with the deltas, and the influx of tributary water may provide protection from dewatering associated with reservoir water surface elevation fluctuations. Portions of tributary deltas are present in the varial zone of Boundary Reservoir, and therefore are affected by fluctuations in water surface elevation. The fluctuations in elevation associated with project operations change portions of the deltas from stream habitat to lacustrine habitat as the water surface rises and then back to stream habitat as the water surface falls.

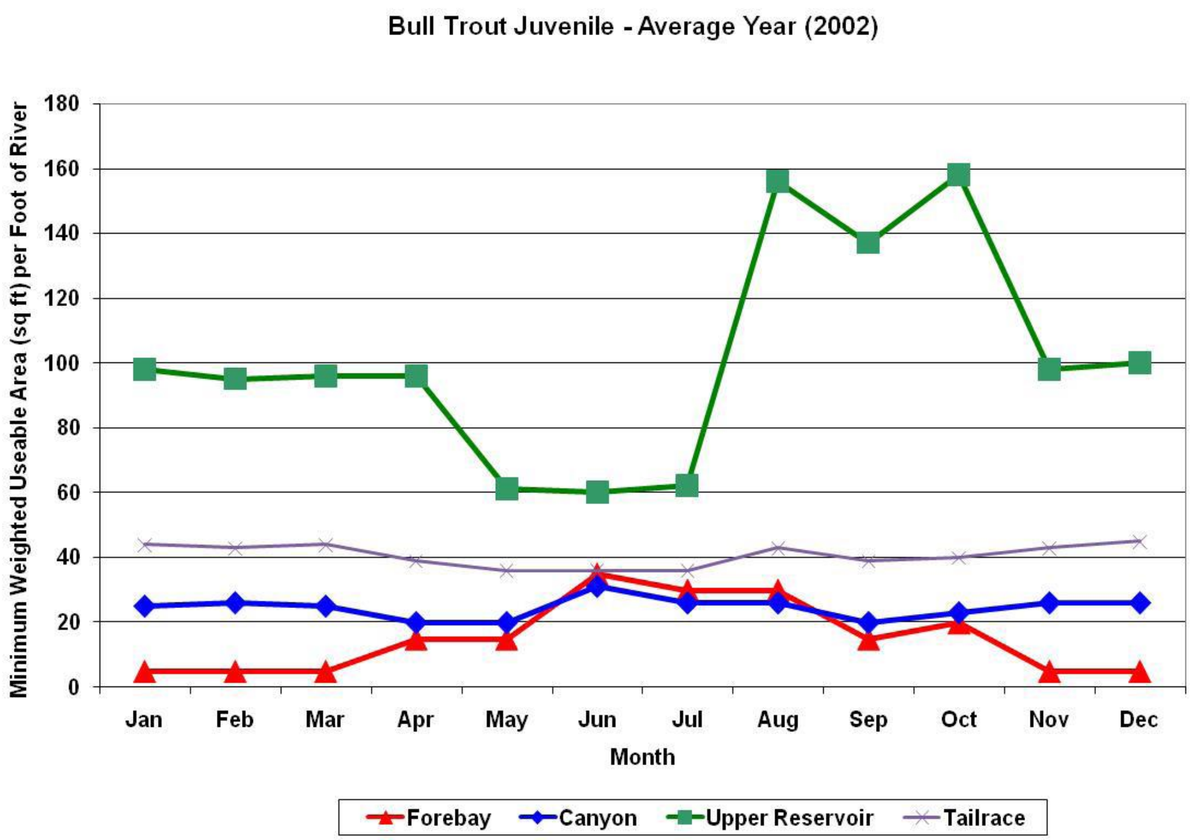



Figure 3–9. Monthly WUA minima for juvenile bull trout in Boundary Reservoir during an average flow year under existing conditions (Source: Seattle, 2010).

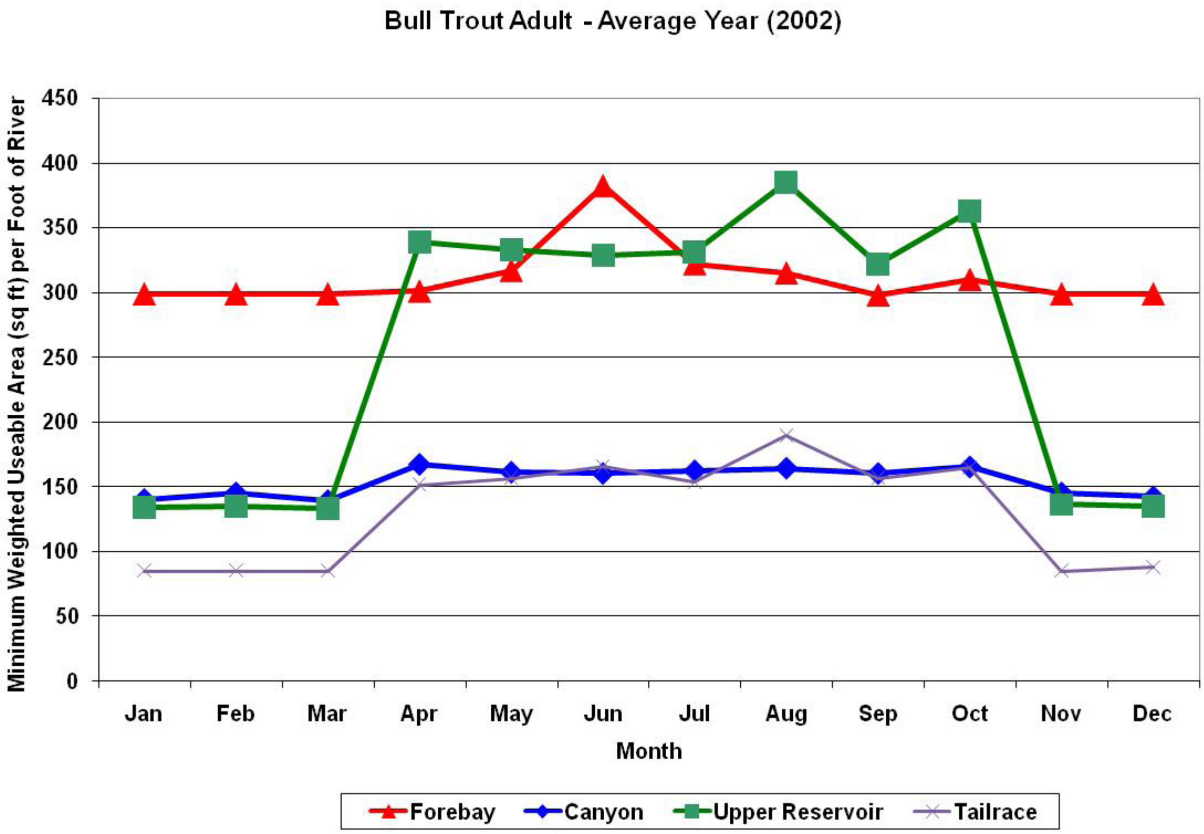



Figure 3–10. Monthly WUA minima for adult bull trout in Boundary Reservoir during an average flow year under existing conditions (Source: Seattle, 2010).

As described previously, there are 28 tributaries that drain into Boundary Reservoir, including 13 unnamed drainages. Following a screening process, habitat modeling was limited to only those tributary deltas with substantial potential salmonid fish habitat (Seattle, 2009a). Habitat modeling occurred on seven tributary deltas, including Slate Creek, Flume Creek, Sullivan Creek, Linton Creek, Pocahontas Creek, Sweet Creek, and Sand Creek. The modeling translated hourly fluctuations in Boundary Reservoir into estimates of a habitat quality rating (HQR) for native salmonids, including bull trout.

The HQR (measured in $ft^2$) was calculated as the product of two components: the area of lacustrine and riverine habitat weighted by their HSI scores. HSI values were calculated for individual representative tributary delta areas for three life stages (i.e., adult, juvenile, and fry) of native salmonids using the species-habitat relationships developed for cutthroat trout by Hickman and Raleigh (1982).[125] The riverine HSI modeled three or four of the following parameters depending on life stage: thalweg depth, percent cover, percent cobble/boulder substrate, percent pool, pool quality (size and depth), and percent fines. The lacustrine HSI model relied on water temperature, DO, and pH. To aid in interpretation of the model results, the HQR values for lacustrine habitat and for riverine habitat for various salmonid life stages were plotted on hourly and cumulative bases over the course of representative wet, dry, and average years. Details of the HQR modeling are provided in Seattle (2009a).

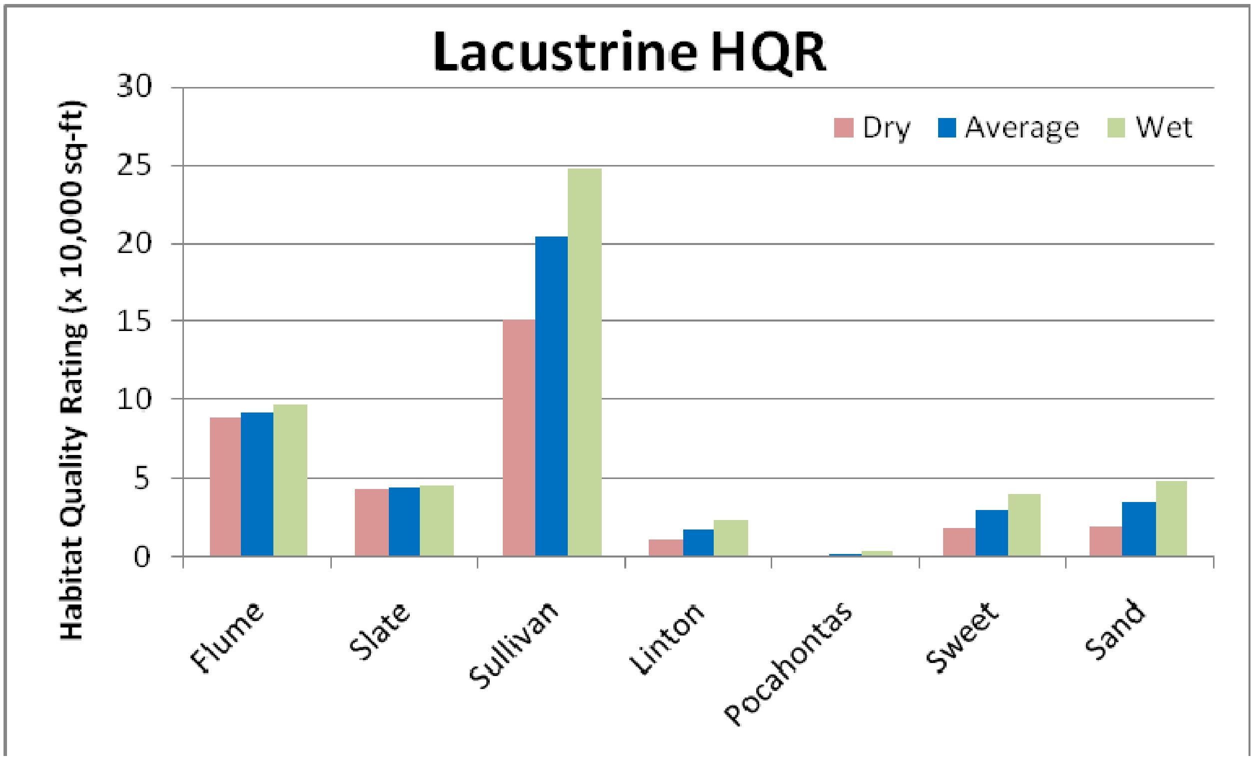
Results of the Hickman and Raleigh (1982) riverine model indicate that the Slate Creek delta had the highest HSI scores for each of the three life stages of trout (table 3-15). Flume Creek and Sullivan Creek (during periods of regulated flow) deltas had the next highest HSI values for the three different life stages of trout. The Pocahontas Creek and Sand Creek deltas were rated as unsuitable because of their dry channels (and associated zero depth of thalweg) at the time of the late summer surveys. For low-flow periods, the suitability is still low in both these creeks for adult salmonids, with an HSI of 0.1.

The Hickman and Raleigh (1982) lacustrine model for salmonid habitat in the shallow water areas of the deltas during periods of inundation suggests a range of habitat quality throughout the year (table 3-16). The model output was driven primarily by the variability in average monthly water temperature (ranging from 34.2 to 72.7 °F, 1.2 to 22 ºC). Monitoring data suggests that DO and pH are relatively stable over the year, with values generally greater than 8.0 mg/L and between 8.0 and 9.0, respectively.

A number of patterns are apparent from the results of the HQR modeling. Each of the modeled tributary deltas had minimum lacustrine HQRs of 0 because water temperatures during August were considered unsuitable. With the exception of Slate, Sullivan, and Sweet creeks, minimum fry, juvenile, and adult riverine HQR values were also 0 under all year types, but different factors were limiting at different tributaries. Average lacustrine HQR values increased under dry, to average, to wet year conditions (figure 3-11). Although not displayed, maximum lacustrine HQR values demonstrated a similar pattern to average HQR values.

---

[125] The use of a cutthroat trout model to represent native salmonid habitat results is an imperfect representation of bull trout habitat in delta areas. Nonetheless, the HQR model is useful as an index for describing the relative importance of the different tributaries to native salmonids and for understanding how project operations may affect habitat conditions.



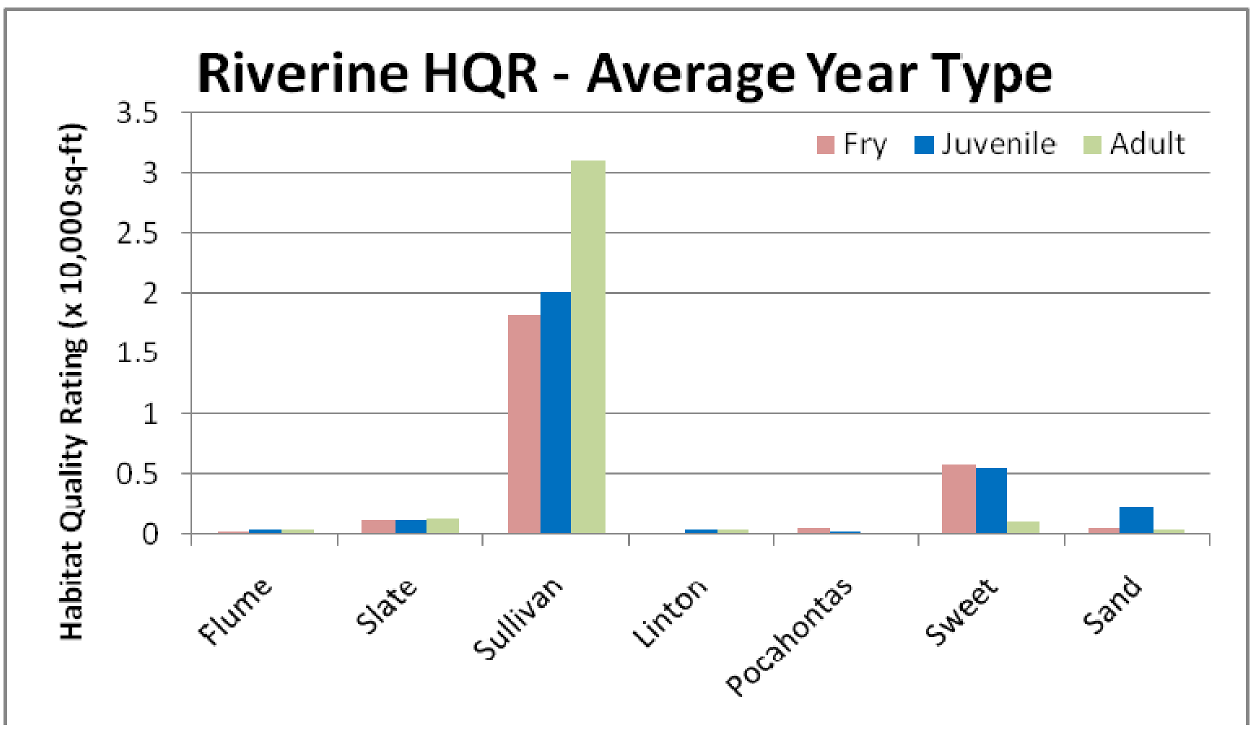




Figure 3-11. Average lacustrine and riverine HQR values. HQR values for Slate and Flume creeks are for delta conditions expected during Years 1-17 of the 50-year evaluation period (Source: Seattle 2010).

The lacustrine HQR results followed the same general pattern for all tributaries, which is a function of water temperature. In the months of April and October, when temperature is within the optimal range, the HQR values peak. Between these two maximums, HQR values rise and fall as water temperatures warm (prior to April), become unsuitably hot (April to October), and then cool (after October). In the wet (1997) and average (2002) years, the lacustrine HQR values reach a maximum at each delta during high mainstem flows because reservoir water surface elevations exceed the upper extent of the delta. Under these high flow conditions, the delta is fully inundated, including areas at higher elevations than the delta, so the lacustrine area is held constant at the maximum. Under these same conditions, the riverine HQR values go to zero because no free-flowing stream habitat exists on the delta.

The Sullivan Creek delta, with average HQRs of 20.4 x $10^5$ $ft^2$ and 2.0 x $10^5$ $ft^2$ for lacustrine and riverine juvenile habitat, respectively, supplies substantially more lacustrine and riverine habitat than any of the other tributaries. Average lacustrine HQR values are about an order of magnitude higher than riverine HQR values. From highest to lowest based on lacustrine HQR values, key tributaries can be ranked as follows: Sullivan, Flume, Slate, Sand, Sweet, Linton, and Pocahontas creeks. Rankings based on riverine HQR values for the average flow year were as follows: Sullivan, Sweet, Slate, and Sand creeks. Flume, Linton, and Pocahontas creeks had nearly negligible suitability, with HQR values all less than 600 $ft^2$ of HQR.

Load following operations and the associated diurnal fluctuations in water surface elevations influence the physical characteristics of thermal plumes at tributary deltas. Modeling of the areal extents of thermal plumes for Flume, Sullivan, Linton, and Sweet creeks during representative wet, dry, and average flow years under existing conditions suggest that the areal extent of thermal plumes shrinks as water levels in Boundary Reservoir are dropped. Complete disappearance of plume areas requires a combination of low project inflow and unusually low forebay water surface elevations, which are uncommon events.

Habitat Connectivity

*Upstream Fish Passage* – At the time of the construction of the Boundary dam, the importance of habitat connectivity for non-anadromous salmonids was not recognized; consequently, fish passage was not considered during its design. At present, the Boundary dam blocks upstream movement and hinders the downstream movement of bull trout in the Pend Oreille River.

Without upstream fish passage, bull trout that survive entrainment through the Albeni Falls, Box Canyon, and Boundary Projects are prevented from migrating back upstream to their natal streams for spawning. Also, bull trout from the Salmo River are blocked from moving upstream past the Boundary dam. Consequently, these fish are prevented from potentially contributing genetic material to upstream populations and using upstream habitat for foraging.

*Downstream Fish Passage* – There are no downstream passage facilities at the Boundary dam. Consequently, any bull trout that is entrained is at risk of injury or death. As described below, there are two components important for understanding the effects of the Boundary dam on bull trout moving downstream in the Pend Oreille River; the level of risk of mortality as a result of passage through the project's turbines or as a result of spill once a fish is entrained, and understanding the risk of entrainment occurring.

As part of the relicensing, Seattle studied entrainment using a desktop analysis of passage survival (R2 Resource Consultants, 2006). The desktop analysis assessed the likely range of mortality to salmonids, depending upon the entrainment route (turbine, spillway, or sluiceway) and fish size (tables 3-5 and 3-6).

Turbine mortality rates were estimated using a predictive equation for Francis turbines developed by the U.S. Department of Energy's Advanced Hydro Turbine System Program, which was based on hundreds of turbine mortality studies and consideration of specific turbine characteristics (Franke *et al*., 1997). Strike and shear are the major factors that are addressed by the predictive equation method. The equation calculates the probability that a fish of a given size is likely to be near or come in contact with components of the turbine and the shear zone, which occurs in very close proximity to the surfaces of the turbine where water is moving at high velocity over the surface of the steel.

A number of field and laboratory studies were reviewed to understand the effects of spillway passage on fish and potential associated mortality levels (Hamilton, 1955; R2 Resource Consultants, Inc., 1998b; PNNL, 2000; Normandeau Associates, 2002). Based on this review, mortality can vary depending on flow conditions. Under extremely low-flow conditions, where flow does not reach the downstream plunge pool, fish mortality is likely to be near 100 percent for fish of all sizes. Under flow conditions where the majority of the spill flow reaches the plunge pool (but about half the water dissipates into mist), small fish (100 mm) that leave the water and free-fall in air to the tailrace are likely to experience a 60-70 percent mortality rate. Small fish that remain in the water are likely to experience near 100 percent mortality, due to shear exposure. Larger salmonids (600 mm) are likely to experience mortality in the range of 40-50 percent. Under higher flow conditions where the majority of flow reaches the plunge pool in a coherent jet, small salmonids are likely to experience 50-80 percent mortality, whereas mortality for large salmonids is likely to be as low as 20-40 percent.

The Boundary dam includes seven sluiceways located at about mid-height (crest elevation 1,795 feet NAVD 88) of the dam that discharge into the plunge pool below the dam. Given the flow volume and velocity, the flow exiting the sluiceways is expected to be fairly well confined as a jet, and given that the tailwater is less than 50 feet below the invert of the sluiceway when the river flow is above approximately 125,000 cfs (typical conditions when sluice gates are in use under current operations), the jet should remain fairly well confined all the way to the tailwater. Thus, entrained fish are more likely to remain in the body of the flow. This, coupled with the close to horizontal trajectory of entry, suggests that mortality of entrained fish in the sluiceway flow should be somewhat lower than that estimated for spill flow of the same magnitude.

The results of the passage survival analysis suggest that some level of mortality or injury to bull trout entrained at the Boundary dam is unavoidable. However, average mortality rates would likely range from 35 to 43 percent for turbine or spillway passage.

During 2007 and 2008, Seattle conducted hydroacoustic and fyke net sampling at the Boundary dam to estimate the number, size, and species, of fish that may be entrained, and the timing of entrainment, in the project turbine intakes and spillways. Hydroacoustic data collection was initiated at the Boundary dam on May 2, 2007 using split-beam target tracking techniques. Fyke nets were initially deployed in the Unit 54 draft tube gatewell downstream of the turbine unit in October 2007. Details of the methods (and results which are summarized herein) of the entrainment study are provided in Seattle (2009c).

Hydroacoustic and fyke net data collected concurrently between March 2008 and February 2009 indicated that fish entrainment is occurring at the project.[126] Monthly fish passage over the March 2008 through February 2009 monitoring period increased steadily from March through July 2008, reaching a peak in July. There was a marked decrease in total project entrainment in August, followed by a slight increase in September. Beginning in October 2008, project entrainment decreased sharply and remained low over the winter months through the end of sampling on March 1, 2009. A total of 54,597 ± 5,176 fish (90 percent confidence interval) were estimated to have been entrained through all operating turbines and spill gates at the project over the one-year period. Non-native and/or hatchery-origin salmonids represented less than 5 percent of this total number. No native salmonids were captured during the fyke netting effort.

FERC (1995) and Coutant and Whitney (2000) indicate the life history traits and behavior of the fish species found in an impoundment, including the non-salmonids, are important factors affecting a species potential for being entrained. For example, schooling fish tend to be entrained on an episodic basis and non-salmonid fish that tend to use littoral habitat may have higher entrainment at turbine units that are closer to the shore. Juvenile or larval fish that have a planktonic life history are likely to have higher entrainment levels than those that are benthic or use backwaters. Species that have seasonal movements for spawning or other specific habitat traits may have higher levels

[126] Suckers, pumpkinseed, and yellow perch dominated the entrainment through unit 54 between February and October 2008, representing 42, 22, and 12 percent of the number, respectively. From November 2008 through March 1, 2009, Burbot (37 percent), black crappie (30 percent), and pumpkinseed (13 percent) dominated the catch.

of entrainment during these movement periods. Other factors that could affect entrainment levels are a species' depth preference and the depth of turbine intakes.

The available information suggests that any bull trout in the vicinity of the Boundary dam would be vulnerable to entrainment, but their low overall abundance in Boundary Reservoir and forebay suggests entrainment of bull trout is extremely rare.

Water Quality

*Total Dissolved Gas* – Supersaturation of gases in water has the potential to adversely affect fish by forming bubbles in tissues as the dissolved gases come out of solution (Weitkamp *et al*., 2003). Ecology standards require that waters remain below 110 percent TDG supersaturation. In section 3.4, *Water Quantity and Quality*, we noted that TDG levels in the project forebay are closely linked to upstream project TDG levels from the upstream Box Canyon and Albeni Falls dams, and that operations at the Boundary Project exacerbate those TDG conditions as water passes through or over the Boundary dam.

The available information suggests that any bull trout residing in the Boundary Reservoir or tailrace during periods of high flow could be at risk of gas bubble trauma from TDG supersaturation. However, due to the species' benthic orientation and preference for deeper water, the risk to bull trout of contracting gas bubble disease is likely lower than that for other salmonid species that prefer shallower water or are more surface oriented.

*Water Temperature* – High water temperatures can affect salmonids by altering the timing of adult and juvenile migrations and may contribute to stress-related mortality or reduced growth. While migrating bull trout may exhibit a short-term tolerance for high water temperatures (KCDNR, 2000), juvenile bull trout are particularly sensitive to changes in water temperature and are typically found in the coldest stream reaches within a basin. Researchers studying tributaries to Lake Pend Oreille found the highest densities of juvenile bull trout at sites with summer maximum temperatures between 51.8 and 57.2 °F (11 and 14 ºC) (Saffel and Scarnecchia, 1995). Based on a review of bull trout temperature studies, Hillman and Essig (1998) concluded that optimal water temperatures for juvenile bull trout growth and rearing range from 53.6 to 57.2 °F (12 to 14 ºC). Spawning activity begins when water temperatures drop below 48.2 °F (9 ºC) in the fall and water temperatures consistently below 42.8 °F (6 ºC) are needed for egg development.

Water temperatures in Boundary Reservoir are cold in winter and warm in summer (*see* section 3.4.1.2, *Water Quantity and Quality, Affected Environment – Boundary Project*), and often exceed the suitable range for bull trout, as they would in the absence of the project. During periods of high water temperatures in excess of 64.4 °F (18 ºC), bull trout that do not locate cool water refugia near mouths of tributaries or by entering tributary streams are likely to be adversely affected by the warm water temperatures in the reservoir. Fish passage through the tributary deltas is a function of reservoir pool level, channel morphology, and tributary inflow.[127]

Cool water refugia at tributary deltas are generally very small, and, as described previously, their size is affected by fluctuations in water surface elevations. Other coolwater refugia may exist in Boundary Reservoir at groundwater seeps, but the location, size, and number of seeps is unknown. Competition for space at thermal refugia may be a factor adversely affecting any bull trout, as thermal refugia are used by triploid rainbow trout, westslope cutthroat trout, and mountain whitefish. Anglers target these areas during warm water periods, which may expose bull trout using these refugia to a higher risk of accidental capture by anglers.

*Dissolved Oxygen* – DO is strongly influenced by, and inversely related to, water temperature. Consequently, high water temperatures can adversely affect the ability of water to retain DO. DO levels can also be affected by plant and animal respiration and the amount of mixing in the water column.

DO monitoring indicated that Boundary Reservoir is generally above the state standard of 8.0 mg/L, but several exceedances were recorded for July and August of 2008 within deeper portions of the Canyon and Forebay reaches, and at a shallow water site near the City of Metaline. In addition, DO decreases about 1.0 mg/L from the surface to the deepest measurement between July and October, being most prevalent in the Forebay Reach. The relicensing studies (Seattle, 2009a) suggest that the presence of the Boundary dam affects the amount of mixing in the northern portion of Boundary Reservoir. Thus, if bull trout were to use the northern portion of the reservoir during late summer periods, they could be adversely affected by the DO levels less than 8 mg/L.

The Environmental Protection Agency (EPA, 1986) reports that DO levels less than 8 mg/L for salmonids, other than embryos, result in some level of impairment, with slight impairment occurring below 6 mg/L, and the limit to avoid acute mortality at 3 mg/L. Except in macrophyte beds, measurements in Boundary Reservoir were greater than 7.0 mg/L and most were above 7.6 mg/L (Seattle, 2009a). Despite some indications of low DO levels near to, and within, macrophyte beds, DO generally remains above state standards and suitable for bull trout.

*Turbidity* – Water quality sampling between May 2007 and March 2008 indicated turbidity levels were well below the Washington State Standard of more than 5 NTUs over background when background is 50 NTUs or less. Based upon the

---

[127] During the summer months, bull trout may not be able to enter any of the tributaries, except Sullivan, Slate, Linton, Flume, and Sweet creeks, because of the lack of flow or presence of natural barriers near the tributary confluences.

available information, turbidity in Boundary Reservoir is not expected to have an adverse effect on bull trout.

Ecosystem Functions

*Gravel Transport* – The nature and quality of salmonid habitat in rivers is determined, in part, by the transport and instream storage of sediments recruited from upland areas (Spence *et al*., 1996). In free-flowing river channels, coarse, gravel-sized sediment is primarily transported downstream during moderate to high flows and is stored within the channel bed and banks during intervening low-flow periods. Suitably-sized gravel is particularly important for bull trout spawning habitat. As indicated previously, bull trout are not known to, and not anticipated to, spawn in the mainstem Pend Oreille River or in the lower reaches of tributaries or their deltas. Instead, spawning habitat would be located in upstream reaches of tributary streams that would not be affected by the project. Consequently, mainstem gravel transport and distribution is not important to maintaining bull trout spawning habitat. However, sediment transport and deposition are important for shaping the morphology of the river and consequently the quality and quantity of rearing or overwintering habitat for bull trout.

The Pend Oreille River between the Boundary and Box Canyon dams has two distinct segments in terms of sediment transport. The section from the Boundary dam upstream to Metaline Falls, consisting of the Forebay and Canyon reaches, is a depositional environment created as a result of the inundation from the Boundary dam. Upstream of Metaline Falls, in the Upper Reservoir Reach, the Pend Oreille River is at times influenced by a backwater effect from the Boundary dam, but often experiences riverine conditions, particularly when forebay water surface elevations are low or inflows are high.

The high energy portion of the Pend Oreille River, the Canyon Reach below Metaline Falls, has been inundated by the Boundary dam. The Upper Reservoir Reach was a low energy environment even prior to hydraulic influence from the Boundary dam. Therefore, its capacity to transport coarse sediment is, and was historically, limited, and the larger gravels and cobbles forming its bed are only mobilized at high flows.

Considering the size of the Pend Oreille River watershed above the study area, the supply of sediment delivered to the study area is small. This disparity results from much of the contributing watershed passing through lakes and reservoirs that effectively trap sediment before entering the study area.

The aforementioned factors combine to create a river that is not exceedingly dynamic in terms of its sediment transport response. The results of the mainstem sediment transport model support this statement in that the only appreciable change in the system predicted by the model was continued deposition below Metaline Falls, primarily in the Forebay Reach. The bed elevation changes and volume of deposition in the Upper Reservoir Reach over the potential 50-year term of a future license are estimated to be relatively minor.

The available information and modeling suggests that the morphology of the riverbed and the sediment size distribution in the Action Area are unlikely to substantially change from the current condition. The Tailrace Reach is, and would continue to be, limited in the availability of gravel as a result of deposition behind the Boundary dam. However, bull trout are not expected to use the Tailrace Reach for spawning (Pratt, 1992), and, thus, may not be affected by reduced gravel levels in the Boundary dam tailrace.

*Woody Debris Transport* – LWD can be an important component of aquatic habitat in both riverine and reservoir habitats (Bjornn and Reiser, 1991; Northcote and Atagi, 1997). LWD provides habitat complexity, cover, and substrate for fish and macroinvertebrates and has been identified as an important component of bull trout habitat (Baxter, 1997). As LWD decomposes, it may also provide nutrients to the water column and sediments (Harmon *et al*., 1986).

The project affects the abundance, distribution, and quality of LWD as a component of aquatic habitat within the reservoir and downstream of the Boundary dam. Fluctuations in Boundary Reservoir water surface elevations can affect the portion of time that a given piece of wood provides habitat, and may affect wood recruitment indirectly by affecting the establishment of new riparian stands adjacent to the varial zone. Wood recruitment mechanisms adjacent to lakes or reservoirs are primarily windthrow, senescence, or mass wasting events. Recruitment may also occur by transport from tributaries or passage over dams during periods of spill. Removal of wood from the system depletes the amount of wood that could potentially contribute to bull trout habitat in the project area. *See* section 2.3.4.2, *Woody Debris Transport*, in Seattle's March 2010 Draft Biological Assessment, for a detailed assessment of LWD transport.

Based on available information, the project has a small effect on LWD through the removal of LWD at the Boundary dam and by limiting the potential development of new riparian stands of trees. The degree to which bull trout would use LWD resources in the reservoir and tailrace is uncertain. Bull trout are strongly associated with LWD and large substrate while occupying streams (Pratt, 1992), but little information is available concerning microhabitat features used in lakes and reservoirs. Bassista *et al*. (2005) tracked five bull trout outfitted with acoustic tags in Lake Pend Oreille. Based on the authors' observations, bull trout are not likely to substantially use LWD along a reservoir, but could use sunken LWD or submerged stumps.

*Floodplain Connectivity* – Rivers construct and maintain channels such that small and moderate-sized discharges (less than or equal to flows with a 2-year recurrence interval) are contained within the channel, while larger discharges that occur less frequently exceed the channel capacity and overflow onto the floodplain. During floods, water is stored in sloughs and side channels, or seeps into floodplain soils and recharges groundwater storage. This stored groundwater slowly drains back to the channel, providing a source of cool inflow during the summer (Naiman *et al.*, 1992). Low-gradient, unconfined channels migrate back and forth across their floodplains in sinuous patterns in response to differential patterns of bank erosion and sediment deposition. Channel migration may occur as a result of slow, steady erosion of the outside of a meander bend, or it may occur as a sudden shift into an old channel during flood events. As a result of these processes, natural low gradient, alluvial channels typically develop a network of low-flow channels containing numerous gravel bars, side channels, abandoned oxbow lakes, sloughs and wetlands. Such off-channel and mainstem margin habitats are an important component of juvenile salmonid rearing habitat and refuge from high flows.

The formation, availability, and quality of off-channel habitat are currently limited in the Action Area due to natural topographic features, flood control operations associated with upstream projects, and land-use changes. Nearly all of Boundary Reservoir and the Boundary dam tailrace north of Metaline Falls are confined within steep-walled canyon topography. Consequently, the availability of floodplain habitat in that part of the reservoir is naturally low. In contrast, the Pend Oreille River between the Box Canyon dam and Metaline Falls is somewhat broader with areas where flood flows result in small backwater sloughs and pools that could trap and/or strand fish. However, bank hardening has contributed to confinement of the river in some places upstream of Metaline Falls. In addition, significant amounts of riprap are present in the Box Canyon tailrace and some riprap is present near the mouth of Sullivan Creek and along the west bank as a result of bank stabilization to protect roads and homes. These activities limit the availability of backwater sloughs and pools in these localized areas.

Based on sediment transport modeling of Boundary Reservoir, the limited off-channel habitat available is likely to persist without substantial change over the next 50 years (Seattle, 2009a). Whether bull trout, if present in the Action Area, would use the available off-channel habitat during portions of the year is unknown. Observations by Bassista *et al*. (2005) in Lake Pend Oreille suggest that they would not use such areas.

*Non-native Species Interactions* – Numerous non-native fish species are present in the Action Area that could have an adverse effect on bull trout. These include smallmouth[128] and largemouth bass, walleye, northern pike,[129] brook trout, triploid

[128] Radiotelemetry studies indicate that smallmouth bass use the flooded delta area at the mouth of Sullivan Creek during spring high-flow periods when young salmonids, including bull trout, would be expected to move downstream and enter the reservoir (Seattle, 2009b).

[129] Recent observations suggest that the population of northern pike in Boundary Reservoir is increasing in size; however, it is unclear how large a population may be sustained within the reservoir.

rainbow trout, brown trout, and lake trout.[130] Many of these species are piscivorous and could forage on any young bull trout that are present. In order of their relative abundance in the mainstem fish community, these relatively large piscivorous non-native species include yellow perch (14.9%), smallmouth bass (10.5%), brown trout (0.6%), largemouth bass (0.4%), walleye (0.3%), northern pike (0.2%), and lake trout (<0.1%).

The higher trophic level species include northern pikeminnow (6.0 percent), the non-native burbot (0.2 percent), cutthroat trout (<0.1 percent), and bull trout (<0.01 percent). Cutthroat trout and bull trout (both native salmonids) rely on tributaries for spawning and rearing habitat, and the non-native brown trout also relies on the tributaries for a portion of its life history. The forage base for piscivorous fish species is also substantially altered in the mainstem due in part to the presence of non-native species such as pumpkinseed, black crappie, and tench, which in combination account for nearly 10 percent of the fish community in the mainstem. While the direct effects of non-native fish on native salmonids in Boundary Reservoir are unclear, it is apparent that non-native fish species currently have a much larger role as top level predators in the fish community than native species do.[131]

Sullivan Creek Drainage

As previously stated, Sullivan Creek has been designated critical habitat for the bull trout, and bull trout have been observed in the lower reaches of the creek. In the 500-foot reach from the former powerhouse upstream to the natural falls in the lower canyon (*see* description below), little spawning habitat for any species exists (Powers, 2008). Pools available in this reach would continue to provide a holding area for any fish that migrates up Sullivan Creek to escape warm temperatures in the Pend Oreille River and Boundary Reservoir. It is expected that removal of the Mill Pond dam would allow spawning-sized material to be flushed downstream into lower Sullivan Creek, which would enhance the value of spawning habitat in the reach, including that for the bull trout.

---

[130] Naturally reproducing non-native trout are relatively rare in Boundary Reservoir, but could contribute to crowding in thermal refugia during periods of high mainstem water temperatures.

[131] The scientific literature suggests that non-native species have an adverse effect on native salmonids (Sanderson *et al*., 2009; Fritts and Pearsons, 2004). However, it is unclear to what extent non-native species in the reservoir have contributed to the decline of native salmonids that historically filled higher trophic levels or whether the non-native species are opportunistically filling higher trophic levels vacated by native species whose abundance has been reduced due to other factors.

The District's proposal to surrender the Sullivan Creek license and remove the Mill Pond dam is based on existing information compiled by the Forest Service and the studies summarized below.

*Sullivan Creek Fish Barrier Assessment* – In 2008, the District surveyed the existing falls located at RM 0.65 on Sullivan Creek (above the old powerhouse, but downstream from the Mill Pond dam) (Powers, 2008). The falls consists of a main drop of 5.6 feet, with lesser falls both upstream of, and downstream from, the main falls. Two flow conditions were assessed for passage of 18-inch bull trout: a low-flow condition (99 cfs) and a high-flow condition (1,528 cfs). Based on the assessment, the falls are passable under low-flow conditions, but become a barrier under high flow conditions.[132] The authors also conclude that turbulence would likely become a passage hindrance at flows ranging from 300 to 500 cfs.

*Harvey Creek Habitat Survey* – The thalweg of Harvey Creek where it empties into Sullivan Lake, for a distance of 790 feet, was surveyed in June 2009. Water surface slope in this reach is 0.8 percent. Bank full flow through this reach, which is consistent with the average annual peak flow, is about 400 cfs. The survey concluded that flows in the 400 to 500 cfs range would mobilize fine sediments smaller than small gravel (< 2.5 mm) and flush them from spawning gravel.

*Entrainment Investigation and Study of Fish Presence in the Vicinity of Sullivan Lake Dam* – To address the issue of fish entrainment that may occur at Sullivan Lake dam under various fall drawdown regimes, the District conducted an entrainment study during October and November 2009. The study documented species and numbers of fish moving through the outlet gates at the dam into Outlet Creek. The data collected included species, length, condition/health, whether there was any apparent injuries, and evidence of predation. A total of 1,291 fish were captured in Outlet Creek during the netting period. No bull trout were captured.

*2009 Sullivan Creek Instream Flow Study* – The District updated the instream flow study that was conducted on Sullivan Creek for the 1994 license amendment. The previous work served as a reference to determine, not only the best flows for target species and life stages, but also to identify at what flow levels increased input from Sullivan Lake and Outlet Creek would affect aquatic habitat, especially for bull trout. The Outlet Creek flow study (Beecher, 2009) examined several selected flows (between 13 and 263 cfs) and associated wetted widths for three transects to help identify a flow release regime for the Sullivan dam that would protect aquatic habitat and fisheries in Outlet Creek throughout the year. The results of the study show that flows of 18 to 101

[132] The conditions through this reach under high-flows are considered a swimming energetics barrier.

cfs provide the threshold for favorable depth (≥ 1 foot),[133] depending upon transect,[134] and a flow of 180 cfs provides the threshold for the favorable rate of change in wetted widths[135] (Beecher, 2009).

*Review of Lake Fertilization* – Lack of productivity was raised as an issue with respect to Sullivan Lake. The District conducted some productivity sampling in Sullivan Lake and Outlet Creek, as well as reviewed 24 sockeye salmon lake fertilization efforts. As discussed in greater detail in section 3.4.1.2, *Water Quantity and Quality, Affected Environment – Sullivan Creek Surrender*, the District's sampling indicates that Sullivan Lake is classified as Oligotrophic. Sullivan Lake is phosphorus limited, which is likely a factor that limits zooplankton production (in terms of both density and species diversity). Total phosphorus in Outlet Creek was similar to that in Sullivan Lake, and zooplankton densities in the creek were similar to average densities found in Sullivan Lake through the entire water column. The studies reviewed by the District suggest that fertilization may provide gains in smolt biomass, but also present complicated biological issues (*e.g.*, algal control).

*Temperature Ranges of Fishes Potentially Found in Sullivan and Outlet Creeks* – The District commissioned a literature review of temperature thresholds for species of fish occurring in Outlet and Sullivan creeks to address the potential effects on stream-dwelling fishes of releasing additional warm water from Sullivan Lake (EES Consulting, 2009). Results of this review indicate that rainbow, brook, and brown trout have the highest temperature tolerances of fish found in Outlet and Sullivan creeks, with lethal temperatures exceeding 75.2 °F (24 ºC). Bull trout and cutthroat trout have a more restricted temperature tolerance, around 69.8 °F (21 ºC).

*Bull Trout Spawning and Incubation Analysis* – Releasing water from Sullivan Lake in the fall raises issues related to: (1) the magnitude of releases during the fall period and the potential effects on fall spawning fish (e.g., bull trout); and (2) as the lake empties, the potential effects on incubating bull trout eggs as flow levels in Outlet and Sullivan creeks recede. To address these concerns, the District commissioned an analysis of bull trout spawning and incubation. The purposes of the analysis were to determine: (1) the amount and location of high quality bull trout spawning habitat over a range of flows; and (2) the effects of reducing streamflow on incubating bull trout eggs. RHABSIM (Riverine habitat Simulation System) was used to produce WUA curves for bull trout spawning for existing conditions and a scenario with enhanced substrate.

---

[133] The depth of 1 foot is above the minimum (> 0.5 foot) for adult resident salmonids for either rearing or spawning and would provide adequate passage.

[134] 18 to 69 cfs provides a maximum depth of ≥ 1 foot, and 69 to 101 cfs provides a mean depth of ≥ 1 foot across the three transects.

[135] The threshold for wetted width is to avoid conditions that could lead to stranding if flows were decreased rapidly from the flow of interest.

The analysis showed that spawning habitat was, and continues to be, sparse in Sullivan Creek due to the presence of the Mill Pond dam, which prevents sediment and gravels from being transported to Sullivan Creek downstream from the dam (EES Consulting, 2009). If the Mill Pond dam is removed and the reach of Sullivan Creek at, and above, the present location of the dam is restored, gravel is expected to be transported downstream to lower Sullivan Creek, and the amount of spawning gravel, as well as spawning and incubation habitat, would increase. Under nearly all scenarios, over 80 percent of the spawning habitat would be protected while eggs are incubating in the gravel. In addition, the majority of spawning flow regimes examined provides at least 90 percent protection of incubating eggs (*see* Appendix E.4.9 of the Sullivan Creek license surrender application).

#### 3.7.1.3 Canada Lynx

The Canada lynx was listed as federally threatened on April 24, 2000. Critical habitat has been designated in Washington; however, there is no critical habitat designated in Pend Oreille County.

In northeastern Washington, lynx use remote, high-elevation (> 4,000 feet) forests dominated by mature spruce, subalpine fir, and thickets of dense lodgepole pine that support prey (primarily snowshoe hare populations (Brittell et al. 1989; Stinson 2001). Only a small amount of the land in the area (within 5 miles) of the Boundary and Sullivan Creek Projects is above elevation 4,000 feet.

Population recruitment and home range sizes of lynx in the United States are similar to those reported during the decline or low phase of snowshoe hare cycles at more northern latitudes (Koehler 1990; Apps 2000). Lynx at the southern periphery of their range may prey on a wider variety of organisms, because of differences in small mammal communities and lower average hare densities compared with northern taiga.

There have been several reported lynx sightings within five miles of the projects. During the 2007-2008 field season, a fisheries study crew observed a lynx swimming across the Canyon Reach of the Boundary reservoir south of Monument Bar in a narrow section of the reservoir (about 300 feet wide) (*see* Big Game Study Final Report, Seattle 2009a). This individual was thought to be a dispersing individual, traversing the area and heading toward higher elevations and more suitable habitat.

The Washington DFW recovery plan for lynx outlines steps to increase lynx populations in the state and defines recovery goals and objectives based on Lynx Management Zones (Stinson 2001). The projects are not located within a designated Lynx Management Zone (LMZ). The two LMZs closest to the projects are the Salmo Priest LMZ to the east and the Little Pend Oreille LMZ to the west. The LMZs have been divided into Lynx Analysis Units (LAUs), which were established to assess habitat conditions and are useful as survey units for documenting lynx occurrence. The projects are nearest to the Russian and Cedar (to the west) and Slate and Totem (to the east) LAUs. The LAUs are about 1 mile from the projects.

#### 3.7.1.4 Woodland Caribou

The woodland caribou was listed as a federally endangered species on January 14, 1983; no critical habitat has been designated for the species. A small number of woodland caribou occur in the southern Selkirk Mountains, with most of the animals occurring in British Columbia, north of the Boundary and Sullivan Creek Projects. Caribou were transplanted into northeastern Washington and northern Idaho, including some in the upper Sullivan Creek drainage on the Sullivan Lake Ranger District, beginning in the late 1990s (Audet and Allen 1996). During early winter, caribou move to low-elevation, old-growth cedar/hemlock forests. They then move up to subalpine fir and whitebark pine stands once snow becomes sufficiently compacted and crusted for caribou to be able to walk on top of it (USFWS 1994). During spring, caribou move downslope to forage in shrub fields, meadows, and open forest stands.

The majority of the caribou population resides in the Salmo-Priest Wilderness Area, more than five miles east of the projects. Areas above elevation 4,000 feet are included in the Selkirk Mountain Woodland Caribou Recovery Area (USFWS 1994).

Over the last 25 years, woodland caribou have occasionally been observed in the general vicinity of the town of Metaline Falls and near the West Side Access Road, and have been documented crossing the Pend Oreille River north of Metaline (CNF Sullivan Lake Ranger District Wildlife Species Occurrence database, 1996; Borysewicz 2008). They have also been observed within two miles to the northwest of Mill Pond. Despite these rare observations, the Boundary Project vicinity lacks the older forests and elevations typically used by this species.

#### 3.7.1.5 Grizzly Bear

The grizzly bear was listed as a federally threatened species on July 28, 1975; no critical habitat has been designated for the grizzly bear. The FWS has determined that the grizzly bear population in the Selkirk area of Idaho and Washington warrants reclassification to endangered status, but such action has been precluded by work on other higher priority species (FR 64(94):26725-26733, May 17, 1999). The Grizzly Bear Recovery Plan lists human activity, road building, forestry, and mining as adversely affecting the grizzly bear (USFWS 1993). Since 1975, habitat protection measures implemented by federal agencies have focused on providing secure habitat for bears that lessens opportunities for human-caused mortality resulting from hunting (i.e., mistaken for black bear, poaching, human-bear conflicts, and livestock-bear conflicts.

The boundary of the Selkirk Mountain Grizzly Bear Recovery Area (Highway 31) is approximately 0.75 miles east of the Boundary Project area boundary. Thus, the Boundary Project area is not within a designated grizzly bear recovery area; however, Sullivan Lake, Mill Pond and portions of Lower Sullivan Creek are within a designated grizzly bear recovery area. The population is estimated to be 40 - 50 animals within the 2,200 square-mile Selkirk Mountain recovery zone (USFWS 2004).

Grizzly bears have been sighted from both sides of the Boundary reservoir and near Sullivan Creek (Borysewicz 2008). However, grizzly bears are not expected to use the Boundary Project are on a regular basis due to human activity and scarcity of key forage species, particularly fruit-bearing shrubs. In 2004, Forest Service biologists observed a grizzly bear feeding on a deer carcass in the lower Sullivan Creek drainage (Seattle 2009). Thus, bears may periodically traverse the project areas as they move between areas of suitable habitat.

Grizzly bears require spring forage habitats that provide large amounts of succulent, palatable herbaceous plants when they emerge from dens sites. In most cases, these habitats are restricted to wetlands and riparian areas. During the summer and fall, berry-producing shrub fields are important. Both spring and summer/fall forage habitats occur in limited portions on the Colville National Forest near the projects (Seattle 2009). Den sites are associated with high elevations near the Salmo-Priest Wilderness Area (Seattle 2009).

#### 3.7.1.6 Gray Wolf

Wolves are wide ranging predators that are currently re-establishing in Washington. Individuals and/or packs may use the project area and adjacent habitats at least occasionally (letter from Preston Sleeger, Regional Environmental Officer, FWS to Kimberly Bose, Secretary, FERC, September 2, 2010). Wolf howling was heard on several occasions by field crews working in the vicinity of Boundary dam during 2007 and 2008, coming from the Canadian side of the international border. Unconfirmed sightings of wolves swimming across the Boundary reservoir and walking along the shoreline were recorded during 2007 field surveys (*see* RTE Wildlife Study, Seattle 2009f). A wolf pack was confirmed by Washington DFW in northeastern Pend Oreille County in July 2009 (letter from Preston Sleeger, Regional Environmental Officer, FWS to Kimberly Bose, Secretary, FERC, September 2, 2010).

### 3.7.2 Environmental Effects

#### 3.7.2.1 Boundary Project

**Description of Action**

Proposed project operations are described in detail in section 2.1, *Action and Action Alternatives.*

<u>Conservation Measures for Aquatic Species</u>

Under the settlement, Seattle proposes to implement the provisions of its FAMP to protect and enhance fish and aquatic resources in the project area and tributaries. The FAMP establishes the goals, program objectives, tasks, and schedule for implementing those provisions during the term of a new license.[136] Seattle would implement the final FAMP in consultation with the FAWG (Fish and Aquatics Work Group). The enhancement measures described in the FAMP are an integrated package of mainstem and tributary measures designed to benefit native salmonid populations (i.e., bull trout, westslope cutthroat trout, and mountain whitefish) and their habitat. The FAMP is divided into the following elements:

- Mainstem Fish Community and Aquatic Habitat Measures
    - Gravel Augmentation below Box Canyon dam
    - Channel modifications for mainstem trapping pools at RM 30.3
    - Mainstem large woody debris and tributary deltas
    - Boundary Reservoir fish community monitoring and evaluation of salmonid predation at select tributary deltas
- Upstream Fish Passage
- Reduction of Project-Related Entrainment Mortality
- Tributary Restoration Measures
    - Tributary non-native trout suppression and eradication
    - Riparian improvement and stream channel enhancement in Sullivan Creek, RM 0.30 to 0.54
    - Riparian, streambank, and channel improvements in Sullivan Creek, RM 2.3 to 3.0, and in North Fork Sullivan Creek
    - LWD placement and road improvements in Sullivan Creek and select tributaries upstream of the confluence with Outlet Creek
    - Culvert replacements and LWD placement in tributaries to Boundary Reservoir
    - Riparian planting, culvert replacement, and channel reconstruction in Linton Creek, RM 0.00 to 0.24
    - Riparian and channel improvements in Sweet Creek, RM 0.0 to 0.6.
    - Habitat improvement in Tier-2 tributaries to Boundary Reservoir
    - Closure and restoration of Sullivan Creek dispersed recreation sites
- Mill Pond Dam Site Monitoring and Maintenance

---

[136] Under the settlement, the settling parties have agreed that enhancement efforts should be primarily directed at Boundary Reservoir tributaries. This maintains the power generation benefits of the Boundary Project while providing the best opportunity for native salmonid protection and recovery.

- Native Salmonid Conservation Program
- Recreational Fish Stocking Program

The aforementioned measures are summarized and discussed below, and described in greater detail in the FAMP (*see* Attachment E-8 to Exhibit E of the License Application).

In addition to implementing the FAMP, Seattle proposes to undertake TDG abatement measures, which are described more fully in section 3.4, *Water Quantity and Quality*, and in detail within the TDG Abatement Plan (*see* Attachment E-4 to Exhibit E of the License Application). Finally, Seattle proposes to implement a Temperature Attainment Plan that would involve improving riparian and aquatic habitat in Boundary Reservoir tributaries.[137]

*Gravel Augmentation below Box Canyon Dam* – The available information from relicensing studies suggests that mountain whitefish spawn in the Box Canyon dam tailrace (Seattle, 2009d). In addition, egg mats successfully collected a small number of eggs believed to be those of mountain whitefish.

Seattle proposes to place a total volume of 1,500 cubic yards ($yd^3$) of screened gravels to increase potential mountain whitefish spawning habitat in the upper reservoir. In an effort to increase gravel retention at the placement sites, Seattle would install up to 189 tons of 3- to 4-foot-diameter boulders in weirs or other structural designs. Construction of the boulder weirs and gravel placement would occur in two phases, and is expected to increase the spawning opportunities and success of mountain whitefish, a potential source of food for bull trout, in Boundary Reservoir. Finally, Seattle proposes to monitor the effectiveness of this measure, which would document the implementation of the program and help determine the appropriate frequency of gravel replenishment.

*Channel Modifications for Mainstem Trapping Pools at RM 30.3* – Relicensing studies during 2007 and 2008 suggest that fry and young-of-year fish may become trapped in pools during periods of declining reservoir water surface elevations and under some conditions may suffer injury or mortality during these events. Although nearly all of the trapped fish observed were non-salmonids, such as suckers, perch, or smallmouth bass fry, these trapping mechanisms could also potentially adversely affect native salmonids if they are present in the trapping areas when water surface elevations decline.

---

[137] The Ecology indicates that riparian plantings and fish habitat improvements in tributaries to the reservoir, plus enhancing and protecting thermal refugia in the reservoir's tributary delta areas, erosion control measures, and associated riparian plantings on the mainstem Pend Oreille River, would help meet Ecology's temperature improvement goals for the Pend Oreille River. *See* Seattle March 2010 Draft Biological Assessment, p. 54.

As part of the settlement, Seattle proposes to excavate a 1,800-foot-long channel, to an elevation below 1,979 feet NAVD 88, to connect mainstem flow to several isolated pools at a large cobble bar near RM 30.3.[138] The objective of this measure is to reduce the risk of fish becoming trapped during declining water surface elevations. In addition, Seattle proposes to monitor the effectiveness of this measure, as described in the FAMP.

*Mainstem Large Woody Debris at Tributary Deltas* – Relicensing studies indicate that native and non-native salmonids use tributary deltas during summer to take advantage of coldwater refugia (Seattle, 2009b). Deltas also serve as transition areas between the reservoir and tributaries and must be used by fish moving between these two habitat types. Habitat studies indicate there is little LWD or other forms of cover in these tributary deltas (Seattle, 2008b).

Under the settlement, Seattle proposes to enhance tributary delta habitat by providing additional cover for salmonids holding in the coldwater refugia at tributary mouths. LWD jams would be placed and maintained in the thalweg in the upper delta regions of Sullivan,[139] Sweet, Slate, and Linton creeks. The Sullivan Creek logjams would have a total volume of not less than 1,700 $ft^3$, while each logjam in Slate, Sweet and Linton creeks would have a volume of not less than 530 $ft^3$. The specific location and design of the LWD jams would be determined in collaboration with the FAWG, but generally would be located in the upper end of tributary deltas to minimize use by non-salmonids. Finally, Seattle proposes to monitor the physical effectiveness LWD jams at ten year intervals and following major flood events (25-year event).

*Boundary Reservoir Fish Community Monitoring and Evaluation of Salmonid Predation at Select Tributary Deltas* – Information on the fish community in Boundary Reservoir can be used in a variety of ways, both by Seattle and the resource agencies. First, Seattle could use trend information in the adaptive management of its proposed environmental enhancement measures under a new license. Second, trend information can help resource management agencies to identify necessary changes in future management direction. Finally, if not kept in check, non-native predator fish species that use the project area can proliferate and become a threat to the already uncommon native salmonids, which could affect proposed recovery efforts for these species.

---

[138] This area is known as the Cobble Sisters area, which was identified as a location with a high occurrence of trapping (Seattle, 2009a).

[139] Placement of LWD jams at the Sullivan Creek delta could be affected by activities required pursuant to the pending surrender proceeding for the District's Sullivan Creek Project. As described in this EIS, removal of the Mill Pond dam could affect downstream enhancement projects due to short- or long-term changes in sediment supply and LWD recruitment and transport. Consequently, Seattle would schedule its enhancement measures for Sullivan Creek to complement upstream activities.

Monitoring the fish community in Boundary Reservoir could assist management agencies in the development of strategies for the recovery of native salmonids and the setting of priorities and schedules for implementing these strategies.

As part of the FAMP proposed under the settlement, Seattle would conduct fish community surveys in Boundary Reservoir beginning in year 5 after license issuance and at five-year intervals thereafter. The objective of the surveys would be to monitor changes in fish population abundance and size structure of focal species over time.[140] In addition, Seattle would conduct a study to evaluate predation on outmigrating native salmonids at select tributary deltas. The objective of the study would be to quantify the proportion (percent by number and biomass) of outmigrating native salmonids from select tributaries that are being consumed by predatory fish within the selected tributary deltas, and determine consumption rates of select predators consistent with the general methods described in Baldwin *et al*. (2003). These two study efforts are described in greater detail in the FAMP.

*Upstream Fish Passage* – Passage barriers (e.g., dams, road crossings, waterfalls, etc.) are an isolating mechanism for local fish populations. A local population that lives above a barrier can only contribute individuals (and their genes) in a downstream direction. If a local population upstream of a passage barrier is extirpated, then there is virtually no opportunity for the local population to become re-established unless other local populations are present farther upstream or there is human intervention. The likelihood of re-establishing local populations is greatly enhanced if upstream populations include migratory life history forms, which are more likely to disperse. Baxter (1999) reported that the migratory form of bull trout is in decline in the Salmo River drainage. Nelson *et al*. (2002) suggested that the loss of the migratory form in some areas increases the risk that local populations could go extinct.

Passage barriers may isolate local populations, but they can also prevent the spread of non-native species such as brook trout, which are considered a threat to native salmonids (Andonaegui, 2003). Most of the tributaries to Boundary Reservoir have been stocked with non-native salmonid species such as brook trout, brown trout, and rainbow trout. However, Lost Creek and at least two sub-watersheds, the North Fork Sullivan Creek and Lunch Creek, have been unaffected by non-native species.

The Boundary dam was built without fish passage facilities because downstream power and water storage projects, such as Grand Coulee and Chief Joseph dams, blocked anadromous fish migrations to the Upper Columbia Basin. However, declines in populations of native salmonids, including bull trout, westslope cutthroat trout, and mountain whitefish have increased focus on migrating resident fish. The NWU Recovery Team for bull trout considers passage at hydroelectric projects on the Pend

---

[140] At a minimum, the focal species would include westslope cutthroat trout, bull trout, mountain whitefish, smallmouth bass, northern pikeminnow, and northern pike.

Oreille River a high priority for recovery (FWS, 2002), and the Bull Trout Recovery Plan calls for upstream passage at the upstream Albeni Falls and Box Canyon dams, as well as the Boundary dam.

As part of the settlement, Seattle proposes to install, operate, maintain, and monitor an upstream trap-and-haul fish passage facility in the Boundary dam tailrace.

The purpose of this fish passage facility is to provide safe, timely, and effective passage for bull trout, cutthroat trout, and mountain whitefish in the project area. The facility would include a fixed entrance(s) and a release location(s) at least 1 mile upstream of the Boundary dam. Seattle would design and construct this upstream fishway using the best available scientific information, including but not limited to the NMFS (2008) Anadromous Salmonid Passage Facility Design Manual, taking into account the site specific conditions at the project, biological information specific to the target species, and other relevant information.

At this time, there is uncertainty regarding an appropriate site within the tailrace for the fixed trap-and-haul facility. In addition, because of the low numbers of native salmonids captured or observed in the Boundary dam tailrace, there is little site-specific information from the project tailrace regarding seasonal movement patterns of target species. Therefore, consistent with NMFS (2008), the process for developing the trap-and-haul facility includes an 8-year research and development phase to evaluate site specific conditions and biological traits of the target species in the project area. This information would be used to develop the final design for the trap-and-haul facility.

In addition to developing the upstream fish passage facility, Seattle also proposes to monitor its operations and modify it as needed based on the monitoring. Within 13 years of license issuance, Seattle would file a Post Construction Evaluation Plan with the Commission. This plan would include methods for documenting fish passage efficiency, passage time, mortality, injury and fallback rates under a representative range of operating scenarios and environmental conditions.

*Measures to Reduce Project-Related Entrainment Mortality* – The Boundary dam was built without entrainment reduction facilities. However, declines in native resident salmonid populations have placed increased emphasis on protection of migrating fish. If fish pass downstream through the Boundary dam facilities, they are exposed to potential injury and mortality, with the level of mortality depending on the pathway, flow rate, and size of fish. Based on relicensing studies and a review of the literature, Seattle determined that smaller fish are expected to have the lowest turbine mortality (5 to 15 percent), while turbine mortality is expected to increase with fish size (i.e., 23 to 65 percent for larger fish). *See* section 3.5.1.1, *Aquatic Resources, Affected Environment – Boundary Project* for further details.

As part of the settlement, Seattle proposes to implement a program to address the effects of entrainment on bull trout, westslope cutthroat trout, and mountain whitefish by either: (1) preventing entrainment at the project; (2) reducing entrainment at the project and addressing for the remaining effects through other measures; or (3) fully addressing the effects of entrainment through other measures.[141] The FAWG would decide which alternative to pursue based on site-specific information developed as part of the program. The measure would be subject to agency and Commission approval. Seattle's proposed program would be a multi-year effort that involves (a) quantifying the effects of entrainment on bull trout, westslope cutthroat trout, and mountain whitefish, (b) if warranted, building facilities at the project to improve survival of the species or implementing appropriate non-operational measures to improve survival of the species, and (c) follow-up monitoring to determine the need for additional measures.

*Tributary Non-native Trout Suppression and Eradication* – Most of the tributaries to the Pend Oreille River, including those flowing into Boundary Reservoir, have been stocked with non-native salmonid species such as brook trout, brown trout, and rainbow trout (McLellan, 2001). The presence of nonnative trout, especially brook trout, has been identified as a serious threat to native salmonids as a result of interbreeding (with bull trout) and competition for habitat and food resources (Andonaegui, 2003). The FWS (1999) stated in its status review that westslope cutthroat trout are usually found in the cooler upper extents of tributaries, but suggested this use was more likely driven by competition from other trout such as rainbow trout and brook trout that are less tolerant of cooler, higher gradient streams, rather than a preference for that habitat type.

Sullivan Creek and Slate Creek have been identified as streams important to the recovery of bull trout in the NWU and reduction of non-native fish species as a priority action (POSRT, 2005). As discussed in sections 3.5.1.1, *Aquatic Resources, Affected Environment – Boundary Project* and 3.5.1.2, *Aquatic Resources, Affected Environmental – Sullivan Creek Project*, brook trout are present in both creeks. Rainbow trout also have been documented in Slate Creek downstream from RM 0.75. Finally, brown trout and kokanee are known to exist in Sullivan Creek, downstream from Sullivan Lake.

Under the settlement, and as part of the FAMP, Seattle proposes to undertake non-native trout suppression or eradication activities in portions of 23 Boundary watershed water bodies (14 are tributaries to Sullivan Creek). For water bodies where non-native suppression is the objective, the level of effort may vary among stream reaches but would be consistent with an average of six electrofishing efforts of one to

---

[141] Based on relicensing activities, a team of fish passage experts evaluated entrainment reduction concepts at the Boundary dam and concluded that a floating surface collector concept would provide the most flexibility and potentially the highest incremental increase in fish protection. However, since little is known about the migration depth of bull trout, westslope cutthroat trout, and mountain whitefish, the efficacy of a floating surface collector concept to reduce entrainment of the target species is uncertain.

three passes per reach every 10 years from the start of implementation through the remaining term of the license. For water bodies designated for eradication of non-native salmonids, the level of effort would be consistent with three chemical treatment applications assuming the use of antimycin, rotenone or an equivalent fish toxicant.

*Riparian Improvement and Stream Channel Enhancement in Sullivan Creek, RM 0.00 to 0.54* – Biological surveys conducted during relicensing indicated that the delta region and lower reaches of Sullivan Creek are used for rearing by cutthroat trout, brown trout, and rainbow trout. The delta has also been identified as a location of known mountain whitefish spawning. Although few bull trout have been observed in Sullivan Creek, it is proposed for designation as "critical habitat" by the FWS.

Seattle undertook a channel assessment from RM 0.47 to RM 0.68 mid-July 2008. The habitat conditions in the surveyed reach were described as poor for fish migration, rearing, and overwintering, as well as for spawning (due to the lack of appropriate sized gravel, and during high flows there is a high potential for any redds to be scoured). The dominant bed surface pattern consists of riffles and rapids, and LWD is rare throughout the surveyed reach. The LWD that does exist is primarily present above the water surface, which limits it as an active component of fish habitat to higher flows. The riparian zone was described as composed of young (< 40 years) mixed vegetation, with some portions devoid of riparian trees or brush (i.e., very sparse).

Under the settlement, and as described more fully in the FAMP, Seattle proposes to implement riparian improvements along the left bank of Sullivan Creek for up to 1,200 feet of stream to improve riparian functions (shade, potential instream LWD, and erosion control). Selection of specific plants and planting locations would be determined in collaboration with the FAWG and following Washington DFW guidelines in Saldi-Caromile *et al*. (2004).[142] In addition, Seattle proposes to improve instream spawning and rearing habitat and channel conditions along 1,200 feet of stream by LWD placement [15 to 20 pieces; following Washington DFW guidelines in Saldi-Caromile *et al*. (2004)], large boulder placement (5 to 10 boulders), and channel modification. It is expected that the addition of structural elements would contribute to pool formation, retention of LWD, and retention of coarse sediment suitable for salmonid spawning. Structural elements along the left bank would help stabilize the streambank, protecting downstream property owners and decreasing bank erosion. Finally, as described in the FAMP, Seattle would monitor the effectiveness of these enhancements.

*Stream and Riparian Improvements in Sullivan Creek from RM 2.3 to 3.0, and in the North Fork Sullivan Creek* – Habitat quality in two reaches of Sullivan Creek, from RM 2.30 to 2.60 and from RM 2.74 to 3.02, is described as low for salmonid spawning

---

[142] Plants would be a mix of native coniferous and deciduous trees, shrubs, and herbaceous plants or ground cover.

for both reaches, moderate for migration and rearing habitat in both reaches, as well as low and moderate, respectively, for overwintering habitat (Seattle, 2009a). The reaches are adversely affected by (a) the presence of the Mill Pond dam, which starves the reach of coarse substrate and LWD,[143] and (b) the presence of Sullivan Lake Road along its right bank, which reduces riparian function.[144] Both reaches lack rearing pools, and have a low abundance of cutthroat and rainbow trout (McLellan, 2001).

North Fork Sullivan Creek has two fish migration barriers, including the North Fork Sullivan dam located at RM 0.25 (Andonaegui, 2003) and the Sullivan Lake Road culvert at the mouth of the stream (Forest Service, 2002). Cool water present within North Fork Sullivan Creek may provide thermal refugia to salmonids during warm summer periods.

Increasing channel structure, decoupling the Sullivan Road from the stream, and enhancing riparian conditions is expected to benefit trout in Sullivan Creek. As part of the settlement, and as described in more detail in the FAMP, Seattle proposes a variety of measures to achieve the aforementioned benefits.[145] The elements would include: (a) seven engineered LWD jams with a target volume of 1,100 cubic feet; (b) placement of up to 10 to 20 boulders averaging 3 feet in diameter in the stream; (c) channel modifications; (d) riparian plantings; (e) streambank modifications at two locations where Sullivan Lake Road is hydrologically connected to the creek; and (f) either road relocation/reconstruction or stream channel diversion at one site on Sullivan Creek. These activities would be completed by year 10 of the license.[146] In addition, Seattle proposes to replace the culvert at the Sullivan Lake Road stream crossing on North Fork Sullivan Creek and place LWD in North Fork Sullivan Creek from the mouth to the

---

[143] LWD density in the two reaches was lower than regional reference levels reported by Fox and Bolton (2007).

[144] Riparian vegetation is described as a mixture of hardwoods and conifers, with the left bank having both young (< 40 years old) and mature (40-80 years old) trees, while the right bank had primarily young vegetation.

[145] The objective of the measure is to decrease bank erosion on the right bank, provide instream structure to promote to create pools and enhance deposition and retention of spawning gravel, decrease the channel width-to-depth ratio, and promote the development of at least a 10-foot vegetated riparian zone along the right bank. The activities associated with the measure could be affected by activities proposed as part of the pending surrender proceeding for the Sullivan Creek Project, which includes the removal of the Mill Pond dam. Therefore, implementation of this measure would be scheduled to complement the Sullivan Creek surrender activities.

[146] Selection of specific structural elements and their placement would be determined in collaboration with the FAWG and follow Washington DFW guidelines in Saldi-Caromile *et al*. (2004).

North Fork Sullivan Creek dam (RM 0.25) by year 15 of the license. Finally, Seattle proposes to monitor the effectiveness of this measure, as outlined in the FAMP.

*LWD Placement and Road Improvements in Sullivan Creek and Select Tributaries Upstream of the Confluence with Outlet Creek* – The Sullivan Creek Watershed Assessment (Forest Service, 1996) identified roads, dispersed recreation, mining, and riparian harvest as anthropomorphic activities contributing to an altered sediment regime, channel straightening, unstable stream banks, and low LWD levels in some areas of Sullivan Creek. The report also suggested that LWD removal from streams may have occurred as part of road building, harvest activities, and to prevent lateral migration of the stream into Sullivan Creek Road. Based upon channel type and current conditions, the Forest Service described most of the tributaries to Sullivan Creek as being at low risk, in good condition, and providing most of the spawning habitat for the watershed. In contrast, most high risk reaches were located in the mainstem Sullivan Creek, and lack of LWD contributed to low levels of sediment storage, channel instability, and poor spawning habitat conditions. The Forest Service identified high priority actions that would improve access to tributary habitat, decrease sediment delivery to Sullivan Creek, provide structure for salmonid rearing habitat, and stabilize stream banks.

As part of the FAMP, Seattle proposes to undertake measures to (a) improve fish and aquatic habitat and access to habitat, (b) improve road and stream crossings, and (c) provide stream channel and landslide stabilization. As described in the FAMP, the measures, to be completed by year 10 of the license, involve (a) placement of LWD in three river reaches of Sullivan Creek (i.e., Outlet Creek to Rainy Creek, Rainy Creek to Gypsy Creek, and Gypsy Creek), (b) road improvements along 12 miles of Sullivan Creek Road between the mouth of Outlet Creek and Leola Creek, and (c) road and channel stability improvements in Sullivan Creek tributaries upstream of Outlet Creek.

*Culvert Replacements and LWD Placement in Tributaries to Boundary Reservoir* – Slumber Creek and Styx Creek are tributaries to Slate Creek, with their confluences at RM 2.0 and 4.9, respectively. Forest Service Road 3155 crosses these tributaries near their mouths (RM 0.20 and 0.10, respectively). During 2008, habitat surveys were conducted upstream and downstream of these culverts for 492 feet in conjunction with evaluation of the culverts (Seattle, 2009a). Neither of the culverts was found to meet Washington State criteria for fish passage. Both tributaries are relatively small with wetted widths less than 7.5 feet, but contain suitable trout habitat over a portion of their lengths (Seattle, 2009a), which would be available under all flow conditions if the culverts were replaced. The Forest Service reports that westslope cutthroat trout and brook trout are present in both streams (Forest Service, 1998b).

Within Flume Creek, McLellan (2001) described two culvert barriers. Both culverts were described as perched between 5 and 8 feet above the downstream plunge pools. Brook trout and a small number of cutthroat trout exist in these creeks (McLellan, 2001; R2 Resource Consultants, 1998). According to McLellan (2001), salmonid habitat, in various amounts, exists throughout these stream reaches, including stretches between, and upstream of, the culverts. The lack of LWD and pool habitat was identified as a concern in certain areas.

The culverts at Lehigh Hill Road that crosses Pocahontas Creek were surveyed and found to be out of compliance with Washington State criteria for fish passage due to high velocities (Seattle, 2009a). These culverts also can become clogged with LWD. PORST (2005) indicates that cutthroat trout and rainbow trout are present in Pocahontas Creek.

With regard to Lime Creek, McLellan (2001) conducted habitat surveys within three reaches downstream of the Highway 31 stream crossing and documented a mean of 435 pieces of LWD per mile, mean gradient ranged from 3 to 10 percent, and pools that account for between 0 and 25 percent of habitat units in the reaches. Brook trout is the only salmonid known to use the stream.

To improve habitat and access to the habitat in the aforementioned creeks, Seattle, as part of the FAMP, proposes to improve fish and aquatic habitat and access to habitat through road and stream crossing improvements, stream channel stabilization, and LWD placement. Activities include replacement of 6 culverts in Slumber, Styx, Flume, and Pocahontas creeks, as well as LWD placement within 1.3 miles of Lime Creek, 1.0 miles of Flume Creek, and 2.7 miles of Sand Creek.[147]

*Riparian Planting, Culvert Replacement, and Channel Reconstruction in Linton Creek, RM 0.00 to 0.24* – Habitat between RM 0.00 and 0.25 is predominantly composed of low gradient riffles, with an average channel slope of 2 percent (Seattle, 2009a). Riparian and rearing habitat conditions within the survey reach were found to be poor, stream bank conditions were determined to be fair, and LWD was poor. Pool depth and pool frequency were not functioning properly, but off-channel habitat was classified as fair. There are thirteen culverts on Linton Creek, including a major stream crossing at RM 0.25. Two culverts downstream of RM 0.25 do not meet Washington DFW passage criteria (Seattle, 2009a). Seattle (2009b) observed cutthroat trout, rainbow trout, brown trout, brook trout, pumpkinseed, and largescale sucker using the tributary. Improvements to the riparian zone would substantially increase shade within 5 to 10 years and increase LWD recruitment to the channel over the long-term.

As part of FAMP, Seattle proposes to replace three culverts, reconstruct the stream channel, place 20 to 25 pieces of LWD, augment gravel substrate in numerous locations, and conduct riparian planting within a distance of up to 50 feet of the stream banks. The objective of this measure is to improve riparian functions, passage conditions at the stream crossings, and spawning and rearing habitat. Seattle proposes

---

[147] The size and number of pieces of LWD would be determined by the FAWG based upon the best available science (e.g., Fox and Bolton, 2007) and site-specific characteristics.

to monitor the effectiveness of the improvements to determine if they are achieving the objectives.

*Riparian and Channel Improvements in Sweet Creek, RM 0.0 to 0.6* – Sweet Creek is the fourth largest tributary draining into Boundary Reservoir. There are a series of natural falls that begin at RM 0.6, which are a complete barrier to upstream passage. The stream passes through a large box culvert at RM 0.5. The culvert blocks transport of LWD, and streambank erosion is occurring downstream of the culvert (Seattle, 2009a). The culvert does not meet Washington DFW criteria for fish passage, but bull trout, cutthroat trout, mountain whitefish, as well as rainbow, brown, and brook trout are known to occur upstream of the culvert (McLellan, 2001). Riparian and instream substrate and LWD conditions are considered to be good, but the reach is dominated by riffles and has relatively few pools (Seattle, 2009a; McLellan, 2001).

The cool-water plume at the tributary delta to Sweet Creek is an important area for salmonids during warm summer months. Bull trout, westslope cutthroat trout, and mountain whitefish have all been observed in lower reaches of Sweet Creek (Seattle, 2009b). Most of the riparian zone of Sweet Creek downstream from RM 0.5 is in good condition (Seattle, 2009a; McLellan, 2001). Nonetheless, several areas could be improved through riparian planting. This is expected to benefit native salmonids and help to maintain coolwater temperatures in the tributary delta.

As part of the FAMP, Seattle proposes to improve and protect riparian conditions, instream habitat conditions, and passage at the culvert at RM 0.5. To provide long-term protection for the relatively intact riparian zone of Sweet Creek downstream of the culvert at RM 0.5, Seattle proposes to pursue the acquisition or protective land easements for 11.8 acres within a 100-foot buffer (excluding existing roads) on either side of Sweet Creek from the mouth to RM 0.50. In addition, Seattle would remove non-native vegetation and plant native brush and trees over a 0.3 acre area. Seattle also proposes to monitor the effectiveness of the measures to determine whether planting success criteria are being achieved.[148]

In addition to the riparian measures, Seattle proposes to increase channel complexity and gravel retention through LWD placement from the mouth of Sweet Creek to RM 0.6. The amount of wood to be placed would include approximately 166 pieces of LWD and of these pieces at least 12 would be 12 inches or greater in diameter and a minimum of 35 feet in length. The bankfull width of Sweet Creek is about 33 feet in this reach, making it suitable for placement of channel spanning LWD. Selection of the specific location and design of the spanning structures would be determined in collaboration with the FAWG and follow Washington DFW guidelines in Saldi-

---

[148] As for all the riparian plantings proposed in the FAMP, the planting success criteria is to achieve at least 80 percent survival of trees and shrubs and 50 percent canopy cover of native species at the end of 3 years from the date of planting.

Caromile *et al*. (2004). Finally, Seattle proposes to improve upstream fish passage at the culvert located at RM 0.5. Improvements could include the addition of baffles, weirs, and/or aprons on the downstream end of the existing culvert.

As part of the FAMP, Seattle would monitor the effectiveness of the improvements in Sweet Creek. The purpose is to assess the measures' condition to determine if structural repairs, log replenishment, additional plantings, or non-native plant removal is needed to maintain the measures' designed functions.

*Habitat Improvement in Tier-2 Tributaries to Boundary Reservoir* –Seattle categorized 28 tributaries flowing into Boundary Reservoir according to habitat availability for native salmonids and the potential opportunity to improve conditions through habitat manipulation. The results of the analysis are included in Seattle (2009a). Tributaries were categorized as either primary, secondary, or excluded from evaluation. Nineteen secondary and excluded tributaries were referred to Tier-2 tributaries. The Tier-2 tributaries include 13 unnamed streams plus Everett Creek, Whiskey Gulch, Beaver Creek, Threemile Creek, Wolf Creek, and Lost Creek.

During relicensing, Tier-2 tributaries were considered a low priority because of their small size and/or presence of passage barriers near their confluence with the Pend Oreille River. Nevertheless, it is possible that these poorly understood tributaries may currently have, or have some potential to provide, habitat for native salmonids.

As part of the FAMP, Seattle proposes to implement measures to improve aquatic habitat conditions in Tier-2 tributaries commensurate with the anticipated benefits to native salmonids. The measures, which would not occur until year 20 of a new license if determined appropriate, would consist of various habitat improvements (e.g., riparian planting, LWD or boulder placement, culvert replacement). Seattle would prepare a site-specific habitat improvement plan for each selected Tier-2 tributary, which would include a monitoring element.

*Closure and Restoration of Sullivan Creek Dispersed Recreation Sites* – According to Forest Service (1996), many of the dispersed campsites in the vicinity of Sullivan Creek are located in riparian areas. The dispersed sites receive heaviest use during the summer recreation season, with a second high-use period occurring during the fall hunting season. Few of the dispersed sites are equipped with sanitary facilities. Many of the dispersed sites received heavy or extreme impact ratings at the time of the watershed assessment. Dispersed recreation has diminished the supply of LWD and resulted in a lack of shrubs and herbaceous cover in some riparian areas. Closure and restoration of the selected dispersed recreation sites are expected to improve riparian function, channel stability, and water quality in Sullivan Creek.

As part of the FAMP, Seattle proposes to close and restore up to 38 recreation sites located in riparian areas along Sullivan Creek to help restore fish habitat. Seattle would implement some combination of measures at each recreation site to be closed,[149] and monitor the effectiveness of the closed and restored sites on an 8-year reoccurring schedule.

*Mill Pond Dam Site Monitoring and Maintenance* –The Mill Pond dam is a complete barrier to the upstream movement of fish. The impoundment has altered natural stream processes in Sullivan Creek by interrupting the downstream transport of all bedload material and some LWD. The dam has created a condition where Sullivan Creek downstream of the Mill Pond dam is sediment depleted (Forest Service, 1996). The sediment transport capacity downstream of the dam exceeds the sediment supply, which has resulted in extensive armoring of the bed surface and a lack of gravels for use by spawning salmonid populations. Mill Pond has also slowed water velocities and increased summer water temperatures in lower Sullivan Creek.

Under the Sullivan Creek settlement, the District proposes to surrender the Sullivan Creek license, and remove the Mill Pond dam and restore the site within 5 years of the Commission issuing an order authorizing the surrender of the license. Benefits of the Mill Pond dam removal and associated site restoration would include the elimination of a man-made barrier to upstream fish passage, an increase in the quantity and quality of habitat for native salmonids, restoration of downstream transport of coarse sediment and LWD, and possible benefits to water quality in the form of reduced summer water temperatures due to reductions in water surface area and increases in water velocity in the area of Mill Pond Reservoir.

As part of the FAMP, Seattle proposes to monitor and maintain the Mill Pond dam site to ensure that the habitat enhancements made to restore the reach continue to function over time. Seattle’s obligation for monitoring and maintaining the site would begin once the Commission determines that the work required by the District’s Mill Pond Decommissioning Plan has been completed and the Commission’s ends its jurisdiction over the Sullivan Creek Project.

*Native Salmonid Conservation Program* – The larger tributaries to Boundary Reservoir contain a variety of fish species, and most salmonid species in the project area occur in the tributaries (Seattle, 2009b). Surveys conducted by the Forest Service, the Washington DFW, and the Kalispel Tribe show that the dominant sport fish in the tributaries are westslope cutthroat trout, brook trout, rainbow trout, and to a lesser extent

---

[149] The measures could include: (a) placement of boulders to occupy existing camping and fire ring locations; (b) placement of boulders to prevent vehicle access; (c) loosening of compacted soils; (d) streambank stabilization measures; (e) slope grading; (f) revegetation with locally derived native trees and shrubs; (g) suppression of invasive weed species, if feasible; (h) removal of fire pits; (i) trash removal; (j) removing pit toilets; and (k) public education.

brown trout and mountain whitefish (Seattle, 2006). These surveys documented bull trout, kokanee, and burbot in lower Sullivan Creek and bull trout in Sweet Creek.

Currently, no self-reproducing bull trout populations occur in any tributaries to Boundary Reservoir. Nonetheless, the NWU recovery team identified Sullivan and Slate creeks as local bull trout populations under a recovered condition based on habitat survey data and professional judgment (FWS, 2002). The NWU recovery team suggested that artificial propagation of bull trout could be needed to seed currently unoccupied habitat. Westslope cutthroat trout are widely distributed in the project area, but threatened by the presence of non-native brook trout.

The FAMP proposed by Seattle provides for a native species conservation program. Seattle would fund the construction and operation of a fish propagation facility for the production of native salmonids to outplant into tributaries draining into Boundary Reservoir, with the initial target being westslope cutthroat trout. However the facility would be designed to propagate two species of fish (which could include bull trout). Selection of species, stocks, and life stages to be produced, as well as population goals for the conservation program, would be developed in consultation with the FAWG.

*Recreational Fish Stocking Program* – Many of the measures included in Seattle's proposed FAMP are designed to benefit native salmonids in the Boundary Reservoir, its tributaries, and the Pend Oreille River in the vicinity of the project. This would come at the expense of popular, non-native species. Moreover, the project would continue to have certain effects on aquatic habitat and the fish community in the Boundary Reservoir.

As outlined in the FAMP, Seattle proposes to stock trout in 18 lakes within a 15-mile area around the project. Trout species stocked in these lakes would consist of westslope cutthroat, rainbow, rainbow triploid, or tiger trout, and may include fall fry, fingerlings, spring fry and catchable-size fish. About 11,678 pounds of fish would be stocked annually beginning no later than year 2 of the license. Seattle proposes to monitor at least six of the lakes receiving the stocked fish each year prior to the springtime opening day of trout season.

The purpose of this element of the FAMP is to mitigate for the loss of recreational angling opportunities at the project and compensate for other fish losses that would continue to occur. This measure has the potential to divert some fishing pressure from Boundary Reservoir to other areas, which may decrease the incidental capture of bull trout from angling in the reservoir.

*Total Dissolved Gas* – TDG levels have the potential to adversely affect any bull trout that use the tailrace during periods of spill. Following issuance of the new license for the project, Seattle proposes to implement measures identified in its TDG Attainment Plan (*see* Attachment E-4 to Exhibit E of the License Application). As described in section 3.4.2.1, *Water Quantity and Quality, Environmental Effects –*

*Boundary Project*, Seattle would initially evaluate three gate alternatives for TDG abatement. The historic performance of these outlets at small gate openings indicates the potential for successfully reducing tailwater TDG levels. Reduction of TDG levels would decrease the risk of gas bubble trauma in bull trout in the Boundary dam tailrace.

Each of the alternative measures could have both beneficial and adverse effects on bull trout. The beneficial effects would be a higher likelihood of attaining TDG compliance levels in the Boundary dam tailrace. However, the measures could also result in increased injury or mortality of fish entrained through the spillways or sluiceways due to the increased risk of fish strike with the added roughening elements. Fish strikes could result in blunt-force trauma to fish and loss of scales. Spreading the flow and reducing the size of water jets could be beneficial for small fish but adversely affect large fish during their landing in the tailrace. Regardless, there is uncertainty surrounding the magnitude of both the potential beneficial and adverse effects of the proposed measures for TDG abatement. This leads to uncertainty regarding the overall net effect to fish, in general, and bull trout in particular.

*Habitat Improvements Fund for Sullivan Lake Tributaries* – Sullivan Lake supports a naturally reproducing, self-sustaining population of kokanee that is a recreational fishery of regional importance. These fish live in Sullivan Lake and spawn in the lower Harvey Creek. In addition, the Sullivan Lake dam represents a barrier to fish movement in Sullivan Creek, blocking access to 1,291 acres and 13 miles of habitat for spawning, rearing, foraging, and overwintering habitat in Sullivan Lake and upstream tributaries, including that for bull trout. Nonetheless, the parties to the settlement agree that the need to protect habitat and refugia for native species (e.g., bull trout and westslope cutthroat trout[150]) outweigh the passage of fish at the Sullivan Lake dam. To improve habitat conditions in the upper Sullivan Lake drainage, Seattle proposes, as part of its settlement, to establish a $2.5 million fund for use by the FAWG to implement habitat improvement measures for tributaries of Sullivan Lake.

<u>Conservation Measures for Terrestrial Species</u>

Proposed environmental measures that will benefit terrestrial, federally listed threatened and endangered species are contained in Seattle's Terrestrial Resources Management Plan (TRMP), and described in section 3.6.2.1. Aspects of the TRMP that will benefit federally listed species include standards and best management practices (BMPs) for Seattle maintenance activities, management prescriptions for Seattle-owned lands within the project boundary, and incorporation of four parcels of land into the project boundary (totaling 276 acres), as well as management of these lands for terrestrial resource protection and enhancement.

[150] Genetic testing of cutthroat trout indicates that relatively pure strains of westslope cutthroat trout occur in Harvey Creek upstream of Sullivan Lake.

### Bull Trout:  Effects and Findings

The potential effects of the project on bull trout include:  (a) fluctuations in reservoir and tributary delta habitat as a result of varying water surface elevation due to load following operations; (b) mortality and injury during entrainment at the Boundary dam; (c) potential for fish trapping or stranding; (d) loss of connectivity with habitat upstream of the Boundary dam; and (e) the risk of gas bubble trauma resulting from elevated TDG concentrations in the Boundary dam tailrace.  These effects were outlined above, and are summarized as follows.

Fluctuations in reservoir and tributary delta habitat would occur under proposed project operations.  Based on habitat modeling for bull trout greater than 6 inches, the quantity of bull trout habitat in the reservoir that would be affected by water surface fluctuation is a substantial portion of the total amount of available habitat.  However, the amount of suitable habitat that is not affected by water surface fluctuation should be more than sufficient to support the current bull trout population in the project area.  Suitable reservoir habitat based upon depth, velocity, and substrate is not limiting bull trout populations at the project.

Variability associated with coolwater plumes in tributary delta regions during the summer has the potential to be limiting if the number of bull trout using Boundary Reservoir increases over the term of a new license.  Inter- and intra-specific competition may occur in coolwater plumes, but the relative importance of the project relative to other factors (e.g., presence and abundance of non-native species, tributary flow magnitudes, etc.) that could affect these interactions is unknown.  Relicensing studies also suggest that the shapes of coolwater plumes change depending on mainstem flow and water surface elevations.  Westslope cutthroat trout demonstrate active adjustments in delta regions to remain within suitable water temperatures, and bull trout are likely to behave similarly.  The need for frequent adjustments in location as a result of fluctuating water surface elevations is likely an intermittent adverse effect.  However, it is difficult to quantify the magnitude of the effect or determine if these adjustments significantly affect overall fish growth or reproductive fitness, because some level of movement would be normal regardless of water surface level fluctuations.

Under proposed operations, it is anticipated that monthly juvenile WUA minimums would be the same as under existing conditions, except during dry years when WUA is expected to be slightly higher compared to existing operations during June (Forebay Reach – 19 to 30 $ft^2$ WUA; Canyon Reach – 22 to 26 $ft^2$ WUA) and July (Forebay Reach – 21 to 30 $ft^2$ WUA; Canyon Reach – 24 to 26 $ft^2$ WUA).  Similarly, physical habitat modeling suggests that monthly adult bull trout WUA minimums would be slightly higher under during June (Forebay Reach – 316 to 322 $ft^2$ WUA; Upper Reservoir Reach – 379 to 388 $ft^2$ WUA; Tailrace Reach – 155 to 157 $ft^2$ WUA) and July (Upper Reservoir Reach – 373 to 388 $ft^2$ WUA).  The adverse effects of fluctuating water surface elevations on tributary coolwater plumes would improve with Seattle's proposal to place LWD jams in the deltas of Linton, Sweet, Slate, and Sullivan creeks;

increase LWD levels and place LWD jams in the lower reach of Sullivan Creek; and improve riparian areas in lower Sullivan, Sweet, and Linton creeks. These measures would improve water quality (temperature) and the quality and quantity of tributary and tributary delta habitat that could be used by bull trout during warm summer months.

The available information suggests that bull trout in the vicinity of the Boundary dam could be vulnerable to entrainment, but their low overall abundance in Boundary Reservoir indicates that entrainment of bull trout is likely rare. If bull trout populations were to become established in Boundary Reservoir tributaries, it is unclear what proportion of the tributary fish would migrate downstream to mainstem habitats. Of those fish that entered Boundary Reservoir, some fish could move downstream, survive interaction with the introduced non-native predators, warm water temperatures, and other impediments to survival associated with the mainstem habitats and enter the Boundary dam forebay. Some tributary fish might also follow the allacustrine life history pattern reported by Dupont *et al*. (2007) and migrate upstream towards Lake Pend Oreille. The portion of those fish that move downstream could be exposed to potential entrainment at the Boundary dam and the associated risk of injury or mortality. In addition, if there are future increases in upstream bull trout population sizes and entrainment through the Albeni Falls and Box Canyon dams occur, then the numbers of bull trout at risk of entrainment at the Boundary dam could also increase.[151]

As described above, the current level of risk of mortality to bull trout from trapping or stranding in the Action Area is considered low because of the low number of bull trout that have been observed in the past and their large size, which is consistent with life history of bull trout in the region (i.e., juveniles rear in tributary streams for at least several years until they reach 6.7 - 11.8 inches in length. Under Seattle’s proposal, the potential for trapping and stranding of bull trout is expected to decrease as a result of excavating a channel between trapping pools located in Cobble Sisters area of the Upper Reservoir Reach and filling one pool near the channel margin. The excavated channel would contain water when reservoir surface elevations are above 1,979 feet. However, the proposed enhancement would not reduce the potential for trapping or stranding of any bull trout elsewhere in the Action Area, except perhaps slightly as the result of the summer forebay water surface restriction. Consequently, some small level of risk to bull trout from trapping and stranding would be ongoing under a new license.

As described in the FAMP and summarized above, Seattle proposes to implement a phased approach to constructing upstream fish passage at the project. There is uncertainty regarding the effectiveness of the proposed trap and haul facility. In addition, it is unlikely that the facility would be able to operate year-round because of physical constraints associated with the Boundary dam tailrace, as well as the temperature and flow regime of the Pend Oreille River, which are independent of the

---

[151] Based on available evidence, high flow years may increase the risk of entrainment relative to normal or low flow years.

operation of the project.  Even under an optimistic scenario where entrainment reduction measures are either not needed or entrainment is reduced because of implemented measures, it is unlikely that all bull trout that survive entrainment at the Boundary dam would return back upstream.  Therefore, upstream connectivity for bull trout is likely to improve under the settlement, but may not be fully restored.

As described above and in section 3.4.2.1, *Water Quantity and Quality, Environmental Effects – Boundary Project*, Seattle is proposing to implement a number of alternatives to improve TDG at the project.  Attainment of TDG compliance is expected to completely eliminate any project-related TDG effects on bull trout in the Boundary dam tailrace.  However, TDG levels in the Action Area (in the reservoir upstream of the dam) are also the result of upstream operations at the Albeni Falls and Box Canyon dams.  Therefore, it is unlikely that the project could independently restore TDG levels throughout in the Action Area (i.e., upstream of its area of influence).  In addition, the measures designed to reduce TDG levels in Boundary Reservoir could also result in adverse effects to bull trout due to fish strike and increased likelihood that larger fish would not remain within plunging water jets if they were to be passed downstream via spillways or sluiceways.

The numerous conservation measures described above (e.g., tributary habitat enhancements, culvert replacements, monitoring and maintenance activities, etc.) are designed primarily to reduce or avoid adverse project effects to native salmonid populations, or to provide benefits to aquatic habitat and fisheries in tributaries draining to Boundary Reservoir.[152]  These measures would promote native salmonid populations and significantly improve the aquatic habitat they use.  The majority of the tributary conservation measures enhance or restore adfluvial aquatic habitat that is currently (lower Sweet and lower Linton creeks) accessible to bull trout or would become accessible in the near future (Sullivan Creek upstream of the Mill Pond dam).  The proposed eradication program for non-native species would reduce or eliminate the significant threat of brook trout to bull trout recovery in the Boundary tributaries.  The native species conservation program would provide the means to potentially introduce bull trout into areas where they are currently not present.  Each of the proposed measures supports the recovery of bull trout in the Pend Oreille River basin, but both individually and in total are unlikely to result in recovery on their own.

---

[152] As described in more detail in section 3.5.2.1, *Aquatic Resources, Environmental Effects – Boundary Project*, monitoring and maintaining the Sullivan Creek habitat improvements, including those of the Mill Pond site, would ensure that the anticipated benefits continue over time and additional measures, if needed, are identified in a timely manner.  The monitoring and maintenance program for Sullivan Creek would further the FWS' goals to protect and enhance critical habitat for bull trout and be consistent with the species' draft recovery plan.

As part of the Sullivan Creek surrender proceeding, the parties to the Sullivan Creek settlement agree that the Sullivan Lake dam should not be removed, nor should fish passage be provided at the dam. The decision to leave the Sullivan Lake dam in place provides an effective barrier to non-native fish migrating up into upstream habitats important for native salmonids, such as bull trout that could move from lower Sullivan Creek further up into the system. However, not providing passage at the Sullivan Lake dam eliminates a large amount of potential habitat that could be used by native fish that occupy Sullivan Creek downstream from the dam.

The Boundary settlement requires Seattle to establish a $2.5 million fund, which would help pay for measures to enhance habitat conditions in Harvey, Noisy, and Jungle creeks that flow into Sullivan Lake. Improving habitat conditions in these tributaries would benefit the Sullivan Lake kokanee and cutthroat trout populations, which potentially could reduce recreational fishing pressure on Boundary tributary streams. This would indirectly improve conditions for bull trout in the Sullivan Creek drainage through improved habitat and enhanced forage opportunities.[153]

Finding

Based on the aforementioned analysis, and the cumulative effects analysis in section 3.7.3, we find that continued operation of the Boundary Project, as proposed with mandatory conditions and additional staff-recommended measures, would likely affect, but not adversely affect existing populations of bull trout or its designated critical habitat in the Action Area.

**Canada lynx: Effects and Findings**

Canada lynx is a wide-ranging species, with territories far beyond the size of the Boundary Project area. Canada lynx use of the project area is presumed to be primarily as a travel corridor between lynx populations on either side of the Pend Oreille River, in the designated LMZs (*see* RTE Wildlife Study, Seattle 2009a). As such, Lynx are not directly dependent on resources associated with the river or project lands. While riparian and upland habitats adjacent to the reservoir would continue to be subject to water fluctuations and erosion, there would be negligible effects on Canada lynx because of the abundance of these habitats in the project area, the wide-ranging habits of this species, and the lynx's intermittent use of the project area.

Disturbance associated with project operation and maintenance, project-related recreation, and implementation of conservation measures would be temporary, and occur on a localized and discrete scale compared to the expansive home ranges of these species. Thus, the any effects would likely be minor.

---

[153] This fund is not addressed in the FAMP because, as stipulated in the settlement, Seattle's responsibilities would be limited to establishing the fund, which would be administered by the FAWG.

Streams, rivers, and lakes, represent potential obstacles to unrestricted wildlife movement across the landscape. Boundary reservoir does not appear to represent a significant barrier to the movement of the lynx as evidenced by the observed crossing of one individual. However, the slope and composition of the shoreline, as well as water currents in the reservoir, are likely to influence where these species can cross.

Seattle's proposed management of project lands would provide some benefit to lynx through enhancement of habitat and by limiting public access. Details of terrestrial land management are provided in the TRMP.

Construction of new roads can reduce available habitat, permit increased recreational activity, and provide travel corridors for lynx and their competitors. No new roads are proposed to be constructed, but several road spurs will be closed by Seattle. Only about 3 miles of project-related roads are paved; the remaining miles are dirt or crushed rock and bordered by native or naturalized vegetation. Preliminary information suggests that lynx do not avoid roads (Ruggiero et al. 2000a), except at high traffic volumes (Apps 2000), which does not occur on project-related roads. Although project-related roads may contribute to cumulative effects on the lynx habitat, they do not make up the majority of roads in the vicinity, and as such their effect is small.

The primary prey of lynx, snowshoe hare, is commonly available in the project vicinity (Seattle 2006), as are other small animals that lynx are known to prey upon (Squires et al. 2007).

Finding

Given the lack of suitable habitat and lack of project effects on lynx prey base, and the minor effect that project roads contribute to the overall landscape, we find that continued operation of the Boundary Project, as proposed with mandatory conditions and additional staff-recommended measures, would likely affect, but not adversely affect the Canada lynx.

**Woodland caribou: Effects and Findings**

There are few records of woodland caribou in the vicinity of the Boundary Project, but this species may use the general area east of the project for winter forage grounds. Woodland caribou are occasionally known to cross the reservoir south of Metaline Falls, where topography may allow easier access to river crossing points. Because of the steeper terrain around the lower reservoir (below Metaline Falls), big game trails are concentrated in areas that follow topographic features such as drainages. Along the upper reservoir (above Metaline Falls) the terrain is gentler and allows for a more diffuse pattern of big game travel. No impediments to big game travel or to reservoir access were identified during field studies and subsequent analysis (*see* Big Game Study, Seattle 2009a). Woodland caribou are likely to use big game trails that other ungulates use, especially in areas of steep topography.

Habitat in the project area is generally unsuitable for woodland caribou because of its low elevation and lack of older forest habitat; therefore, project operations are not expected to affect caribou. Project-related roads are not a primary component of the road network in the project area and are not expected to hinder the movement of any woodland caribou that may wander into the area. Caribou may benefit from the land management activities associated with the TRMP.

Finding

Because of the marginal quality of available caribou habitat, and the extremely low use of the area by woodland caribou, we find that continued operation of the Boundary Project, as proposed with mandatory conditions and additional staff-recommended measures, would likely affect, but not adversely affect the woodland caribou.

**Grizzly Bear: Effects and Findings**

The Grizzly Bear Recovery Plan lists human activity, road building, forestry, and mining as adversely affecting grizzly bears (USFWS 1993). Road density and associated human activity can affect grizzly bear movements and can cause significant mortality to bears from road kills and human-bear conflicts (Mace and Jonkel 1980). A number of studies have shown that grizzly bears tend to avoid areas with open roads (McLellan and Mace 1985, Kasworm and Manley 1988, Aune and Kasworm 1989), but that they may also become habituated to habituated to high levels of human disturbance, as long as it was predictable and non-lethal (McArthur 1979; Dood et al. 1986).

Grizzly bears may occasionally use the project area, but project operations do not have an effect on the habitat of this wide-ranging species for reasons described above for the Canada lynx. In addition, the project area roads represent a minor contribution to the landscape conditions and will not hinder the movement of grizzly bears that may wander through the area. As noted earlier, Seattle's road closures would likely improve conditions slightly. Use of the Boundary Wildlife Preserve by snowmobiles and all terrain vehicles (ATVs) could discourage use of this area by bears if they were to wander into this area. Measures to limit such future use in the preserve would prevent these potential adverse effects. Other disturbances from project-related operations and maintenance and implementation of aquatic conservation measures would be temporary, localized, such that any effects on grizzly bears that may use the area would be negligible given the large home range and abundance of similar habitats.

Finding

Because of the low grizzly bear use of the project area and minimal effects on habitat from continue project operations, we find that continued operation of the Boundary Project, as proposed with mandatory conditions and additional staff-recommended measures, would likely affect, but not adversely affect the grizzly bear.

**Gray Wolf: Effects and Findings**

Wolves are wide ranging species. Individuals and/or packs of the expanding wolf populations in Washington may occasionally use the project area and adjacent habitats. Effects of project operations, project-related erosion, and disturbance from project-related activities represent negligible effects on the gray wolf for the same reasons noted above for the Canada lynx, grizzly bear, and woodland caribou. Interior also concluded that project operations would likely have negligible effect on gray wolves because the abundance of these habitats and the wolves' wide-ranging habits (from Preston Sleeger, Regional Environmental Officer, FWS to Kimberly Bose, Secretary, FERC, September 2, 2010).

Finding

In the Draft EIS, , we found that continued operation of the Boundary Project, as proposed with mandatory conditions and additional staff-recommended measures, would likely affect, but not adversely affect the gray wolf for the above reasons. A finding is not required now because the gray wolf in eastern Washington is no longer listed as a threatened and endangered species.

#### 3.7.2.2 Sullivan Creek Project

**Description of Action**

In accordance with the Sullivan Creek settlement, the District proposes to undertake a variety of measures as conditions of the license surrender that would enhance fish habitat in the project area. As described in greater detail in section 3.4.2.2, *Water Quantity and Quality, Environmental Effects – Sullivan Creek Surrender*, the District proposes to implement (a) changes in its management of lake levels at Sullivan Lake, (b) flow releases from the Sullivan Lake dam, (c) ramping, and (d) a water supply program. The District proposes to remove the Mill Pond dam (both the concrete and log crib dams) and restore Sullivan Creek in the currently submerged area of the Mill Pond.[154] Measures to remediate the stream area would include installation of woody debris, large boulders and gravel, and rock weirs/riffles intended to control or moderate channel incision, and planting vegetation.

To enhance water temperatures in Outlet and Sullivan creeks, the District proposes to install a cold water release facility at Sullivan Lake.[155] To protect fish

---

[154] The work would be carried out by Seattle, as a cooperating agency, in accordance with an Interlocal Agreement between the District and Seattle.

[155] To deliver cold water from Sullivan Lake, a cold water intake would be designed and built to withdraw water from depth at Sullivan Lake and deliver the cold water to the project tailrace (McMillen, 2011). The cold water intake would be designed for a flow capacity ranging from 150 to 160 cfs with Sullivan Lake at full elevation of 2,588.66 feet. In order to ensure water temperatures are approximately 41 °F or below, the intake structure for the pipeline would be at a depth of approximately 120 feet below the water surface of the reservoir.

populations in Sullivan Lake and reduce entrainment through the dam, the District proposes to install fish screens at the intake of the cold water release facility that meet NMFS design criteria for approach velocity.[156] The District does not propose, nor do the agencies recommend, screens for the low-level outlet gates. The District proposes to implement a Harvey Creek Bedload Mobilization program.

**Bull Trout: Effects and Findings**

Operation of the Sullivan Creek Project, as currently exists, causes entrainment of fish at the Sullivan Creek dam during flow releases. Bull trout currently do not exist above the Sullivan Creek dam, and, therefore are not subject to entrainment through the dam. The existing warm water released from Sullivan Lake during the summer and early fall increases temperatures downstream of the dam, which decreases the suitability of this area for native trout habitat (especially that for cutthroat trout and bull trout that use the lower portions of Sullivan Creek). In addition, the Mill Pond dam prevents the upstream movement of fish, and the downstream movement of sediment through the system.

The adverse effects of current operations on fish and their habitat are expected to be reduced as a result of the license surrender. Temporary direct effects to fish would likely occur during the dewatering of the Mill Pond for dam removal. Fish that become trapped would be relocated to another portion of Sullivan Creek during the dewatering activities. Screening structures would be used on the siphon pipe inlet to eliminate the potential for fish being sucked into the pipe. Fish screens would also be placed upstream of the construction area in Sullivan Creek to preclude fish from entering the work area.

Removing the Mill Pond dam and implementing stream restoration activities would, in the long term, significantly improve the water quality of the affected reach by reducing water temperatures and improving DO. License surrender would facilitate the removal of the Mill Pond dam and the restoration of the area now covered by the dam, which would increase native fish habitat in the watershed, including that for bull trout. In addition, existing habitat would be enhanced. Native vegetation and LWD would be introduced and the recovered streambed would be "engineered" to resemble a natural stream, as well as monitored to ensure effectiveness of the restoration.

The District would implement operational provisions for Sullivan Lake to facilitate the movement of sediment at the mouth of Harvey Creek (i.e., Harvey Creek Bedload Mobilization Project). By providing flows capable of moving sediment, this

---

[156] The pipeline intake will be fitted with two tee style fish screens (McMillen, 2011). The screen(s) would be designed to meet a maximum approach velocity of 0.4 fps, as required by NMFS for intake structures which include active cleaning systems, and an air burst cleaning system would be provided with an air line.

program would benefit spawning habitat in the creek, and in the delta area where it empties into Sullivan Lake.

The District currently releases water from Sullivan Lake in the fall, and limits summer flows to Outlet and Sullivan creeks to a defined minimum flow. The District's proposals to modify how it would operate Sullivan Lake and implement its water supply program would result in higher flows in the downstream river reaches during the summer, which would improve aquatic habitat for bull trout in Sullivan Creek. The ramping provisions of the proposal would help ensure that stranding of fish and other aquatic biota does not occur, or is minimized.

According to McMillan (2011), the District could install the cold water release facility either in the summer (option 1) or in the fall (option 2). Option 1 would require the pipeline to be built in July and August at full reservoir levels with a turbidity curtain. This option would require a higher cofferdam, with underwater excavation and backfill of the pipeline. This option could have short-term localized water quality and aquatic habitat effects during construction. Option 2 would allow construction to occur in the fall with low reservoir levels behind a cofferdam that has been dewatered. Water quality and aquatic habitat effects would likely be negligible, due to lower lake levels to start and the fact that no underwater excavation and pipeline backfill would be necessary. Neither option is expected to have any effect on bull trout or its habitat during construction, as flow downstream from the dam in Outlet and Sullivan creeks would not be interrupted and lake levels in Sullivan Lake would be maintained in accordance with the new operating protocol outlined in the settlement. The cold water released from Sullivan Lake through the constructed facility is expected to improve water quality and have a beneficial effect on native salmonid habitat in Outlet and Sullivan creeks downstream of the dam, and potentially all the way to the confluence of the creek with the Pend Oreille River. The District would operate the Sullivan Lake dam to maximize the amount of water passed through the cold water release facility, which would be screened to exclude fish and, thus, prevent entrainment.

Finding

Based on the aforementioned analysis, and the cumulative effects analysis in section 3.7.3, we find that surrender of the Sullivan Creek Project and removal of the Mill Pond dam, as proposed with additional staff-recommended measures, would likely affect, but not adversely affect existing populations of bull trout or its designated critical habitat in the Action Area.

**Canada lynx: Effects and Findings**

Canada lynx use of the project area is presumed to be primarily as a migration corridor to higher elevation habitats. The District reports no confirmed sightings in the Mill Pond or Sullivan Creek area and does not anticipate lynx use habitat resources of Mill Pond or Sullivan Creek on a regular basis for hunting, resting or shelter (McMillen 2010).

No new roads or structures are proposed as a condition of the license surrender that would fragment lynx habitat. Over time, restoration of upland and riparian habitats associated with Mill Pond and Sullivan Creek may result in a slight improvement in habitat conditions for lynx traveling through the area. Converting Mill Pond back to a riverine system could potentially create about 50 acres of additional habitat for small mammals. Thus, the likelihood of lynx using the restored area of Mill Pond may increase due to the potential increase in food sources over time. However, human disturbance would still be present in this area from the campground and National Forest trail system and would continue to likely deter the lynx from using this area.

Lynx may be disturbed by noise generated during dam removal and stream restoration activities. Construction activities will include the use of heavy machinery estimated to start in June and end in November. Temporary construction noise may travel up to 0.5 miles via line of sight. However, the conifer forest and topographic features surrounding Mill Pond are anticipated to dampen and reduce the distance that construction noise will travel from the construction area to about 0.25 miles. This temporary effect is anticipated to be minimal due to the lack of lynx use of the project area, the existing amount of human disturbance in the vicinity of Mill Pond, and the abundance of suitable habitat and prey at higher elevations within the surrounding Coleville National Forest. No critical habitat will be affected by the surrender of the license and removal of Mill Pond.

Finding

For the above reasons, we find that surrender of the Sullivan Creek Project and removal of the Mill Pond dam, as proposed with additional staff-recommended measures, would likely affect, but not adversely affect existing populations of Canada lynx.

**Woodland caribou: Effects and Findings**

As noted above for the Boundary Project analysis, there are few records of woodland caribou in the vicinity of Sullivan Creek Project—one observation near Mill Pond to the northwest and over 0.5 miles away in 1987 (WDFW 2009a). This species may use the general area in the vicinity of the Sullivan Creek Project for winter forage grounds. However, they typically tend to shy away from human disturbance and generally avoid areas within 0.6 miles of campgrounds and up to 2,460 ft from trails (Whittington and Mercer 2004; as cited by Seattle 2009b). Caribou have also been noted to avoid areas within 820 ft of linear features such as gravel roads (Dyer 1999; as cited by Seattle 2009b). The campground and road to Sullivan Lake would continue to deter use of the Sullivan Lake Project area following license surrender.

If caribou were present during the removal of Mill Pond dam and the installation of the cold-water release structure in Sullivan Lake, they are anticipated to avoid the immediate construction areas. As noted above for the lynx, potential construction disturbance would temporary (June to November) and localized, and would have a negligible effect given the abundance of similar available habitats, lack of caribou use of the area (which is likely the result of the existing human disturbance in the vicinity of Mill Pond), and its low elevation and lack of older forests  No woodland caribou critical habitat would be affected.

Finding

For the above reasons, we find that surrender of the Sullivan Creek Project and removal of the Mill Pond dam, as proposed with additional staff-recommended measures, would likely affect, but not adversely affect existing populations of woodland caribou.

**Grizzly Bear:  Effects and Findings**

As noted above, observations of grizzly bear in the project area are rare.  Existing wetlands along the edge of Mill Pond that may produce herbaceous plants that bears could forage on in the spring would be converted to an upland plant community following removal of Mill Pond dam.  However, herbaceous wetlands lost due to the dewatering of Mill Pond would be replaced within the restored Sullivan Creek corridor.

Disturbance from construction activities would be temporary and direct effects are anticipated to be minimal for the same reasons as discussed above for the Canada lynx—i.e., limited use of the area, the existing level of human activity in the vicinity of Mill Pond, and abundance of suitable habitat within the surrounding the project.  Over time, the restored 50 acres of habitat would likely provide habitat for deer, bulb-producing sedges, grasses, and forbs, and berry-producing shrubs, which could result in a small benefit for any grizzly bears that move through the area.

Finding

For the above reasons, we find that surrender of the Sullivan Creek Project and removal of the Mill Pond dam, as proposed with additional staff-recommended measures, would likely affect, but not adversely affect existing populations of grizzly bear.

**Gray Wolf:  Effects and Findings**

Gray wolves are expected to use the project area only occasionally.  Effects of continued Sullivan Creek operations and construction related activities associated with the removal of Mill Pond dam are expected to represent negligible effects on the gray wolf for the same reasons noted above for the Canada lynx, grizzly bear, and woodland caribou.

Finding

In the Draft EIS, we found that surrender of the Sullivan Creek Project and removal of the Mill Pond dam, as proposed with additional staff-recommended measures, would likely affect, but not adversely affect existing populations of gray wolf for the above reasons. A finding is not required now because the gray wolf in eastern Washington is no longer listed as a threatened and endangered species.

### 3.7.3 Cumulative Effects

No cumulative effects were identified for the Canada lynx, woodland caribou, grizzly bear, or gray wolf. The following focuses on bull trout.

*Bull Trout Recovery Activities* – There are a number of plans that provide guidance for the management of aquatic resources in the project area. These include:

- Watershed Management Plan for WRIA 62 (Golder Associates, Inc., 2005)
- The NWPPC Intermountain Province Subbasin Plan (GEI Consultants, 2004)
- Draft Bull Trout Recovery Plan (FWS, 2002)
- The Inland Native Fish Strategy (INFISH; Forest Service, 1995)
- The Land and Resource Management Plan for the Colville National Forest (Forest Service, 1988)
- The Clark Fork - Pend Oreille Basin Water Quality Study: A summary of Findings and a Management Plan
- Joint WDFW/Tribal Wild Salmonid Policy (Washington DFW and Western Washington Treaty Tribes, 1998)

A common goal among these plans is the improvement of aquatic habitat and water quality to benefit native salmonids, especially bull trout. However, there is no comprehensive list of activities that contribute to the recovery of bull trout in the NWU and Lake Pend Oreille area because of the wide variety of federal, state, tribal, and non-governmental organizations that conduct activities in the region. Nonetheless, some of the major activities that are ongoing or have been recently completed are:

- Mainstem Fish Passage
  - Albeni Falls passage feasibility studies
  - Upstream and downstream passage at Box Canyon dam
- Tributary Habitat Restoration, Enhancement, and Passage
  - Box Canyon Project enhancement measures
  - Kalispel resident fish project
  - Road abandonment and bank stabilization
  - Riparian fencing and planting
  - Tributary passage and screening

- Bull Trout Research and Monitoring
    - Monitoring in the Priest River sub-basin
    - Genetic inventory of bull trout in the Pend Oreille sub-basin
    - Kalispel resident fish project
    - Resident fish stock status above Chief Joseph and Grand Coulee dams
    - Granite Creek watershed assessment
- Mainstem Pend Oreille River Water Quality
    - Temperature TMDL implementation for the Pend Oreille River
    - Water quality monitoring

Implementation of most of the actions associated with the plans and many of the ongoing activities rely on funding that can vary widely from year to year. Because of the variability in annual funding, it is uncertain if or when activities recommended in the various state and federal plans, such as the establishment of downstream and upstream passage at the Albeni Falls dam, would be implemented.

Recovery activities implemented by organizations regulated by federal and state agencies have more certainty regarding their funding and schedule. For example, as part of the Box Canyon Settlement Agreement, the District agreed to install downstream passage facilities with the goal of 95 percent fish passage efficiency by 2015 or 10 years after issuance of a license. The District also agreed to restore 164 miles of tributary streams to Box Canyon Reservoir within 25 years.

Taken together, numerous activities that improve habitat, fish passage, and water quality are likely to occur in the watershed and would contribute to the recovery of bull trout during the term of a new license. Therefore, it is likely that the incidence of bull trout using Boundary Reservoir, tailrace, or tributaries would increase, but the magnitude of the increase, the timing of increases, and whether recovery criteria would be achieved is uncertain.

*Sullivan Creek Fishery Enhancement Fund* – As explained in section 3.5.4, *Aquatic Resources*, *Cumulative Effects*, the District entered a Fish MOA with the Washington DFW to provide the Washington DFW funds to address fishery management activities in Sullivan Lake and associated tributaries. As previously discussed, this measure, while having merit if the funds are used by the Washington DFW for management activities in Sullivan Lake and its watershed, lacks specificity. Therefore, it is impossible for us to evaluate how the funds would benefit aquatic biota in the Sullivan Creek drainage in any meaning, measurable way.

*Hatchery and Harvest Practices* – Washington DFW manages fisheries in the Action Area and regulates private and public hatchery releases. Washington DFW modifies and publishes recreational fishing regulations on an annual basis. Currently, recreational anglers may not target bull trout, but may incidentally catch and release bull trout. Changes in the regulations such as seasons, closed areas, and harvestable sizes and numbers of other trout species could also change the likelihood of the incidental catch of bull trout by reducing or increasing the level of effort expended by anglers.

*Flood Control Operations* – Significant storage reservoirs within the basin include Hungry Horse Reservoir and Flathead Lake in Montana, and Lake Pend Oreille and Priest Lake in Idaho. Other projects along the mainstem Pend Oreille River upstream of the project include the Box Canyon Project, the Albeni Falls Project, the Clark Fork River Project in Idaho and Montana, and the Thompson Falls Project in Montana. Downstream of the Boundary dam, the Pend Oreille River flows past Seven Mile and Waneta dams, both in Canada, before entering the Columbia River. Because of the basin size and corresponding annual flow, typically no single project has an overriding influence on flows in the river. Potential influence on flows by individual projects is greater during low-flow periods and for those reservoirs having significant storage capacity (Enserch, 1994). In addition to the dams listed above, the Sullivan Creek Project is located on Sullivan Creek, the main tributary to Boundary Reservoir.

The upstream projects have a significant effect on inflows to the project reservoir. In the absence of the upstream impoundments, flows would typically exceed regulated flows from May through July, during the periods when water is stored in upstream projects (Seattle, 2008a). Regulated flows are typically greater than unimpaired flows from August through April, as stored water is released from upstream projects. Future changes to flood control and other operations at these upstream projects could affect the timing and magnitude of inflows to the Boundary Project and, as a result, interact with project operations to influence water surface elevations in the reservoir.

*Box Canyon Project* – The District recently received a new license for its Box Canyon Project. There are a number of measures included in the license designed to benefit bull trout, such as turbine upgrades, upstream fish passage, and restoration and enhancement of tributary streams. These improvements, if successful, could increase the number of bull trout using the Boundary Reservoir, the Boundary dam tailrace, and the tributaries to Boundary Reservoir.

*Boundary and Sullivan Creek Projects* – The measures proposed by Seattle as part of the Boundary settlement (including on-going monitoring of the Mill Pond site) and the measures proposed by the District as part of the Sullivan Creek settlement, taken together, would increase the extent of habitat connectivity for native salmonids, including bull trout, and improve aquatic habitat and water quality in Sullivan Creek.

*Waneta Upgrade and Seven Mile Project Operations* – BC Hydro's Seven Mile Project is located 11 river miles downstream of Boundary dam, and Seven Mile Reservoir, at times, backs water up to the base of the Boundary dam. The average maximum water surface elevation of Seven Mile Reservoir is approximately 1,734 feet NAVD 88 (BC Hydro, 2003). Because of downstream water quality and flow requirements and capacity limitations at the Waneta Project (the next project downstream of Seven Mile), the Seven Mile Project operates to reregulate flows from the Boundary Project. Upgrades to the capacity at the Waneta Project are anticipated to allow the Seven Mile Project to modify its operations to engage in a greater degree of load following. The specific effects of any operational modifications at the Seven Mile Project on pool levels in the Boundary dam tailrace are uncertain. However, changes could affect the amount of suitable rearing habitat available to bull trout in the Boundary dam tailrace, and may affect the design and operation of Seattle's proposed upstream trap-and-haul facility.

## 3.8 RECREATION

### 3.8.1 Affected Environment

Opportunities for recreation within the region surrounding the Boundary and Sullivan Creek Project are plentiful. Both projects lie partially within the Colville National Forest, which provides a spectrum of recreation opportunities ranging from designated wilderness to developed campgrounds. Other public agencies including BLM (Boundary Recreation Site), Washington State Parks and Recreation Commission (Crawford State Park), Washington State Department of Transportation (Sweet Creek Falls Rest Stop), and Pend Oreille County PUD (Campbell Park) manage land within the region and provide opportunities for outdoor recreation. Visitors to the area can hunt, camp, fish, rock climb, hike, view wildlife, boat, picnic, swim and paddle.

#### 3.8.1.1 Boundary Project

**Project Area Recreation Resources**

A variety of unique natural features attract visitors to the project. The canyon reach, which extends from the community of Metaline Falls to the project forebay, provides the opportunity to boat through a narrow steep-walled canyon and see wildlife, waterfalls, geologic features, and evidence of historic mining activities. Peewee Creek flows over the edge of the western canyon wall and forms a high narrow waterfall into the project forebay that is visible from the opposite shore of the reservoir. Metaline Falls is located at a hydrologic constriction near the entrance to the canyon reach and appears more as a rapid than as a waterfall due to the reservoir impoundment. The rapids are enjoyed by some motorized and non-motorized boaters depending upon water levels in the reservoir.

Four developed recreation areas are contained within the project boundary: Forebay Recreation Area; Tailrace Recreation Area; Metaline Waterfront Park Boat Launch; and Vista House. The Forebay Recreation Area, Tailrace Recreation Area, and Vista House are project facilities, maintained and operated by Seattle.

The Forebay Recreation Area is located on the western shoreline of Boundary reservoir immediately upstream of the project dam. Some of the recreation opportunities at the site include picnicking (two areas), tent and RV camping (11 sites), boating (a two-lane concrete boat ramp with a boarding dock), fishing, playing horseshoes, and sightseeing (an historic miner's log cabin and a view of the Boundary dam). A restroom building with flush toilets and 20 parking spaces are provided at the site.

The Tailrace Recreation Area is located immediately downstream of Boundary dam on the western bank of the Pend Oreille River and provides limited day use opportunities. Visitors must pass through a security checkpoint and are only allowed access to the site between 10:30 am and 4:30 pm daily. The primary attraction for visitors is the Visitor's Gallery interpretive area and the ability to view the dam from the river near the base of the dam. Covered picnic tables are provided near the parking area. The Visitor's Gallery, located at the entrance to the underground powerhouse, contains interpretive displays which explain the construction and operation of the facilities. Public restrooms are also provided in the Visitor's Gallery.

The Metaline Waterfront Park Boat Launch is located in the community of Metaline on the western shore of Boundary reservoir. Portions of this park lie within the project boundary including the boat launch and boarding float, covered picnic tables, playground equipment, pedestrian bridge and a segment of the access road. The majority of the park is managed by the Town of Metaline via an easement granted to the community[157] by Seattle, with the boarding float being the only facility maintained by Seattle.

The Vista House Recreation Area is located immediately downstream of Boundary dam on a bluff overlooking the eastern bank of the Pend Oreille River and the dam. The site was built to provide a safe place for the public to view dam construction. The Vista House provides an indoor area for visitors to enjoy scenic views of the project and surrounding areas as well as the opportunity to learn about the natural and cultural resources of the region through interpretive displays. A path to a wooden observation platform lower on the bluff provides outdoor views, and additional interpretive signs are located along the path. Restrooms with flush toilets are provided in the Vista House.

The recently authorized Pacific Northwest National Scenic Trail extends from Northern Montana through Colville National Forest to the Olympic Peninsula. Within the project boundary, the trail crosses through the Vista House Recreation Area and over Boundary dam. Due to security concerns, hikers are escorted across the dam by Seattle staff.

**Recreation Use**

Seattle conducted surveys of recreation visitors on selected sampling days between May 19, 2007 and October 31, 2007, representing the peak recreation season at the project. Visitor use was estimated using a visitor registry at the Vista House Recreation Area, a visitor log at the Tailrace Recreation Area, and visitor counts in

---

[157] FERC order granting change in land rights issued May 17, 1976.

conjunction with interviews conducted throughout the remainder of the project area (see Table 3-19). A variety of recreation pursuits were documented at the project through on-site interviews with visitors and mail-back questionnaires from local residents. The primary activities identified by visitors and area residents were quite similar, with viewing scenery, fishing, motor boating, developed camping, swimming, and canoeing/kayaking representing the most frequently reported activities pursued at the Project (see Table 3-20).

Table 3-19. Recreation use by project area (Source: Seattle 2009, as modified by staff)

| Facility/Resource | Estimated Annual Use (Recreation Days) |
|---|---|
| Vista House Recreation Area | 2,200 |
| Tailrace Recreation Area | 2,400 |
| Forebay Recreation Area – Day Use | 1,900 |
| Forebay Recreation Area – Campground | 4,600 |
| BLM Boundary Recreation Area | 100 |
| Metaline Waterfront Park (Reservoir-based use) | 1,800 |
| Box Canyon Boat Launch | 600 |
| Dispersed Campsites along the reservoir shore | 400 |
| Private Shoreline Use Areas | 1,000 |
| **Total Project-Related Use** | **15,000** |

Table 3-20. Primary recreation activity for visitors and area residents at Boundary reservoir (Source: Seattle 2009, as modified by staff).

| Primary Recreation Activity | Visitors (N=589) | Area Residents (N=278) |
|---|---|---|
| Viewing Scenery | 16% | 17% |
| Fishing | 16% | 14% |
| Developed Camping | 10% | 5% |
| Swimming | 9% | 8% |
| Canoeing/Kayaking | 8% | 4% |
| Motor boating | 8% | 15% |
| Socializing | 7% | |
| Picnicking | 3% | 6% |
| Day hiking | 3% | 2% |
| Traveling SR 31 | 2% | |
| Dispersed camping | 2% | |
| Hunting | 1% | 3% |

#### 3.8.1.2 Sullivan Creek Project

Sullivan Lake provides opportunities for fishing, boating, camping, swimming, hiking, paddling, water skiing, ice fishing, scuba diving, and wildlife observation. The Forest Service manages four campgrounds at the reservoir: East Sullivan Campground with 38 camping/RV sites, bathrooms, picnic area, boat launch, and a swim area; West Sullivan Campground provides similar amenities with 10 camping/RV sites; Sullivan Lake Group Campground which can accommodate 50 people and provides bathrooms, a swim area, boat launch, and RV dump station; and Noisy Creek Group Campground with analogous facilities. Four developed trails are also located at Sullivan Lake.

The Mill Pond area includes the following recreation facilities: 1) campground with ten sites and an informal boat launch; 2) loop trail around the pond which links to other trails; 3) picnic area; and 4) historic interpretive display.

Sullivan Creek downstream of Mill Pond provides a unique whitewater boating opportunity in the region. During the typically dryer fall months, drawdown flows from Sullivan Lake provide challenging whitewater for experienced paddlers.

The District does not own or operate any recreation facilities.

Recreation use at Sullivan Lake and Mill Pond occurs primarily between mid-May and Labor Day. As reported by Forest Service concessioners, Forest Service campgrounds at Sullivan Lake and Mill Pond were nearly full (93 and 83 percent occupancy, respectively) during high use weekends, and averaged about half full throughout the recreation season (54 and 34 percent occupancy, respectively) (Forest Service 2008).

Recreation use at Sullivan Lake is concentrated at the shoreline and boat launch areas. Sullivan Lake is popular for boat fishing, water skiing, personal watercraft, kayaking, and canoeing. Fishing activity is for rainbow, German Brown, cutthroat, Kokanee, and ling cod (Burbot). Mill Pond day use activity is concentrated at the Mill Pond Historic site where visitors can see remnants of the early 1900’s hydroelectric project (Forest Service 2008). Accessible, interpretive trail #520 loops through the historic site. There is also a low level of day use boating activity and use of the small lake for fishing (rainbow, German brown, eastern brook, and Kokanee). Day users include those using the lake, viewing the scenery, picnicking, hiking, and visiting historic sites.

### 3.8.2 Environmental Effects

#### 3.8.2.1 Boundary Project

**Project Operations**

Existing project operations cause the project reservoir to fluctuate primarily between elevations of 1,994 feet and 1,974 feet, about 20 feet. Such fluctuations negatively affect recreation opportunities, recreational experiences, and use of existing boat ramps. In a survey of area residents, 54 percent reported problems or concerns about water conditions, including the effect of water surface elevations on their ability to safely launch or retrieve boats.

To facilitate reservoir access for recreational activities, Seattle would continue to maintain forebay water surface elevations at or above 1,984 feet from 6:00 am through 8:00 pm from Memorial Day weekend (starting Friday evening) through Labor Day weekend (ending Monday evening). Night time forebay water surface elevations during this time frame would be maintained at or above elevation 1,982. Interior recommends that Seattle continue its operational practices to facilitate recreational access. The Forest Service Condition 3(1) requires Seattle to continue the operational limits from Memorial Day to Labor Day.

*Staff Analysis*

Seattle's restrictions on reservoir fluctuations during the summer limit the adverse effects on recreational access, particularly in the lower reservoir. Because no changes in project operations are proposed, boating access to shoreline recreation amenities in the forebay and canyon reaches would continue to decrease as the water level recedes and the effect of reservoir fluctuations on the public's recreational experience would not change from current conditions.

Extending the existing boat ramp at Forebay Recreation Area ten horizontal feet and one vertical foot, as proposed by Seattle, would provide three foot water depth above the toe of the ramp at elevation 1,984 feet. Similarly, the planned upgrade of the boat ramp at Metaline Waterfront Park would provide three foot water depth above the toe of the ramp at 1,988 (water levels remain higher in this portion of the reservoir due to the natural constriction at Metaline Falls). The boat launch improvements would increase public access to project waters and enhance recreation experiences. Construction of the proposed Metaline Falls Portage Trail and Boater Access would improve boater access around Metaline Falls, further off-setting adverse affects associated with changing water levels associated with project operations.

**Shoreline Management Program**

Seattle proposes to develop a Shoreline Management Program (SMP). Its program is an element of the Terrestrial Resources Management Plan (TRMP). Seattle would identify, define, and map appropriate shoreline land use designations, develop and implement guidelines for permitting private and public (non-federal) shoreline development, manage debris accumulation and removal, and create and implement a project public safety and education program. The project public safety and education program would assess potential public safety, interpretation, and education needs and concerns on project lands and waters and develop actions to address those needs and concerns. The SMP would be developed in conjunction with Pend Oreille County and Ecology to assure that the plan is consistent with the state's shoreline management act and the county's shoreline master program.  Seattle would coordinate with the Forest Service and BLM regarding actions affecting federal lands.

*Staff Analysis*

Although the shoreline of Boundary reservoir is relatively undeveloped to date, the county population is expected to increase 20 percent by 2024[158].  Higher populations may lead to increased pressure for shoreline development.  Through implementation of the SMP, Seattle would be proactive in the establishment of land use designations which would help educate current and future landowners regarding appropriate shoreline development.  Clearly defined land use designations and permitting procedures should provide the tools necessary for Seattle to manage future development pressures and protect shoreline resources.  The SMP also calls for the timely removal of shoreline debris which is likely to enhance the recreational experience of visitors.  The project public safety and education program would likely enhance visitor experiences by addressing safety issues and increasing understanding of the project as well as the natural and cultural resources in the project vicinity.

**Recreation Resources Management Plan**

Seattle filed a Recreation Resources Management Plan (RRMP) that includes the following programs: (1) a capital improvements program which highlights proposed recreation facilities during the first decade following license issuance and guides the level of development at each site; (2) an operations and maintenance (O&M) program which specifies the recreation facilities for which Seattle is taking responsibility, establishes O&M standards for those facilities, and identifies the recreation season during which the facilities will be open to the public; (3) a shoreline dispersed recreation management program which establishes guidance regarding the management, development and use of dispersed recreation sites along the reservoir shoreline; (4) a recreation monitoring program which describes standards for visitor use capacity, social capacity, and biophysical capacity to facilitate desired recreational experiences; (5) a travel and public access management plan which addresses the need to provide adequate operational access to project facilities, to manage public access for safety and security reasons, and to ensure adequate public access to recreation use areas and facilities; and (6) the development of an interpretation and education program to create an overall theme for the project and to identify appropriate locations for interpretation and education opportunities.  Forest Service Condition 3(5) requires implementation of the Recreation Management Plan.

We discuss each program below.

*Capital Facility Improvements Program*—The capital facilities improvements program includes proposed locations, conceptual layouts, and descriptions for

---

[158] Washington State Growth Management Projections for Counties 2000-2030, see http://www.ofm.wa.gov/pop/gma/projections07.asp

developed recreation facilities. Some of the measures are modifications to existing project recreation facilities; others require development of new project recreation sites and use areas (table 3-21). The development categories range from 0 to 5, with a higher number reflecting an increased level of site impact. These categories would be used to guide the intensity of recreation facility development over the course of the next license. Additionally the capital improvements planned during the first decade of the new license term are specified and design guidelines[159] are proposed to reduce the aesthetic impacts of recreation facility development on the landscape. Finally, accessibility, operations, and maintenance issues are addressed in the capital improvements program.

Table 3-21. Project recreation site capital improvements (Source: Seattle 2010).

| **Area/Site** | **Development Level** | **Planned Improvements** |
|---|---|---|
| Vista House Recreation Area (existing) | Level 5 | • Add I&E signage and/or other opportunities at the overlook platform.<br>• Provide ADA-accessible parking, vault toilet, and pathways that connect ADA-accessible facilities. |
| Peewee Falls Viewpoint and Trail (new) | Level 3 to 4 | • Extend existing NFS road 3165315, as needed, and develop a new trailhead at the end of the road, a trail, and a view point of Peewee Falls (the trailhead, trail, and viewpoint would be ADA-accessible). Develop appropriate support facilities, including ADA-accessible parking, vault toilet, and signage. |
| Tailrace Recreation Area/Machine Hall Visitors' Gallery (existing) | Level 5 | • Update I&E signage and displays at the Machine Hall Visitors' Gallery (see I&E Program) (the extent of upgrades at this site will be consistent with the level of anticipated use; security restrictions contribute to low use levels).<br>• Provide ADA-accessible parking, vault toilets, and pathways that connect ADA-accessible facilities. |

[159] The Rocky Mountain Province elements of the guidebook entitled *Built Environment Image Guide for National Forests and Grasslands* were adopted for use at the Boundary project.

| Area/Site | Development Level | Planned Improvements |
|---|---|---|
| Forebay Recreation Area (existing) | Level 5 | • Enhance campground facilities at this site: increase the number of designated recreation vehicle (RV) and tent campsites (phased – up to approximately 24 total), better delineate campsites, provide appropriate signage, use vegetation and/or other site features (e.g., rocks) to create separation between campsites and day use picnic sites, and limit vehicle access to roads and parking areas.<br><br>• Enhance day use picnic sites with signage, improved access, and separation from campsites.<br><br>• Provide additional I&E signage and/or other opportunities (see I&E Program).<br><br>• Extend an existing boat ramp lane so that boats may be launched/retrieved during the primary recreation season (Memorial Day weekend to Labor Day weekend) without problems due to fluctuating reservoir water surface elevations. Provide adequate parking, signage, and circulation at the boat launch.<br><br>• Provide ADA-accessible parking, restrooms, boarding float, picnic sites, campsites, and pathways that connect ADA-accessible facilities. |
| Riverside Mine Canyon Viewpoint and Trail (new) | Level 3 to 4 | • Develop a new trail and trailhead in the vicinity of the Riverside Mine to a viewpoint of the canyon. The trail alignment would take advantage of the existing NFS road network in this area (specifically NFS Road 3100172), and trailhead, trail, and viewpoint would be ADA-accessible.<br><br>• Develop appropriate support facilities, including ADA-accessible parking, vault toilet, and signage. |
| Eastside Trail (new) | Level 2 to 3 | • Construct an Eastside Trail (to Forest Service standards) that connects the Peewee Falls and Riverside Mine Canyon viewpoints. The trail would be designed and managed to meet semi- |

| Area/Site | Development Level | Planned Improvements |
|---|---|---|
| | | primitive non-motorized standards.<br>• New trail will take advantage of trailhead facilities at both the Peewee Falls and Riverside Mine Canyon trailheads.<br>• Seattle would not groom the trail during the cross-country skiing season. |
| Metaline Falls Portage Trail and Boater Access (new) | Level 3 to 4 | • Develop a new portage trail in the vicinity of the falls to provide non-motorized boaters an alternative to avoiding or running the rapids at the falls.<br>• Construct a non-motorized boat access at the northern terminus of the portage trail. The non-motorized boat access will include parking, appropriate signage, and restrooms.<br>• Provide I&E signage. |
| Metaline Waterfront Park Boat Launch (existing) | Level 5 | • Replace the existing boat launch and extend a boat ramp lane so that boats may be launched/retrieved during the primary recreation season (Memorial Day weekend to Labor Day weekend) without problems due to fluctuating reservoir water surface elevations.<br>• Provide adequate gravel roadway access to the boat ramp, improved circulation and parking for single vehicles and vehicles with trailers, and other boat launch support facilities (e.g., signage, boarding float).<br>• Provide ADA-accessible parking, boarding float, and pathways that connect ADA-accessible facilities.<br>• Provide an accessible dual vault restroom in the vicinity of the boat launch parking area or potentially combine this new facility with a new, larger upgraded park restroom facility (location undefined) developed in coordination with the Town of Metaline. |

*Staff Analysis*

The specific recreation facilities proposed for development (each addressed separately below) would combine to provide a diverse spectrum of recreation opportunities for visitors to the project that is consistent with existing and anticipated use. The Commission encourages the use of universal design principles, whenever possible, to expand recreational opportunities to a broader cross section of the general public. Seattle's efforts would be consistent with Commission policy.

Forebay Recreation Area

The Forebay Recreation Area is the most heavily developed and used recreation area at the project. Camping in this area meets or exceeds capacity on occasion, with campers expanding into day use areas. Additionally recreation survey respondents identified a need for more camping facilities and improved boat launching facilities. The planned upgrades at the Forebay Recreation Area would accommodate growing use, enhance visitor experiences, and protect natural and cultural resources at the site.

Vista House Recreation Area

The Vista House was developed to provide a sheltered location for a curious public to watch construction of the dam and excavation of a cavern for the powerhouse. The structure continues to serve as a scenic viewpoint and it houses a variety of interpretive displays. The Vista House Recreation Area provides an easily accessible location for people traveling on the International Selkirk Loop Scenic Drive to see project facilities and stretch their legs. The overlook platform provides a good opportunity to educate visitors about the project as well as the natural, cultural and historic resources of the area. The development of accessible facilities would allow a broader cross section of the population to enjoy the amenities.

Tailrace Recreation Area

Public access to the Tailrace Recreation Area, which also provides employee parking for the powerhouse, is limited. Due to enhanced security, all visitors must pass through a secure checkpoint and the site is open only during specified hours. The underground visitor's center provides an overview of project operations and allows visitors to see the turbine room. While visitors enjoy seeing inside the project powerhouse, the interpretive elements in the Machine Hall Visitors' Gallery are in need of updating. Seattle's proposal to modernize the signs and displays would enhance visitor experience at the Tailrace Recreation Area.

Metaline Falls Portage Trail and Boater Access

Due to project operations, water levels can change enough in this portion of the reservoir to make traversing the falls hazardous to some boaters. When combined with high river flows, the falls become impassible. Seattle's summer operating regime reduces the variability in water levels. Even with the operational constraints some paddlers do not wish to challenge their skills by floating through the falls. Over half of the residents and one tenth of the visitors responding to the recreation resource survey noted concerns regarding water conditions, including navigating Metaline Falls.

Development of the proposed portage trail around Metaline Falls as well as a non-motorized boat access with parking, signage, and restrooms at the northern terminus of the new trail would provide an alternative to those non-motorized boaters that prefer not to run the falls. Establishing a new boat access point would also allow non-motorized boaters a convenient place to launch boats for treks either through the narrow canyon reach or to the upper reservoir reach of Boundary reservoir.

Currently no public access point to the reservoir exists between Metaline Waterfront Park and Forebay Recreation Area. The proposed facilities would enhance public access to project waters, provide restroom facilities near the shoreline for boaters, and make available the first water access point on the east side of the reservoir.

East Side Viewpoints and Trails

While much of the land between Highway 31 and the eastern shore of the canyon reach is public (managed by the Forest Service), recreation amenities are limited. Seattle proposes the development of two viewpoints, with associated parking and access trails, overlooking natural features in this scenic area of the project. The most northerly viewpoint, which would focus on Peewee Falls, would be accessed off the forest road leading to the Vista House (FR 3165-000). Forest Road 3165-329 would be upgraded and a trailhead would be developed to include accessible parking and an accessible vault toilet. An accessible trail, approximately 750 feet in length would be constructed to an accessible viewpoint with interpretive elements overlooking Peewee Falls. A second viewpoint with similar facilities would be developed approximately four miles upriver off of FR 3100-172. Additionally, Seattle proposes the construction of the Eastside Trail to extend along the rim of the canyon reach from the Peewee Falls Viewpoint to the Riverside Mine Canyon Viewpoint for a distance of approximately six miles.

The two viewpoints would provide visitors without boats the opportunity to glimpse portions of the canyon reach and experience a section of the reservoir that is not visible from the existing paved road network. The Eastside trail would link the two viewpoints and create the first opportunity for long distance hiking at the project. The Washington Statewide Comprehensive Outdoor Recreation Plan (WA SCORP)[160] supports the development of trails to enhance opportunities for physical activity and improve overall public health. The WA SCORP also reports that 73percent of Washingtonians reported participation in walking/hiking, and prefer to walk on unpaved paths and sidewalks. The Forest Service identified a local interest in developing a

[160] Defining and Measuring Success: The Role of State Government in Outdoor Recreation – A Statewide Outdoor Recreation Planning Document (2008). Washington State Recreation and Conservation Office, Olympia, WA.

broader trail network in the area[161]. These facilities would help meet the local and regional need for trails and expand the range of recreational opportunities currently available at the project, thus enhancing the experience of visitors.

Metaline Waterfront Park Boat Launch

The Town of Metaline's Waterfront Park provides a wide range of recreational opportunities for town residents. Although a variety of the park's recreation amenities fall within the project boundary, only the boarding float at the boat ramp is considered to be a project recreation facility and thus maintained by Seattle. Through the relicensing process Seattle agreed to upgrade the boat ramp and dredge a channel leading to the toe of the ramp, in order to improve circulation and parking for vehicles with and without trailers (including the addition of accessible parking), to develop an accessible dual vault toilet, to add an accessible boarding float and to create pathways linking accessible facilities.

The development of new recreation facilities at Metaline Waterfront Park would expand the variety of recreation opportunities for visitors to the project, as well as for Metaline residents. Extending the boat ramp and dredging a channel to the toe of the ramp would enable boaters to launch and retrieve boats without having to worry about fluctuating reservoir levels due to project operations. The new parking area and upgraded ramp would accommodate a wider variety of vehicles and watercraft.

Schedule of Facility Capital Improvements

All of the recreation facility capital improvement measures would be completed during the first 10 years following license issuance.[162] The schedule was developed in coordination with other project-related construction projects to maximize efficiency and minimize disturbance to recreation visitors and area residents. Appendix 7 of the recreation plan provides an approximate schedule and estimated costs for currently planned recreation capital improvements. The schedule for completing the proposed capital improvement projects assigns a priority to the measures as years 3 to 5, 6 to 7, or 8 to 10 of the license. To facilitate Commission oversight of the license, a more definitive schedule should be provided and the improvements should not extend past the latter date for each priority to ensure that the recreational amenities are timely completed.

Seattle would communicate and document any updates, if needed, including the schedule and estimated costs, on an annual basis as a component of the annual

---

[161] Preliminary 4(e) Terms and Conditions, Justification Statements, and Comments on the Boundary Hydroelectric Project (P-2144), submitted August 24, 2010 by USDA Forest Service, Portland, OR.

[162] Appendix 7 of the recreation plan provides an approximate schedule for developing the projects and lists estimated costs for currently planned recreation capital improvements.

recreation report and work plan process, which would be filed with the Commission. Schedules and costs associated with potential future recreation facility capital improvement projects that result from monitoring would be documented during the annual recreation report and work plan process which would provide the Commission a mechanism for determining the need for additional measures.

*Recreation Facility Operations and Maintenance Program*—Seattle would operate and maintain the following project developed recreation sites: Vista House Recreation Area, Peewee Falls Viewpoint and Trail, Tailrace Recreation Area/Machine Hall Visitors' Gallery, Forebay Recreation Area Riverside Mine Canyon Viewpoint and Trail, Eastside Trail, Metaline Falls Portage Trail and Boater Access site, and Metaline Waterfront Park Boat Launch (the boat launch and boarding float only). Seattle would routinely maintain these recreation sites and use areas for public use during the primary recreation season (Memorial Day weekend through Labor Day weekend). At those recreation sites located on non-Seattle owned lands (but within the project boundary), Seattle would coordinate O&M efforts with the appropriate landowner to ensure consistent O&M standards and frequencies. For example, Seattle's O&M standards and frequencies at the new Riverside Mine Canyon Viewpoint and Trail would be consistent with applicable Forest Service O&M standards. O&M standards and frequencies would be reviewed and revised, if needed (in particular to acknowledge changes in Forest Service, BLM, or other applicable O&M standards), during the new license term. Any changes would be documented and reviewed during the annual review process.

*Staff Analysis*

Seattle's O&M schedule would include the majority of the high use recreation seasons and would maximize recreational benefits at the existing project facilities.

*Shoreline Dispersed Recreation Management Program*—The Shoreline Dispersed Recreation Management Plan establishes a method to formalize 16 dispersed recreation sites along the reservoir and to rehabilitate any sites found in environmentally sensitive or otherwise unsuitable areas. Although only 1.7 percent of respondents to the visitor survey identified dispersed camping as the primary reason for their visit to the project, it is unknown how many people utilize the dispersed sites for day or overnight purposes. When asked about their satisfaction with boat-in campsites respondents provided the second lowest response[163] for all facilities at the project, with only RV hook-ups/facilities scoring lower.

In an effort to increase visitor satisfaction, six dispersed recreation sites located on federal lands (site 2 (BLM recreation area), 4 (Ledbetter Cove), 7 (Deadman's Eddy), 12 (Lime Creek), 13 (Monument Bar), and 14 (Wolf Creek)) would be

[163] Mean response of 3.57 on a 5-point scale with 1 = "not at all satisfied" and 5 = "extremely satisfied."

minimally developed through the addition of fire rings, picnic tables, tent pads, watercraft landing sites, bulletin boards and primitive sanitation systems.

*Staff Analysis*

Multiple areas along the reservoir shoreline are used for dispersed recreation activities (e.g., camping, shoreline fishing, day use, etc.). These areas tend to be characterized by easy shoreline access (via watercraft) and relatively flat topography. To a great degree, use in the lower reservoir has been established where topography allows shoreline access. In the upper reservoir area, in addition to topography, a key constraint to dispersed recreation use along the shoreline is private land ownership. Given these conditions, it is not anticipated that a large number of additional dispersed recreation sites will be established during the new license period.

At the present time, the focus of the Shoreline Dispersed Recreation Management Program is on the 16 shoreline sites that have already been established and deemed suitable. Six sites would be improved to accommodate existing usage. Enhancements would be minimal to both provide a continued rustic experience and to protect sensitive resources. The remaining 10 designated dispersed shoreline recreation sites would remain undeveloped and monitored. This would help protect and provide for the desired visitor experience at these sites. These sites would be improved as needed.

Seattle's approach would reduce environmental effects at dispersed shoreline recreation sites and enhance recreational experiences for most visitors. Those visitors desiring a more rustic experience will likely seek out or create sites without amenities. Seattle will monitor the shoreline to limit the proliferation of such sites to no more than 10 percent of the managed dispersed sites during any six year monitoring cycle.

*Recreation Monitoring Program*—In order to track recreation impacts, use levels, and user perceptions over time, Seattle proposes to implement a recreation monitoring program which would assess visitor use capacity, social capacity, and biophysical capacity. Recreation site capacity, reservoir surface capacity, and dispersed recreation sites would be assessed every six years, while perceived crowding and conflict would be evaluated on a 12 year cycle. Litter and sanitation issues would be tracked on an ongoing basis as Seattle staff visit recreation facilities. Results of the monitoring efforts would be reported annually for litter or sanitation issues and in conjunction with FERC Form 80 submissions for the less frequent monitoring initiatives. The monitoring program developed by Seattle would provide data to inform future management decisions regarding recreation facility operations, maintenance and development.

*Staff Analysis*

Seattle's monitoring approach would use defined indicators and standards commonly used by the recreation industry to identify changing resource needs and perceptions.  This approach would ensure regular evaluation and revision of the recreation plan to accommodate increasing and changing use patterns in the area.

*Travel and Public Access Management Program*—The Boundary Project is located in an area with sparse road infrastructure, thus access to project facilities, lands and waters can be challenging.  The travel and public access management plan identifies 12 roads necessary to gain access to project facilities and areas needed for operations and maintenance.  Either a portion or all of the roads were identified as being needed for project purposes including six for project operations, three for access to project recreation facilities, and three to serve both functions.

*Staff Analysis*

No additional roads were identified that were needed primarily or solely for project purposes.  Maintaining the identified roads would allow the public to access the existing and planned recreation facilities, and Seattle to maintain and operate the project.

*Multiple Resource Interpretation and Education Program*—A draft Interpretation and Education (I&E) framework is provided in the recreation plan.  Seattle proposes to file a final program within three years of license issuance for Commission approval.  The purpose of the I&E Program is to provide enhanced experiences for visitors, encourage participation in multi-resource protection measures by area visitors, and promote cooperative, safe behaviors to benefit all project area resources and visitors.  The focus of the I&E Program is primarily on project area resources, although it may contain broader, regional themes and messages.  The potential I&E theme, subthemes, topics, and messages may include the following: wayfinding, water trail, cultural/historical resources, scenic byway, geologic resources, renewable energy, dam engineering, terrestrial resources, fish and aquatic resources, visitor management and rules, and Project operations and public safety.  In addition, the I&E Program would identify media (e.g., signs, brochures, internet, etc.), sites, and services (e.g., tours) to be provided during the new license term.

*Staff Analysis*

The preliminary framework would likely achieve the stated goals and objectives.  However, without further details on the location, media, and themes, staff can not fully evaluate the benefits.  These details are best developed in coordination with the fishery and wildlife programs that are being further refined following license issuance.

#### 3.8.2.2 Sullivan Creek Project

**Removal of Mill Pond Dam**

The proposed license surrender conditions submitted by the Forest Service include the removal of Mill Pond dam.  A variety of recreation facilities have been developed around the pond including a campground with ten sites, an informal boat launch, trails, and a day use area.  Mill pond is readily accessible off of a paved road and provides an uncommon opportunity to recreate at a small water body. Removal of Mill Pond would eliminate some recreational opportunities and alter others.

*Staff Analysis*

Removal of Mill Pond dam would displace recreational visitors that currently walk on the trail around the pond, camp next to the pond, boat in the pond, or fish in the pond. Removal of the pond and restoration of Sullivan Creek would extend the reach of the river open to paddlers and stream fishing. The existing camping and day use facilities would continue to provide access to the creek. Individuals seeking the recreational opportunities displaced by dam removal should be able to find substitutable locations nearby within the Colville National Forest.

**Reservoir Level Operations**

During September and October discharge flows from Sullivan Lake are to be managed, to the extent consistent with other temperature, flow, and water supply constraints, to provide discharge flows between 180 and 220 cfs on at least three weekends to support whitewater paddling. Additionally, discharge flows would be forecasted and posted online one week in advance to provide advance notice to paddlers. Reservoir operations may reduce the functionality of some existing docks and boat ramps on Sullivan Lake. The District has agreed to conduct an assessment of proposed reservoir level operations on these facilities and take steps to mitigate any impacts, such that Sullivan Lake docks and ramps would be fully functional across the agreed range of project summer operations prior to beginning the new operational changes. Improvements to any Forest Service facilities would meet Forest Service standards and be approved by the Forest Service.

*Staff Analysis*

Whitewater paddling has been documented below Mill Pond dam on Sullivan Creek (Marti, 1996). American Whitewater stated that boatable flows now occur in October and November and that the proposed discharge flows would move those flows to September and October, which would be better for paddlers (Colburn, 2010). Stream rehabilitation would yield a longer reach of Sullivan Creek available to paddlers, thus enhancing their recreation experience. We concur.

Under existing operations, the reservoir is drawdown starting October 1, after the primary recreation season, and starts refilling in February to reach full pool (2,588.66 feet) by June 1. Proposed operations would begin the fall drawdown about one month earlier, but still after the close of the typical recreation season and the high recreation use period. The recreation experience of the few cabin owners and others using the lake during this period would diminish relative to current operations.

Under current operations, the reservoir does not always reach full pool (2,588.66 feet) by June 1. The District's modeling of lake elevations for the last 11 years indicates that the average date of reaching full pool was June 20; full pool was not reached in three dry years (District, 2009b).

The District modeled the effect of its proposed minimum discharge flows and holding the reservoir at elevation 2,570 during the winter months over an 11-year time frame that included three average years, six dry years, and two wet years (District, 2010). The modeling analysis shows that under the proposed higher minimum discharge flows, the reservoir reaches full pool by June 1 in 3 out of the 11 years modeled; and it reaches full pool no later than June 28. The average date for attaining full pool is June 9. Holding the reservoir five feet higher in the winter substantially improves the District's ability to attain a full pool by June 1.

Not obtaining full pool by the beginning of the typical summer recreation season and maintaining full pool could adversely affect use of some boat docks and ramps. The record does not identify how many ramps or docks exist on the reservoir, their state of repair, or at what levels they would become unusable. The District did not model the water supply flows, but our review of the average annual flow in Outlet Creek relative to proposed releases for the water supply program, indicates that the proposed releases are typically being spilled during the summer recreation season in most years. Therefore, there likely would not be any effect on reservoir levels, except in the driest years. Regardless, the District's proposed corrective measures would ensure that the existing docks and ramps would continue to be useable under the proposed operations. Therefore, the District's proposed Sullivan Lake operations are expected to have only a minor effect on recreation use.

## 3.9 LAND USE AND AESTHETICS

### 3.9.1 Affected Environment

#### 3.9.1.1 Boundary Project

**Land Use**

Much of the land within the Project vicinity is currently undeveloped, with more than two-thirds (67.6 percent) defined as open space. Of this open space, forested land accounts for 48.9 percent, and wetlands and reservoirs account for 14.5 percent. Developed land uses comprise 30.3 percent of the project vicinity. The largest developed land use category is timber production, with more than 3,200 acres (24.2 percent), followed by agricultural and mining activities, representing more than 232.6 acres (1.7 percent) and 216.5 acres (1.6 percent), respectively. Hydropower facilities account for 74 acres (0.5 percent), while transmission lines for those facilities cover 198.1 acres (1.5 percent) in the project vicinity. Residential land uses cover 183 acres (1.4 percent), while commercial uses cover a total of only 16.5 acres (0.1 percent). The majority of residential uses and all of the commercial activities are focused in and around the towns of Metaline and Metaline Falls. An additional 41 acres (0.3 percent) in the Project vicinity are devoted to public recreation sites.

Downstream of Boundary dam, forested open space accounts for more than 56 percent of the portion of the project vicinity from the dam to the U.S.-Canada border.

Boundary dam and its associated facilities account for the only other land uses in this portion of the project vicinity, with project facilities and transmission lines covering 62.5 acres. There are no residential, commercial, or agricultural activities in this portion of the project vicinity.

Land ownership patterns adjacent to Boundary Reservoir are a mixture of public and private ownership. North of Metaline Falls, the reservoir shoreline is a mixture of private (Seattle), state, and federal ownership, with a large portion of the eastern shoreline falling within the Colville National Forest, managed by the Forest Service. The BLM, Spokane District, manages a large area along the western shoreline. The portion of the reservoir shoreline south of Metaline Falls is predominantly in private ownership, with some Forest Service lands along the eastern shoreline.

The total land area within the project boundary is 2,719.7 acres. The Federal government owns approximately 34.5 percent of this total, with Forest Service lands within the Colville National Forest accounting for 609.24 acres and lands owned by the BLM accounting for 329.35 acres. The remaining land is owned by Seattle City Light, state, county, city, and private entities.

There are approximately 41 roads in the broader project vicinity, with 12 of those roads being used or proposed for use for project-related purposes. The roads are managed by the Forest Service, BPA, Seattle, and private users. Approximately 3 miles of the project-related roads are paved; the remaining miles are dirt or crushed rock, and bordered by native or naturalized vegetation.

**Aesthetic Resources**

The project is located within the Pend Oreille River valley bounded on the east by the Selkirk Mountains and on the west by the Chewelah Mountains. The landscape character varies from a narrow canyon with steep walls to a broader river valley with expansive views. In addition to the mining, logging and power industries, some rural development has impacted the natural scenery. Public access to Boundary reservoir is limited due to topography and land ownership.

As part of the relicensing process, an assessment of the aesthetic environment was conducted at various locations within the project vicinity where opportunities for scenic vistas of project features exist (Tetra Tech, 2009). The study employed protocols developed by the Forest Service (Scenery Management System), BLM (Visual Resource Management), and the Corps of Engineers (Visual Resources Assessment Procedure) to create a visual conditions form to record aesthetic data at Key Observation Points (KOP). Scenic integrity ratings were established for each of the eight land-based and five water-based KOPs.

The land-based KOPs were found to have either moderate or low overall scenic integrity.[164] KOPs at the Vista House and Tailrace Recreation Areas were found to have low scenic integrity due to the prevalence of man-made structures within the altered landscape. The remaining six land-based KOPs were rated slightly higher due to a greater degree of landscape integrity and less dominant man-made structures.

The overall scenic integrity ratings for the water-based KOPs ranged from low to high. Only the Boundary reservoir forebay was identified as having low scenic integrity, due to the presence of the dam and other project facilities. The upper Boundary reservoir KOPs at Metaline Pool and Wolf Creek were found to have moderate scenic integrity because man-made structures were less prevalent in the viewshed and the landscape contained a variety of natural features. The KOPs with high scenic integrity were those with the most dramatic natural features such as Peewee Falls or sheer rock cliffs abutting a narrow reservoir channel.

In addition to the scenic integrity analysis, Seattle also included questions regarding visual quality at the project in the recreation studies conducted as part of the relicensing process. A majority of respondents reported seeing project features while pursuing recreational activities in the project vicinity, with half of those individuals indicating that the views enhanced their experience (40 percent indicating the presence of project features had no impact on their experience).

For all future recreation facility capital improvements and renovations Seattle plans to use the Built Environment Image Guide for National Forests and Grasslands as guidance in order to protect the aesthetic character of the area.

#### 3.9.1.2 Sullivan Creek Project

The project boundary includes all of Sullivan Lake, Mill Pond and Outlet Creek as well as portions of Sullivan and Harvey Creeks. The existing project boundary encompasses about 1,873 acres, of which 522 acres fall within the Colville National Forest. The remaining lands within the project boundary are owned by the District or privately owned. The area in the project vicinity is owned and managed by a combination of the Colville National Forest, Pend Oreille County, the District, the State of Washington and private parties. The lands in the project area are primarily managed for recreation, timber harvest, and wildlife management, with jurisdiction for management activities falling under the Colville National Forest and Pend Oreille County.

---

[164] The scenic integrity was ranked on a 6-point scale ranging from “very high” to “unacceptably low.”

### 3.9.2 Environmental Effects

#### 3.9.2.1 Boundary Project

**Project Boundary Modifications**

The original project boundary was based on the line of ordinary high water as observed by surveyors in 1967. In 2009, the surveyed line of ordinary high water differed from this original line, resulting in a project boundary that now varies from 40 feet to 440 feet from the ordinary high water line. The original 200-foot buffer was designed to provide a level of safety for nearby mining operations.

Seattle proposes to bring new project habitat lands and lands required for project operations into the project boundary. These lands include: (i) the 100-acre Operations and Maintenance Support Area, (ii) the 149-acre Boundary Wildlife Preserve (BWP) and adjacent 89-acre parcel (the BWP Addition); (iii) the portions of the Tailrace East (86.9 acres), Everett Creek (82.7 acres), and Sullivan Creek (17.7 acres) parcels that currently reside outside the Project boundary; and the Metaline Falls Portage Trail. Seattle also proposes to include the following roads, all of which are used exclusively or primarily for project purposes: the 0.28-mile-long portion of the West Side Access Road not already in the boundary, approximately 1.7 miles of roads within the Operations and Maintenance Support Area road network, the 0.23-mile-long Bonneville Power Administration (BPA) substation road, the 0.15-mile-long portion of the spur off of BPA substation road not already in the boundary, the 0.08-mile-long section of south end of National Forest road (FR) 6200-348 not already in the boundary, the 0.08-mile-long section of FR 3165-350 not already in the boundary, the 0.3-mile-long section of FR 3100-325, the 0.4-mile-long FR 3165-315 (for East Peewee Falls Trail and Viewpoint), the 1.07-mile-long section of FR 3100-172, and the 0.2-mile-long FR 3100-178 (for Riverside Mine Canyon Viewpoint).[165]

Seattle proposes to modify the project boundary around the lower reservoir. The project boundary around the lower reservoir, as shown in the 1967 exhibit K drawings, is based on the predicted line of high water at an elevation of 1,990 feet National Geodectic Vertical Datum 1929.[166] Seattle proposes to express the observed high water level in the lower reservoir as contour lines between 1,994 feet to 1,996 feet NAVD 88, as measured in 2009.[167] Initially, Seattle proposed to modify the project boundary to create a fixed 200-foot buffer zone from the contour lines representing the observed high water level of the lower reservoir. However, in their August 24, 2010, comments the Forest Service said that adjusting the project boundary to a fixed 200-foot buffer around the reservoir would place an undue burden on the Forest Service by increasing

[165] Road lengths not explicitly provided by Seattle were estimated using the exhibit G drawings filed on March 29, 2010.

[166] Approximately equal to 1,994 feet NAVD 88.

[167] Addendum to Exhibit G of the License Application.

field work and surveying cost on Forest Service lands adjacent to the project boundary. Specifically, the Forest Service states that under the current project boundary, it would be able to use the existing FERC boundary monuments to identify the current boundary in a single surveying visit, but if the boundary would change, multiple field visits would be required to establish where the boundary is located. There are approximately 125 FERC boundary monuments identified around the existing project boundary.[168]

In its October 19, 2010, response to Forest Service comments, Seattle revised its proposal; it now proposes to retain the project boundary as-is in areas around the lower reservoir where the original project boundary is approximately[169] 200 feet or more from the observed high water level as measured in 2009, and to re-establish the buffer in areas where the existing boundary is less than 180 feet from the high water level through surveying. Seattle states that this modified proposal would result in avoiding the need to re-survey the entire reservoir area, minimize potential confusion between the old and new project boundaries, and avoid inconvenience to the Forest Service.

Seattle proposes to revise the project boundary in the upper reservoir to match the ordinary high water observed during the 2009 survey, expressed as level foot contours between 2,004 feet and 2,007 feet.[170] Seattle also proposes to revise the project boundary in the vicinity of the Pend Oreille County PUD Campbell Park boat ramp where the recently revised FERC boundary for the Box Canyon project overlaps with the current FERC boundary for the project. Seattle proposes to revise the project boundary in this area to align with the Box Canyon project boundary, thereby eliminating the overlap.

Seattle also proposes to construct the following new recreation facilities at the Boundary Project: (1) the Riverside Mine Canyon Viewpoint and Trail; (2) the Eastside Trail, including the East Peewee Falls Trail area; (3) and the Metaline Falls Portage Trail and Boater access. Portions of these facilities fall outside of the project boundary as proposed by Seattle. Seattle also proposes to acquire about 158 acres of wildlife habitat lands and bring those lands into the project boundary. As part of the FAMP, Seattle would also monitor and maintain a number of habitat improvement measures in Sullivan, Linton, and Sweet Creeks, as well as other Tier 2 tributaries to the reservoir, but does not propose to modify the project boundary to include these features.

---

[168] Study No. 22, Land and Roads Study, Revised Final Report, Figure 5.1.1 (maps 2 through 10). Filed with the Commission March 16, 2009.

[169] "Approximately" being 90%, or within 20 feet, of the 200-foot buffer from the current high water mark, as stated by Seattle. This approach would allow for retention of existing project boundary markers when the existing project boundary is near (within 20 feet) the targeted 200-foot buffer.

[170] Except in those areas where the vegetation lines better reflected the ordinary high water level.

*Staff Analysis*

The majority of the lands that Seattle would bring into the project boundary are owned by Seattle. They have and would continue to be used for project purposes, including maintenance and operation and preservation of wildlife habitats. The additional roads being brought into the project boundary would ensure continued access to project and recreational resources for the public and for Seattle.

There are areas where the project boundary is currently only 40 feet from the current ordinary high water level. Seattle's proposed boundary adjustments would enlarge the buffer zone around the project, thereby providing additional shoreline control and protection of environmental resources consistent with other proposed environmental measures. Bringing the project boundary out to at least 180 feet from the current ordinary high water level (while retaining the current boundary in those areas greater than 180 feet from the current ordinary high water level) would maintain many of the current monuments in place needed for Forest Service activities. Re-establishing the survey monuments as proposed by Seattle would avoid or reduce any administrative burden on the Forest Service.

The refinement of the project boundary in the area of District's Campbell Park would result in a clear delineation of which entity holds responsibility for the management of those areas that are currently overlapping with the Box Canyon project.

Seattle would maintain and operate new recreational facilities, acquire and manage new lands for wildlife, and install, monitor, and maintain a number of new aquatic habitat improvements on lands outside the current project boundary. The Commission typically requires lands and waters that are to be maintained by the licensee as a condition of its license to be brought into the project boundary because these lands and waters would serve project purposes and reflect the Commission's ongoing responsibilities to ensure compliance with the license.[171] The exception to this requirement is for one time actions where the licensee would not continue to be

[171] Project boundaries are used to designate the geographic extent of the lands, waters, works, and facilities that the license identifies as comprising the license project and for which the licensee must hold the rights necessary to carry out project purposes (*See Policy Statement on Hydropower Licensing Settlements*, 116 FERC ¶61,270 September 21, 2006).

responsible for the measures.[172] Because the new recreation facilities have not been built, the new wildlife lands acquired, or the exact habitat improvements put in place, it would be premature to require their inclusion in the project boundary. However, they may need to be brought into the project boundary upon completing construction or their acquisition.

Including the lands in the project boundary does not mean that the licensee must obtain fee-ownership of the lands or change property rights; it does mean that a licensee would have to obtain sufficient rights with respect to the facility or measure to comply with the requirements of the license.

Seattle's proposal with the addition of the project lands and roads, the refinement of the boundary in the upper reservoir, and the refinement of the buffer to an approximate 200-foot buffer from the lower reservoir would increase the project boundary by approximately 544 acres to an estimated 3,263 acres, 639 acres of which would be on Forest Service lands, and 327 acres are estimated be on BLM lands. As Seattle has not filed a full set of exhibit G drawings that show the compromise proposal, we will not be approving the exhibit G drawings filed, and will be using the federal land totals as approved in the exhibit K drawings from 1968 until new drawings and federal land tabulations are filed and approved by the Commission.

**Re-establishment of the Public Land Survey System Corners**

Seattle and the Forest Service propose to re-establish three Public Land Survey System Corners, or establish witness corners, delineating the project boundary within and adjacent to lands of the Colville National Forest in an area upstream of Metaline Falls that currently does not have such permanent markers installed. As part of the proposal, Seattle would also survey, mark and post to Forest Service standards and specifications, Forest Service lands adjacent to the project. This would include posting project boundary signage at all public access points at the project boundary, identifying for the public where the project boundary falls. These locations include, but are not limited to, Metaline Waterfront Park, Boundary Forebay Recreation Area, the recreation site across from Everett Island, and at any new overlooks or trail access points.

*Staff Analysis*

---

[172] For example, if a licensee is required once to place material in a stream in order to create fish habitat, but is not required to undertake other measures in that area during the license term, the Commission may not include that reach within the project boundary. If, however, the licensee is obligated to undertake measures throughout the license term, such as implementing an ongoing habitat restoration plan, the Commission may require that the affected lands be included in the project boundary (*See e.g., PacifiCorp*, 105 FERC ¶61,237 at P 114 (2003)).

Re-establishing the survey monuments would assist Seattle and the Forest Service in their day-to-day land management activities.  Establishing project boundary signage at all public access points would identify for the public where the project boundary is located, as there are restrictions on activities within the project boundary that do not apply to lands of the Colville National Forest.

**Travel and Public Access Management Program**

To ensure that there is road and/or boat access to areas designated for wildlife preserves, recreation use, and other project purposes, Seattle proposes to implement a Travel and Public Access Management Program as part of the Recreation Resources Management Plan.  This program identifies project-related roads and establishes both public and operational access guidelines for these roads.  In developing this program, Seattle identified 12 roads needed for project purposes (table 3-22).  While most of the 12 project-related roads are included or partially included in the existing FERC project boundary, Seattle proposes to bring the following new roads into the project boundary: the maintenance facility road network; and portions of FR 3165-325; FR-3165-315, FR 3100-172, and FR 3100-178.  Only those roads used exclusively, or primarily for, project purposes are proposed to be brought into the project boundary.

Table 3-22. Project-related roads (Source: Seattle 2010, as modified by staff).

| **Road** | **Owner**[173] | **Provides Access To:** |
|---|---|---|
| West Side Access Road | Seattle, Forest Service | Forebay Recreation Area access road, Tailrace Recreation Area, Maintenance facility road network, and dam access tunnel |
| Maintenance facility road network | Seattle | Operations and Maintenance Support Area and Tailrace Recreation Area |
| Seattle Forebay Recreation Area | Seattle | Forebay Recreation Area |
| BPA Substation Road | BPA, Forest Service | BPA Substation |
| Spur off of BPA Substation Road | BPA, Seattle, Forest Service | BPA Substation |
| South end of FR 6200-348 | Forest Service, Seattle | Project operations in the area of the transmission lines |
| FR 3165-350 | Seattle, Forest Service | Provides vehicular access across dam and connects FR 3165-000 (non-project road) to the West Side Access Road |
| Tailrace boat launch road | Seattle, Forest Service | Tailrace boat launch and project operations on the west side of the tailrace. |
| FR 3165-325 | Forest Service | Between FR 3165-000 (non-project road) and FR 3165-315, leading to the proposed East Peewee Falls Trail Area and proposed Eastside Trail |
| FR 3165-315 | Forest Service | Proposed East Peewee Falls Trail Area and proposed Eastside Trail |
| FR 3100-172 | Forest Service | The access roads to the proposed Eastside Trail and the Riverside Mine Canyon Overlook from State Route 31 |
| FR 3100-178 | Forest Service | The south end of the proposed Eastside Trail and Riverside Mine Canyon Overlook |

As part of the Travel and Public Access Management Program, Seattle proposes to reconstruct, and maintain portions of the Forest Service roads listed above that provide access to the proposed recreation sites at the Eastside Trail, the Riverside Mine overlook, and the Peewee Falls overlook. These roads would be reconstructed and

[173] Refers to entities that either: 1) own the road surface, or 2) utilize the road to access their ownership. Use of roads by the public is not addressed in this table, though public access is provided on several Project-related roads.

maintained by Seattle as required by Forest Service 4(e) condition 8 to accommodate the proposed recreation use.

The Travel and Public Access Management Program also contains provisions to: continue to manage and restrict public access to project hydroelectric facilities and areas (dam, intake forebay, trash racks, tailrace, operations and maintenance area, machine hall, spillways, road across the dam, transmission lines, and other facilities) by maintaining a security program[174] consistent with the Department of Homeland Security National Threat Level; educate the visiting public, including adequate warning signs, about security procedures at the project in conjunction with the Multi-Resource I&E Program; periodically reassess public access and group tour restrictions to the Tailrace Recreation Area and Machine Hall Visitors' Gallery; develop and implement a plan to maintain roadways used to access project recreation facilities; if necessary, provide for adequate snow removal during the primary recreation season;[175] communicate with the public when vehicle access is not possible; implement boating enhancement measures; and implement trail enhancement measures to provide increased pedestrian access to project recreation sites and unique natural features of the project area.

*Staff Analysis*

Implementation of the Travel and Public Access Management Program would result in providing public access to the proposed recreational facilities and continued access to existing recreational facilities in the project area. Implementation would also ensure that Seattle maintains roads needed for both operational and recreation needs to a standard that is sufficient to provide a reasonable level of service, to protect project resources, and to protect the resources of the Colville National Forest. Implementation would also provide a level of public safety by restricting access to areas that may endanger public safety or national security.

**Effects of Project Operations on Aesthetics**

Project operations have the potential to influence aesthetics through the raising and lowering of the reservoir pool. Summer operation restrictions have resulted in an average fluctuation of 7 feet at the forebay and 3-4 feet upstream of Metaline Falls.

*Staff Analysis*

The aesthetics of the Boundary reservoir shoreline are negatively affected as the reservoir pool is dropped when generating power. Although a "bath tub ring" is discernable due to fluctuations in water levels even with the voluntary restrictions, the scale is relatively small when considered in context with the surrounding landscape.

---

**174** Including provisions to modify the program based on changes to safety and/or security needs or requirements.

**175** Seattle does not intend to provide snow removal during the off-season for recreation.

Because project operations would not change under Seattle's proposal, there would be no change in the aesthetic character of the project from existing project operations. Seattle's current operations limit the adverse effect on the aesthetic setting and recreating public using the Forebay and Canyon reaches during the summer recreation season. Formalizing existing voluntary project operations would assure the status quo regarding water levels would continue into the future.

**Groundwater Monitoring Well Decommissioning**

As a condition of its existing license, Seattle installed a series of groundwater monitoring wells in the late 1950s along the lower portion of the project reservoir (from the town of Metaline downstream to nearly the project dam) presumably as a means to monitor the effects of the project on groundwater levels on the adjoining mines. The wells are no longer needed and Seattle is taking steps to remove them and close the associated spur roads across Forest Service and BLM lands that were used to construct and maintain the wells. Seattle prepared and filed a Monitoring Well and Road Decommissioning Plan with the settlement agreement. Seattle proposes to implement the plan, and the Forest Service Condition 3 requires its implementation. Interior recommends its implementation pursuant to section 10(a).

The plan describes how Seattle would close 18 well heads, restore the sites as appropriate, and close associated spur roads as needed. Wells would be decommissioned by filling the wells with cement grout from bottom to top. The concrete pads around the well heads would be demolished, a hole would be dug around the well head, and the well head cut off approximately four feet below the ground surface, if possible. The holes would be backfilled with the excavated material, the ground graded to match the existing topography, and the bare ground surface seeded with grass. All demolition debris and other waste products would be removed from the site and disposed of at a location off of federal land. Site-specific plans would be developed for each well head and associated spur road prior to implementation. Cultural resource and rare, threatened and endangered plant surveys would be conducted, as necessary, prior to site disturbance.

Seattle would also close the spur off of Forest Road 316-5340, which as been used in the past to access a survey monument. This road is no longer needed for project purposes and would be decommissioned at the same time as the monitoring well roads; this road is also addressed in this plan.

Seattle would complete the well decommissioning and road closures within two years of license issuance.

*Staff Analysis*

There is no record of a problem of project operations adversely affecting groundwater levels or seepage into adjoining mines. Thus there does not appear to be a need for Seattle to maintain these groundwater monitoring wells.

Seattle's proposed measures would restore federal lands, would be conducted in a manner that would control erosion and release of cement or other chemicals that could be harmful to fish and wildlife, and would control noxious weeds in the disturbed area. While project roads are not considered a significant problem for project area wildlife, roads can increase human access and increase disturbance; closing these spurs would indirectly benefit wildlife by reducing the number of roads in the area

#### 3.9.2.2 Sullivan Creek Project Surrender

The viewshed is not expected to change around Sullivan Lake, other than some possible seasonal differences in lake levels. The primary aesthetic impact will be the removal of Mill Pond dam.

**Effects of Mill Pond Dam Removal on Aesthetics**

Removal of Mill Pond dam and restoration of Sullivan Creek would increase noise during construction, and alter views of the pond as the dam is removed, the pond is dewatered, and aquatic habitat structures are installed.

*Staff Analysis*

Construction activities would result in temporary, short-term noise and dust associated with the use of heavy equipment. The use of best management practices, and soil erosion control measures would minimize the adverse effects. In the long-term, aesthetic views would shift from an open pond to riverine system that blends into the forest. Long term aesthetic effects should be minimal for visitors unfamiliar with the existing landscape. For those visitors whose destination is Mill Pond, the loss of the pond will likely negatively impact their experience and may change visitor use at the site.

## 3.10 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), requires that the Commission evaluate the potential effects on properties listed or eligible for listing in the National Register of Historic Places (National Register). Such properties listed or eligible for listing in the National Register are called historic properties. In this document we also use the term "cultural resource" for properties that have not been evaluated for eligibility for listing in the National Register. Cultural resources represent things, structures, places, or archeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic. Section 106 also requires that the Commission seek concurrence with the State Historic Preservation Officer on any finding involving effects or no effects to historic properties, and allow the Advisory Council on Historic Preservation (Council) an opportunity to comment on any finding of effects to historic properties. If Native American (i.e., aboriginal) properties have been identified, Section 106 also requires that the Commission consult with interested Indian tribes that might attach religious or cultural significance to such properties. In this case, the Commission must take into account whether any historic property could be affected by either a proposed new license for the Boundary Project or with the surrender of the Sullivan Creek Project, and allow the Council an opportunity to comment prior to issuance of any new license or surrender for these projects.

## 3.10.1 Affected Environment

### 3.10.1.1 Cultural History of the Boundary and Sullivan Creek Project Areas

#### Prehistory and Ethnographic Period

The Boundary and Sullivan Creek Projects fall within the Plateau physiographic area of the interior Northwest. The interior Northwest has experienced more than 10,000 years of human occupation, as demonstrated by the archaeological record and, in the more recent past, by the ethnographic record. As archeological units (defined by the presence of diagnostic artifacts, primarily by chipped stone dart and arrow points), the prehistoric culture history of the interior Northwest can be divided into three periods (Period I-III), representing aboriginal occupations that tended to increase in size and settlement complexity up until European contact. Periods IA and IB (11,500-6,400 years B.P.) represented the earliest interval of human occupation in the region by big game hunters, of which the earliest inhabitants settled the area during the end of the Pleistocene (IA), and made more substantial permanent settlements in the following sub period hunting and gathering modern-day plant and animal communities. Period II (6,400-3,900 years B.P.), was represented by an interval of more warmer and dryer weather, and populations began to adapt to fishing salmon in larger numbers due to it’s predictability over the diminishing of larger mammalian game. In the following Period III interval (3,900 to 200 years B.P.), the climate became cooler and wetter, and salmon runs increased, allowing for larger populations to congregate along the fishways. Although the project area was occupied by aboriginal groups, prior to European contact, very little cultural resource information was located dating to this later period. At the time of European contact, the project area was occupied by Interior Salish-speaking groups associated with the modern-day Kalispel Indians. The Kalispel were, no doubt, descendants of the earlier aboriginal inhabitants of the area who had been living in the area for thousands of years.

#### Historic Period

Early settlers in the project area were trappers and traders associated with the British North West Company, which dominated the interior Northwest fur trade in the early nineteenth century. The discovery of placer gold near Fort Colville on the Columbia River in 1855 caused a small rush of several hundred prospectors to the area, provoking conflicts with the local Native American population. Although prospectors were aware of the presence of various ore deposits in the Pend Oreille valley as early as 1869, it was not until 1928 that they discovered large commercial ore bodies. By the 1950s, the mines in Pend Oreille and Stevens counties had produced nearly the entire output of lead and zinc for the entire State of Washington. Small amounts of gold have been found in most lode mines within the region, but it generally has been of minor value compared with the other metals (Ferguson and Root 2004). Most of the major deposits were found in the Metaline Falls area of the county.

By 1912, Metaline Falls had entered the modern industrial world, with various businesses, hotels, parks, and electric lighting. In 1910, a man named Lewis Larsen made a mining claim, the Pend Oreille Mines and Metals Company (POMMC). This enterprise became the largest producer of lead and zinc in Washington. From 1942 to 1952, 20 percent of the nation's lead and 13 percent of its zinc was produced in the Metaline district. The Josephine Mine, later renamed Clark, may have been Larsen's first set of claims to form the nucleus of his thriving mining company. By the second decade of the twentieth century, the once-remote wilderness that early fur traders originally traversed had been largely replaced with the characteristic traces of civilization that follow the mining frontier.

The greatest impediment to early lode mining in eastern Washington was inadequate transportation facilities. With the arrival of the railroads, the limited extent of transport by steamboat was remedied. In 1889, the Spokane Falls and Northern Railroad expanded northward from Spokane to service the prosperous mining industry along the upper Columbia River. Soon, the tracks were extended to Northport and eventually into Canada. By 1910, the Idaho and Washington Northern Railroad was being built downriver to Ione, Metaline, and Metaline Falls to service the Pend Oreille Valley (Baltien 1996). These improved transportation facilities attracted an increasing number of homesteaders and spurred on forms of industry in addition to mining, such as logging, agriculture, and cement production.

Before the 1900s, most of present day Pend Oreille County was covered with forests. The lumber industry began there in 1888 when Edwin Winchester built a sawmill on Winchester Creek in the Calispell Valley. This mill functioned primarily to supply early settlers with lumber for their building projects. A few years earlier, railroad tracks were extended to Metaline Falls. As in other areas of the Pacific Northwest, the timber industry boomed after railroads and cheap transportation arrived.

The demand for energy to serve the developing industrial needs sparked the development of hydropower in the region. Plans were developed by Lewis Larson in 1905 to harness hydroelectric power from Sullivan Creek in order to establish a Portland cement factory at Metaline Falls, located near good source of limestone. In 1909, a wagon road was constructed approximately five miles to connect the Pend Oreille River and Sullivan Lake. That same year a work camp for the construction crew was established one and a half miles northwest of the lake on a flat above Sullivan Creek. In 1910 the crew constructed a 50 foot high log crib dam on the lake's northwest corner, and another dam adjacent to the work camp on Sullivan Creek. The operating plan for the newly constructed Sullivan Creek hydroelectric project was that Sullivan Lake would be used as a storage reservoir while Mill Pond would be used as the water source for the proposed hydroelectric plant at the confluence at Sullivan Creek and the Pend Oreille River at Metaline Falls. In 1910 a wooden flume and earthen canal was constructed to convey water from Mill Pond to the power house. A boardwalk was constructed on top of the wood flume, where townspeople of Metaline Falls could enjoy a scenic walk up to Sullivan Lake. Maintenance of the wood flume became a constant ordeal, due to the numerous springs running along the north-facing slope of where the flume was positioned. In the 1920s and 1930s, large sections of the flume failed and were replaced, and in the spring of 1956, many of the underlying trestle supports were washed away, rendering the flume inoperable, and was never rebuilt in subsequent years, due to the availability of cheaper electricity. In 1958, the District purchased the Sullivan Creek project, hoping to rejuvenate the hydroelectric facility up into the present. In the same year, Pend Oreille PUD was given a new license by FERC to operate the facility, but was never used.

Studies of the potential for a hydroelectric development in the Z Canyon area, just upstream of the current Boundary Project dam site, were begun as early as 1914. Colonel Hugh L. Cooper, the engineer who undertook the initial investigations, applied for a license from the Federal Power Commission (FPC, FERC's predecessor), but the application was denied (Sugiyama 1980). In 1943, the U.S. Army Corps of Engineers (USACE) published a comprehensive "308 Report" on the Columbia River and its tributaries, which included the finding that the Boundary site, approximately 1 mile downstream from the Z Canyon site and 1 mile upstream from the Canadian border, was superior to the Z Canyon site for construction of a hydroelectric project. The report recommended a dam that would create a reservoir to the elevation of 2,062.5 feet above mean sea level (NGVD 29), which is the elevation of Lake Pend Oreille. However, the USACE encountered considerable opposition to this proposal during hearings held in 1947, and instead built the Albeni Falls dam, near the outlet to Lake Pend Oreille. In 1951, the City of Seattle commissioned a study of undeveloped potential hydropower sites in the state of Washington. Based on the study's findings and recommendations, the City of Seattle applied for a preliminary permit on October 28, 1953, to build a dam at the Boundary site. Seattle received its license in 1961, began construction in 1963, and started operations in 1967.

#### 3.10.1.2 Boundary Project Cultural Resources

Seattle conducted an extensive cultural resources inventory for the Boundary Hydroelectric Project Area of Potential Effect (APE),[176] which included the following areas:

- Downstream of Metaline Falls—the reservoir and the land within the FERC project boundary, which includes most project facilities, the land 200 horizontal feet (along the ground surface) inland of the high water elevation (1,994 feet ) along both shorelines, and the transmission line right-of-way (ROW) from the powerhouse to the Bonneville Power Administration interconnection.
- Upstream of Metaline Falls—the reservoir and the land within the FERC project boundary, plus the land within 25 horizontal feet inland of the high water elevation along both shorelines (approximately 2,019 feet), extending south to the FERC Project boundary for the Box Canyon Project.
- The Seattle-owned Boundary Wildlife Preserve (BWP) (155 acres) and adjoining Seattle-owned property (85 acres).
- Major Project-related roads—the Seattle ROW for the road from Boundary dam to the Vista House and the road from the dam to County Road 2975. The Pend Oreille County ROW for the road from the Vista House to State Route 31.
- All Seattle-owned lands outside the FERC Project boundary, in the Pend Oreille Valley between Box Canyon dam and the international border, including lands where there are Project-related structures or activities, such as maintenance and equipment staging locations.
- In addition, the APE was adjusted to include any areas where other resource studies (such as erosion or dispersed recreation) identify a project effect in an area not within the original APE.

The investigation included background and archival research in the summer of 2007, and field surveys in the fall of 2007, and again in the spring of 2008. All of Seattle's proposed study plans, defining the APE, and subsequent HRA surveys and reports were reviewed and commented on by a cultural resources work group (CRWG).

---

[176] The area of potential effects (APE) is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historical resources if any such cultural resources exist. For hydroelectric projects, the APE usually consists of all lands within the existing FERC project boundary, in addition to any lands beyond the FERC project boundary where other historic properties could be affected by the project.

The CRWG consisted of representatives of Seattle, their cultural resources contractors, Washington SHPO, Kalispel Tribe, BLM, Forest Service and FERC.

The results of the cultural resources inventory located 25 archeological sites and two historic structures in the Boundary Project APE (table 3-23). Of these 27 cultural resources, only two were identified as pre-contact aboriginal archeological sites. Of the 27 cultural resources located in the project's APE, two historic districts were established, the Josephine Mine and Pend Oreille Mines and Metal Company, both determined to be eligible for inclusion in the National Register. Another historic archeological site, the Carl Harvey Homestead (site 45PO584), was also determined eligible for inclusion in the National Register. The remaining cultural resource sites, most of which were associated with either of the two mining historic districts, located in the project's APE were not considered eligible for inclusion in the National Register. No traditional cultural properties were located.

Table 3-23. Cultural resources found at the Boundary Project (Source: Seattle, 2009).

| Site Designation | Site Type | Cultural Materials | NRHP Eligibility | Land Ownership | DOE Concurrence |
|---|---|---|---|---|---|
| 45PO520 – Josephine Mine | Historic Mining Property | Collapsed buildings; mining debris | Yes, NRHP-eligible, Historic District | BLM | Incorporated into Josephine Mine Historic Mining District |
| 45PO573 Chickahominy Prospects | Historic Mining Property | Prospect Pits | No, but within NRHP-eligible Historic District | BLM | Incorporated into Josephine Mine Historic Mining District |
| 45PO575 – Flume Creek Aqueduct | Historic Mining Property | Aqueduct suspended over the Pend Oreille River | Yes, part of NRHP-eligible Historic District | Seattle and BLM | Incorporated into Josephine Mine Historic Mining District |
| 45PO576 – Robert .E. Lee Lode | Historic Mining Property | Adit, ore cart rails | No | Seattle | 1/6/2009 |
| 45PO577 – POMMC Powerhouse Dump | Historic Debris Scatter | Domestic refuse | No, but within NRHP-eligible Historic District | Seattle | 1/6/2009 |
| 45PO578 – Riverside Mine | Historic Mining Property | Collapsed mine buildings; adit | No | Forest Service | 1/6/2009 |
| 45PO579 – Raise 3 | Historic Mining Property | Deteriorated mine structures | No | BLM | 3/3/2009 |
| 45PO580 – Flusey Lode | Historic Mining Property | Adit/prospect pit and historic debris | No | Seattle | 1/6/2009 |
| 45PO581 | Pre-Contact Feature | Fire-cracked rock; possible lithic artifact | No | State of Washington | 1/6/2009 |
| 45PO582 – | Historic Mining | Mine, adit; some | No | Seattle | 1/6/2009 |

| Site Designation | Site Type | Cultural Materials | NRHP Eligibility | Land Ownership | DOE Concurrence |
|---|---|---|---|---|---|
| Metaline Mine/Hercules Adit | Property | discarded equipment | | | |
| 45PO583 | Pre-Contact Feature | Fire-cracked rock scatter and a single flake | No | Seattle | 1/6/2009 |
| 45PO584 – Carl Harvey Homestead | Historic Homestead | Collapsed cabin; historic debris scatters | Yes | Seattle and Forest Service | 16/2009 |
| 45PO585 | Historic Homestead | Collapsed 20th century log cabins and debris scatters | No | Seattle | 1/6/2009 |
| 45PO586 | Historic Homestead | Collapsed cabins and trash scatters | No | Seattle | 1/6/2009 |
| 45PO587 | Historic Structure Unknown | Cobble feature | No | Forest Service | 6/22/2009 |
| 45PO589 – Z Canyon Footbridge | Historic Transportation | Remains of footbridge across the Pend Oreille River | No | Seattle | 1/6/2009 |
| 45PO590 | Historic Mining Property | Mining adit | No | Seattle | 1/6/2009 |
| 45PO592 | Historic Mining Property | Mining adit | No | Seattle | 1/6/2009 |
| 45PO593 | Historic Transportation | Rail bed or roadway | No | Seattle | 1/6/2009 |
| 45PO594 | Historic Mining Property | Mining adit | No. | BLM | 8/18/2009 |
| 45PO597 | Historic Mining Property | Prospect trench | No | Forest Service | 6/22/2009 |
| 45PO598 | Historic Mining Property | Prospect trench | No | Seattle | 5/14/2009 |
| 45PO599 | Historic Mining Property | Prospect trench | No | BLM | 6/1/2009 |
| 45PO600 | Historic Mining Property | Prospect trench | No | Forest Service | 1/6/2009 |
| Pend Oreille Mines and Metals Company Powerhouse | Energy Facility | Abandoned mid-20th century powerhouse | Yes, part of NRHP-eligible Historic District | Seattle | HPI Report submitted to Washington SHPO 7/17/2009 |
| Miner's Cabin (Ross Cabin) | Domestic – Single family house | Homestead cabin | No | Seattle | HPI Report submitted to Washington SHPO 7/17/2009 |

#### 3.10.1.3 Sullivan Creek Project Cultural Resources

As part of a 1994 license amendment, the District completed an extensive cultural resources assessment (HRA 1994). The investigations included archival research and background work, and a field survey of the Sullivan Creek Hydroelectric Project area (APE) between June 22 and June 24, 1993. This included Sullivan Lake dam, Mill Pond dam, Sullivan Lake reservoir, Mill Pond, Sullivan Creek diversion dam and conduit—which consists of an 0.8 mile long abandoned conduit, power conduit—which consists of 12,500 feet of abandoned wooden flume, 2,500 feet of abandoned earthen canal, and 1,150 feet of an 8 foot diameter horseshoe tunnel, powerhouse, and Mill Pond Historic Site—which includes portions of the wooden flume listed above, cabin with porch, large outhouse, unfinished or partly demolished cabin, stable (or blacksmith shop), small outhouse, and the existing Mill Pond dam, listed above

The results of the cultural resources investigations documented 14 cultural resources within the Sullivan Creek Project APE (table 3-24). All but one of the cultural resources are considered contributing elements to the Sullivan Creek Historic District, which, in turn, is determined to be eligible for inclusion in the National Register. The other cultural resource located in the project's APE is a pre-contact archeological site located on Forest Service lands along the shoreline of Sullivan Lake. Another site, the MacDougall homesite, although near, is not within the project's APE. No traditional cultural properties were located in the project's APE.

Table 3-24. Cultural resources found at the Sullivan Creek Project (Source: Seattle, 2009).

| Site Designation | Site Type | Cultural Materials | NRHP Eligibility | Land Ownership | DOE Concurrence |
|---|---|---|---|---|---|
| 45PO102H | Sullivan Dam | Concrete dam | No, but considered a contributing element to Sullivan Creek Historic District | Forest Service | 1980/1993 |
| | Diversion Ditch | Earthen ditch | Undetermined, but considered a contributing element to Sullivan Creek Historic District | Forest Service | |
| CF532 | Mill Pond Crib Dam | Wooden dam, inundated | No, but considered a contributing element to Sullivan Creek | Forest Service | 1980/1983 |

| **Site Designation** | **Site Type** | **Cultural Materials** | **NRHP Eligibility** | **Land Ownership** | **DOE Concurrence** |
|---|---|---|---|---|---|
| | | | Historic District | | |
| SH-1 | Old County Road Segment | Roadbed | Undetermined, but considered a contributing element to Sullivan Creek Historic District | Forest Service | |
| | Flume, Trestles, Canal, and Penstock | 12,500 feet of wooden structures and 2,500 of earthen canal, steel penstock | No, but considered a contributing element to Sullivan Creek Historic District | Forest Service and District | 1989/1993 |
| | Mealsite Dump | Small can dump adjacent to flume | Undetermined, but considered a contributing element to Sullivan Creek Historic District | District<br><br>(not recorded) | |
| | Telephone Poles Connected to Flume | Series of wooden telephone pools | Undetermined, but considered a contributing element to Sullivan Creek Historic District | District<br><br>(not recorded) | |
| | Ditch Walker's Cabin | A-frame wood cabin | Undetermined, but considered a contributing element to Sullivan Creek Historic District | District<br><br>(not recorded) | |
| | Overflow Waste Ditch | Earthen ditch | Undetermined, but considered a contributing element to Sullivan Creek Historic District | District<br><br>(not recorded) | |
| | Sullivan Creek Powerhouse<br><br>(Decommissioned) | Brick Structure | No, but considered a contributing element to Sullivan Creek Historic District | District | 1980/1983 |

| Site Designation | Site Type | Cultural Materials | NRHP Eligibility | Land Ownership | DOE Concurrence |
|---|---|---|---|---|---|
| CNF-1[177] | Mill Pond Flume Site/Construction Camp | Remains of construction camp | No, but considered a contributing element to Sullivan Creek Historic District | Forest Service | 1993 |
| | MacDougall Homesite | Remains of milled wood house | Undetermined, but not in APE | District | |
| SH-2 | Can dump at SE end of Mill Pond | Euroamerican artifact scatter | Undetermined, but considered a contributing element to Sullivan Creek Historic District | Forest Service | |
| SH-3 | Historic Scatter, Mining Test Pits | Euroamerican artifact scatter and features | Undetermined, but considered a contributing element to Sullivan Creek Historic District | Forest Service | |
| 45PO148 | Pre-contact Site on Sullivan Lake Shore | Aboriginal artifact scatter | Undetermined | Forest Service | |

[177] The construction camp site (CNF-1 contains the following features: Existing concrete dam (modified in 1956 an again in 1976), earthen dike (built in 1973), blacksmith shop (deteriorated), disassembled or incomplete log structure, small outhouse, large outhouse, log cabin, road remnants, bridge abutment remnants (downstream of Mill Pond Dam), cultural material scatter, and intake and log flume remnants (a portion located on Forest Service lands)

## 3.10.2 Environmental Effects

### 3.10.2.1 Boundary Project

Potential adverse effects to historic properties located within the Boundary Project APE could result from general project-related ground-disturbing activities, proposed mitigation and enhancement measures, recreational activities, encroachment by adjacent private landowners, shoreline erosion, vandalism and looting of archeological materials. In particular, potential adverse effects as described above could occur on contributing elements associated with the National Register-eligible Josephine Mine Historic District, Pend Oreille Mines and Metal Company, and Carl Harvey Homestead.

To resolve any existing and future potential adverse effects to historic properties located within the project's APE, Seattle crafted a historic properties management plan (HPMP) in consultation with members of the CRWG. Seattle's HPMP (dated March 2010) establishes an HPMP coordinator to implement various procedures and programs including educating employees and the public on the value and protection of significant cultural resources; defines a process for basic management standards to protect historic properties; includes procedures for handling and noticing inadvertent discoveries and human remains; establishes protocols for emergency situations, and monitoring and protecting specific archeological sites, historic buildings, and structures, in particular those associated with the Josephine Mine Historic District, Pend Oreille Mines and Metal Company, and Carl Harvey Homestead.

*Staff's Analysis*

Commission staff concludes that Seattle's proposal on implementing the HPMP for the term of a new license would effectively resolve potential project-related adverse effects to historic properties.

### 3.10.2.2 Sullivan Creek Project

Potential long-term adverse effects to historic properties from the surrender of the Sullivan Project license include removal of the historic properties from federal jurisdiction, the temporary insertion of a drain pipe near site CNF-1 (a small collapsed outhouse feature), the removal of the Mill Pond dam and the log crib dam within Mill Pond, and removal of pond sediments from the Mill Pond dam that could affect buried archeological deposits.

Construction of the cold water release facility would occur in the area of the existing Ranger District and campground; the District compound was determined eligible for the National Register in 1989. Construction of the new facility would require a structure to house the pump. Construction of this structure could disturb a cultural resource site, especially an archeological deposit, and if inappropriately designed, the structure could adversely affect the integrity of the district's National Register character. The Forest Service states that a cultural resources inventory needs to be conducted within the APE for the proposed cold water release facility and that the design of the housing structure must reflect the existing Ranger District and campground Depression-era Civilian Conservation Corps (CCC) western rustic structure characteristics.

The District proposes to craft a memorandum of agreement (MOA) with the Washington SHPO, Forest Service, Kalispel Tribe, and the Council (if they choose to participate) to implement the following measures: (1) prior to the removal of the Mill Pond dam and associated historic resources, complete a DAHP Level II mitigation documentation report and present it to the Washington SHPO and Council; (2) information gathered for the report and previous resources documentation would be used by the District to create and install new interpretive panels along the current interpretive trail at the site of the Mill Pond dam; (3) the District, in conjunction with the Forest Service, would consider in future planning, the historic significance of any remaining historic features of the landscape and would not adversely affect the integrity of those aspects of the landscape that are considered significant; and (4) the District would be responsible for an archeological survey and monitoring within the APE prior to and during stream restoration activities. Implementation of the MOA by the District will conclude the project's section 106 requirements involving the surrender process.

*Staff Analysis*

An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualifies it for inclusion in the National Register of Historic Places. The District's proposed measures would mitigate for adverse effects on historic properties associated with the removal of Mill Pond dam and restoration of the Sullivan Creek.

However, once the Commission terminates the Sullivan Creek license, historic properties that are within the project boundary on private lands would no longer be under federal jurisdiction and protection. This is also considered an adverse effect on historic properties. The District has not proposed any measures to protect these resources.

Completing a cultural resources inventory within the APE for the proposed water release facility would protect or mitigate against any potential adverse effects to a cultural resource site, especially an archeological deposit that might be affected by the construction of the facility, including any construction staging areas adjacent to Sullivan Lake dam. Consultation with the Forest Service and Washington SHPO on a final design of the cold water release facility would also ensure that the rustic character of the adjacent Ranger District and CCC camp would not lose its significance as a 1930s era camp and ranger historic district.

Completing a DAHP Level II mitigation documentation report of the Sullivan Creek powerhouse, and any other associated contributing element of the Sullivan Creek Historic District that is on District lands would fully mitigate for any loss of these properties once they are removed from federal oversight. Commission staff notes that in the District's June 22, 2010 response to our May 19, 2010 additional information request, the District states that the Washington SHPO also recommends that the Sullivan Creek powerhouse be documented, and that the District is currently consulting with the Washington SHPO on determining what adverse effects are directly impacting the powerhouse, and what applicable measures to resolve such effects should be implemented.

## 3.11 SOCIOECONOMICS

### 3.11.1 Affected Environment

As one of Washington's least populated counties, Pend Oreille County (County) is characterized by a low-population-density, rural landscape separating a number of small towns and cities. Due in part to the presence of the National Forest both east and west of Boundary Reservoir, land development along the reservoir is limited to the area north of Metaline Falls. Mining, timber harvest, and recreational activities are more common than urban land uses. The County's largest urban area is the City of Newport (also the county seat), located at the southern end of the County. Metaline, Metaline Falls, and Ione are three towns near the Boundary and Sullivan Creek Projects, and each has fewer than 500 residents. In the recent past, population increases have mostly occurred in the unincorporated parts of the County rather than in existing towns and cities. This pattern of population growth is expected to continue in the future. Relatively inexpensive land and affordable housing generally characterize the real estate market in the county. Prominent employers in the county have included the Teck Cominco Company and the Ponderay Newsprint Company.

Pend Oreille County is characterized predominantly by resource-dependent industries and rural land uses, and has comparatively low incomes and high poverty rates relative to the state as a whole (Seattle 2006). Over the last 25 years, the unemployment rate in the County has been substantially higher than the state as a whole and the County was one of 16 counties designated by the State as a "distressed area" in 2004.

The primary source of tax revenue for Pend Oreille County is through intergovernmental agreements. In 2006, the County obtained a total of $9,507,237 from such agreements, including payments from the state and federal government (State of Washington OFM 2007). Property taxes generated the second largest revenues for the County, producing a total of $2,910,261. "Charges for services" ($1,949,009), retail sales and use tax ($794,456), and "all other taxes" ($1,052,110) also generated sizeable tax revenues for the County. Total revenues in unincorporated Pend Oreille County in 2006 came to $18,669,763.

Washington State law requires the City of Seattle to compensate counties and school districts for loss of revenues and increased costs caused by the operation of the Boundary Project (RCW 35.21.425-427). Under the most recent 10-year agreement, Seattle provided annual payments to the County that were allocated by the County in specified amounts to each of the affected jurisdictions (the County, towns of Metaline, Metaline Falls, and Ione; and the Selkirk, Cusick, and Newport School Districts) (City of Seattle 1999). From 1998 - 2008, impact payments varied by a negotiated amount but were approximately $1.2 million annually. On September 24, 2010, Seattle filed, for informational purposes only, a new agreement for continuing payments for the period 2009 - 2019.

Seattle contracts with Pend Oreille County Fire District #2 for fire protection at the Boundary Project facilities. Seattle also contributes to local services through local purchasing and vendor agreements. In 2004, Seattle made approximately $217,000 in payments to merchants within Pend Oreille County. Vendor payments increased to $275,174 in 2005. Vendors included in this total vary from the District and the Pend Oreille Telephone Company to local electrical and hardware stores. Purchases from these vendors generate sales tax revenue for local jurisdictions. In 2004 and 2005, $10,527 and $7,350, respectively, were paid in local sales tax.

Through the tax and fee revenues discussed above, the County supports a range of programs for its residents. In 2006, the County's three largest expenditures for services included almost $3.8 million for the security of persons and property (police, fire, etc.), approximately $3.9 million for "capital outlays", and $4,465,868 for transportation-related activities (State of Washington OFM 2007). General government services ($3,297,006), health services ($1,501,446), and monies for natural resources ($1,317,193) represented the County's three other major expenditures. Other expenditures, including debt service, support of culture and recreation activities, and economic development each totaled less than $400,000.

## 3.11.2 Environmental Effects

### 3.11.2.1 Boundary Project

The Boundary Project currently, and would continue under a new license, to provide economic benefits to the local economy through direct compensation payments to local jurisdictions in lieu of taxes, and Seattle's fire protection contract. Seattle would continue to maintain an at-cost power contract with the District, which would contribute to the District's ability to provide some of the lowest cost power in the region.

In addition, proposed capital improvement projects, such as turbine efficiency upgrades, fish passage facilities, and recreation improvements, would benefit the local economy through local hiring and purchasing of materials and services. While the majority of these capital improvement projects and the O&M projects would be performed by existing Seattle fulltime staff with specialized experience in maintaining hydroelectric facilities, to a certain extent, some of the substantial costs and expenditures associated with these projects (estimated at about $237 million in capital expenditures for facility upgrades and about $203 million in capital expenditures for environmental measures) would be expended locally for goods and services and potential equipment rental.

Short-term local laborers also could be involved, in particular for some of the O&M projects. In addition, the influx of Seattle work crews into the project vicinity to accomplish the work represents a positive impact in the form of expenditures on local goods and services and for short-term housing (for some of the projects that require longer term construction). These impacts have not been quantified but would be beneficial to the local communities.

No negative socioeconomic effects were identified by stakeholders, nor were additional measures recommended to address socioeconomic effects. Staff did not identify the need of any additional measures.

#### 3.11.2.2 Sullivan Creek Project

Removal of Mill Pond dam and restoration of Sullivan Creek would temporally increase heavy truck traffic on the local roads. No other direct effects of the license surrender were identified.

The sale of 5,000 ac-ft of water to downstream users on the Columbia River during June 1 to August 31would help off set the District's costs for habitat improvements, thereby reducing the burden of increased rates to its customers.

## 3.12 NO-ACTION ALTERNATIVE

### 3.12.1 Boundary Project

Under the No-action alternative, 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, depending on the success of basin-wide efforts, DO and TDG levels at the project would continue to exceed state water quality standards on occasion, as would temperature levels in the reservoir.

### 3.12.2 Sullivan Creek Project

As explained above, there would be no change in the environmental setting of the project. The District would continue to operate the Sullivan Creek Project as it does currently. There would be no change in Sullivan Creek temperatures or stream flows. Mill Pond would continue to provide a recreational lake fishery.

# 4.0 DEVELOPMENTAL ANALYSIS

## 4.1 BOUNDARY PROJECT

In this section, we look at the Boundary Project's use of the Pend Oreille River for hydropower purposes to see what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp*.,[178] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered for the protection, mitigation and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e. for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

### 4.1.1 Power And Developmental Benefits of The Project

Tables 4-1 summarizes the assumptions and economic information we use in our analysis for the Boundary Project. This information was provided by Seattle in its license application and in Seattle's addendum filed with the Settlement Agreement. We find that the values provided by Seattle and the District are reasonable for the purposes of our analysis. Cost items common to all alternatives include: net investment (the total investment in power plant facilities remaining to be depreciated); normal operation and maintenance cost; and Commission fees.

---

[178] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 4-1. Parameters for economic analysis of the Boundary Project (Source: Seattle 2009, 2010, as modified by staff).

| Parameter | Value |
|---|---|
| Period of analysis (years) [a] | 30 |
| Future major capital cost, $[b] | $236,768,000 |
| Relicensing cost, $[c] | $34,000,000 |
| Operation and Maintenance, $/year[d] | $11,394,932 |
| FERC fees[e] | $1,878,653 |
| Energy value ($/MWh)[f] | $32.92 |
| Interest rate[g] | 5.44 |
| Discount rate[h] | 3.20 |

[a] The Commission uses a 30-year period of analysis for all economic analysis.
[b] Future major capital costs include generator rebuilds, forebay wall hardening, rock damage mitigation, replacement of step-up transformers and isophase bus, ozone abatement and other minor improvement projects scheduled over a 30-year period of analysis and expressed as $2009.
[c] Relicensing costs include the administrative, legal/study, and other expenses to date.
[d] Estimated by staff to 2009 dollars based on the applicant's reported values for 1998-2007, for existing plant operation and maintenance for the current license, administrative and general expenses, and insurance.
[e] Commission fees are based on statements of the 2009 annual charges received from the Commission for federal lands, 2010 administrative charges based on authorized capacity, and 2009-2010 charges for headwater benefits. .
[f] Estimated by staff based on the Addendum to Exhibit D of the License Application, page 7, based on an average on-peak value of $35.70 and an average off-peak value of $28.62.
[g] Based on Seattle's weighted average cost of capital.
[h] Based on the Seattle's rate for annualizing costs as provided in the Addendum to Exhibit D of the License application..

### 4.1.2 Comparison of Alternatives

Table 4-2 summarizes the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: no-action, the applicant's proposal, the staff alternative, and the staff alternative with mandatory conditions.

Table 4-2. Summary of the annual cost of alternative power and annual project cost for four alternatives for the Boundary project (Source: staff).

| | **No Action** | **Applicant Proposal** | **Staff Alternative** | **Staff Alternative with Mandatory Conditions** |
|---|---|---|---|---|
| Installed capacity (MW) | 1,003 | 1,003 | 1,003 | 1,003 |
| Annual generation (MWh) | 3,572,750 | 3,612,588[179] | 3,612,588 | 3,612,588 |
| Annual cost of alternative power ($/MWh) | $117,614,930<br>32.92 | $118,926,400<br>33.29 | $118,926,400<br>33.29 | $118,926,400<br>33.29 |
| Annual project cost ($/MWh) | $20,428,260<br>5.72 | $50,197,050<br>14.05 | $49,991,830<br>13.99 | $50,260,070<br>14.07 |
| Difference between the cost of alternative power and project cost ($/MWh) | $97,186,670<br>27.20 | $68,729,350<br>19.24 | $68,934,570<br>19.30 | $68,666,330<br>19.22 |

### 4.1.3 No-action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project would have an installed capacity of 1,003 MW, and generate an average of 3,572,750 MWh of electricity annually. The average annual cost of alternative power would be $117.6 million, or about $32.9/MWh. The average annual project cost would be $20.4 million, or about $5.7/MWh. Overall, the project would

[179] The turbine runner replacements and other upgrades for Units 55 and 56 are expected to increase the annual generation of the project by 39,838 MWh. Seattle may need to file for a capacity amendment after the refurbishment and testing of turbines 55 and 56 is complete.

produce power at a cost which is $97 million, or $20.2/MWh, less than the cost of alternative power.

### 4.1.4 Seattle's Proposal

Seattle proposes to upgrade two turbines to increase efficiency. Upon completion of the upgrades, Seattle estimates that the project would generate an additional 39,838 MWh per year, bringing the average generation to 3,612,588 MWh per year. The average annual cost of alternative power would be $118.9 million, or about $33.3/MWh. The capital cost of project upgrades of the turbines and generators is estimated at $236,768,000 over a 30-year period. Among other measures, Seattle also proposes to develop and implement an upstream fish passage program having a total capital cost of $114,149,000. In total, the average annual project cost would be $50.2 million, or about $14/MWh. Overall, the project would produce power at a cost which is $68.7 million, or $19.2/MWh, less than the cost of alternative power.

### 4.1.5 Staff Alternative

The staff alternative includes the same developmental upgrades as Seattle's proposal and, therefore, would have the same capacity and energy attributes. However, as described in section 3.5, staff do not recommend establishing a fund for habitat improvements in tributaries to Sullivan Lake, the fish tissue sampling, or the recreational fish stocking program. Staff recommends that an operations and monitoring plan be developed. Table 4-2 shows the staff-recommended additions, deletions, and modifications to Seattle's proposed environmental protection and enhancement measures, and the estimated cost of each.

Based on a total installed capacity of 1,003 MW and an average annual generation of 3,612,588 MWh, the cost of alternative power would be $118.9 million, or about $33.3/MWh. The average annual project cost would be $50 million, or about $14/MWh. Overall, the project would produce power at a cost which is $68.9 million, or $19.3/MWh, less than the cost of alternative generation.

### 4.1.6 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative, with the exception of the addition of the following items that are covered under the Forest Service's 4(e) conditions, and are therefore mandatory: the habitat fund, fish tissue sampling, recreational fish stocking program, and a fee paid directly to the Forest Service for expenses related to the management of the project.[180] This alternative would have an average annual cost of alternative power of $118.9 million, or about $33.3/MWh. The average annual project cost would be $50.3 million, or about $14.1/MWh. Overall, the project would produce power at a cost which is $68.7 million, or $19.7/MWh, less than the cost of alternative power. This alternative would cost $63,020 more than the project proposed by Seattle and $268,240 more than the staff alternative.

### 4.1.7 Cost of Environmental Measures

Table 4-3 gives the cost of each of the environmental enhancement measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

---

[180] Section 10(e)(1) of the FPA requires the Commission to collect from licensees annual charges to reimburse federal and state natural and cultural resource agencies their administrative costs incurred in administering their responsibilities under Part 1 of the FPA. The Forest Service included, as preliminary section 4(e) condition 4, a cost reimbursement schedule totaling $1,183,810 (in 2010$ based on the Forest Service's formula for escalating payment values) that is to be collected directly from the District over a 30-year license term. Because this condition may be inconsistent with the FPA's provisions regarding the recovery of administrative costs, our economic analysis does not include the Forest Service's identified administrative costs in our current annual cost assumptions. However, because it is a 4(e) condition, our economic analysis accounts for this fee as a PM&E measure in the Staff Alternative with Mandatory Conditions.

Table 4-3. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the Boundary Project (Source: Seattle, 2010).

| **Enhancement/Mitigation Measure** | **Recommending Entity** | **Capital Cost** | **Annual Cost**[a] | **Levelized Annual Cost**[b] |
|---|---|---|---|---|
| Implement the Boundary Resource Coordinating Committee and Work Groups (Article 2), which includes: | Seattle, Interior, Forest Service, WDFW, Staff | $0 | $0[c] | $0 |
| | | | | |
| Implement the Terrestrial Resources Management Plan (Article 3), which includes: | Seattle, Interior, Forest Service, WDFW, Staff | | | |
| a. Erosion Control Program | Same as above | $397,000 | $8,120 | $28,900 |
| b. Habitat Management, Enhancement, and Protection Program | Same as above | $1,419,000 | $13,900 | $88,190 |
| c. Integrated Weed Management Program | Same as above | $0 | $106,710[d] | $106,710 |
| d. RTE Plant Species Program | Same as above | $0 | $72,590 | $72,590 |
| e. Wildlife Program | Same as above | $0 | $110,100 | $110,100 |
| f. Shoreline Management Program | Same as above | $141,280 | $0 | $7,400 |
| Subtotal for Article 3: | | $1,957,280 | $311,420 | $413,890 |
| | | | | |
| Acquire and manage about 158 acres of riparian and upland habitat and about 13,022 lineal feet of varying habitats (Article 4) | Seattle, Interior, Forest Service, WDFW, Staff | $500,000 | $0 | $26,170 |
| | | | | |
| Implement the Recreation Resources Management Plan (Article 5), which includes: | Seattle, Interior, Forest Service, Staff | | | |

| Enhancement/Mitigation Measure | Recommending Entity | Capital Cost | Annual Cost[a] | Levelized Annual Cost[b] |
|---|---|---|---|---|
| a. Recreation Facility Capital Improvements Program | Same as above | $5,834,320 | $0 | $305,400 |
| b. Recreation Operations and Maintenance Program (including participating in the development of a regional water trail program on the Pend Oreille river) | Same as above | $0 | $143,590 | $143,590 |
| c. Shoreline Dispersed Recreation Management Program | Same as above | $252,030 | $0[e] | $13,190 |
| d. Recreation Monitoring Program | Same as above | $0 | $32,400 | $32,400 |
| e. Multi-resource I&E program (to be developed) | Same as above | $0 | $10,470 | $10,470 |
| f. Reporting and Consultation with the Recreation Resources Work Group | Same as above | $0 | $10,000 | $10,000 |
| g. Travel and Public Access Management Program (not specifically identified as an element of Article 5) | Same as above | $579,380 | $15,000 | $45,330[f] |
| Subtotal for Article 5: | | $6,665,730 | $211,460 | $560,380 |
| | | | | |
| Implement the Monitoring Well and Road Decommissioning Plan (Article 6) | Seattle, Interior, Forest Service, Staff | $305,000 | $260 | $16,230 |
| | | | | |
| Implement the Programmatic Agreement for Managing Historic Properties (Article 7), which includes HPMP | Seattle, Forest Service, Staff | $25,000 | $8,750 | $10,060 |
| | | | | |
| Implement the Water Quality Plans (Article 8), which include: | Seattle, Interior, Forest Service, | | | |

| **Enhancement/Mitigation Measure** | **Recommending Entity** | **Capital Cost** | **Annual Cost**[a] | **Levelized Annual Cost**[b] |
|---|---|---|---|---|
| | WDFW, Staff | | | |
| a. Aquatic Invasive Species Control and Prevention Plan | Same as above | $0 | $160,050 | $160,050 |
| b. Dissolved Oxygen Attainment Plan | Same as above | $0 | $19,890 | $19,890 |
| c. Fish Tissue Sampling Plan | Seattle, Interior, Forest Service, WDFW | $0 | $3,400 | $3,400 |
| d. Temperature Attainment Plan | Seattle, Interior, Forest Service, WDFW, Staff | $0 | $49,730 | $49,730 |
| e. Total Dissolved Gas Attainment Plan | Same as above | $15,204,470 | $380,960 | $1,176,870 |
| Subtotal for Article 8: | | $15,204,470 | $614,480 | $1,409,940 |
| | | | | |
| Implement the Fish and Aquatic Resources Plans (Article 9), which include: | Seattle, Interior, Forest Service, WDFW, Staff | | | |
| a. Mainstem Fish Community and Aquatic Habitat Measures Program (9A) | Same as above | $10,199,040 | $104,880 | $638,770 |
| b. Upstream Fish Passage program (9B) | Same as above | $60,620,000 | $113,070 | $3,286,350[g] |
| c. Reduction of Project Related Entrainment Program (9C) | Same as above | $70,000,000 | $0 | $3,664,290[h] |
| d. Tributary Non-native Trout Suppression and Eradication Program (9D) | Same as above | $0 | $717,570 | $717,570 |
| e. Tributary Fish Community and Aquatic Habitat Measures (9E) | Same as above | $23,355,180 | $1,408,760 | $2,631,330 |
| f. Mill Pond Dam Site Monitoring and Maintenance | Same as above | $0 | $1,800 | $1,800 |

| **Enhancement/Mitigation Measure** | **Recommending Entity** | **Capital Cost** | **Annual Cost**[a] | **Levelized Annual Cost**[b] |
|---|---|---|---|---|
| (9F) | | | | |
| g. Native Salmonid Conservation Program (9G) | Same as above | $13,346,500 | $1,287,780 | $1,986,430[i] |
| h. Recreational Fish Stocking Program (9H) | Seattle, Interior, Forest Service, WDFW | $0 | $72,000 | $72,000 |
| i. Establish a Sullivan Lake Upper Tributary Fund (9I) | Seattle, Interior, Forest Service, DFW | $2,500,000 | $0 | $130,870 |
| Subtotal for Article 9: | | $180,020,720 | $3,705,861 | $13,129,410 |
| | | | | |
| Adjust FERC project boundary to include project-related facilities, lands, roads and approximate 200-foot buffer to the lower reservoir[j] that are currently outside of the project boundary | Seattle, Staff | $500,000 | $0 | $26,170 |
| Survey, install permanent monuments, and identify by signage National Forest Service lands at three identified corners within the project boundary | Seattle, Forest Service, Staff | $50,000 | $0 | $2,620 |
| | | | | |
| Forest Service schedule of payments | Forest Service | $61,970 [k] | $0 | $61,970 |
| | | | | |
| Develop and implement a Operations Compliance Monitoring Plan | Staff | $20,000 | $0 | $1,050 |

[a] Annual costs typically include operational and maintenance costs and any other cost which occur on a yearly basis.
[b] All capital costs and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing all costs.
[c] Unless otherwise noted in the individual programs below, the cost of convening and supporting the individual work groups is imbedded in the individual program costs.

[d] Includes the applicant's cost for monitoring invasive species through the term of the license or until discontinued by Ecology and the WQWG and FAWG.
[e] Operations and maintenance cost included in the Recreation Facility Operations and Maintenance Program.
[f] Only includes costs expected during first 30 years of the license.
[g] 30-year annualized cost of operating the upstream fish passage management program for years 15-30 of the license.
[h] Includes a $23,000,000 cost for research, monitoring for years 1 to18 of the license and a $47,000,000 cost to either build facilities or implement appropriate non-operational measures in years 19 to 30 of the license.
[i] Staff estimate of 30-year annualized cost for monitoring in years 5-30 of the license.
[j] The Forest Service recommended no changes to the project boundary to re-establish the 200-foot buffer around the lower reservoir.
[k] Only the value of the first 30 years of payments requested by the Forest Service, escalated to $2010, were accounted for here.

## 4.2 SULLIVAN CREEK PROJECT

### 4.2.1 Costs Associated with the District's Proposal

In this section, we look at the costs associated with the surrender of the Sullivan Creek project. Our analysis includes an estimate of: (1) the cost of individual measures proposed by the applicant for the protection, mitigation and enhancement of environmental resources affected by the removal of Mill Pond dam and the modification to Sullivan dam; (2) alternatives proposed by staff; and (3) the no-action alternative.

Table 4-4 summarizes the projected annualized cost for each of the alternatives considered in this DEIS: no-action, the applicant's proposal, and the staff alternative For each of the surrender alternatives, our analysis includes an estimate of the cost of the operations and maintenance required for the two alternatives and the cost of the individual measures considered in the EIS for the protection, mitigation, and enhancement of environmental resources affected by the project. This estimate helps to support an informed decision concerning what is in the public interest with respect to the proposed surrender.

As currently operated, the project acts as a storage facility and has no generating capacity; therefore, we do not consider the cost of alternative power in these projections, as was done for the Boundary Project analysis.

Table 4-4. Estimated costs associated with project decommissioning and removal (Source: staff).

| | No Action | District's Proposal | Staff Alternative |
|---|---|---|---|
| Annual project operations and maintenance cost | $62,800 | $62,800 | $62,800 |
| Annual proposed costs of environmental measures | N/A | $971,920 | $975,870 |
| Total annual costs of O&M and environmental measures | $62,800 | $1,034,720 | $1,038,670 |

Under the no-action alternative, the project would continue to operate as it does now. The project would not be surrendered, Mill Pond dam would not be removed, and the proposed environmental protection measures at Sullivan Creek dam would not be implemented. The project would cost $62,800 in annual operations and maintenance charges per year.[181]

The District proposes to remove Mill Pond dam, add a cold-water release facility to Sullivan Lake dam, implement environmental monitoring of both project areas, and to surrender the FERC license after all installation, removal, and monitoring requirements are completed. The surrender of the project under the District's proposal would cost $1,034,720 per year.

### 4.2.2 Costs Associated with Staff Recommendations

In addition to the applicant's proposed measures for the surrender and decommissioning of the Sullivan Creek project, staff recommends that the District prepare an Operations and Maintenance plan that would state how Sullivan dam would be operated until the decommissioning activities are completed, and would describe how conflicting water uses would be addressed during low-water years. Staff estimates that this plan would cost approximately $20,000, or $1,020 per year, to develop and implement this plan. Staff also recommends that the District complete a DAHP Level II mitigation documentation report for the Sullivan Creek powerhouse and other associated contributing elements of the Sullivan Creek Historic District on District lands within the project boundary. Staff estimates that this would cost $50,000 or $2,550 per year. Staff's recommended measures bring the total annualized cost for the surrender of the Sullivan Creek project to $1,038,670 per year.

### 4.2.3 Cost of Environmental Measures

Table 4-5 gives the cost of each of the environmental measures considered in our analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis[182] to provide a uniform basis for comparing the benefits of a measure to its cost. Much of this information was provided by the District in its surrender application. We find that the values provided by the District are reasonable for the purposes of our analysis.

---

[181] The actual cost for operating Sullivan Lake dam and Mill Pond dam would likely be higher, as the additional facilities that would remain in place at Mill Pond dam would need to be monitored and maintained. However, the District did not provide a cost of continuing to operate the project under a FERC license, so we have used the projected cost provided for operations and maintenance at Sullivan Lake dam as an estimate of continued project operations.

[182] The 30-year period of analysis was chosen for consistency with our analysis of the no-action alternative, and because Sullivan Lake and dam would continue to operate under a Forest Service permit after the surrender is effective. Normally, we would consider the total cost of license surrender and site restoration without converting it to an annual cost over a period of years.

Table 4-5. Estimated costs associated with project decommissioning and removal (Source: District, 2009 and staff).

| | Capital Cost | Annual Cost | Levelized Annual Cost [a] |
|---|---|---|---|
| **Applicant's proposed measures** | | | |
| Fill and drain operations | $8,000 | $2,880 | $3,290 |
| Add lake level gage to Sullivan dam | $8,000 | $1,440 | $1,850 |
| Add USGS gage to Harvey Creek | $15,000 | $3,000 | $3,770 |
| Monitor bedload in Harvey Creek | | $1,500 | $1,500 |
| Monitoring of run-off in Harvey Creek | | $1,120 | $1,120 |
| Recreation measures | $45,000 | $0 | $2,300 |
| Cold-water release facility | $2,704,920 | $20,000 | $158,000 |
| Mill Pond dam removal | $15,300,000 | $0 | $780,600 |
| HAER Level 2 Report and photographic documentation of historical resources at Mill Pond | $100,000 | $0 | $5,100 |
| Prepare for and attend resource committee meetings | $0 | $6,400 | $6,400 |
| Dam maintenance, gage repairs, and weed removal | $0 | $5,000 | $5,000 |
| Low-level gate maintenance | $0 | $3,000 | $3,000 |
| Total cost for the applicant's proposed measures | $18,180,920 | $44,340 | $971,920 |
| | | | |
| **Staff's proposed measures** | | | |
| Preparation of an Operations and Maintenance plan for Sullivan Lake dam | $20,000 | $0 | $1,020 |
| DAHP Level II mitigation documentation report of Sullivan Creek powerhouse and other associated contributing elements of the | $50,000 | $0 | $2,550 |

| | Capital Cost | Annual Cost | Levelized Annual Cost [a] |
|---|---|---|---|
| Sullivan Creek Historic District on District lands within the project boundary | | | |
| Provide a final design for the cold water release facility that is compatible with the 1930s era historic district associated with the Ranger District and CCC Camp | $7,500 | $0 | $380 |
| Total cost for the additional measures proposed by staff | $77,500 | $0 | $3,950 |
| | | | |
| **Total cost for the license surrender measures** | $18,258,420 | $44,340 | $975,870 |

[a] All capital costs and annual costs are converted to equal annual costs in 2010 dollars over a 30-year period at 3 percent to give a uniform basis for comparing all costs between a FERC license or an anticipated Forest Service Special Use Authorization.
[b] Annualized cost over 30 years of a $20,000 payment made each year for years 1 to 17 after the issuance of the surrender.

# 5.0 STAFF'S CONCLUSIONS

## 5.1 BOUNDARY PROJECT

### 5.1.1 Comparison of Alternatives

In this section, we compare the developmental and non-developmental effects of Seattle's proposal, Seattle's proposal as modified by staff, staff's alternative with mandatory conditions, and the no-action alternative.

We estimate that the annual generation would be 3,612,588 MWh after completing the turbine runner upgrades under the proposed action, the staff alternative, and the staff alternative with mandatory conditions, and 3,572,750 MWh under the no-action alternative.

The environmental effects of the alternatives are summarized in table 5-1. The staff alternative does not include Seattle's proposed fish tissue sampling, recreational fish stocking program, or funding of habitat enhancement measures in Sullivan Lake tributaries; it does include a recommendation for Seattle to develop an Operations Compliance Monitoring Plan to document compliance with summer reservoir limits; a recommendation to modify the recreation plan to provide a more definitive schedule for completing the capital improvements; and reporting requirements to facilitate Commission review and approval of plans. The staff alternative with mandatory conditions includes the three measures excluded from the staff alternative plus staff's additional recommended measures. Otherwise, the action alternatives are identical and the environmental effects would be the same.

Table 5-1. Comparison of alternatives for the Boundary Project (Source: staff).

| **Resource** | **No-Action Alternative** | **Seattle's Proposal** | **Staff Recommended Alternative** | **Staff Recommended Alternative with Mandatory Conditions** |
|---|---|---|---|---|
| Generation (MWh) | 3,572,750 | 3,612,588 | 3,612,588 | 3,612,588 |
| Soils | Reservoir fluctuations, wave action, flood flows, etc., would continue. Rate/amount of future loss of shoreline habitats likely less than historical levels (about 15 acres). | Factors affecting shoreline erosion would continue. Three high value recreation sites would be stabilized; all erosion sites monitored and appropriate stabilization measures determined if occurring in high resource area and/or exceeding 6.1 acres of land loss. Portions of Sullivan, Linton and Sweet Creek stream channels stabilized, reducing sediment input to the reservoir. | Same as Seattle's proposal | Same as Seattle's proposal |
| Water Quality | | | | |
| • Temperature | Surface water temperatures would continue to exceed 20 °C at times during summer months. | Suite of actions (riparian plantings, stream channel improvements, etc.) would reduce temperatures in contributing tributaries which may translate to slightly cooler water in the stream deltas. Surface reservoir temperatures | Same as Seattle's proposal | Same as Seattle's proposal |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| | | would continue to exceed 20 °C at times during summer months. | | |
| • Dissolved Oxygen | DO concentrations would occasionally be lower than 8 mg/l in summer months. | Same as no-action, except Seattle would continuously monitor DO in the summer for 5 years to confirm compliance with standards under most water conditions and identify potential measures if needed to comply with water quality standards. | Same as Seattle's proposal | Same as Seattle's proposal |
| • Total Dissolved Gas | Sequencing of Units 55 and 56 would continue to reduce project contribution to TDG levels during normal operation (non-spill events); TDG likely to exceed state standard of 110 % saturation during high flows (70,000 to 108,300 cfs). | Sequencing of Units 55 and 56 may not be needed to reduce TDG following turbine runner upgrades. A step-wise evaluation and implementation of structural modifications to the project's sluice gates and spillways would likely reduce TDG levels and achieve state standards in 10 years. | Same as Seattle's proposal | Same as Seattle's proposal |
| • Lead and Zinc levels in fish tissues | No fish tissue sampling for lead and zinc, except as may be collected by | Tissue samples collected from sport fish and suckers from four sites one time to assess human | Same as no action alternative | Same as Seattle's proposal |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| | the state for food consumption advisories. | health risks from fish consumption. If health advisories are warranted, state would determine next steps. | | |
| • Aquatic Macrophytes and Invasive Species | Existing macrophyte beds (223 acres) may spread and populations of Zebra mussel, quagga mussel, and New Zealand mud snail may establish and spread. | Installation of bottom barriers would reduce or eliminate dense macrophyte beds at seven sites that hinder recreation and potentially trap fish in pools during reservoir fluctuations. Monitoring for Zebra mussel, quagga mussel, and New Zealand mud snail, and development and implementation of control methods, if found, would protect the aquatic habitats in the reservoir. | Same as Seattle's proposal | Same as Seattle's proposal |
| Aquatic Resources | | | | |
| • Aquatic Habitat | Reservoir fluctuations, warm water temperatures, low primary and secondary productivity, and | Adding 1,500 cubic yards of gravel below Box Canyon dam would enhance native mountain whitefish spawning; excavating an 1,800-foot-long channel | Same as Seattle's proposal, except stocking of area lakes would not | Same as Seattle's proposal |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| | presence of non-native predatory sport fish would continue to limit native salmonid production and habitat. Stocking of triploid trout is discontinued to reduce competition with native salmonids; this eliminates a non-native recreational fishery at the reservoir. | would connect mainstem flow with several isolated pools, reducing trapping of fish during reservoir fluctuations; adding 1,700 cubic feet of LWD to tributary deltas would enhance habitat quality of these areas; riparian and stream channel enhancements in Sullivan, Linton, and Sweet Creeks, and other tributaries to the reservoir, would improve over 2 miles of native salmonid habitat, including that for bull trout; removal of non-native trout from tributaries would reduce competition in the tributaries and improve native salmonid production; building a native fish propagation facility would produce native species to supplement tributaries draining into Boundary reservoir; monitoring fish abundance and | occur, likely resulting in a net reduction in available non-native trout recreational fishery in the project area; however a native recreational fishery would be improved. $2.5 million would not be made available for habitat improvements in Harvey Creek, resulting in no change in the existing conditions. | |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| | | size in the tributary deltas would assist in evaluating the success of the implemented enhancement measures in conserving and recovering native salmonids; stocking of 18 area lakes would enhance recreational fishing opportunities, offset the discontinuance of reservoir stocking program, and reduce fishing pressure on native salmonids; and providing funds may result in habitat improvements in Harvey Creek, a tributary to Sullivan Lake. | | |
| • Entrainment | Continued annual loss of about 55,000 resident fish, including potentially targeted native species (bull trout, westslope cutthroat trout, and mountain whitefish). | Targeted evaluation of the feasibility and efficacy of entrainment reduction facilities, such as a floating surface collector; installation would reduce potential loss of bull trout and other fish. | Same as Seattle's proposal | Same as Seattle's proposal |

| **Resource** | **No-Action Alternative** | **Seattle's Proposal** | **Staff Recommended Alternative** | **Staff Recommended Alternative with Mandatory Conditions** |
|---|---|---|---|---|
| • Fish Passage | Upstream movement of fish blocked by Boundary dam. | Installation of trap and haul fishway, following more detailed evaluation of target fish movements in tailrace to appropriately site the facility, would improve connectivity of upstream bull trout populations and would be consistent with bull trout recovery plans. | Same as Seattle's proposal | Same as Seattle's proposal |
| Terrestrial Resources | | | | |
| • Habitat Management | Reservoir fluctuations would continue to limit upland and riparian development. Passive management would provide some protection of the 238-acre Boundary Wildlife Preserve. | Management of 749 acres of Seattle-owned lands within the project boundary would benefit wildlife and plant communities, and ensure remaining lands are managed to prevent degradation of natural resources. Monitoring and controlling noxious weeds on all project lands would protect existing wildlife habitats; monitoring of rare plants and nesting bald eagles, peregrine falcons, and | Same as Seattle's proposal | Same as Seattle's proposal |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| | | bank swallows would determine if specific management actions to reduce project-related recreation disturbance are needed; acquiring and managing about 158 acres of riparian and upland habitat and about 13,022 lineal feet of various habitats adjacent to stream channels within a few miles of the project would benefit federally listed species and big game and offset effects of project-related recreation and reservoir fluctuations on project wildlife and wildlife habitats. | | |
| • Shoreline Management | No shoreline management program would be implemented. | Development of a shoreline management program would ensure shoreline land uses are compatible with wildlife and recreation management objectives. | Same as Seattle's proposal | Same as Seattle's proposal |
| Threatened and | No change to existing | Aquatic habitat measures and | Same as | Same as Seattle's |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| Endangered Species | conditions. Project effects on woodland caribou, grizzly bear, lynx, and gray wolf would continue to be negligible. Habitat conditions for bull trout would continue to be impaired and upstream movement blocked by Boundary dam. | water quality plans would improve aquatic habitats, reconnect habitat in the main-stem Pend Oreille River and promote recovery of bull trout. Acquisition and management of lands could benefit recovery of woodland caribou, grizzly bear, lynx, and gray wolf. | Seattle's proposal | proposal |
| Recreation Resources | | | | |
| • Operation | Minimum lake elevation limits during summer recreation season minimizes effects of reservoir fluctuations on recreation access. | Same as no-action alternative. | Same as no-action alternative; operation compliance monitoring plan would provide a mechanism for the Commission to monitor compliance with | Same as staff-alternative |

| **Resource** | **No-Action Alternative** | **Seattle's Proposal** | **Staff Recommended Alternative** | **Staff Recommended Alternative with Mandatory Conditions** |
|---|---|---|---|---|
| | | | the reservoir limits. | |
| • Recreational Facilities | Vista House, Forebay Recreation, and Tailrace Recreation Areas would continue to be maintained. | Recreation experience would be enhanced by adding handicapped accessible vault toilets and pathways and updated signage at Vista House and Tailrace Recreation Areas; developing new trailhead, trail and view point at Peewee Falls and Riverside Mine Canyon viewpoints; constructing a new trail connecting Peewee Falls and Riverside Mine Canyon viewpoints; developing a Metaline Falls Portage Trail; extending Metaline Waterfront Park boat launch and providing handicapped parking, toilets, and paths. | Same as Seattle's proposal. | Same as Seattle's proposal |
| • Shoreline Dispersed Recreation | Lack of management at 16 established dispersed recreation sites may | Adding fire rings, picnic tables, tent pads, watercraft landing sites, bulletin boards and | Same as Seattle's proposal | Same as Seattle's proposal |

| Resource | No-Action Alternative | Seattle's Proposal | Staff Recommended Alternative | Staff Recommended Alternative with Mandatory Conditions |
|---|---|---|---|---|
| Management | result in some environmental degradation and reduced recreational experience. | primitive sanitation systems would improve use at six sites, and reduce environmental degradation; monitoring of the remaining sites and making improvements, as appropriate, would ensure continued recreational experience. | | |
| • Recreation Monitoring Program | FERC Form 80 reporting would continue to provide recreation use at project facilities. | Proposed monitoring program would provide information on visitor use capacity, social capacity, and biophysical capacity as future demands change, enhancing decision making on future recreation needs. | Same as Seattle's proposal | Same as Seattle's proposal |
| • Travel and Public Access Management Program | 12 roads used primarily or exclusively for project operations or to access project recreation facilities would continue to be maintained. | Same as no-action; bringing the roads into the project boundary would facilitate Commission oversight of the license,. | Same as Seattle's proposal | Same as Seattle's proposal |

| **Resource** | **No-Action Alternative** | **Seattle's Proposal** | **Staff Recommended Alternative** | **Staff Recommended Alternative with Mandatory Conditions** |
|---|---|---|---|---|
| Groundwater monitoring well and road closure | Wells and road remain open. | Closure of 18, with the potential for one additional, groundwater monitoring wells and spur roads used to access the wells would reduce in a small way the number of roads in the area, improving wildlife habitat; restoration of lands would be consistent with Forest Plan. | Same as Seattle's proposal | Same as Seattle's proposal |
| Cultural Resources | No HPMP to protect cultural resources. | Implementing the HPMP would protect cultural resources | Same as Seattle's proposal | Same as Seattle's proposal |

### 5.1.2 Comprehensive Development and Recommended Alternative

Section 4(e) and 10(a) of the FPA require the Commission, in considering whether and under what conditions to issue a license, to give equal consideration to the power development purposes and 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. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the Boundary Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the staff alternative as the preferred option. We recommend this option because: (1) issuance of a new hydropower license by the Commission would allow Seattle to continue operating the project as a beneficial and dependable source of electrical energy; (2) the 1,003 MW of electric energy generated from a renewable resource may offset the use of fossil-fueled generating plants, thereby conserving nonrenewable resources and reducing atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would substantially protect and enhance fish and wildlife and their habitats, foster the recovery of the federally listed bull trout, enhance recreational opportunities, and protect cultural resources.

In the following section, we make recommendations as to which environmental measures proposed by Seattle or recommended by agencies and other entities should be included in any license issued for the project. In addition to the Seattle's proposed environmental measures, we recommend additional environmental measures to be included in any license issued for the project. We describe these proposed requirements in the draft license articles in Appendix A. We also discuss which measures we do not recommend including in the license in section 5.1.2.3 below.

#### 5.1.2.1 Environmental Measures Proposed by Seattle

Based on our environmental analysis of Seattle's proposal in section 3 and the costs presented in section 4, the following environmental measures proposed by Seattle[183] would protect and enhance environmental resources and would be worth the

[183] Seattle proposes to include in the license a formula for escalating all costs or payments specified in the new license and management plans (article 10). While we do not object to including an escalation requirement to ensure that adequate planning and funding are available to implement the approved plans, any costs contained in the

cost. Therefore, we recommend including these measures in any license issued for the project.[184] Article numbers in parentheses reference proposed article numbers contained in settlement agreement filed on March 29, 2010.

---

recommended plans should not be construed as spending caps (see for example the spending limits contained in the Fish and Aquatics Management Plan for the development and evaluation of upstream passage and installation of facilities to reduce entrainment). To so clarify, Commission staff recommends including a condition in the license reserving the Commission's authority to require the licensee to undertake such measures as may be appropriate and reasonable to implement approved plans and other requirements in any issued license. Also, the proposed article for the entrainment reduction program contemplates a two phase implementation process, with phase 1 from year 19 through year 33, and phase 2 from year 34 through the end of the license term. The license term is a matter for the order on license; thus, such measures may need to be modified to conform to the license term.

[184] The following proposed plans and programs contemplate being developed and implemented in consultation with the various workgroups, but without Commission approval: Terrestrial Resource Management Plan; Adaptive Management Plan to monitor effectiveness of terrestrial resource measures; Long-Term Erosion Control Monitoring Program; Riparian Habitat Management Plans for Everett Creek and Boundary Wildlife Preserve (BWP); Upland Habitat Management Plan for BWP, BWP Addition, Tailrace East, and Everett Creek; Road Maintenance Plan; Final Multi-Resource Interpretation and Education Program; Tributary Management Plan Mill Pond Dam Site Monitoring and Maintenance Plan; Tributary Delta Predation Study Plan; Forebay Hydraulic Study Plan; Design Plans for Native Fish Conservation [Propagation] Facility. To enable Commission oversight of the license, we recommend including a requirement to file these plans for Commission approval. Likewise, the following reports should be filed to demonstrate compliance with the license requirements and facilitate the Commission's oversight of the license: Annual Compliance Report; Aquatic Vegetation Bottom Barrier Effectiveness Reports; Temperature Data and Attainment (Measure Implementation) Reports; Total Dissolved Gas Data and Attainment Reports; and Fish and Aquatics Management Plan Annual Compliance Reports. The Dissolved Oxygen Attainment Plan contemplates potential future modifications to project operations or facilities to address dissolved oxygen issues in the reservoir. We recommend including a provision stipulating that any such future changes would require an amendment of the license. Proposed Article 9(d) provides for the filing of annual compliance reports to document activities that occur as part of the FAMP. Staff recommends that the annual reports also include a description of the activities planned for the upcoming year. This addition would help facilitate Commission oversight of the license by affording staff an opportunity to review and approve plans, as warranted, for proposed activities.

**Operations** (proposed article 1)

- From Memorial Day weekend (starting Friday evening) through Labor Day weekend (ending on Monday evening), maintain forebay water surface elevations at or above 1,984 feet from 6:00 am through 8:00 pm, to facilitate recreational access and use. From 8:00 pm through 6:00 am maintain forebay water surface elevations at or above 1,982 feet.
- Operate Units 55 and 56 above 125 MW and sequence their startup and shutdown so that they are the last units to be brought on line and the first units to be shut down to reduce total dissolved gas under normal, non-spill operations. Revaluate unit sequencing following other unit upgrades.

**Coordination** (proposed article 2)

- Establish and convene Boundary Resource Coordinating Committee and the following work groups as needed to meet consultation requirements: Fish and Aquatics Work Group, Water Quality Work Group, Terrestrial Resources Work Group, Recreation Resources Work Group, and Cultural Resources Work Group.

**Fish and Aquatic Resources**

- Implement the following plans to improve and monitor water quality (proposed article 8): Aquatic Invasive Species Control and Prevention Plan, Dissolved Oxygen Attainment Plan, Temperature Attainment Plan, and Total Dissolved Gas Attainment Plan filed as Exhibits 6, 7, 9, and 10 to the settlement agreement.
- Implement the Fish and Aquatics Management Plan (FAMP), filed as Exhibit 11 to the settlement agreement, which consist of the following components to improve fish habitat, provide passage of resident fish, and foster recovery of bull trout and native resident fishes: (A) Mainstem Fish Community and Aquatic Habitat Measures, (B) Upstream Fish Passage, (C) Reduction of Project-Related Entrainment Mortality, (D) Tributary Non-native Trout Suppression and Eradication, (E) Tributary Fish Community and Aquatic Habitat Measures, (F) Mill Pond Dam Site Monitoring and Maintenance, and (G) Native Salmonid Conservation Program.

**Terrestrial Resources**

- Implement the Terrestrial Resource Management Plan, filed as Exhibit 2 to the settlement agreement, which consists of the following programs (proposed article 3): (i) Erosion program, (ii) Habitat Management, Enhancement, and Protection and Program, (iii) Integrated Weed Management Program, (iv) Rare, Threatened or Endangered Plant Species Program, (v) Wildlife Program, and (vi) Shoreline Management Program.
- Within 5 years of license issuance, acquire and manage, within the area defined in the settlement agreement, about 158 acres of highly diverse riparian and

upland habitat and about 13,022 lineal feet of varying habitats immediately adjacent to water features to benefit federally listed species and big game and offset the effects of project-related recreation and reservoir fluctuations on project wildlife and wildlife habitats (proposed article 4).

**Recreation Resources**

- Except as modified below, implement the Recreation Resource Management Plan, filed as Exhibit 3 to the settlement agreement, which consists of the following programs (proposed article 5): (i) Recreation Facility Capital Improvements Program, (ii) Recreation Facility Operations and Maintenance Program, (iii) Shoreline Dispersed Recreation Management Program, (iv) Recreation Monitoring Program, (v) Travel And Public Access Management Plan, and (vi) Multi-Resource Interpretation and Education Program.

**Land Uses**

- Implement the Well Monitoring and Road Decommissioning Plan, filed as Exhibit 4 to the settlement agreement, to close groundwater monitoring wells and roads to wells no longer needed for project purposes (proposed article 6).

**Cultural Resources**

- Implement a programmatic agreement and Historic Properties Management Plan (HPMP), filed as Exhibit 5 to the settlement agreement, to protect cultural resources (proposed article 7).[185]

#### 5.1.2.2 Staff Recommended Changes to Seattle's Proposal

In addition to Seattle's proposed measures for the Boundary Project, we recommend that Seattle prepare an operation compliance monitoring plan that specifies the methods that would be used to document compliance with the summer lake elevation limits and provides for filing an annual compliance report. We also recommend that the recreation plan be modified to clarify when recreational facility improvements would be completed.

Below we discuss the basis for staff-recommended modifications to Seattle's proposal.

**Operation Compliance Monitoring Plan**

Seattle proposes, and the Forest Service stipulates, that Seattle continue to maintain minimum forebay water surface elevations during the summer to enhance recreational access to the project reservoir. Seattle's operating regime specifies water

---

[185] Consistent with Commission practice, Commission staff would craft a programmatic agreement to implement the HPMP, and the programmatic agreement would be made part of any new license for the project.

surface elevations that must be met during certain times of the day. While Seattle proposes to notify the Commission following any deviations for the elevations due to specific conditions or events (e.g., equipment failure, unanticipated maintenance activities requiring extended outages, natural disasters, emergency load and reserve support as required by WECC and NERC, etc.), it does not explain how it would monitor compliance with the pool elevations. Therefore, we recommend that Seattle develop and implement an Operation Compliance Monitoring Plan to provide the Commission a means to ensure compliance with the proposed summer water surface elevation limits. The compliance monitoring benefits of the plan would justify the cost ($2,620 annualized over 30 years).

**FAMP – Tributary Management Plan Modification**

Under the FAMP, Seattle proposes to use chemicals as part of its non-native fish eradication efforts, specifically rotenone, antimycin, or an equivalent fish toxicant. The Sweet Creek residents express concern with the use of chemicals to suppress or eradicate non-native fish in the Boundary watershed, specifically in Sweet Creek. The residents note that Sweet Creek provides drinking water and domestic use water for the ranch residents, as well as water used by the Selkirk school complex. The Sweet Creek residents request that no chemicals be introduced into Sweet Creek or its adjacent areas.

This issue is addressed, in detail, in Appendix C, page 22, of this final EIS. As discussed on page C-22, the FAMP recognizes the existing uses of Sweet Creek. Moreover, the consultation process laid out in the FAMP should address many, if not all, the concerns of the Sweek Creek residents. The TMP (or Tributary Management Plan) would be developed in consultation with the FAWG, whose membership does not include the Sweet Creek residents.

To ensure that the Sweet Creek residents' issues are addressed, Seattle should consider the residents' concerns as it develops the TMP. To this end, we recommend that the final TMP filed with the Commission for approval address the details outlined in the FAMP, as well as: (1) any potential health risks associated with the proposed treatments; and (2) the potential for any chemical used to affect an individual's or entities' water supply. We also recommend Seattle address these issues with not only the members of the FAWG, but also the appropriate state entity tasked with protecting public health; in this case, the Washington Department of Health. There would be no additional cost to implement this modification to the TMP.

**Recreation Resources Management Plan Modifications**

Seattle proposes to implement the recreation resources management plan filed with the settlement agreement. Forest Service stipulates under section 4(e) and Interior recommends that Seattle implement the plan. The plan includes a schedule for completing the proposed capital improvement projects (appendix 7 to the plan) within the first 10 years of the license, and assigns a priority to the measures as years 3 to 5, 6 to 7, or 8 to 10 of the license. To facilitate Commission oversight of the license, we recommend that the capital improvements be completed by the latter date within each range identified, as clarified below.

- Within five years of license issuance: complete the recreation facility improvements at the Forebay Recreation Area and the Metaline Waterfront Park Boat Launch.
- Within seven years of license issuance: complete the Peewee Falls Viewpoint and Trail, Riverside Mine Canyon Viewpoint and Trail, and Metaline Falls Portage Trail and Boater Access Site.
- Within seven years of license issuance: complete enhancements at the six designated dispersed shoreline recreation sites identified in the recreation plan.
- Within ten years of license issuance: complete the recreation facility improvements at the Eastside Trial, Vista House Recreation Area, and Tailrace Recreation Area/Machine Hall Visitors' Gallery.

There would be no additional cost to implement the above measures because they are within the timeframes and specifications contemplated by the plan.

#### 5.1.2.3 Measures Not Recommended by Staff

The following measures proposed by Seattle and recommended by other interested parties are not sufficiently connected to the project's environmental effects and would serve no project purpose: fish tissue sampling (proposed article 8(iii)), recreational fish stocking program (proposed article 9(H)), and funding of habitat improvements in tributaries to Sullivan Lake (article 9(I)). We discusses the basis for not to recommending these measures below. However, we note that all of these measures are included in the Forest Service's 4(e) conditions, and that valid 4(e) conditions would be made part of any license issued for the project.

**Fish Tissue Sampling Plan**

Seattle proposes to collect fish tissue from game fish and suckers collected in four areas in the project reservoir to monitor for lead and zinc levels in fish tissues. The data would be provided to Ecology and Washington Department of Health (WDOH) to assess human health risks from fish consumption. If health advisories are warranted, Ecology and WDOH would determine the next steps for tissue sampling or health advisory issuance.

As discussed in section 3.4.2.2, multiple lines of evidence indicate that project operation does not affect the bioavailability or mobility of toxins, including lead and zinc. Seattle's proposed fish tissue sampling plan would not be able to determine the source of lead or zinc in the fish tissues or determine a causal relationship between lead and zinc levels in resident fish tissues and project operations. Because there is no relationship to project effects and it would serve no project purpose, we do not recommend that the proposed Fish Tissue Sampling Plan be included in any license issued for the Boundary Project.

**Recreational Fish Stocking Program**

To mitigate the continuing effects of project water level fluctuations and fish entrainment on the aquatic habitat and the fish community in the Boundary Reservoir and the Pend Oreille River, Seattle and parties to the settlement agreement focused on measures designed to benefit native salmonids in the Boundary Reservoir and its tributaries. Such measures include habitat enhancements, improved passage at the Boundary dam, and within tributaries to the lake, fish entrainment protection, water quality improvements, implementing a native fish conservation program, and fish stocking. To offset the loss of recreational angling opportunities at the project[186] and compensate for other fish losses that would continue to occur through entrainment, Seattle proposes to stock westslope cutthroat, rainbow, triploid rainbow, and/or tiger trout in 18 lakes within a 15-mile area around the project. Fry, fingerlings, and catchable-size fish could be stocked. To determine the efficacy of the program, Seattle would monitor at least six of the lakes each year prior to the springtime opening day of trout season.

The measures contained in the FAMP, which we recommend, with the exception of the recreational fish stocking program, would eventually provide a recreational fishery for non-native fishes in the project reservoir and tributaries; these measures include eradication of non-native species from tributaries to the project and stocking with natives, construction of a hatchery to raise native species for stocking the tributaries, habitat improvements to benefit mountain whitefish spawning in the reservoir, and habitat improvements in tributaries and at their confluence with the reservoir to benefit native fisheries. We also recommend measures related to upstream fish passage, measures to reduce entrainment of fishery resources, measures to improve boat access to the reservoir, and measures to improve water quality in the project area and the larger tributaries flowing into the reservoir.

Stocking resident, non-native fish in nearby lakes would no doubt provide recreational angling opportunities within close proximity to the project. However, fishery management decisions regarding native fish restoration in the Pend Oreille River basin are not the responsibility of a licensee. The licensee is responsible for providing appropriate public recreation opportunities at its project. To this end, the licensee would undertake measures, as part of the FAMP, to establish a native recreational fishery, consistent with resource agency goals. If the public interest is to promote a native fishery over the non-native recreational fishery, stocking resident, non-native

[186] Because of competition with native salmonids, Washington DFW no longer supports Seattle's voluntary stocking of triploid trout (sterile trout) in the Boundary Reservoir, which has become a popular recreational fishery in the Boundary Reservoir.

trout in project waters would not be prudent. A licensee should not be expected to mitigate for the lost non-native recreational fishery by undertaking measures off-site. Therefore, we do not recommend that the Commission include this element of the FAMP in any license it may issue for the Boundary Project.

**Fund for Habitat Improvements in Tributaries to Sullivan Lake**

Sullivan Lake, which is a component of the District's Sullivan Project, is fed by Harvey, Noisy, and Jungle Creeks, and supports a naturally reproducing, self-sustaining population of kokanee that is a recreational fishery of regional importance. Sullivan Lake discharges into Outlet and Sullivan Creeks, which empty into the Boundary Project reservoir. The Sullivan Lake dam represents a barrier to fish movement in Sullivan Creek, blocking access to 1,291 acres and 13 miles of habitat for spawning, rearing, foraging, and overwintering habitat in Sullivan Lake and upstream tributaries, including that for bull trout. The parties to the settlement agreement, however, agree that the need to protect habitat and refugia for native species outweighs the passage of fish at the Sullivan Lake dam. As part of its settlement agreement, Seattle proposes to establish a $2.5 million fund to help pay for activities to enhance habitat conditions in Harvey, Noisy, and Jungle creeks that flow into Sullivan Lake. The fund would be administered by the FAWG.

Improving habitat conditions in these tributaries would benefit native fish populations in the Sullivan Lake drainage, including kokanee, cutthroat trout, and bull trout populations (should they become established in the future). Improving instream habitat conditions also is likely to enhance the forage base for native fishes. However this measure lacks a connection to the Boundary Project's effects on aquatic resources in the Pend Oreille River and tributaries that flow into Boundary Reservoir. Improving habitat in these streams would provided little, if any, benefit to resources affected by continued operation of the Boundary Project and would serve no project purpose. Therefore, we do not recommend that the Commission include this element of the FAMP in any license it may issue for the project.

#### 5.1.2.4 Project Boundary Modifications

We recommend that Seattle's proposed changes to the project boundary be approved. Most of the approximately 544 acres of land that would be added have been and would continue to be used for project purposes, including maintenance and operation and preservation of wildlife habitats; a small portion (a few acres) would enlarge the buffer zone around the project thereby providing additional shoreline control and protection of environmental resources. Refinement of the project boundary in the area of District's Campbell Park would also resolve conflicts with District's upstream Box Canyon project boundary. There would be no adverse environmental effect associated with the boundary modifications; there would likely be a small increase in annual charges associated with administering a staff-estimated additional 30 acres of federal lands (i.e., once the revised exhibit G drawings are filed and the federal acreage retabulated).

Seattle would also modify the project boundary in the future after acquiring about 158 acres of wildlife habitat lands. Because Seattle would manage these lands for the life of the license, they should be brought into the project boundary upon acquisition. Similarly, because Seattle would also monitor and maintain aquatic habitat enhancements in Sullivan, Linton and Sweet Creeks and other tributaries for the life of the license, the affected stream segments where aquatic habitat improvements are installed would likely need to be brought into the project boundary and revised Exhibit G drawings filed for Commission approval after the measures are completed. Likewise, the native fish hatchery, which would be constructed, operated, and maintained by Seattle, would need to be brought into the project boundary, and revised Exhibits A and G filed for Commission approval upon completing construction.

#### 5.1.2.5 Conclusion

Based on our review of the agency and public comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the Boundary Project, as proposed by Seattle (with the exception of the fish tissue sampling, recreational fish stocking, and funding tributary improvements to Sullivan Lake), with staff-recommended measures, would be the best adapted plan for improving or developing the Pend Oreille River watershed.

### 5.1.3 Unavoidable Adverse Effects

Some potential effects of relicensing the Boundary Project are unavoidable or can not be completely eliminated by Seattle's proposed measures. Unavoidable adverse effects would include:

- reduced productivity in near-shore areas due to fluctuating water surface elevations, to the extent fluctuations are caused by project operations;
- disruption of sediment transport;
- disruption of LWD transport;
- trapping and stranding of fish and other aquatic organisms due to fluctuating water surface elevations, to the extent fluctuations are caused by project operations;
- fluctuations in aquatic habitat and availability of thermal refugia in tributary delta regions, to the extent fluctuations are caused by project operations; and
- fish entrainment.

All of the unavoidable adverse impacts identified above are long term and would occur throughout the term of any new license issued for the project. The magnitude of these effects on native salmonids is difficult to evaluate, because few native salmonids reside in the Boundary reservoir, and many non-project factors also affect native salmonid population abundance.

Reservoir fluctuations would continue to reduce near-shore aquatic habitat productivity. Seattle proposes to implement extensive habitat improvements to enhance aquatic habitat productivity in tributaries to the project. Seattle also proposes water quality improvements which would lessen the effects of the reservoir fluctuations on aquatic habitat productivity in the reservoir.

Disruption of sediment and LWD transport are caused by the existence of dams on the Pend Oreille River and are, therefore, cumulative in nature. Seattle proposes to implement a gravel augmentation program for the river reach between RM 29.1 and the Box Canyon dam to increase potential mountain whitefish spawning habitat; LWD jams would be placed in the deltas of Sullivan, Sweet, Slate, and Linton creeks to provide cover for salmonids occupying the mouths of these tributaries.

Trapping and stranding of fish, as well as fluctuations in aquatic habitat and thermal refugia, are site-specific and occur episodically. Trapping and stranding effects are greatest during large-magnitude drawdowns that occur infrequently. Seattle proposes to excavate a channel to connect mainstem flow to several isolated pools at a large cobble bar near RM 30.3 to reduce the risk of fish becoming trapped during periods of declining water surface elevation. In addition, Seattle proposes to install bottom barriers at select locations to suppress invasive macrophyte abundance, thereby reducing the risk of macrophyte-related stranding and trapping at these locations.

Stream temperatures and TDG levels are likely to continue to exceed state standards until upstream projects are able to reduce their contributions to elevated temperatures and TDG levels. Thermal refugia are important primarily during summer when mainstem water temperatures can exceed the tolerance limits of native fish. Although some thermal refugia are generally available to fish seeking cool water, reservoir fluctuations from load following operations result in continuous changes to the shape and location of the thermal plumes, which means fish must frequently adjust their locations to remain in desirable thermal conditions. For native salmonids that prefer relatively cool water temperatures, these effects could be substantial.

The Pend Oreille River supports small populations of native fishes that use the river as a migratory corridor to access rearing, foraging, and spawning habitat in the river's tributaries. The river also supports a variety of non-native species that are recreationally important or serve as forage fish for predatory species. These fish are subjected to entrainment and mortality at the project, either via passage through the generating units or when water is spilled at the dam. The on-going levels of mortality, if they continue, would reduce the benefits of fish production gained in the additional habitat provided by passage at the Box Canyon dam. Seattle's proposed fish entrainment reduction program would substantially reduce, but likely not eliminate, fish entrainment and mortality at the project.

Some minor erosion and sediment deposition would continue to occur from project reservoir fluctuations and from implementing the various environmental measures. Reservoir fluctuations would continue to prohibit riparian development in the fluctuation zone and erosion would continue to eliminate habitat. Seattle's TRMP would offset or compensate for these adverse effects.

### 5.1.4 Summary of Section 10(j) Recommendations and 4(e) Conditions

#### 5.1.4.1 Fish and Wildlife Recommendations

Under the provisions of section 10(j) 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. Section 10(j) of the FPA also states that whenever the Commission believes that any fish and wildlife agency recommendation may be 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.

In response to our REA notice, Interior and the Washington DFW submitted recommendations for the project on September 2, 2010 (supplemented on October 4, 2010) and September 3, 2010, respectively. Table 5-2 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.

Of the 16 recommendations that we consider to be within the scope of section 10(j), we include all within the staff alternative (table 5-2).

Table 5-2. Fish and wildlife agency recommendations for the Boundary Project (Source: staff).

| Recommendation | Agency | Within the Scope of Section 10(j) | Annualized Cost ($) | Adopted? And Basis for Preliminary Determination of Inconsistency |
|---|---|---|---|---|
| Maintain lake levels consistent with proposed Article 1 of the settlement for recreation. | Washington DFW | No – Not a specific measure to protect, mitigate, or enhance fish and wildlife | 0 | Yes |

| Recommendation | Agency | Within the Scope of Section 10(j) | Annualized Cost ($) | Adopted? And Basis for Preliminary Determination of Inconsistency |
|---|---|---|---|---|
| | | resources. | | |
| Implement proposed Article 2 of the settlement – Boundary Resource Coordinating Committee and Work Groups. | Washington DFW, Interior | No – Not a specific measure to protect, mitigate, or enhance fish and wildlife resources. | 0[a] | Yes |
| Implement Terrestrial Resources Management Plan and associated provisions identified in proposed Article 3, including: | Washington DFW, Interior | | | |
| (i) erosion program | | Yes | $28,900 | Yes |
| (ii) habitat management, enhancement, and protection program | | Yes | $88,190 | Yes |
| (iii) integrated weed management program | | Yes | $106,710 | Yes |
| (iv) rare, threatened, and endangered plant program; | | No-measure designed to protect rare plants, not to protect, mitigate, or enhance fish and wildlife resources | $72,590 | Yes |
| (v) Wildlife Program | | Yes | $110,100 | Yes |
| (vi) Shoreline Management Program | | Yes | $7,400 | Yes |
| Acquire and manage about 158 acres of riparian and upland habitat and about 13,022 lineal feet of varying habitats immediately adjacent to water features within the area specified in the agreement to benefit listed species and big game | Washington DFW | Yes | $26,170 | Yes |

| Recommendation | Agency | Within the Scope of Section 10(j) | Annualized Cost ($) | Adopted? And Basis for Preliminary Determination of Inconsistency |
|---|---|---|---|---|
| wildlife, as identified in proposed Article 4. | | | | |
| Implement the Water Quality Plans and associated provisions identified in proposed Article 8 including. | Interior | | | |
| (i) aquatic invasive species control and prevention plan | | Yes | $106,050 | Yes |
| (ii) dissolved oxygen attainment plan | | Yes | $19,890 | Yes |
| (iii) fish tissue sampling plan | | No-study that could have been completed prior to filing and not a specific measure to protect, mitigate, or enhance fish and wildlife resources | $3,400 | No. no nexus to project effects (see section 5.1.2) |
| (iv) temperature attainment plan | | Yes | $49,730 | Yes |
| (v) total dissolved gas attainment plan | | Yes | $1,176,870 | Yes |
| Implement the Fish and Aquatics Management Plan and associated provisions identified in proposed Article 9, including the following: | Washington DFW, Interior | | | |
| (i) mainstem fish community and aquatic habitat measures – Article 9(A) . | Washington DFW, Interior | Yes | $638,770 | Yes |
| (ii) install, operate, maintain, and monitor an | Washington DFW | Yes | $3,286,350 | Yes |

| Recommendation | Agency | Within the Scope of Section 10(j) | Annualized Cost ($) | Adopted? And Basis for Preliminary Determination of Inconsistency |
|---|---|---|---|---|
| upstream fish passage facility, including developing a Fish Passage Plan, – Article 9(B). | | | | |
| (iii) implement measures to reduce fish entrainment and turbine mortality – Article 9(C). | Washington DFW | Yes | $3,664,290 | Yes |
| (iv) implement non-native salmonid suppression and eradication activities in portions of 23 waterbodies in the Boundary Reservoir watershed – Article 9(D). | Washington DFW, Interior | Yes | $717,570 | Yes |
| (v) implement tributary fish community and aquatic habitat measures – Article 9(E). | Washington DFW, Interior | Yes | $2,631,330 | Yes |
| (vi) implement the Mill Pond dam site monitoring and maintenance provisions – Article 9(F). | Washington DFW, Interior | Yes | $1,800 | Yes |
| (vii) implement the native salmonid conservation program provisions – Article 9(G). | Washington DFW, Interior | Yes | $1,986,430 | Yes |
| (viii) implement the recreational fish stocking program – Article 9(H) . | Washington DFW, Interior | No – recreation measure, not a specific measure to protect, mitigate, or enhance fish and wildlife resources. | $72,000 | No, no nexus to project effects or purposes (see section 5.1.2). |
| (ix) establish the $2.5 million Sullivan Lake Upper Tributary Fund for improving aquatic habitat | Washington DFW, Interior | No – Not a specific measure to protect, | $130,870 | No, no nexus to project effects or purposes; tributaries are |

| Recommendation | Agency | Within the Scope of Section 10(j) | Annualized Cost ($) | Adopted? And Basis for Preliminary Determination of Inconsistency |
|---|---|---|---|---|
| in Harvey, Noisy, and Jungle creeks – Article 9(I) . | | mitigate, or enhance fish and wildlife resources. | | upstream of Sullivan Lake dam, which blocks fish movement (see section 5.1.2). |

[a] Consultation and reporting requirements included in individual measures.

#### 5.1.4.2 Land Management Agencies' Section 4(e) Conditions

In section 2.1.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the preliminary 4(e) conditions submitted by the Forest Service, and note that section 4(e) of the FPA 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. The Forest Service, by letter filed on August 26, 2010, states that it does not anticipate needing to modify its preliminary 4(e) conditions, but it reserves the right to do so if the Commission materially modifies the Settlement Agreement in a licensing order.

Of the Forest Service's conditions, we consider Conditions 2, 4, 5, 6, and 7 to be standard, administrative, or legal in nature and not specific environmental measures. We, therefore, do not analyze these conditions in the EIS. [187]

Table 5-3 summarizes our conclusions with respect to the four conditions that we consider to be environmental measures. We include in the staff alternative two conditions as specified by the Forest Service, and did not recommend parts of two conditions; the measures not adopted in total are discussed in more detail in section 5.2, *Comprehensive Development and Recommended Alternative*.. Regardless, we included all of these conditions in our staff alternative with mandatory conditions.

---

[187] We do not, however, recommend including part of one of the administrative provisions. Specifically, we do not recommend including the cost reimbursement schedule included in Forest Service 4(e) condition 4, stipulating payments ($61,970 annualized over 30 years) for reimbursing the Forest Service for its administrative costs.

Table 5-3. Forest Service 4(e) conditions considered environmental measures, their annualized cost, and staff recommendations (Source: staff).

| Condition | Annualized Cost | Recommended? |
|---|---|---|
| 1. Compliance with Settlement Agreement | $0 | In part[a] |
| 3. Implementation of Settlement Agreement Articles | $15,566,080 | In part[a] |
| 8. National Forest System Roads | $18,632[b] | Yes |
| 9. National Forest System Land Boundary Survey | $2,620 | Yes |

[a] We do not recommend the recreational fish stocking program ($72,000), the Sullivan Lake Tributary Fund ($130,870), or the Fish Tissue Sampling Plan ($3,400).

[b] This includes $90,000/15 years for major maintenance and $15,000/year annual maintenance for roads leading to project recreation facilities.

### 5.1.5 Consistency with Comprehensive Plans

Section 10(a)(2)(A) of the FPA, 16 U.S.C.§803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 14 comprehensive plans (listed below) that are applicable to the Boundary Project, located in Washington., No inconsistencies were found.

Forest Service. 1988. Colville National Forest land and resource management plan. Department of Agriculture, Colville, Washington.

Interagency Committee for Outdoor Recreation. 2002. Washington State Comprehensive Outdoor Recreation Planning Document (SCORP): 2002-2007. Olympia, Washington. October 2002.

Interagency Committee for Outdoor Recreation. 1991. Washington State trails plan: policy and action document. Tumwater, Washington. June 1991.

Northwest Power and Conservation Council. 2009. Columbia River Basin fish and wildlife program. Portland, Oregon. Council Document 2009-09. October 2009.

Northwest Power and Conservation Council. 2010. The Sixth Northwest conservation and electric power plan. Portland, Oregon. Council Document 2010-09. February 2010.

Northwest Power and Conservation Council. 1988. Protected areas amendments and response to comments. Portland, Oregon. Council Document 88-22 (September 14, 1988).

U.S. Fish and Wildlife Service and Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.

U.S. Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

Washington Department of Community Development. Office of Archaeology and Historic Preservation. 1987. Resource protection planning process - Paleoindian study unit. Olympia, Washington. 55 pp.

Washington Department of Community Development. Office of Archaeology and Historic Preservation. 1987. A resource protection planning process identification component for the eastern Washington protohistoric study unit. Olympia, Washington. 51 pp.

Washington Department of Ecology. 1994. State wetlands integration strategy. Olympia, Washington. December 1994. 80 pp.

Washington Department of Ecology. 1986. Application of shoreline management to hydroelectric developments. Olympia, Washington. September 1986.

Washington Department of Fisheries. 1987. Hydroelectric project assessment guidelines. Olympia, Washington. 91 pp.

Washington State Energy Office. 1992. Washington State hydropower development/resource protection plan. Olympia, Washington. December 1992. 34 pp.

## 5.2 SULLIVAN CREEK PROJECT

### 5.2.1 Comparison of Alternatives

In this section, we compare the effects of the District’s proposal, the District’s proposal as modified by staff, and the no-action alternative (i.e., continuing to operate the project as licensed). The project does not generate electricity and would not do so in the future.

Surrendering the project with removal of Mill Pond dam as proposed would have a total cost of $18,180,920[188] (with an annualized cost of $1,034,720), and as proposed with staff modifications, it would have a total cost of $18,258,420 (annualized cost of $1,038,670).

We summarize the environmental effects of the different alternatives in table 5-4.

---

[188] This cost includes all capital costs provided by the applicant, and a present-value cost of all cost given as annual costs in the surrender application (monitoring, demolition, restoration, etc.).

Table 5-4. Comparison of alternatives for the Sullivan Creek Project.

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| Operation | | | |
| • Sullivan Lake Elevations | Drawdown would begin October 1 until lake reaches elevation 2,565 (typically December 31); beginning on or before April 1 reservoir would be refilled to reach full pool (2,588) by June 1, subject to hydrologic conditions; lake held at full pool until September 31 to benefit recreation. | Drawdown would begin about one month earlier (the day after Labor Day) to reach elevation 2,577 by November 15 and the minimum winter pool elevation of 2,570 (five feet higher than currently operated) by December 31; beginning on or before April 1 reservoir would be refilled to try to reach full pool by June 1; lake maintained at full pool through Labor Day, subject to hydrologic conditions, water availability, and discharge flow requirements.<br><br>During high run-off (120% of long-term average) years; Sullivan Lake held at elevation 2,575 until May 20 to facilitate mobilization of sediment at the confluence of Harvey Creek and Sullivan Lake (Harvey Creek Project); this is expected to improve access to habitats in Sullivan Lake, but will be discontinued if not effective after four such events. | Same as District's proposal, except specific requirements placed on reaching and maintaining reservoir limits, subject to minimum flow requirements and operating emergencies. This would facilitate Commission oversight of license and provide a reasonably certain level of environmental protection. Operation compliance monitoring plan would provide a mechanism to demonstrate compliance with the |

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| | | | operational constraints. |
| • Minimum discharge flow to Outlet Creek | 10 cfs, or inflow if less | —June 1 to June 30: 30 cfs;<br>—July 1 through the end of fall drawdown (when Sullivan Lake reaches 2,570 feet): 20 cfs;<br>—From the date the lake reaches 2,570 (target is January 1) until spring filling: inflow;<br>—April 1 through May 31=10 cfs or inflow, if less<br><br>Minimum discharge flows would enhance aquatic habitat and better mimic natural flow regimes. | Same as District's proposal |
| • Mill Pond dam | No storage; outflow would equal inflow. | Dam removed and stream channel restored | Same as District's proposal |
| Soils | No soil erosion issues identified | Mill Pond dam removal would require excavation, grading, and disposal of about 40,000 cubic-yards of sediment, on-site, and stabilization of about 380,000 cubic yards on-site; soil erosion control measures, revegetation and stabilization efforts, and noxious weed control measures would minimize or eliminate adverse effects of erosion and sedimentation on aquatic and terrestrial systems; site-specific control methods still need to be defined in final decommissioning plan. | Same as District's proposal |

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| Aquatic Resources | | | |
| • Temperature | Water released from the upper layers of Sullivan Lake during July/August would continue to be marginal for some life stages of salmonids; reaching as high as 24 °C in August. During summer months, Sullivan Creek water temperatures below Mill Pond dam can continue to exceed 20 °C, with Mill Pond impoundment increasing temperatures by about 2.0 to 2.4 °C. | The cold water intake would discharge colder water (about 6.5 °C) from 36.5 meters below the surface of Sullivan Lake, into Outlet Creek, meeting water quality standards (16.0 ºC average daily maximum temperature over a seven day period) and achieving temperatures in Sullivan Creek that do not exceed 14 ºC or causing a change average daily temperatures by more than 2 ºC when flows are less than 14 ºC, depending on Sullivan Lake water temperatures. This would result in more desirable conditions for native salmonids. Prior to installation of the cold water release structure, discharges through the low level gates would be managed to prevent Sullivan Creek temperatures from exceeding 16 ºC. | Same as District's proposal |
| • Lake Habitat | Kokanee spawning habitat and lake production limited under current operation; operations would continue to contribute to superimposition of kokanee redds in the tributaries and sediment build-up in the headwater of Sullivan Lake, reducing available fish habitat. | Lowering Sullivan Lake earlier in the fall would make Harvey Creek kokanee spawning beds available sooner, potentially increasing kokanee spawning success and reducing redd superimposition. Releasing flows through the cold water intake would likely increase Sullivan Lake productivity by retaining more nutrients. Harvey Creek Bedload Mobilization Project may reduce sediment buildup improving access to habitats in | Same as District's proposal |

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| | | Harvey Creek. Removing Mill Pond would eliminate 63 acres of lake habitat, which would be replaced with natural stream channel. | |
| • Stream Habitat | Mill Pond dam would continue to block passage of fish to headwaters of Sullivan Creek. | Removal of Mill Pond dam and restoration of Sullivan Creek would improve upstream and downstream fish passage, potentially provide access to 16 miles of aquatic habitat in the basin, and restore sediment and large woody debris transport capacities to the lower portion of Sullivan Creek, resulting in increased habitat complexity and available spawning gravels for resident salmonids, including bull trout. | Same as District's proposal |
| • Discharge Flow Limits and Ramping Rate | With no flow limits or ramping rate restrictions, storage releases would continue to result in dramatic increases and then decreases in flow in Outlet and Sullivan Creeks over a relatively short period (October - December), potentially flushing fry and juvenile fish from their habitat, disturbing aquatic habitat, and reducing spawning success. Rapid changes in flow could result in fish stranding and mortality, | Limiting discharges to a maximum flow of 200 cfs, except during higher than average rain events, up-ramping rates to discharge flows no more than 80 cfs per day, and down-ramping rates to 10 cfs per hour would reduce scour of fish habitat, flushing of young fish from the stream, and reduce the potential for stranding. Preventing rapid changes in flows would decrease energy demands on fish, and reduce the potential for stranding.<br>Limits on maximum discharge flow of two times the minimum flow during spring and summer releases would increase available fish habitat, reduce adverse effects of dewatering | Same as District's proposal |

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| | loss of food resources, and behavior responses that causes mortality and limits growth. | spawning substrate, and reduce loss of food resources. | |
| • Entrainment | All flows would continue to be released through unscreened low level outlet gates (about 6 meters), resulting in the loss of fish from the lake. | Withdrawing water from 36.5 meters through the screened cold water intake, designed to maintain a maximum intake velocity of 0.4 fps approach velocity, would help prevent fish entrainment and loss of fish from Sullivan Lake. | Same as District's proposal |
| Terrestrial Resources | No changes to terrestrial resources | Removal Mill Pond dam and restoration of Sullivan Creek would result in the loss of 63 acres of lake habitat and the creation of an equivalent amount of stream riparian and upland habitats, resulting in minor, localized changes in wildlife species composition. The pond and Sullivan Creek upstream to the confluence with Outlet Creek would be planted with native vegetation that would benefit wildlife. About 0.5 acres of upland coniferous forest would be permanently removed for construction access during dam removal. Short-term, minor, localized disturbance to wildlife would occur during deconstruction activities. Noxious weeds would be controlled to minimize adverse effects on wildlife habitats. | Same as District's proposal, but more detailed revegetation plan filed with final decommissioning plan would ensure protection and enhancement of resources as anticipated. |
| Threatened and Endangered | Mill Pond dam would continue to block access to some | Removal of Mill Pond dam and restoration of Sullivan Creek would improve access to 16 | Same as District's proposal. |

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| Species | designated bull trout critical habitat. No effect on terrestrial species. | miles of potential bull trout spawning and rearing habitat. Deconstruction activities may disturb woodland caribou, grizzly bear, gray wolf and lynx, but effects would be short-term, minor, and undetectable because of limited use of the area. | |
| Recreation Resources | Maintaining Sullivan Lake elevations at full pool between June 1 and September 31 would continue to protect recreation access. Flows suitable for whitewater boating would continue to occur after October when cold weather makes the available flows less desirable. | Recreational access on Sullivan Lake would diminish slightly from the day after Labor Day to October 1, relative to existing operations. Before implementing the new operating regime, the District would repair existing docks and ramps to ensure that they would continue to function under new operations. Whitewater boating flows between 180 and 220 cfs, provided on at least three weekends in September or October; with flows posted online one week in advance, would enhance whitewater boating opportunities. Removal of Mill Pond dam would eliminate a lake fishing opportunity; but stream fishing opportunities would increase. | Same as District's proposal. |
| Cultural Resources | No change in existing resources | The District's DAHP Level II mitigation documentation would mitigate adverse effects of removing Mill Pond dam. | Same as District proposal, except mitigation would extend to all remaining contributing |

| Resource | No-Action | District's proposal | Staff Alternative |
|---|---|---|---|
| | | | elements of the Sullivan Creek Historic District on District lands within the project boundary, including the Sullivan Creek powerhouse. |

### 5.2.2 Recommended Alternative

In considering the surrender of one of its licenses, the Commission must ensure that, in the Commission's judgment, the decision and disposition of the license will adequately protect the public interest. This section contains the basis for, and a summary of our recommendations for surrendering the Sullivan Creek Project. We weight the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we recommend the staff alternative as the preferred option because: (1) the District’s proposal would foster the orderly disposition of the District’s license, including the removal of Mill Pond dam; (2) removal of Mill Pond dam and restoration of Sullivan Creek would help promote the recovery of the listed bull trout and enhance conditions for native salmonids by providing access to 16 miles of good habitat and improving the quality of habitat in Sullivan Creek; (3) installation of the cold water intake and changes in operation of Sullivan Lake would improve aquatic habitat in Sullivan Creek and complement Seattle’s and the state’s efforts to reduce temperatures in the Pend Oreille River; (4) operation of Sullivan Lake would continue to provide for established recreation opportunities, including camping, boating and fishing; (5) DAHP Level II mitigation documentation would mitigate possible adverse effects on cultural resources, including Mill Pond dam and all contributing elements of the Sullivan Creek historic district that would be removed from federal oversight; (6) federal lands would be restored;, and (7) additional staff measures would assist the Commission’s oversight of the license until the surrender becomes effective. We find that the benefits of this alternative exceed those of the no-action and the recommended measures would protect and enhance fish and wildlife resources, and protect water quality, recreation, and cultural resources.

In the following section, we make recommendations as to which environmental measures proposed by the District should be included in any order approving the surrender of the project (Appendix B contains staff’s draft license surrender conditions). We also discuss the basis for staff’s additional measures, as well as the measures that we do not recommend including in any surrender order.

#### 5.2.2.1 Measures Proposed by District

Based on our environmental analysis of the District’s proposal discussed in section 3 and the costs discussed in section 4, we find that the following environmental and operational measures proposed by District (with the exception of the qualified lake level language discussed further below) would adequately protect and enhance environmental resources and would be worth the costs. Therefore, we recommend that the Commission accept the District’s proposal to surrender the Sullivan Creek Project, subject to the following conditions proposed by the District:

- Within three years of a surrender order, install a cold water release structure at the Sullivan Lake dam and fit it with fish screens to improve temperatures in Outlet and Sullivan Creeks and prevent entrainment of fish.
- Until the surrender becomes effective, manage discharges from Sullivan Lake to provide the following minimum flows in Outlet Creek (as measured by the existing gage on Outlet Creek):
    - June 1 through June 30: 30 cubic feet per second (cfs).
    - July 1 through the end of fall drawdown (when elevation of Sullivan Lake reaches 2,570 feet mean sea level—by December 31): 20 cfs.
    - From the date that Lake Sullivan reaches an elevation of 2,570 feet (expected January 1) until the beginning of spring filling (by May 31): outflow shall equal inflow.
    - From April 1 through May 31: 10 cfs or inflow, whichever is less.
- Until the surrender becomes effective, and prior to installing the cold water release structure, operate Sullivan Lake as follows:

  *Spring Operations*: Start refilling Sullivan Lake on or before April 1 and seek to achieve and maintain a full pool elevation of 2,588.6 feet (as measured at Sullivan Lake dam) by May 31, subject to hydrologic conditions, water availability[189], and dam discharge flow requirements. Refilling rates would be adjusted as necessary to accommodate the Harvey Creek bedload mobilization activities.

  *Summer Operations*: From June 1 through Labor Day of each year, the District would use its best efforts to reach and maintain Sullivan Lake at a target of elevation 2,588.6 feet (full pool) for recreation purposes

  *Fall Operations*: Starting the day following Labor Day, begin drawing down Sullivan Lake in a manner that reaches the maximum flow target of 200 cfs during periods of normal or below normal precipitation and 225 cfs during periods of higher than normal precipitation as quickly as possible, given the following constraints: (1) maintain discharge flows to meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period) and so as not to cause the combined waters of Outlet and Sullivan Creeks, as measured at the "below confluence water temperature gage," to exceed 16 °C; (2) strive to reach a drawdown water surface elevation of 2,577 feet by no later than November 15 and a water surface elevation of 2,570 by

[189] We assume that the terms "hydrologic conditions" and "water availability" are synonymous and refer to the amount of inflow coming into Sullivan Lake on a given year.

December 31; (3) maintain an up-ramping rate not to exceed more than 80 cfs per day, and ensure not to exceed a change of more than 2 °C in average daily temperature per day as measured at the below confluence water temperature gage; and (4) maintain a down-ramping rate not to exceed 10 cfs per hour.

- Until the surrender becomes effective and after installing the cold water intake, operate Sullivan Lake as follows:

*Spring Operations*: Same as described above.

*Summer Operations*: Same as above, but in addition, manage the discharges from the cold water pipe and the Sullivan Lake dam low-level outlet gates: (1) to meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period); (2) with the goal of preventing the daily average "below confluence water temperature" from exceeding 14 °C; and (3) with the goal of preventing the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 °C, when daily average "above confluence water temperature" is less than 14 °C.

*Fall Operations*: Starting the day following Labor Day, begin drawdown Sullivan Lake in the manner described below.

(1) Manage the discharges from the cold water pipe and the Sullivan Lake dam gates to meet state water temperature standards, with the goal of (a) preventing the daily average "below confluence water temperature" from exceeding 14 °C, and (b) preventing the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 °C, when the daily average "above confluence water temperature" is less than 14 °C. To prevent thermal shock of the downstream system, flows would be up-ramped or down-ramped to prevent waters below the confluence from changing daily average temperature more than 2 °C per day.

(2) Maintain the operation described in item (1) above until fall turnover (typically mid-October), when Sullivan Creek temperatures may fall below Outlet Creek temperatures by several degrees and it may not be possible to maintain a 1 °C water temperature difference.

(3) Subject to the temperature constraints in item 1 above, maximize discharge flows through the cold water pipe and minimize the use of the low-level gates at the dam during fall drawdown. When low level gates are used, releases shall be made from two gates simultaneously.

(4) Ramp up discharge flows no more than 80 cfs per day and down-ramp at a rate not to exceed 10 cfs per hour at the Outlet Creek gage.

(5) Manage drawdowns to reach a lake water surface elevation of 2,577 feet by no later than November 15 and an elevation of 2,570 feet by December 31.

(6) After November 15, all releases from Sullivan Dam up to the capacity of the cold water pipe, shall be made through the pipe.

(7) Forecast discharge flows  and post online one week in advance to support recreational use.

- When forecasts predict runoff to exceed 120 percent of the long-term average, operate Sullivan Lake to facilitate the mobilization of Harvey Creek bedload at the head of Sullivan Lake by holding Sullivan Lake level at no more than elevation 2,575 feet until May 20 of that year.
- To document compliance with the above discharge flows, ramping rates, temperature limits, and lake elevations, install, operate and maintain a flow gage and recording device at Sullivan dam; maintain the USGS gage on Outlet Creek if discontinued by the USGS; maintain a gage and recording device on Harvey Creek; and install, maintain, and monitor a continuous water temperature gage on Sullivan Creek at least 300 feet downstream of the confluence with Outlet Creek, and a continuous water temperature gage on Sullivan Creek upstream of its confluence with Outlet Creek and Sullivan Creek.
- Subject to the above temperature and flow constraints, manage fall drawdown to provide discharge flows between 180 and 220 cfs on at least 3 weekends in September or October to support whitewater paddling; post available flows at least one week prior to their release.
- Before implementing the new operating regime, repair existing docks and ramps to ensure that they would continue to function under new operations.
- Within five years of the Commission's order on surrender of the license, remove the Mill Pond dam and the original log-crib dam; manage sediment; restore the Sullivan Creek stream channel to a natural stream system, designed for up to a 100-year flood event; plant the affected area (defined as stream channel, floodplain, and upland areas from immediately downstream of the Mill Pond dam to Outlet Creek) with native species; control noxious weeds; and conduct short-term monitoring and maintenance to ensure restoration is successful.  File a final Mill Pond Decommissioning Plan for Commission

approval within two years of the Commission's order on surrender based on detailed, site-specific engineering designs.[190]

### 5.2.2.2 Additional Staff Recommended Measures

We recommend modifying the District's characterization of proposed Sullivan Lake operating rules to include specific reservoir elevation requirements, subject to hydrologic conditions, discharge flow requirements, and operating emergencies beyond the control of the licensee. We recommend that the District prepare an operation compliance monitoring plan that includes identifying the location of the Harvey Creek gage and reporting requirements to document compliance with the various operational constraints on Sullivan Lake water; to file a more detailed revegetation plan; and to complete a DAHP Level II mitigation documentation report of all contributing elements of the Sullivan Creek Historic District that would remain on District lands within the project boundary following the surrender.

Below we discuss the basis for staff-recommended modifications to the District's proposal.

**Sullivan Lake Operation**

The District proposes a number of complex operational constraints for managing Sullivan Lake discharges and elevations. In dry water years, achieving and maintaining the proposed lake levels by a specified date while also complying with discharge requirements may be difficult, if not impossible. Recognizing this, the District qualified the lake level requirements by using language including "shall strive to," or "use its best efforts to reach and maintain" lake levels.

The Commission prefers conditions that impose clear obligations on licensees. Otherwise, the Commission will neither be able to provide a reasonably certain level of environmental protection, nor would it have a clear basis for enforcing the provisions of any surrender order. However, we recognize the need to provide the District with certain operational flexibility when all conditions can not be met simultaneously. Based on the record, it appears that the settling parties agree that achieving specified reservoir levels are subordinate to discharge flow constraints. Given that the District would repair existing docks and ramps on Sullivan Lake to ensure that they would continue to function under the new operations, not achieving a full pool during the summer by a

---

[190] To ensure that the final decommission plan meets the Commission's dam safety needs, we recommend including the Commission's standard construction requirements for filing final removal plans and specifications that contain contract plans and specifications, a quality control and inspection program, a temporary construction emergency action plan, a blasting plan (if needed), a disposal plan, a detailed erosion control plan, and cofferdam construction drawings and specifications. This plans should be based on the draft plan filed by the District.

date certain would not cause substantial adverse effects on recreation. The effect of not achieving a full pool during the summer on the lake fishery would also be minimal because the quantity and quality of habitat available to aquatic organisms would change little given the morphology of the lake. However, operating Sullivan Lake within the proposed discharge constraints would have significant benefits to aquatic resources in Outlet and Sullivan Creeks. Therefore, we recommend that the District operate Sullivan Lake to achieve and maintain its proposed lake levels by a date certain, subject to hydrologic conditions and the District's proposed discharge requirements and the associated temperature constraints. We also recommend that the District be able to deviate from the proposed operations during emergencies beyond its control and for short periods of time upon mutual agreement with the Forest Service, Ecology, and Washington DFW. Staff's recommended Sullivan Lake operation is nearly identical to that proposed by the District; therefore, it should not impose any additional cost on the surrender.

**Operation Compliance Monitoring Plan**

The gages and temperature monitoring devices that the District would install and operate should provide adequate documentation of flows, lake levels, ramping rates, and temperature limits; however the District did not include a description of where the gages would be located or propose a mechanism for reporting monitoring results. Given the complexity of the project's operation, we recommend that the District develop and implement an Operation Compliance Monitoring Plan that would identify where the Harvey Creek gage would be located, define a maintenance and operating schedule for all the gages and temperature monitoring devices, and include a reporting schedule that would provide the Commission a means to ensure compliance with the proposed operations. We find the compliance monitoring benefits of the plan would justify the cost to prepare and implement the plan ($20,000, or $1,050 annualized over 30 years).

**Revegetation Plan**

The District filed a draft Mill Pond Decommissioning Plan with the settlement agreement that describes the procedures and schedule for removing the dam, stabilizing the lake bed, controlling erosion, and restoring the stream channel and adjacent uplands. The draft plan includes a generalized approach for establishing native vegetation in upland and riparian areas based on hydrology and function (e.g., soil stabilization, habitat). The District intends to file a final plan within two years of the Commission's order approving the surrender that would include more details based on final engineering designs. The Forest Service, Interior, and Washington DFW recommend that the District implement the plan and file final design plans prior to undertaking removal activities. The District intends to complete the removal and site restoration within five years of the Commission's order approving the settlement agreement.

As recognized by the District and the settling parties, the draft removal plan lacks sufficient detail at this time, and it is unclear exactly what the District would include in its final plan to ensure the success of its revegetation efforts. Therefore, staff recommend that, within two years after the surrender order, the District file, for Commission approval, a detailed revegetation plan describing site-specific stabilization measures and riparian and upland plantings to restore Sullivan Creek. The plan should be based on the measures included in the draft Mill Pond Removal Plan, filed as Appendix E to the Sullivan Creek settlement agreement, and should include, at a minimum, the following: (1) site preparation and design details; (2) detailed provisions for site stabilization; (3) a description of plant species to be used and where they will be planted, the source of plant materials, planting densities and methods, and fertilization and irrigation requirements; (4) a description of methods to control noxious weeds for 3 years after dam removal; (5) a description of the proposed 3-year monitoring program, including performance standards and success criteria, that would include, at a minimum, 80 percent survival of trees and shrubs and 50 percent canopy cover of native species after 3 years from the date of planting; (6) procedures to be implemented if monitoring reveals that establishment of vegetation is not successful or areas of erosion are identified; and (7) an implementation schedule. Staff's recommendation would not cost any more than already projected by the District, but would ensure that sufficient detail is provided for Commission approval.

**Cultural Resources DAHP Level II Mitigation Documentation**

As part of the Mill Pond Decommissioning Plan, the District proposes to complete a DAHP Level II mitigation documentation report of Mill Pond dam facilities prior to removing the dam to mitigate the long-term loss of historic structures eligible for listing on the Natural Register. When the license surrender becomes effective, other contributing elements of the Sullivan Creek Historic District (e.g., Sullivan Creek powerhouse) on District lands within the project boundary would no longer be under federal oversight. Therefore, we recommend that the District complete a DAHP Level II mitigation documentation report for all contributing elements of the Sullivan Creek Historic District that would remain on District lands within the project boundary following the surrender. We estimate that this would cost $50,000 ($2,250 annualized over 30 years), and find the benefits to be worth the cost.

**Cultural Resources Inventory in APE for the Proposed Cold Water Release Facility, and Design Plan for the Facility that is Compatible with the Adjacent Ranger District and CCC Camp Historic District**

Because archeological resources may exist in areas adjacent to the Sullivan Lake Dam site, and where such areas may be affected by ground-disturbing activities related to the construction of the cold water release facility, we recommend that the District, in consultation with the Forest Service and Washington SHPO, conduct a cultural resources inventory within the cold water release facility APE.[191] In consultation with the Forest Service and Washington SHPO, we also recommend that the District file for Commission approval a final design for the cold water release facility that is compatible with the visual character of the historic district associated with the 1930s era Ranger District and CCC Camp. We estimate that these two measures would cost $7,500 ($380 annualized over 30 years). Consistent with Commission practice, Commission staff would craft a memorandum of agreement directing the District to file for Commission approval a historic properties treatment plan within six months of an order accepting the surrender of this project. The historic properties treatment plan would include all the specific measures recommended by the District and Commission staff to resolve any anticipated adverse effects to historic properties as a result of the surrender. The memorandum of agreement stipulating the filing of this historic properties treatment plan would be made part of any surrender order issued by the Commission for this project.

#### 5.1.2.3 Measures not Recommended by Staff

In section 5.17 of the settlement agreement, the District contemplates selling or leasing storage in Sullivan Lake to Ecology's Columbia River Basin Water Supply Management Program from June 1 to Labor Day. Depending on whether it is a dry water year or an average/high water year, the District would discharge flows at a rate that would not exceed 60 cfs in June (50 cfs in a dry water year), 45 cfs in July (30 cfs in a dry water year), and 35 cfs between August 1 and the day after Labor Day (30 cfs in a dry water year). The District would manage the release of the flows to ensure that any water released does not exceed two times the minimum discharge flow for the defined period (described above); that any such discharge would be released at as steady a rate as possible, as measured by the day-to-day change in daily average cfs; and that the discharges would meet the proposed temperature constraints for Outlet and Sullivan Creeks. Revenue from the releases would be put into an account to pay for the various environmental measures that the District would implement as a condition of the surrender and in operating the project under the Forest Service SUA. Proposed surrender condition 10 contained in the settlement agreement would have the Commission require the releases as proposed.

---

[191] If archeological resources are discovered, they would need to be evaluated for their National Register eligibility, and if eligible, steps would need to be taken to resolve any potential adverse effects to them prior to any construction activity associated with the building of the cold water release facility. Determinations of eligibility and resolutions of potential adverse effects would be done by the District in consultation with Forest Service and Washington SHPO, and with the Kalispel, if the archeological resources were aboriginal in nature.

While we do not object to the District releasing storage from Sullivan Lake, as contemplated by the settlement parties, we do not contemplate the need to authorize such releases so long as they conform to the proposed flow, temperature, and ramping rate constraints to protect aquatic habitat in Sullivan Creek (i.e., the aforementioned limitations on maximum flows and cause no other inconsistency with the requirements of any surrender approved by the Commission). The proposed flow limits would: ensure that aquatic organisms, especially fry and small fish, are not subject to unnatural flow fluctuations. Such limitations would also ensure that summer and fall water temperatures in Outlet and Sullivan Creeks meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period) and bull trout temperature targets (14 °C), and maintain Sullivan Lake at full pool, thereby protecting summer recreation access and shallow water habitats in Sullivan Lake. We note that the District's proposed flows for the last week of July in average/high water years (45 cfs) exceed the limit of two times the minimum discharge flow (20 cfs). Therefore, we recommend including the two times the minimum discharge flow be applied from June 1 through the day after Labor Day. Therefore, our recommended maximum flow would be 40 cfs.

### 5.2.3 Unavoidable Adverse Effects

Removal of the Mill Pond dam would result in the permanent loss of 63 acres of lake habitat. Short-term, local disturbances of wildlife would occur during deconstruction activities. People seeking to recreate on Mill Pond would be displaced to other nearby lakes.

Page intentionally left blank

## 6.0 LITERATURE CITED


Alt, D.D. and D.W. Hyndman. 1984. Roadside Geology of Washington. Mountain Press Publishing Company, Missoula, Montana.

Ames, K.M., and A.G. Marshall. 1981. Villages, Demography, and Subsistence Intensification on the Southern Columbia Plateau. *North American Archaeologist* 2(1):25-52.

Andonaegui, C. 2003. Bull trout habitat limiting factors for Water Resource Inventory Area (WRIA) 62 (Pend Oreille County, Northeast Washington State). Washington State Conservation Commission, Olympia, WA.

Andrefsky, W., Jr., G. C. Burtchard, K. M. Presler, S. R. Samuels, P. H. Sanders, and A. Thoms. 2000. The Calispell Valley Archaeological Project Final Report (5 volumes). Project. Report Number 16, Center for Northwest Anthropology, Washington State University, Pullman.

Apps, C. D. 2000. Space-use, diet, demographics, and topographic associations of lynx in the southern Canadian Rocky Mountains: a study. Chapter 12 *In* Ruggiero, L.F., K. B. Aubry, S. W. Buskirk, et al., tech. eds. Ecology and conservation of lynx in the United States. Univ. Press of Colorado. Boulder, CO. 480 pp.

Audet, S., and H. Allen. 1996. Selkirk Mountains Woodland Caribou Herd Augmentation in Washington: A Cooperative Interagency Plan. U.S. Fish and Wildlife Service and Washington Department of Fish and Wildlife. Olympia, Washington.

Aune, K., and W. Kasworm. 1989. Final report East Front grizzly studies. Montana Dept. Fish, Wildlife and Parks, Helena. 332 pp.

Baldwin, C.M., J.G. McLellan, M.C. Polacek, and K. Underwood. 2003. Walleye predation on hatchery releases of kokanees and rainbow trout in Lake Roosevelt, Washington. North American Journal of Fisheries Management. 23:660-676.

Baldwin, C.M. and J.G. McLellan. 2005. Fisheries Survey of the limnetic zone of Sullivan Lake, Washington, using hydroacoustics and gill nets, September 2003. Washington Department of Fish and Wildlife, Wenatchee, WA.

Baltien, P. 1996. *The Gold Seekers. A 200 Year History of Mining in Washington, and Lower British Columbia*. Statesman Examiner, Inc. Colville, Washington.

Bamonte, T., and S. Schaeffer Bamonte. 1999. Spokane and the Island Northwest: Historical Images. Tornado Creek Publications. Spokane, Washington.

Bassista, T. P., M. A. Maiolie, and M. A. Duclos. 2005. Lake Pend Oreille predation research project. Idaho Department of Fish and Game, Annual Report to Bonneville Power Administration, Contract 2002-009-00, Report number 05-04, Portland, Oregon.

Baxter, J. S. 1995. Chowade River bull trout studies 1995: habitat and population assessment. Report prepared for British Columbia Ministry of Environment, Lands and Parks, Fisheries Branch, Fort St. John, British Columbia, 108 p.

Baxter, C. V. 1997. Geomorphology, land-use, and groundwater-surface water interaction: a multi-scale, hierarchical analysis of the distribution and abundance of bull trout (*Salvelinus confluentus*) spawning. M.S., University of Montana, Missoula, MT.

Baxter, J. 1999. Bull Trout Studies in the Salmo River Watershed: 1998 and 1999.

Baxter, J. and G. Nellestijn. 2000. Report on non-sportfish abundance and migration patterns in the Salmo River: Winter 1999 to Summer 2000. Baxter Environmental and Salmo Watershed Streamkeepers Society, Prepared for Columbia-Kootenay Fisheries Renewal Partnership and Columbia Basin Trust.

BC Hydro. 2003. Seven Mile River consultative report and water use plan, executive summary. Prepared by B.C. Hydro Project Team. January 2003. Available online at http://www.bchydro.com/wup/completed/seven_mile/seven_mile_exec_sum_cc.pdf.

Beecher, H. 2009. Memorandum to Doug Robison, Brad Caldwell, and John Blum regarding Outlet Creek flows released from Sullivan Lake on July 15, 2009. July 17, 2009.

Bjornn, T. C., and D. W. Reiser. 1991. Habitat Requirements of Salmonids in Streams. *In* Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats. Edited by W. R. Meehan. American Fisheries Society. Special Publication 19, pp 83–138.

Bohm, F.C., and C.E. Holstine. 1983. *A People's History of Stevens County*. Stevens County Historical Society. Colville, Washington.

Borysewicz, M. 2008. E-mails and conversation between Michael Borysewicz, Forest Service biologist, and Greg A. Green, Tetra Tech, regarding big game, bats, lynx, peregrine falcons, grizzly bears, 1925 fire, and timber harvesting. March 24, April 17, May 12, June 2 and 6, and August 8 and 19, 2008 as cited in Seattle 2010).

Boyd, R.T. 1985. The Introduction of Infectious Diseases Among the Indians of the Pacific Northwest, 1774-1874. Unpublished Ph.D. dissertation, Department of Anthropology, University of Washington, Seattle.

Boyd, R. T. 1998. Demographic History Until 1990. In Plateau, Handbook of North American Indians Vol. 12, pp. 467-483, edited by Deward E. Walker, Jr. Smithsonian Institution, Washington, D.C.

Boyle, S.D. 1996. National Register of Historic Places Registration Form, Metaline Falls United States Border Station, Pend Oreille County, Washington. On file at the Washington State Department of Archaeology and Historic Preservation, Olympia, Washington.

Brittell, J., R. J. Poelker, S. J. Sweemey, and G. M. Koehler. 1989. Native cats of Washington, Section III: Lynx. Washington Department of Wildlife. Olympia, Washington.

CES (Cascade Environmental Services, Inc). 1994a. Draft Fisheries Studies Report – Instream Flow Report, Sullivan Creek Project. April 1994.

CES. 1994b. Instream Flow Study Additional Information, Volume I. Sullivan Creek Hydroelectric Project. May 1994.

CES. 1994c. Instream Flow Study Additional Information, Volume II. Sullivan Creek Hydroelectric Project. September 1994.

CES. 1996a. Final Report of Evidence for the Presence or Absence of Bull Trout in the Sullivan Creek Drainage. Prepared for Sullivan Creek Instream Flow Committee, Public Utility No. 1 of Pend Oreille County, Washington. September 1996.

CES. 1996b. Response to FERC Additional Information Request – Electroshocking Study Results for the Sullivan Creek Project. September 1996.

CES. 1996c. Response to FERC Additional Information Request – Fry Abundance Data for the Sullivan Creek Project. September 1996.

Chance, D.H. n.d. Cabins in Clearings: Homesteading in the Pend Oreille County of Washington.

Chance, D. H. and J. V. Chance. 1982. Kettle Falls, 1971 and 1974: Salvage Archaeology in Lake Roosevelt. University of Idaho Laboratory of Anthropology. Anthropological Research Manuscript Series 69. Moscow, Idaho.

Chatters, J.C. 1989. Resource Intensification and Sedentism on the Southern Plateau. *Archaeology in Washington*. 1: 1-20.

Chatters, J.C. 1995. Population growth, climate cooling, and the development of collector strategies on the Southern Plateau, western North America. *Journal of World Prehistory* 9: 341-400.

Chatters, J.C. 1998. Environment. In *Plateau*, vol. 12, *Handbook of North American Indians*. Edited by Deward E. Walker, J. Smithsonian Institution. Washington, D.C., pp. 29-48.

Colburn, K. 2010. Transcript from the Boundary and Sullivan Technical Conference. Held June 10 in Spokane, WA.

Coutant, C. C., and R. R. Whitney. 2000. Fish behavior in relation to passage through hydropower turbines: a review. Transactions of the American Fisheries Society. 129:351-380.

District (Public Utility District No. 1 of Pend Oreille County). 1994. Application for Amendment of License for Major Project – Existing Dam, Sullivan Creek Hydroelectric Project, Project No. 2225. Appendices Vol. I of IV. Prepared by HDR Engineering, Inc., Bellevue, Washington. November 1994.

District (Public Utility District No. 1 of Pend Oreille County). 2010. Application for Surrender of License Sullivan Creek Project FERC No. 2225. March 2010.

Dingee, R.L. 1930. Historical Sketches of Pend Oreille County, Washington. Miner Print. Newport, Washington.

Dood, A. R., R. D. Brannon and R. D. Mace. 1986. Final programmatic environmental impact statement: the grizzly bear in northwestern Montana. Montana Dept. Fish, Wildlife, and Parks, Helena. 287 pp.

DuPont, J. M., R. S. Brown, and D. R. Geist. 2007. Unique allacustrine migration patterns of a bull trout population in the Pend Oreille River drainage, Idaho. North American Journal of Fisheries Management. 27:1268-1275.

DuPont, J. and N. Horner. 2003. Middle Fork East River bull trout assessment, 2003 Annual Performance Report. Program: Fisheries Management F-71-R-28. Project: I-Surveys and Inventories, Subproject I-A. Idaho Department of Fish and Game, Panhandle Region, Boise, ID.

Dyer, S. J. 1999. Movement and distribution of Woodland Caribou (*Rangifer tarandus caribou*) in response to industrial development in northeastern Alberta. M.S. Thesis, University of Alberta, Edmonton, AB. 106 pp.

Ecology. 2006. Water Quality Standards for Surface Waters of the State of Washington. Chapter 173-201A WAC. Olympia, Washington.

Ecology, Kalispel Tribe of Indians, Idaho Department of Environmental Quality, and U.S. Environmental Protection Agency. 2007. Pend Oreille River Total Maximum Daily Load for Temperature Draft. Prepared by Tetra Tech, Fairfax, VA, for the Tri-State Water Quality Council, Sandpoint, ID, August 2007.

EES Consulting. 2009a. Working draft habitat suitability indices for species and life history stage proposed for the instream flow study. Prepared for the Sullivan Lake Project Mediation Team and the Public Utility District No. 1 of Pend Oreille County, WA. May 28, 2009.

EES Consulting. 2009b. Working draft Sullivan Lake elevation management scenarios. Prepared for the Sullivan Lake Project Mediation Team and the Public Utility District No. 1 of Pend Oreille County, WA. June 22, 2009.

EES Consulting. 2010. Draft entrainment investigations and study of fish presence in the vicinity of Sullivan Lake Dam. Prepared for the Public Utility District No. 1 of Pend Oreille County, WA. February 2010.

Engel, S. 1995. Eurasian Water milfoil as a Fishery Management Tool. Fisheries. 20(3): 20–27.

Enserch (Enserch Environmental Corp). 1994. Boundary Reservoir: hydrologic and erosion processes affecting the Boundary Wildlife Preserve. Prepared by Enserch Environmental Co for Seattle City Light, September, 1994.

EPA (U.S. Environmental Protection Agency). 1986. Quality Criteria for Water, 1986. Office of Water Regulations and Standards, U.S. Environmental Protection Agency, Washington, DC.

EPA. 2002. Preliminary Assessments and Site Investigations Report, Lower Pend Oreille River Mines and Mills, Pend Oreille County, Washington. TDD: 01-08-0009. Seattle.

Fahey, J. 1986. The Kalispel Indians. University of Oklahoma Press, Norman.

Fandrich, B., L. M. Peterson, and S. Deaver. 2000. A Cultural History of the Kalispel Indians (Draft). Prepared for The Kalispel Tribe Department of Natural Resources, Usk. Ethnoscience, Inc., Billings, Montana.

Ferguson, D., and M. Root. 2002a. Cultural Resources Site Record of Site NELDP-0012. Site form on file at the Bureau of Land Management, Spokane District Office, Spokane.

Ferguson, D., and M. Root. 2002b. Cultural Resource Site Record for Site NELDP-0018. Site form on file at the Bureau of Land Management, Spokane District Office, Spokane.

FERC (Federal Energy Regulatory Commission). 1995. Preliminary Assessment of Fish Entrainment at Hydropower Projects. A Report on Studies and Protective Measures. FERC, Washington, DC.

FERC. 1998. Final Environmental Impact Statement, Sullivan Creek Hydroelectric Project, Washington (FERC Project No. 2225). Federal Energy Regulatory Commission, Washington, DC.

FERC. 2004. Final Environmental Impact Statement, Box Canyon Hydroelectric Project, Washington and Idaho (FERC Project No. 2042). Federal Energy Regulatory Commission, Washington, DC.

FISRWG (10/1998). Stream Corridor Restoration: Principles, Processes, and Practices. By the Federal Interagency Stream Restoration Working Group (FISRWG)(15 Federal agencies of the U.S. gov't). GPO Item No. 0120-A; SuDocs No. A 57.6/2:EN 3/PT.653. ISBN-0-934213-59-3.

Forest Service (USDA Forest Service). 1988. Colville National Forest Plan, as Amended. Colville National Forest, Colville, WA.

Forest Service. 1995. Inland Native Fish Strategy Environmental Assessment and Decision Notice. Intermountain, Northern, and Pacific Northwest Regions. USDA Forest Service.

Forest Service. 1996. Sullivan Creek Watershed Assessment. USDA Forest Service.

Forest Service. 1997. Final Environmental Assessment Report. Sullivan Creek Hydropower Project, FPA 4(e) Terms and Conditions. USDA Forest Service, Colville National Forest. Colville, Washington.

Forest Service. 1998a. Slate-Salmo Watershed Assessment. USDA Forest Service, Pacific Northwest Region. Newport, Washington.

Forest Service. 1998b. Z-Slumber Timber Sale Biological Evaluation of Effects to Threatened, Endangered, and Sensitive Species. Colville National Forest, Sullivan Lake Ranger District.

Forest Service, U.S. Fish and Wildlife Service, Bureau of Land Management, and Washington Department of Fish and Wildlife. 2001. Wildlife of Northeast Washington. Colville National Forest, Little Pend Oreille National Wildlife Refuge and other public wildlands. Newport, Washington.

Forest Service. 2004. R6 Stream Survey Protocol – Sullivan Creek. Colville National Forest. Newport, Washington.

Forest Service. 2005. Fish distribution map, Colville National Forest. USDA Forest Service, Colville National Forest. Newport, Washington.

Forest Service. 2008. Sullivan Creek Sullivan Creek Hydroelectric Project Existing Information Analysis Colville National Forest. USDA Forest Service, Colville National Forest. Newport, Washington.

Fraley, J. J. and B. B. Shepard. 1989. Life history, ecology, and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River systems, Montana. Northwest Science. 63:133-143.

Franke, G.F., D.R. Webb, R.K. Fisher, Jr., D. Mathur, P.N. Hopping, P.A. March, M.R. Headrick, I.T. Laczo, Y. Ventikos, and F. Sotiropoulos. 1997. Development of environmentally advanced hydropower turbine system design concepts. Idaho National Engineering and Environmental Laboratory.

Fritts, A. L., and T. N. Pearsons. 2004. Smallmouth bass predation on hatchery and wild salmonids in the Yakima River, Washington. Transactions of the American Fisheries Society. 133:880-895.

Fox, M. and S. Bolton. 2007. A Regional and Geomorphic Reference for Quantities and Volumes of Instream Wood in Unmanaged Forested Basins of Washington State. North American Journal of Fisheries Management. 27:342-359.

FWS. (U.S. Fish and Wildlife Service). 1994. Recovery plan for woodland caribou in the Selkirk Mountains. First Revision. Prepared by the Selkirk Mountain Woodland Caribou Recovery Team. USFWS, Region 1, Portland, Oregon. 51pp + appendices.

FWS. 1998. Bull Trout Interim Conservation Guidance. Lacey, WA. 47 pp.

FWS. 1993. Revised Grizzly Bear Recovery Plan. Missoula, Montana. 181 pp.

FWS. 1999. Status review for westslope cutthroat trout in the United States. Regions 1 and 6 of the U.S. Fish and Wildlife Service, Portland, OR., and Denver, CO.

FWS. 2000. Biological Opinion - Effects to Listed Species From Operations of the Federal Columbia River Power System. BI-OP prepared by United States Fish and Wildlife Service (Regions 1 and 6). BI-OP consultation document sent to Action Agencies: Army Corps of Engineers, Bonneville Power Administration, and Bureau of Reclamation.

FWS. 2002. Bull trout (*Salvelinus confluentus*) draft recovery plan. Region 1 U.S. Fish and Wildlife Service, Portland, OR.

USFWS. 2004. Species Assessment and Listing Priority Assignment Form: Grizzly Bear. Available: http://www.fws.gov/mountain-prairie/species/mammals/grizzly/grizzlybearSelkirk2004.pdf. (November 2008).

FWS. 2007. National bald eagle management guidelines. Washington, D.C. 23 pp

Gaylord, M. n.d. Eastern Washington's Past: Chinese and other Pioneers, 1860-1910. United States Department of Agriculture Forest Service, Pacific Northwest Region.

GEI Consultants, Inc. 2004. Intermountain Province Subbasin Plan, Pend Oreille Subbasin. Submitted to Northwest Power and Conservation Council, Portland, Oregon, on behalf of: Intermountain Province Oversight Committee and Intermountain Province Subbasin Work Teams.

Geist, D.R., R.S. Brown, A.T. Scholz, and B. Nine. 2004. Movement and survival of radio-tagged bull trout near Albeni Falls Dam (Final Report). Prepared for the Department of the Army, Seattle District, Corps of Engineers, Batelle Pacific Northwest Division, Richland, WA and Eastern Washington University, Cheney, WA.

Gilbert, C.H. and B.W. Evermann. 1894. A report upon investigations in the Columbia River Basin with descriptions of four new species of fishes. Pages 19-61, *In*: Report of the Commissioner of Fish and Fisheries on Investigations in the Columbia River Basin in Regard to the Salmon Fisheries. Government Printing Office.

Golder Associates. 2005. Pend Oreille River Watershed Management Plan. Report prepared for the WRIA 62 Watershed Planning Unit. March 2005.

Gough, S. 1997. Data Recovery Excavations at Site 45PO422: A Camas Processing Site in the Calispell Valley, Pend Oreille County, Washington. Eastern Washington University Reports in Archaeology and History 100-99. Archaeological and Historical Services, Eastern Washington University, Cheney.

Hallock, D. 2003. Amphibian Inventory of Lentic Habitats in the Colville National Forest: 2001-2002 Survey Results. Prepared by Washington Department of Natural Resources, Washington Natural Heritage Program, Olympia, Washington. Report to Colville National Forest. Kettle Falls, Washington

Hamilton, J. A. R. 1955. An investigation of the effect of Baker Dam on downstream migrant salmon. University of Washington.

Harmon, M. E., J. F. Franklin, F. J. Swanson; P. Sollins, S. V. Gregory; J. D. Lattin; N.H. Anderson; S. P Cline, N. G. Aumen, J. R. Sedell, G. W. Lienkaemper, K. Cromack, Jr., and K. W. Cummins. 1986. Ecology of coarse woody debris in temperate ecosystems. Pages 133-302, *In* A. Macfadyen and E.D. Ford (eds.) Advances in Ecological Research, vol. 15; Academic Press, Inc. 171 pp.

Heede, B.H. and J.N. Rinne. 1990. Hydrodynamic and fluvial morphologic processes: Implications for fisheries management and research. North American Journal of Fisheries Management. 10(3):249-268

Hickman, T. and R.F. Raleigh. 1982. Habitat Suitability Index Models: Cutthroat Trout. U.S. Fish and Wildlife Service, Ft. Collins, CO.

Hillman, T. W. and D. Essig. 1998. Review of bull trout temperature requirements: a response to the EPA bull trout temperature rule. Idaho Division of Environmental Quality, Boise, ID.

Hunter, M.A. 1992. Hydropower flow fluctuations and salmonids: A review of the biological effects, mechanical causes, and options for mitigation. Technical Report Number 119. State of Washington Department of Fisheries, Habitat Management Division, Olympia, Washington.

Holstine, C. 1987. *Forgotten Corner: A History of the Colville National Forest, Washington*. Colville Statesmen-Examiner, Inc., Colville, Washington.

Howe, M.C. 1976. *Historical Sketches of Pend Oreille County*. The Miner Print.

Hudson, L., S. Boswell, C. D. Carley, W. Choquette, C. Miss, D. H. Chance, and M. A. Stamper. 1981. A Cultural Resource Overview for the Colville and Idaho Panhandle National Forests and the Bureau of Land Management-Spokane and Coeur d'Alene Districts Northeastern Washington/Northern Idaho. Volume I: Cultural Resource Narrative Cultural Resource Consultants, Sandpoint, Idaho.

Hyatt, K.D., D.J. McQueen, K.S. Shortreed, and D.P. Rankin. 2004. Sockeye salmon (*Oncorhynchus nerka*) nursery lake fertilization: Review and summary of results. Environmental Review. 12:133-162.

Kasworm, W. F. and T. L. Manley, 1988. Grizzly bear and black bear ecology in the Cabinet Mountains of northwest Montana. Contract Rep., Montana Dept. Fish, Wildlife, and Parks, Helena. 122 pp.

KCDNR (King County Department of Natural Resources). 2000. Literature review and recommended sampling protocol for bull trout in King County. Prepared by E. Connor, R2 Resource Consultants, Inc. Redmond, Washington for King County Department of Natural Resources. Seattle, WA. 42 pages.

Knight, R. L. and K. Gutzwiller. 1995. Wildlife and Recreationists: Coexistence through Management. Island Press. Washington, D.C.

Knight, R. L., and S. K. Knight. 1984. Responses of wintering bald eagles to boating activity. J. Wildlife. Mgmt. 48:999-1004.

Koehler, G. M. 1990. Population and habitat characteristics of lynx and snowshoe hares in north central Washington. Canadian Journal of Zoology 68: 845-851.

Lembcke, S. 2001. Email regarding the RL&L Report. Personal communication to A. Solonsky, Seattle City Light, 2001.

Lyons, K. J. 2003. An Ethno-Archaeological Analysis of the Kalispel Aboriginal Fisheries of the Pend Oreille Watershed: The Relative Importance of Salvelinus confluentus to the Kalispel Bands (Draft). Unpublished draft paper prepared for the 2003 FCRPS Conference, Portland, Oregon. Kalispel Natural Resources Department, Kalispel Tribe of Indians, Usk, Washington.

Mahoney, J. M., and S. B. Rood. 1998. Streamflow requirements for cottonwood seedling recruitment – an integrative model. Wetlands 18: 634-645.

Mace, R. D. and C. Jonkel. 1980. The effects of logging activity on grizzly bear movements. Spec Rep. No. 38. Border Grizzly Proj., Univ. Montana, Missoula. 11 pp.

Marti, J. (1996). Recreational Instream Flow Evaluation for Sullivan Creek below Mill Pond Dam. Prepared for Washington State Department of Ecology.

McArthur, K. L. 1979. The behavior of grizzly bears in relation to people in Glacier National Park: a literature review. Prog. Rep., U S D I Nat'l. Park Serv., Glacier Natl. Park, MT. 70 pp.

McLellan, B. N. and R. D. Mace. 1985. Behavior of grizzly bears in response to roads, seismic activity, and people. Preliminary report, Can. Border Grizzly Proj., Cranbrook, B. C. 53 pp.

McLellan, J. G. 2001. 2000. WDFW Annual Report for the Project, Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dams. Washington Department of Fisheries, Spokane, WA.

McLellan, J.G. 2009. Characteristics of the Kokanee Spawning Run in Harvey Creek, Washington, and its Potential Use as an Egg Source. Northwest Science. 83(1):1-15.

McInturff, M. 1971. Interview with Alfred Kempe, Metaline Falls. Collection of John Ogmundson, Metaline Falls, Washington.

McIntyre, J.D. and B.E. Rieman. 1995. Westslope Cutthroat Trout. Chapter 1 in Young, M.K. (ed.) Conservation Assessment for Inland Cutthroat Trout. USDA Forest Service. General Technical Report RM-GTR-256. Fort Collins, Colorado.

McMillen, Morton D. 2010. Mill Pond Removal and Restoration: Alternatives Analysis and Evaluation of Recommended Alternative. Prepared for Seattle City Light. Appendix A-2 to the Pend Orielle PUD License Surrender Application.

Moulton, G. E. 1990. The Definitive Journals of Lewis & Clark: Down the Columbia to Fort Clatsop. Volume 6 of the Nebraska Edition. University of Nebraska Press, Lincoln.

Mourning Dove. 1990. Mourning Dove, a Salishan Autobiography. Edited by Jay Miller. University of Nebraska Press, Lincoln.

Muckleston, K. W. 2003. International Management in the Columbia River System. Oregon State University. UNESCO/IHP/WWAP, IHP-VI Technical Documents in Hydrology, PCCP series, no. 12.

Naiman, R. J., T. J. Beechie, L. E. Benda, D. R. Berg, P. A. Bison, L. H. MacDonald, M. D. O'Connor, P. L. Olson, and E. A. Steel. 1992. Fundamental elements of ecologically healthy watersheds in the Pacific Northwest coastal ecoregion. *In* R.J. Naiman, ed., Watershed Management: Balancing Sustainability with Environmental Change. Springer-Verlag, New York. pp. 127–188.

Nelson, M. L., T. E. McMahon, and R. F. Thurow. 2002. Decline of the migratory form in bull charr, *Salvelinus confluentus*, and implications for conservation. Environmental Biology of Fishes. 64:321-332.

New Zealand Mudsnail Management and Control Plan Working Group. 2007. National Management and Control Plan for the New Zealand Mudsnail (Potamopyrgus antipodarum). http://www.anstaskforce.gov/Documents/NZMS_MgmtControl_Final.pdf. Accessed November 23, 2010.

Nilsson, C., and P. A. Keddy. 1988. Predictability of change in shoreline vegetation in a hydroelectric reservoir, northern Sweden. Canadian Journal of Fisheries and Aquatic Sciences 45(11):1896-1904.

Nine and Scholz. 2005. Fishery and Limnology study of Sullivan lake – Final Report. Eastern Washington University.

NMFS (National Marine Fisheries Service). 2008. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, OR. 137 pp.

Normandeau Associates. 2002. Estimation of juvenile salmonid spillway passage survival at North Fork Dam. Prepared for Portland General Electric.

Northcote, T. G. and D. Y. Atagi. 1997. Ecological interactions in the flooded littoral zone of reservoirs: the importance and role of submerged terrestrial vegetation with special reference to fish, fish habitat and fisheries in the Nechako Reservoir of British Columbia, Canada. Skeena Fisheries Report, SK- 111.

Piper, W.J. 1990. "The Ferries." In The Big Smoke, p.27-33. Pflum Press, Chicago, IL.

Pickett, P.J., H. Rueda, and M. Herold. Total Maximum Daily Load for Total Dissolved Gas in the Mid-Columbia River and Lake Roosevelt. Summary Report. Washington State Department of Ecology Publication No. 04-03-002. June 2004.

PNNL (Pacific Northwest National Laboratory). 2000. Laboratory studies on the effects of shear on fish. Prepared for the U.S. Department of Energy.

Pokotylo, D. L. and D. Mitchell. 1998. Prehistory of the Northern Plateau. In Plateau,Handbook of North American Indians Vol. 12, pp. 81-102, edited by Deward E. Walker, Jr. Smithsonian Institution, Washington, D.C.

POSRT (Pend Oreille Salmonid Recovery Team). 2005. Strategy for Protection and Improvement of Native Salmonid Habitat in the Pend Oreille Watershed, Washington Water Resource Inventory Area 62. Pend Oreille Conservation District, Newport, WA.

Powers, P. 2008. Sullivan Creek RM 0.65 fish barrier assessment. Prepared for EES Consulting by Waterfall Engineering, L.L.C. 10 pp.

Pratt, K. L. 1992. A review of bull trout life history. Pages 5-9, *In*: Proceedings of the Gearhart Mountain bull trout symposium. Oregon Chapter, American Fisheries Society.

R2 Resource Consultants, Inc. 1998a. Boundary Hydroelectric Project, bull trout field investigations, draft data report. Report of R2 Resource Consultants to Seattle City Light, Seattle, WA.

R2 Resource Consultants, Inc. 1998b. Annotated bibliography of literature regarding mechanical injury with emphasis on effects from spillways and stilling basins. Prepared for U.S. Army Corps of Engineers Portland District.

R2 Resource Consultants, Inc. 2006. Early Information Development: Fish Connectivity at the Boundary Hydroelectric Project (FERC No. 2144). Prepared for Seattle City Light, Seattle, WA. Prepared by R2 Resource Consultants, Inc., Redmond, WA.

Rieman, B. E. and F. W. Allendorf. 2001. Effective population size and genetic conservation for bull trout. North American Journal of Fisheries Management. 21:756-764.

Rieman, B. E. and J. D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. Gen. Tech. Rep. INT-302. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River Basins. North American Journal of Fisheries Management. 17:1111-1125.

Ruby, R. H. and J. A. Brown. 1992 A Guide to the Indian Tribes of the Pacific Northwest. University of Oklahoma Press, Norman.

Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, et al., tech. eds. 2000a. Ecology and conservation of lynx in the United States. Univ. Press of Colorado. Boulder. 480 pp.

Saffel, P. D. and D. L. Scarnecchia. 1995. Habitat use by bull trout in belt-series geology watersheds of northern Idaho. Northwest Science. 69:304-317.

Saldi-Caromile, K., K. Bates, P. Skidmore, J. Barenti, D. Pineo. 2004. Stream Habitat Restoration Guidelines: Final Draft. Co-published by the Washington Departments of Fish and Wildlife and Ecology and the U.S. Fish and Wildlife Service. Olympia, Washington.

Sanderson, B., K. A. Barnas, and M. W. Rub. 2009. Nonindigenous species of the Pacific Northwest: an overlooked risk to endangered salmon? BioScience. 59:245-256.

Saunders, D., R. J. Hobbs, and C. R. Margules. 1991. Biological consequences of ecosystem fragmentation: a review. Conservation Biology 5:18-32.

Schalk, R.F. 1977. The structure of an anadromous fish resource. In *For Theory Building in Archaeology*. Edited by L.R. Binford. Academic Press. San Francisco. Pp. 207-249.

Scholz, A., H. J. McLellan, D. R. Geist, and R. S. Brown. 2005. Investigations of migratory bull trout (*Salvelinus confluentus*) in relation to fish passage at Albeni Falls Dam. Final Report prepared for U.S. Dept. of the Army, Corps of Engineers, Seattle District. Contract No. DACW68-02-D-001.

Seattle Audubon Society. 2008. BirdWeb. Available online at: http://www.birdweb.org/birdweb/index.aspx (accessed October 30, 2008).

Seattle (Seattle City Light). 2006. Pre-Application Document for the Boundary Hydroelectric Project (FERC No.2144). Prepared by Long View Associates, Seattle, WA. Available at:

http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp. May 2006.

Seattle. 2008a. Compilation of Project hydrologic data: preparation of hydrologic database and hydrologic statistics in support of relicensing studies, Boundary Hydroelectric Project (FERC No. 2144). Prepared by R2 Resource Consultants, Inc., Redmond, WA. March 2008.

Seattle. 2008b. Initial Study Report - Boundary Hydroelectric Project (FERC No. 2144). Seattle, WA. Available at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp. March 2008.

Seattle. 2009. Application for the Boundary Hydroelectric Project (FERC NO. 2144). May 2009.

Seattle. 2009a. Updated Study Report - Boundary Hydroelectric Project (FERC No. 2144). Seattle, WA. Available at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp. March 2009.

Seattle. 2009b. Evaluation of Total Dissolved Gas and Potential Abatement Measures Final Report. March 2009.

Seattle. 2009c. Toxics Assessment: Evaluation of Contaminant Pathways Final Report. March 2009.

Seattle. 2009b. Fish Distribution, Timing, and Abundance Study Final Report. Seattle, WA. Available at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp. April 2009.

Seattle. 2009c. Fish Entrainment and Habitat Connectivity Study Final Report. Seattle, WA. Available at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp.

Seattle. 2009d. Technical memorandum describing Project effects on whitefish spawning conditions at the mouth of Sullivan Creek. Available at: http://www.seattle.gov/light/news/issues/bndryRelic/br_document.asp. May 2009.

Seattle. 2010. Boundary H Hydroelectric Project (FERC No. 2144) Aquatic Invasive Species Control and Prevention Plan. March 2010.

Seattle. 2010b. Boundary Hydroelectric Project (FERC No. 2144) Dissolved Oxygen Attainment Plan. March 2010.

Seattle. 2010c. Boundary Hydroelectric Project (FERC No. 2144) Temperature Attainment Plan. March 2010.

Smith, A. H. 1961. An Ethnohistoric Analysis of David Thompson's 1809-1811 Journeys in the Lower Pend Oreille Valley, Northeastern Washington. Ethnohistory 8(4):309-381.

Small, M.P. and J. Von Bargen. 2009. Boundary Hydroelectric Project Westslope cutthroat and rainbow trout genetics program report. Prepared by Molecular Genetics Lab, Conservation Unit, Science Division, Washington Department of Fish and Wildlife.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmon conservation. Management Technology. TR-4501-96-6057.

Squires, J, R. Ruggiero, and F. Leonard. 2007. Winter prey selection of Canada lynx in northwestern Montana. *The Journal of Wildlife Management* 71:310315.

State of Washington OFM (Washington State Office of Financial Management). 2007. Pend Oreille County Profile. From the 2007 Washington State Data Book. Available: http://www.ofm.wa.gov/databook/county/pend.asp. October 2008.

Stinson, D. W. 2001. Washington state recovery plan for the lynx. Washington Department of Fish and Wildlife, Olympia, Washington.

Stolz, S., and J. Schnell. 1991. The wildlife series, trout pages 196-207, Stackpole Books, Harrisburg, PA., 370 pp.

Sugiyama, K. 1980. History of the Boundary Project. City of Seattle, Office of Community Relations.

Tetra Tech. 2009. Study Number 21: Aesthetic/Visual Resources Study Report. Prepared for Seattle City Light.

Thoms, A. V. 1989. The Northern Roots of Hunter-Gatherer Intensification: Camas and the Pacific Northwest. Unpublished doctoral dissertation, Department of Anthropology, Washington State University, Pullman.

Todd, B.L. and C.F. Rabeni. 1989. Movement and habitat use by stream-dwelling smallmouth bass. Transactions of the American Fisheries Society. 118:229-242.

U.S. Army Corps of Engineers. 2010. Zebra Mussel life history and biology. http://el.erdc.usace.army.mil/zebra/zmis/zmishelp4/life_history_and_biology.htm . Accessed on November 23, 2010.

USGS. 2010. Flow data from gage 12397100: Outlet Creek near Metaline Falls, WA. http://wa.water.usgs.gov/data/realtime/adr/2004/12397100.2004.sw.pdf. Accessed on November 29, 2010.

Watson, G. and T. W. Hillman. 1997. Factors Affecting the Distribution and Abundance of Bull Trout: An Investigation at Hierarchical Scales. Plum Creek Timber Company Technical Report #2. North American Journal of Fisheries Management. 17:237-252.

Washington DFW (Washington Department of Fish and Wildlife) and Western Washington Treaty Indian Tribes. 1998. Washington State Salmonid Stock Inventory - Appendix Bull Trout and Dolly Varden. Washington Department of Fish and Wildlife, Olympia, WA.

Washington DFW. 2001. Washington State Elk Heard Plan: Selkirk Elk Herd. Washington DFW Wildlife Management Program, Olympia, Washington (February 2001) (http://wdfw.wa.gov/publications/00451/wdfw00451.pdf.).

Washington DFW. 2010. 2010 Game status and trend report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA. (http://wdfw.wa.gov/publications/01159/wdfw01159.pdf.)

Washington State Historical Society. 1940. Building a State. Washington, 1889-1939, n.p.

Weitkamp, D.E, R.D. Sullivan, T. Swant, and J. DosSantos. 2003. Behavior of resident fish relative to total dissolved gas supersaturation in the lower Clark Fork River. Transactions of the American Fisheries Society. 132:5, 856-864.

Whittington, J., and G. Mercer. 2004. Proceedings of the Species at Risk 2004 Pathways to Recovery Conference. 1 March 2–6, 2004, Victoria, B.C. Species at Risk 2004 Pathways.to Recovery Conference Organizing Committee, Victoria, B.C. T.D. Hooper, editor.

Williams, C. K., B. F. Kelly, B.G. Smith, and T.R. Lillybridge. 1995. Forested Plant Associations of the Colville National Forest. Gen. Tech. Rep. PNW-GTR-360. United States Department of Agriculture, U.S. Forest Service, Pacific Northwest Research Station. Portland, Oregon

Winans, W.P. 1904. Stevens County, Washington: Its Creation, Addition, Subtraction, and Division. Pamphlet on file at Seattle Public Library, Seattle.

Wydoski, R.S. and R.R. Whitney. 2003. Inland Fishes of Washington. University of Washington Press, Seattle and London.

## 7.0 LIST OF PREPARERS

David Turner—FERC Project Coordinator (Wildlife Biologist; M.S., Zoology; B.S., Forest Resources and Wildlife Biology).

Allan Creamer – Fisheries and Aquatic Resources, and Threatened and Endangered Species (Fisheries Biologist; B.S. and M.S., Fisheries Science).

Ryan Hansen – Water Quantity and Quality (Fisheries Biologist; M.S., Environmental Science and Public Policy; B.S., Biology).

Frank Winchell—Cultural Resources (Archeologist; B.A., M.A., Ph.D., Anthropology)

Jennifer Harper—Need for Power, Developmental Resources, and Geology and Soils (Engineer; Ph.D., Environmental Health Engineering; MSCE, Civil Engineering)

Mark Ivy—Recreation, Aesthetics and Land Use (Outdoor Recreation Planner; Ph.D., Outdoor Recreation Management; M.S., Recreation & Resources Development; B.S., Natural Resource Planning)

Patrick Murphy—Vegetation and Wildlife Resources, Threatened and Endangered Species (Wildlife Biologist; M.S. and B.S., Wildlife Management)

# 8.0 LIST OF RECIPIENTS

Honorable Maria Cantwell
U.S. Senator
915 Second Ave, Ste. 3206
Seattle WA 98174

Honorable Patty Murray
U.S. Senator
2988 Jackson Federal Building
Seattle, WA 98174

Honorable Doc Hastings
U.S. Representative
2715 St Andrews Loop Suite D
Pasco, WA 99301

Honorable Christine Gregoire
Office Of The Governor
PO Box 40002
Olympia WA 98504-0002

Yakama Nation
Dept. of Natural Resources
PO Box 151
Toppenish, WA 98948

Ralph Sampson, Jr.
Chair, Tribal Council
Yakama Nation
PO Box 151
Toppenish, WA 98948

Michael O. Finlely, Chairman
Colville Business Council
PO Box 150
Nespelem, WA 99155

Elwood Patawa, Chairman
Confederated Tribes Of The Umatilla
PO Box 638
Pendleton OR 97801

Confederated Tribes Of The Warm Springs Reservation
Attn: Ron Suppah, Chair
PO Box C
Warm Springs, OR 97761-3001

Janea Holmquist
Washington State Senator
PO Box 40413
Olympia, WA 98504-0413

Bill Hinkle
Washington State Representative
401 John L. O'Brien Building
PO Box 40600
Olympia, WA 98504-0600

Judy Warnick
Washington State Representative
403 John L. O'Brien Building
PO Box 40600
Olympia, WA 98504-0600

Jerome Delvin
Washington State Senator
201 Irv Newhouse Building
PO Box 40408
Olympia, WA 98504-0408

Brad Klippert
Washington State Representative
436 John L. O'Brien Building
PO Box 40600
Olympia, WA 98504-0600

Larry Haler
Washington State Representative
122 D Legislative Building
PO Box 40600
Olympia, WA 98504-0600

Jim Honeyford
Washington State Senator
107 Irv Newhouse Building
PO Box 40415
Olympia, WA 98504-0415

Bruce Chandler
Washington State Representative
427 B Legislative Building
PO Box 40600
Olympia, WA 98504-0600

David Taylor
Washington State Representative
438 John L. O'Brien Building
PO Box 40600
Olympia, WA 98504-0600

Linda Evans Parlette
Washington State Senator
316 Legislative Building
P.O. Box 40412
Olympia, WA 98504-0412

Cary Cardotta
Washington State Representative
122 B Legislative Building
P.O. Box 40600
Olympia, WA 98504-0600

Mike Armstrong
Washington State Representative
426 A Legislative Building
P.O. Box 40600
Olympia, WA 98504-0600

Dennis Beich
WDFW
1550 Alder Street NW
Ephrata, WA 98823-9699

Guy Gregory
Washington State Department of Ecology
N. 4601 Monroe
Spokane, WA 99205-1295

Bonneville Power Administration
Attn: Rob Swedo
P.O. Box 3621
Portland, OR 97208-3621

U.S. Department Of Energy
Office Of River Protection
Attn: Mary Beth Burandt
PO Box 450, Mail Stop H6–60
Richland, WA 99352

Dennis Bly
Lincoln County Commissioner
P.O. Box 28
Davenport, WA 99122

Paul Stoker
Columbia Basin GWMA
449 E. Cedar Blvd
Othello, WA, 99344

U.S. Army Corps of Engineers
Jim Fredericks
PO Box 3755
Seattle, WA 98124-3755

National Marine Fisheries Service
Attn: Dale Bambrick
304 S Water St.
Ellensburg, WA 98926

Fish & Wildlife Services
Attn: Jeff Tayer
1917 Marsh Rd.
Yakima, WA 98907

Washington State Department of Ecology
SEPA Unit
PO Box 47703
Olympia, WA 98504-7703

Washington Department of Agriculture
Attn: Dan Newhouse
PO BOX 42560
Olympia, WA 98504

Washington Parks & Recreation Commission
PO Box 42668
Olympia, WA 98504

Washington Department of Fish & Wildlife
Attn: Phil Anderson, Director
600 Capitol Way N.
Olympia, WA 98501-1091

Washington Department of Natural Resources
Attn: Sandy Moody
PO BOX 47014
Olympia, WA 98504-7014

Washington State Dept of Transportation
Attn: Bill Preston
PO BOX 12560
Yakima WA, 98901

Washington State Dept of Archaeology
& Historic Preserve
Attn: Robert Whitlam
PO BOX 48343
Olympia, WA 98504-8343

Washington State Recreation & Conservation
Attn: Jim Eychaner
PO BOX 40917
Olympia, WA 98504-0917

Scott Revell
Kennewick Irrigation District
PO Box 6900
Kennewick, WA 98336-0401

Director
Bonneville Power Administration
PO Box 3621
Portland, Oregon 97208-3621

Columbia River Gorge Commission
Chairman
PO Box 730
White Salmon, WASHINGTON 98672-0730

Dana Marcelle Mangold
Department of Ecology
4601 N. Monroe
Spokane, WASHINGTON 99205

Washington Farm Bureau
Attn: John Stuhlmiller
975 Carpenter Rd NE, Suite 301
Lacey, WA 98516

Yakima County Commissioners
Attn: Mike Leita
128 North 2nd Street
Yakima, WA 98901

Northwest Power and Conservation Council
Attn: Tony Grover
851 S. W. 6th Ave, Suite 1100
Portland, OR 97204

American Rivers
Attn: Michael Garrity
4005 20th Ave NW, Suite 221
Seattle, WA 98199

National Wildlife Federation
Attn: Steve Malloch
6 Nickerson Street # 200
Seattle, WA 98109

Center for Environmental Law and Policy
Attn: Rachael Osborn
25 West Main, Suite 234
Spokane, WA 99201

Columbia River Intertribal Fish Commission
Attn: Julie Carter
729 NE Oregon St. Suite 200
Portland, OR 97232

Sierra Club
Attn: Bill Arthur
180 Nickerson Street, Suite 202
Seattle, WA 98109

Lower Columbia Audubon Society
Attn: Richard Leaumont
9016 Sunset Trail
Pasco, WA 99301

Citizens for a Clean Columbia
434 Orando Ave
Wenatchee, WA 98801

Dave Sauter
Klickitat County Commissioner
205 S Columbus MS-CH4
Goldendale, WA 98620

Dorothy Black, Planning Manager
Grant County Planning
PO Box 37
Ephrata, WA 98823

Mona Janopaul
FOREST SERVICE
Stop 1124
1400 Independence Ave SW
Washington, DC 20250

U.S. Forest Service
Forest Supervisor
765 S Main St
Colville, WASHINGTON 991142507

Kirk Holmes
Kittitas County Community Development Services
411 North Ruby St., Suite A
Ellensburg, WA 98926

Gary Chandler
Vice Present of Government Affairs
Association of Washington Businesses
1414 Cherry St SE

Kathleen Collins
Water Policy Alliance
3905 Lakehills Drive SE
Olympia, WA 98501

Jon Culp
Washington State Conservation Commission
921 Murry St
Okanagon, WA 98840

Craig Simpson
East Columbia Basin Irriigation District
PO Box E
Othello, WA 99344

Rick George, Program Manager
Environmental Planning and Right Protection
Umatilla Tribes
PO Box 638
Pendleton, OR 97801

Bill Gray, Manager
Area Manager
Bureau Of Reclamation
32 "C" St NW
Ephrata, WA 98823

Walt Dortch
U.S. Forest Service
21905 64th Avenue West
Mountlake Ter, WASHINGTON 98043-2278

Joe Lucas
Grant County PUD
PO BOX 878
Ephrata, WA 98823

Mo Mcbroom, Policy Director
Washington Environmental Council
615 2nd Avenue St 380
Seattle, WA 98104

Merrill Ott, Commissioner
Stevens County Commission
215 S Oak St
Colville, WA 99114

Gary Passmore
Environmental Trust Director
Colville Tribes
PO Box 150
Nespelem WA, 99155

Lisa Pelly, Executive Director
Washington Rivers Conservancy
103 Palouse Suite 33
Wenatchee, WA 98801

Rudy Peone
Natural Resources Director
Spokane Tribe
6208 Ford/Wellpinit Road
PO Box 100
Wellpinit, WA 99040

Mike Schwisow
Columbia Basin Development League
606 Columbia St NW, Suite 101
Olympia, WA 98501

Teresa Scott
Washington Department of Fish and Wildlife
600 Capitol Way North
Olympia, WA 98501

Rudy Plager
Adams County Commissioners
210 W Broadway
Ritzville, WA 99169

Jim Eychaner
Interagency Committee for Outdoor Recreation
PO Box 40917
Olympia, WA 98501

Phillip Katzen
Kanji & Katzen, PLLC
401 Second Ave. S.
Suite 700
Seattle, WA 98104

Rich Stevens, Commissioner
Grant County
35 C St NW
Ephrata, WA 98823

David Turner
PO Box 1072
Harpers Ferry, WV 25425

Darryll Olsen
Columbia-Snake Rivers Irrigation Association
3030 W. Clearwater, Suite 205-A
Kennewick, WA 99336

Dr. Brenda Bateman
Senior Policy Coordinator
Oregon Department of Water Resources
Summer Street NE, Suite A
Salem, OR 97301

Brent Foster
Columbia River Keeper
724 Oak St
Hood River, OR 97301

Washington State Library
PO Box 42460
Olympia, WA 98504-2460

Bob Morton
Washington State Senator
115D Irv Newhouse Building
PO Box 40407
Olympia, WA 98504-0407

Shelly Short
Washington State Representative
422 John L. O'Brien Building
PO Box 40600
Olympia, WA 98504-0600

Mark Schoesler
Washington State Senator
110 Irv Newhouse Building
PO Box 40409
Olympia, WA 98504-0409

Joe Schmick
Washington State Representative
427 Legislative Building
PO Box 40600
Olympia, WA 98504-0600

Joel Kretz
Washington State Representative
335 Legislative Building
PO Box 40600
Olympia, WA 98504-0600

Susan Fagan
Washington State Representative
122C Legislative Building
PO Box 40600
Olympia, WA 98504-0600

Jim DeGraffenreid
Planning Services Director
Lincoln County Land Services
27234 State Route 25 N
Davenport , WA 99122

Todd McLaughlin
Pend Oreille County Planning
P.O. Box 5066
Newport, WA 99156

Chris Mylar
Clerk of the Board
Pend Oreille County
P O Box 5025
Newport, WA. 99156

Mark D Kulaas
Douglas County Land Services
140 19th Street NW, Suite A
East Wenatchee, WA 98802

Erik Johansen
Stevens County Land Services
215 S. Oak St.
Colville, WA 99114

Irene Whipple
Ferry County Planning Dept.
PO Box 305
Republic, WA 99166

Perry Huston
Office of Planning and Development
Okanogan County
123 5th Ave N Ste 130
Okanogan, WA 98840

Sen. Linda Evans Parlette
316 Legislative Building
PO Box 40412
Olympia, WA 98504-0412

Rep. Cary Condotta
122B Legislative Building
PO Box 40600
Olympia, WA 98504-0600

Rep. Mike Armstrong
426A Legislative Building
PO Box 40600
Olympia, WA 98504-0600

Mark Cauchy
Pend Oreille Public Utility District
PO Box 190
Newport, WA 99156-0190

Deane Osterman
Natural Resources Dept.
Kalispel Tribe of Indians
P.O. Box 39
Usk, WA 99180

Mary Wagner
Pacific Northwest Region
U.S. Forest Service
333 SW First Avenue
Portland, Oregon 97204-3440

Loren Torgerson
Washington State Department Of Natural Resources
225 S Silke Road
Colville, WA 99114-0190

Karen Gustin
Superintendent
Olympic National Park
600 East Park Avenue
Port Angeles, WA 98362

Kristine Wilson
Perkins Coie LLP
The PSE Building
10885 NE 4th Ave., Suite 700
Bellevue, WA 98004

Markham A Quehrn
Perkins Coie LLP
Suite 700
10885 N.E. Fourth St
Bellevue, WA 98004-5579

Pat Kelleher
6530 Wilson creek road
Ellensburg, WA 98926

Elizabeth Thomas
K&L Gates LLP
925 4th Ave Ste 2900
Seattle, WA 98104

Donald E Kempf
Stillaguamish Tribe
Po Box 277
Arlington, WA 98223-0277

DAN HAAS
U.S. National Park Service
909 1st Ave
Seattle, WA 981041055

Maria Cantwell
United States Senate
511 Dirksen Senate Office Building
Washington, DC 20515-0001

Kristen Bonanno
U.S. Forest Service
PO Box 3623
Portland, OREGON 97208-3623

Neil Wise
Washington Office of Attorney General
PO Box 40100
Olympia, WA 98504-0100

Joan Marchioro
Washington Office of Attorney General
PO Box 40117
Olympia, WA 00117

Forest Practice Coordinator
Washington State Dept. of Natural Resources
950 Farman St N
Enumclaw, WA 980229282

John Snyder
Davis Wright Tremaine LLP
1919 Pennsylvania Ave., NW
Washington, DC 20006-3401

Jorge Carrasco, .
Seattle City Light
PO Box 34023
Seattle, WA 98124-4023

U.S. Bureau of Indian Affairs
Director
Portland Area Office
911 NE 11th Ave
Portland, OR 972324169

Jeff Vail
United States Department of Agriculture
1400 Independence Ave SW
Washington, DC 20250

U.S. Army Corps of Engineers
Secretary
PO Box 2870
Portland, OREGON 97208-2870

Lee Van Tussenbrook
Washington Department of Fish & Wildlife
2108 Grand Blvd
Vancouver, WA 986614624

Washington Dept. of Agriculture
406 General Administration Building
Olympia, WA 98504-0001

Bill Frymire
Washington Office of Attorney General
PO Box 40100
Olympia,WA 00100

Brett Swift
American Rivers
320 SW Stark Street, Suite 412
Portland, OR 97204

Barbara Greene
Seattle City Light
700 5th Ave, Suite 3205
Seattle, WA 98104

Jerry R Boggs
Selkirk Conservation Alliance
PO Box 1809
Post Falls, ID 83869

State Director (OR-936.1)
U.S. Bureau of Land Management
PO Box 2965
Portland, OR 97208-2965

Jocelyn Somers
Office of the General Counsel
United States Department of Agriculture
1220 SW 3rd Ave Ste 1734
Portland, OR 97204

Jennifer Frozena
U.S. Department of Interior
911 N.E. 11th Avenue
Portland, OR 97213

Washington Department of Fish & Wildlife
Chief
Habitat Division
600 N. Capitol Way
Olympia, WA 985040001

Washington Office Of Archaeology
SHPO
PO Box 48343
Olympia, WA 98504-8343

Douglas L. Robison
Washington Department of Fish and Wildlife
2315 N. Discovery Place
Spokane Valley, WA 99216-1566

Thomas O’Keefe
PNW Stewardship Director
American Whitewater
3537 NE 87th St.
Seattle, WA 98115

Mark Sprengel
Selkirk Conservation Alliance
PO Box 1809
Post Falls, ID 83856

Rich Bowers
Hydropower Reform Coalition
803 Reveille Road
Bellingham, WA 98229

Dennis Beich
Washington Dept of Ecology
PO Box 47600
Olympia, WA 98504-7600

Kevin Colburn
American Whitewater
2725 Highland Dr.
Missoula, MT 59802

Shirley and Wilhelm Botzheim
378 Sweet Creek Road
Metaline, WA 99152

Bob Dach
Bureau of Indian Affairs
911 N.E. 11th Avenue
Portland, OR 97232

Deane Osterman
Director
Kalispel Natural Resources
Department
P.O. Box 39
Usk, WA 99180

Walt Dortch
U.S. Forest Service
140 Emens Ave N
Darrington, WA 98241-9502

Sara L. Hunt
Washington Dept. of Ecology
4601 N Monroe ST
Spokane, WA 99205

Jerry R. Boggs, Ph.D.
Selkirk Conservation Alliance
PO Box 1809
Priest River, ID 83869

Steven Kern
Seattle City Light
700 5th Ave., Suite 3200
P.O. Box 34023
Seattle, WA 98124-4023

Susan Rosebrough
National Park Service
Rivers, Trails and Conservation
Assistance
909 First Avenue
Seattle, WA 98104

Mike Petersen
The Lands Council
25 West Main Ave., Suite 222
Spokane, WA 99201

Jean Parodi
Washington Dept of Ecology
PO Box 47600
Olympia, WA 98504-7600

Mark Miller, Assistant Project
Leader
Spokane Field Office
U.S. Fish and Wildlife Service
11103 East Montgomery
Drive

Joyce Launer
Sweet Creek Residents
PO Box 45
Metaline, WA 99152

Bob Geddes
Public Utility District #1 of
Pend Oreille County
P.O. Box 190
Newport, WA 99156

Laura Jo West
Forest Supervisor
Colville National Forest
Mailing Address 765 South
Main Street
Colville, WA 99114

Steve Llewellyn
The Lands Council
25 West Main Ave., Suite 222
Spokane, WA 99201

# APPENDIX A

## Boundary Project

## Draft License Articles Recommended by Staff

This page intentionally left blank.

## APPENDIX A Draft Boundary License Articles Recommended by Staff

I. Mandatory Conditions

We recommend including Interior's amended preliminary section 18 prescriptions, which are identical to proposed license articles 9(B) and 9(C) of the settlement agreement, in any license issued. We also recommend including Forest Service's section 4(e) conditions 1(in part), 3 (in part), 8, and 9, in any new license issued. Forest Service 4(e) Condition 1 stipulates that Seattle must implement all the provisions of the Boundary settlement agreement, including exhibits and attachments, relating to protection, mitigation and environmental measures and other obligations on National Forest System lands, except those related to the District's Mill Pond dam removal and the installation of the cold water release intake on Sullivan Lake. Similarly, 4(e) Condition 3 stipulates that the licensee shall implement proposed license articles 1 through 10 included in the settlement agreement. We recommend that any license issued include all the measures contained in the proposed license articles except proposed articles 8a (iii) (Fish Tissue Sampling), 9(H) (Recreational Fish Stocking Program), and 9(I) (Fund for Habitat Improvements in Tributaries to Lake Sullivan). While we do not recommend including these measures in a new license, all valid 4(e) conditions would be made part of any license issued for the project. The following additional draft articles are based on the inclusion of all of the above prescriptions and conditions in a license.

II. Draft License Articles

Draft Article 201. *Administrative Annual Charges*. The licensee shall pay the United States annual charges, effective as of the date of commencement of project construction, and as determined in accordance with the provisions of the Commission's regulations in effect from time to time for the purposes of:

(a) reimbursing the United States for the cost of administration of Part 1 of the Federal Power Act. The authorized installed capacity for that purpose is 1,003,253 kilowatts; and

(b) recompensing the United States for the use, occupancy and enjoyment of 938.59 acres of its lands (other than for transmission line right-of-way).

Draft Article 202. *Exhibit F Drawings*. Within 45 days of the date of issuance of the license, the licensee shall file the approved exhibit drawings in aperture card and electronic file formats.

(a) Three sets of the approved exhibit drawings shall be reproduced on silver or gelatin 35mm microfilm. All microfilm shall be mounted on type D (3-1/4" X 7-3/8") aperture cards. Prior to microfilming, the FERC Project-Drawing Number (i.e., P-2144-

1001 through P-2144-1005) shall be shown in the margin below the title block of the approved drawing. After mounting, the FERC Drawing Number shall be typed on the upper right corner of each aperture card. Additionally, the Project Number, FERC Exhibit (i.e., F-1, etc.), Drawing Title, and date of this license shall be typed on the upper left corner of each aperture card.

Two of the sets of aperture cards shall be filed with the Secretary of the Commission, ATTN: OEP/DHAC. The third set shall be filed with the Commission's Division of Dam Safety and Inspections - Portland Regional Office.

(b) The licensee shall file two separate sets of exhibit drawings in electronic raster format with the Secretary of the Commission, ATTN: OEP/DHAC. A third set shall be filed with the Commission's Division of Dam Safety and Inspections Portland Regional Office. Exhibit F drawings must be identified as Critical Energy Infrastructure Information (CEII) material under 18 CFR § 388.113(c). Each drawing must be a separate electronic file, and the file name shall include: FERC Project-Drawing Number, FERC Exhibit, Drawing Title, date of this license, and file extension in the following format [P-2144-1001, D-1, Description, MM-DD-YYYY.TIF]. Electronic drawings shall meet the following format specification:

IMAGERY - black & white raster file
FILE TYPE – Tagged Image File Format (TIFF), CCITT Group 4
RESOLUTION – 300 dpi desired (200 dpi min)
DRAWING SIZE FORMAT – 24" X 36" (min), 28" X 40" (max)
FILE SIZE – less than 1 MB desired

Draft Article 203. *Exhibit G Drawings*. Within 90 days of the effective date of the license, the licensee shall file, for Commission approval, revised Exhibit G drawings enclosing within the project boundary all principal project works necessary for operation and maintenance of the project, including revisions to the project boundary required to bring the new project lands and roads within the boundary, and including any revisions around the lower reservoir to bring the project boundary to a minimum distance of 180 feet from the current ordinary high water level of the reservoir. The Exhibit G drawings must comply with sections 4.39 and 4.41 of the Commission's regulations. The licensee shall also provide a tabulation of federal lands within the revised project boundary so that Article 201 may be amended for the purpose of annual charges for federal land use and occupancy.

Draft Article 204. *Headwater Benefits*. If the licensee's project was directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement during the term of the original license (including extensions of that term by annual licenses), and if those headwater benefits were not previously assessed and reimbursed to the owner of the headwater improvement, the licensee shall reimburse the owner of the headwater improvement for those benefits, at such time as they are assessed, in the same manner as for benefits received during the term of this new license. The benefits will be assessed in accordance with Part 11, Subpart B, of the Commission's regulations.

Draft Article 301. *Contract Plans and Specifications*. At least 60 days prior to the start of any construction (including, but not limited to, volitional fish passage facilities), the licensee shall submit one copy of its plans and specifications and any supporting design documents to the Commission's Division of Dam Safety and Inspections (D2SI) - Portland Regional Engineer, and two copies to the Commission (one of these shall be a courtesy copy to the Director, Division of Dam Safety and Inspections). The submittal to the Regional Engineer must also include as part of preconstruction requirements: a Quality Control and Inspection Program, Temporary Construction Emergency Action Plan, and Soil Erosion and Sediment Control Plan. The licensee may not begin construction until the Regional Engineer has approved in writing the plans and specifications and determined that all preconstruction requirements have been satisfied.

Draft Article 302. *Cofferdam Construction Drawings*. Before starting any removal, construction, or stream restoration activities the licensee shall review and approve the design of any contractor-designed cofferdams and deep excavations and shall make sure construction of cofferdams and deep excavations is consistent with the approved design. At least 30 days before starting construction of any cofferdam, the licensee shall submit one copy to the Commission's Division of Dam Safety and Inspections (D2SI) – Portland Regional Engineer and two copies to the Commission (one of these copies shall be a courtesy copy to the Commission's Director, Division of Dam Safety and Inspections), of the approved cofferdam construction drawings and specifications and the letters of approval.

Draft Article 303. *As-built Drawings.* Within 90 days of completion of construction of the facilities authorized by this license, the licensee shall file for Commission approval, revised exhibits A, F, and G, as applicable, to describe and show those project facilities as built. A courtesy copy shall be filed with the Commission's D2SI - Portland Regional Office, the Director, D2SI, and the Director, Division of Hydropower Administration and Compliance.

Draft Article 304. *Project Modification Resulting From Environmental Requirements.* The planning and design of any permanent or temporary modification which affects the project works or operation resulting from environmental requirements shall be coordinated as early as feasible with the Commission’s Division Dam Safety and Inspections - Portland Regional Office (D2SI-PRO). Within 90 days of receipt of the license a letter is to be sent to the D2SI-PRO providing a plan and schedule of any proposed modifications (including, but not limited to, modifications to control Total

Dissolved Gas) to the water-retaining features of the project in the planning and design phase resulting from environmental requirements of the license. The schedule is to allow sufficient review time for the Commission to insure that the proposed work does not adversely affect the project works, dam safety or project operation.

Draft Article 305. *Turbine Upgrades*. Within 90 days of the completion of the proposed upgrades on Units 55 and 56, the licensee shall file with the Commission, a description of the exact installed capacities of each unit. This information will be used to revise the annual charges under Article 201(a).

Draft Article 401. *Commission Approval, Notification, and Filing of Amendments*

(a) Requirement to File Plans for Commission Approval

Certain conditions found in the U.S. Forest Service's (Forest Service) section 4(e) conditions require the licensee to prepare plans in consultation with other entities for approval and implement specific measures without prior Commission approval. The following table indicates the agencies (composition of the working groups are established by Forest Service Condition 3(2)) that the licensee shall consult before preparing the plans along with the deadline for filing the plans with the Commission for approval.

| **Forest Service 4(e) condition no.** | **Description** | **Consultation** | **Due Date** |
|---|---|---|---|
| 3(3) | Revised Terrestrial Resource Management Plan | Terrestrial Resources Working Group | Every 5 years from license issuance |
| 3(3) | Adaptive Management Plan to monitor effectiveness of terrestrial resource measures | Terrestrial Resources Working Group | 1 year from license issuance |
| 3(3) | Long-Term Erosion Control Monitoring Program | Terrestrial Resources Working Group | 1 year from license issuance |
| 3(3) | Riparian Habitat Management Plans for Everett Creek and Boundary Wildlife Preserve (BWP) | Terrestrial Resources Working Group | 4 years from license issuance |

| Forest Service 4(e) condition no. | Description | Consultation | Due Date |
|---|---|---|---|
| 3(3) | Upland Habitat Management Plan for BWP, BWP Addition, Tailrace East, and Everett Creek | Terrestrial Resources Working Group | 4 years from license issuance |
| 3(5) | Road Maintenance Plan | Recreation Resources Working Group | 1 year from license issuance |
| 3(5) | Final Multi-Resource Interpretation and Education Program | Recreation Resources Working Group | 3 years from license issuance |
| 3(9E) | Tributary Management Plan | Fish and Aquatic Working Group | 1 year from license issuance |
| 3(9F) | Mill Pond Dam Site Monitoring and Maintenance Plan | Fish and Aquatic Working Group | Within one year of the Commission ending its jurisdiction over the Sullivan Creek Project |
| 3(9Ad) | Tributary Delta Predation Study Plan | Fish and Aquatic Working Group | 3 and 14 years from license issuance |
| 3(9C) | Forebay Hydraulic Study Plan` | Fish and Aquatic Working Group | Within 15 years of license issuance |
| 3(9G) | Design Plans for Native Fish Conservation [Propagation] Facility | Fish and Aquatic Working Group | Within 4 years of license issuance |

The licensee shall submit to the Commission documentation of its consultation, copies of comments and recommendations made in connection with each plan, and a description of how each plan accommodates the comments and recommendations. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information. The licensee shall also include with each plan filed with the Commission, documentation that the plan has been approved by the Forest Service. With regard to the Tributary Management Plan [Condition 3(9E)], the licensee shall provide a copy of the plan to the Sweet Creek residents for their review and comment prior to filing the plan with the Commission. The Commission reserves the right to make changes to any plan submitted. Upon Commission approval, each plan or recommended measure becomes a requirement of the license, and the licensee shall implement the plan or measure, including any changes required by the Commission.

(b) Requirement to File Reports

Certain conditions of the U.S. Forest Service's (Forest Service) section 4(e) conditions require the licensee to file reports with other entities. These reports document compliance with requirements of this license and may have bearing on future actions. Each such report shall also be submitted to the Commission. These reports are listed in the following table:

| **Forest Service 4(e) condition no.** | **Description** | **Due Date** |
|---|---|---|
| 3(1) | Operational Incidence Reports | Within 10 days of the incident |
| 3(8) | Aquatic Vegetation Bottom Barrier Effectiveness Reports | Within one year of license issuance, and by March 31 each year thereafter |
| 3(8) | Temperature Data and Attainment (Measure Implementation) Reports | Within one year of license issuance, and by March 31 each year thereafter |
| 3(8) | Total Dissolved Gas Data and Attainment Reports | Within one year of license issuance, and by March 31 each year thereafter |
| 3(8) | Aquatic Invasive Species Control and Prevention Plan Quality Assurance Project Plan (QAPP) | Nine months from license issuance |
| 3(8) | Dissolved Oxygen Attainment Plan QAPP | Nine months from license issuance |

| Forest Service 4(e) condition no. | Description | Due Date |
|---|---|---|
| 3(8) | Temperature Attainment Plan QAPP | Nine months from license issuance |
| 3(9) | Fish and Aquatics Management Plan Annual Compliance Reports | Within one year of license issuance and by March 31 each year thereafter |

Forest Service 4(e) condition number 3(9), provides for the filing of annual compliance reports. The purpose of these annual reports is to document all activities that occurred for each element of the Fish and Aquatics Management Plan for the preceding year. To facilitate Commission oversight of this license, the licensee shall also include in the annual reports a description of any activity planned for the upcoming year, in addition to the activities completed for the year.

The licensee shall submit to the Commission documentation of any consultation, and copies of any comments and recommendations made by any consulted entity in connection with each report. The Commission reserves the right to require changes to project operations, facilities, or measures based on the information contained in the reports and any other available information.

(c) Requirement to File Amendment Application

Certain Forest Service conditions contemplate unspecified long-term changes to project operations or facilities for the purpose of mitigating environmental impacts. These changes may not be implemented without prior Commission authorization granted after the filing of an application to amend the license. These conditions are listed below.

| Forest Service 4(e) condition no. | Description |
|---|---|
| 3(8) | Alternative methods of aquatic macrophyte control if bottom barriers prove inadequate |
| 3(8) | Future modifications to reduce dissolved oxygen levels in the reservoir |

Draft Article 402. *Funding*. Notwithstanding the limitation on expenditures as expressed in the mandatory conditions and included in this license, the Commission reserves the right to require the licensee to undertake such measures as may be appropriate and reasonable to implement approved plans and other requirements in this license.

Draft Article 403. *Operation Compliance Monitoring Plan*. Within one year of license issuance, the licensee shall file with the Commission, for approval, an Operation Compliance Monitoring Plan to ensure compliance with summer lake elevations required by Forest Service 4(e) condition 3(1). The plan at a minimum shall include:

(a) a detailed description of how reservoir levels will be measured to ensure compliance with summer diurnal lake elevation requirements of maintaining forebay water surface elevations at or above 1,984 feet NAVD 88 from 6:00 am through 8:00 pm and at or above 1,982 feet NAVD 88 from 8:00 PM through 6:00 AM from Memorial Day weekend through Labor Day weekend.

(b) a provision to file an operation compliance monitoring report by December 31 of the first complete year following license issuance and continuing annually by December 31 for each year thereafter for the term of the license, that documents the following for the previous water year (July through June): (a) Boundary reservoir hourly water surface elevations; and (b) if deviations from the targeted water surface elevations occurred, the reasons for the deviations and any proposals for corrective actions to avoid future occurrences, as appropriate.

The licensee shall include with the Operation Compliance Monitoring Plan, documentation of consultation with the U.S. Forest Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, and Washington Department of Fish and Wildlife; copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities; and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the consulted entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan shall not begin until the plan is approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

Draft Article 404. *Tributary Management Plan*. The Tributary Management Plan (TMP) developed by the licensee as part of the Fish and Aquatics Management Plan (FAMP), as required by Forest Service Condition 3(9E), shall include not only the details outlined in the FAMP, but shall also address (a) any potential health risks associated with the proposed use of rotenone, antimycin, or other chemical used in the eradication of fish from individual creeks, and (b) the potential for any chemical used to affect an individual's or entities' water supply. The licensee, in developing the TMP, shall consult with not only the Fish and Aquatics Working Group, but the Washington Department of Health and the U.S. Environmental Protection Agency, as well, to address any potential health risks associated with the use of such chemicals.

Draft Article 405. *Boundary Recreation Resource Management Plan*. The Boundary Recreation Resource Management Plan filed on March 29, 2010, and consisting of Exhibit 3, pages 1 through 48, and Appendices 1 through 8, is approved and shall be implemented with the following modifications:

Recreation Facility Capital Improvements

Within five years of license issuance, the licensee shall complete the recreation facility improvements identified in the recreation plan at the Forebay Recreation Area and the Metaline Waterfront Park Boat Launch.

Within seven years of license issuance, the licensee shall build the new Peewee Falls Viewpoint and Trail, the new Riverside Mine Canyon Viewpoint and Trail, and the new Metaline Falls Portage Trail and Boater Access Site as described in the recreation plan. Also within seven years of license issuance, the license shall complete the enhancements at the following designated dispersed shoreline recreation sites defined in section 4.3.2 and depicted on figure 4.3-1 of the plan: site 2 (BLM recreation area), 4 (Ledbetter Cove), 7 (Deadman's Eddy), 12 (Lime Creek), 13 (Monument Bar), and 14 (Wolf Creek). Following completion of the above recreational improvements, the licensee shall revise the project boundary as necessary to include the recreational facilities and dispersed recreation sites within the project boundary and file revised Exhibit G drawings in accordance with Article 203.

Within ten years of license issuance, the licensee shall complete the recreation facility improvements at the Vista House Recreation Area, at the Tailrace Recreation Area/Machine Hall Visitors' Gallery, and Eastside Trail.

As-Built Drawings

Within 90 days of completing construction of the recreation facilities described in the plan, the licensee shall file, for Commission approval, as-built drawings, pursuant to Article 303 that show the location (including GIS data), type, and layout of all the existing and newly constructed facilities in relation to the existing Boundary Project boundary.

Draft Article 406. *Columbia River Basin Fish and Wildlife Program.* The Commission reserves the authority to order, upon its own motion or upon the recommendation of federal and state fish and wildlife agencies, affected Indian Tribes, or the Northwest Power and Conservation Council, alterations of project structures and operations to take into account to the fullest extent practicable the regional fish and wildlife program developed and amended pursuant to the Pacific Northwest Electric Power Planning and Conservation Act.

Draft Article 407. *Use and Occupancy*. (a) In accordance with the provisions of this article, the licensee shall have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee shall also have continuing responsibility to supervise and control the use and occupancies, for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee shall take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee shall require multiple use and occupancy of facilities for access to project lands or waters. The licensee shall also ensure, to the satisfaction of the Commission's authorized representative that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee shall: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensee shall file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed. If no conveyance was made, the licensee does not have to inform the Commission.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must submit a letter to the Director, Office of Energy Projects, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Director, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee shall consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee shall determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed shall not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; and (ii) the grantee shall take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project shall be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article shall not apply to any part of the public lands and reservations of the United States included within the project boundary.

# APPENDIX B

## Sullivan Creek Project

## Draft License Surrender Conditions Recommended by Staff

## APPENDIX B Draft Sullivan Creek License Surrender Conditions Recommended by Staff

(A) *Surrender of the Sullivan Creek Project*. Surrender of the license for the Sullivan Creek Project No. 2225 is accepted, subject to the conditions set forth in ordering paragraphs (B) through (P). The surrender shall not be effective until the licensee has fulfilled these conditions and the Commission's Director, Division of Hydropower Administration and Compliance, has issued a letter stating that all conditions of the surrender order have been satisfied.

(B) *Special Use Authorization*. The licensee shall obtain a special use authorization as required by 36 CFR §251 for occupancy and use of National Forest System lands from the U.S. Forest Service for project facilities that will remain on National Forest System lands after the surrender becomes effective. The surrender shall not be effective until the licensee has filed a copy of the special use authorization with the Commission.

(C) *Removal Plans and Specifications.* At least 60 days before starting removal of the Mill Pond dam and the original log crib dam, and the restoration of Sullivan Creek, but no later than two years from this surrender order, the licensee shall submit one copy of the following documents to the Commission's Division of Dam Safety and Inspections (D2SI) - Portland Regional Office and two copies to the Commission (one of these shall be a courtesy copy to the Director, D2SI): (1) a detailed description of the sequence of activities and schedule for removing the project features and restoring the site; (2) final contract plans and specifications; (3) a Quality Control and Inspection Program required by ordering paragraph (F); (4) a Temporary Construction Emergency Action Plan required by ordering paragraph (H); (5) a blasting plan, if necessary; (6) a public safety plan for the period during removal activities; (7) a disposal plan; and (8) a detailed erosion and sediment control plan. The plans and specifications shall be based on the draft Mill Pond Removal Plan filed as Appendix E to the Sullivan Creek Settlement Agreement filed on March 29, 2010.

The implementation schedule required by item (1) above shall provide for commencing removal activities within three years of this surrender order and completing removal of Mill Pond dams, and restoring the Sullivan Creek channel within five years of the surrender order.

The licensee shall not begin removal activities until the Division of Dam Safety and Inspections - Portland Regional Office has reviewed and commented on the plans and specifications, determined that all preconstruction requirements have been satisfied, and authorized start of removal activities.

(D) *Removal Progress Reports.* During removal and restoration activities, the licensee shall submit one copy to the Division of Dam Safety and Inspections (D2SI) -

Portland Regional Office and two copies to the Commission (one of these copies shall be a courtesy copy to the Director, D2SI), of monthly progress reports.

(E) *Revegetation Plan.* Within two years from this surrender order, the licensee shall file, for Commission approval, a detailed revegetation plan describing site stabilization measures and riparian and upland plantings to restore Sullivan Creek. The plan shall be based on the measures included in the draft Mill Pond Removal Plan filed as Appendix E to the Sullivan Creek Settlement Agreement, and shall include, at a minimum, the following: (1) site preparation and design details; (2) detailed provisions for site stabilization; (3) a description of plant species to be used and where they will be planted, the source of plant materials, planting densities and methods, and fertilization and irrigation requirements; (4) a description of methods to control noxious weeds for 3 years after dam removal; (5) a description of a 3-year monitoring program, including performance standards and success criteria, that would include, at a minimum, 80 percent survival of trees and shrubs and 50 percent canopy cover of native species after 3 years from the date of planting; (6) procedures to be implemented if monitoring reveals that establishment of vegetation is not successful or areas of erosion are identified; and (7) an implementation schedule.

The licensee shall prepare the plan after consultation with the U.S. Fish and Wildlife Service, U.S. Forest Service, Washington Department of Fish and Wildlife, Washington Department of Ecology, Seattle City Light, and Kalispel Tribe. The licensee shall include with the plan documentation of consultation, copies of consulted entities' comments and recommendations on the completed plan, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No removal activities shall begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

A courtesy copy of the filed plan shall be sent to the Commission's Division of Dam Safety and Inspections-Portland Regional Office (D2SI-PRO) Regional Engineer and Director, Division of Dam Safety and Inspections.

(F) *Quality Control and Inspection Program.* At least 90 days before starting removal activities, the licensee shall submit one copy to the Division of Dam Safety and Inspections (D2SI) - Portland Regional Office Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, D2SI) of the Quality Control and Inspection Program (QCIP) for the Commission's review and approval. The QCIP shall include an erosion and sediment control plan as specified in ordering paragraph (C).

(G) *Cofferdam Construction Drawings and Specifications*. Before starting removal activities, the licensee shall review and approve the design of any new contractor-designed cofferdams and deep excavations. At least 30 days before starting construction of the cofferdams, the licensee shall submit one copy to the Commission's Division of Dam Safety and Inspections (D2SI) - Portland Regional Office Regional Engineer and two copies to the Commission (one of these copies shall be a courtesy copy to the Commission's Director, D2SI) of the approved cofferdam construction drawings and specifications and the letters of approval.

(H) *Temporary Construction Emergency Action Plan.* At least 90 days before starting removal activities, the licensee shall submit one copy to the Commission's Division of Dam Safety and Inspections (D2SI)- Portland Regional Office Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, D2SI) of the Temporary Emergency Action Plan (TEAP) for the Commission's review and approval. The TEAP shall describe emergency procedures in the case of failure of the dam during construction of the drainage tunnel and draining of the reservoir, any large sediment control structure, or any other water retaining structure that could endanger construction workers or the public. The TEAP shall include a notification list of emergency response agencies; a plan drawing of the proposed cofferdam arrangement; the location of safety devices, escape routes, and informational and warning signage; a brief description of testing procedures; and measures for managing traffic in the project area to ensure public safety during dam removal.

(I) *Sullivan Lake Cold Water Release Structure*. Within three years of this license surrender order, the licensee shall install a cold water release structure at Sullivan Lake dam. The structure shall consist of a 48-inch diameter pipe, fitted with fish screens that meet National Marine Fisheries Service design criteria of 0.4 feet per second (fps) approach velocity at the inlet, and routed through one of the three existing low-level outlet gates at Sullivan Dam, as described in the 95 percent draft design report filed January 27, 2011. At least 90 days prior to any ground-disturbing activities to install the intake structure, the licensee shall file, for Commission approval, final contract plans and specifications as required by ordering paragraph (C). Final plans and specifications shall include a spill prevention and control and hazardous materials plan, as needed.

The licensee shall maintain and operate the cold water release structure as described below in ordering paragraph (J).

The licensee shall prepare the final plans and specifications after consultation with the U.S. Fish and Wildlife Service, U.S. Forest Service, Washington Department of Fish and Wildlife, Washington Department of Ecology, Seattle City Light, and Kalispel Tribe. The licensee shall include with the final plan documentation of consultation, copies of consulted entities’ comments and recommendations on the completed plan, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. No ground-disturbing activities shall begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

A courtesy copy of the filed plan shall be sent to the Commission's Division of Dam Safety and Inspections-Portland Regional Office Regional Engineer and Director, Division of Dam Safety and Inspections.

(J) *Sullivan Lake Reservoir Operations and Levels*. Until the surrender becomes effective, as provided in ordering paragraph A, the licensee shall operate Sullivan Lake, as required below, to provide for recreation on Sullivan Lake, empty the reservoir in the fall to promote access to spawning habitat in Harvey Creek, and to protect aquatic resources in Outlet and Sullivan Creeks.

(1) Interim Operations

Prior to the construction of the Sullivan Lake Cold Water Release Structure required by ordering paragraph (I), the licensee shall operate the Sullivan Lake as follows:

a. *Spring Operations*: Each year, the licensee shall start refilling Sullivan Lake on or before April 1st and shall achieve and maintain a Sullivan Lake elevation of 2,588.6 feet (as measured at Sullivan Lake dam) by May 31, subject to hydrologic conditions and discharge requirements defined in ordering paragraph (K). Refilling rates shall also be adjusted as necessary to accommodate the Harvey Creek Bedload Mobilization activities, required in ordering paragraph (L).

b. *Summer Operations*: From June 1 through Labor Day of each year, the licensee shall maintain Sullivan Lake at elevation 2588.6 feet (full pool), subject to hydrologic conditions and discharge requirements defined in ordering paragraph (K).

c. *Fall Operations*: Starting the day following Labor Day each year, the licensee shall begin drawing down Sullivan Lake in a manner that reaches the maximum flow target of 200 cfs during periods of normal or below normal precipitation and 225 cfs during periods of higher than normal precipitation as quickly as possible, given the following constraints: (1) maintain discharge flows to meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period) and so as not to cause the combined waters of Outlet Creek and Sullivan Creek, as measured at the "below confluence water temperature gage," to exceed 16 degrees C; (2) reach a drawdown water surface elevation of 2,577 feet by November 15 and a water surface elevation of 2,570 by December 31, subject to hydrologic conditions and minimum discharge flows and associated temperature constraints described in ordering paragraph (K); (3) maintain an up-ramping rate not to exceed 80 cfs per day, as measured at the

U.S. Geological Survey (USGS) gage #12397100 on Outlet Creek, and ensure not to exceed a change of more than 2 degrees C in average daily temperature per day as measured at the below confluence water temperature gage; and (4) maintain a down-ramping rate not to exceed 10 cfs per hour, as measured at the USGS gage #12397100 on Outlet Creek

(2) Post-Cold Water Release Structure Installation

Upon completion of construction of the cold water release structure required by ordering paragraph (I), the licensee shall operate Sullivan Lake in the following manner each year:

a. *Spring Operations*: Each year, the licensee shall start refilling Sullivan Lake on or before April 1st and shall achieve and maintain a Sullivan Lake elevation of 2,588.6 feet (as measured at Sullivan Lake dam) by May 31, subject to hydrologic conditions and discharge flow requirements and associated temperature constraints defined in ordering paragraph (K). Refilling rates shall also be adjusted as necessary to accommodate the Harvey Creek Bedload Mobilization activities, required in ordering paragraph (L).

b. *Summer Operations*: From June 1 through Labor Day of each year, the licensee shall maintain Sullivan Lake at elevation 2588.6 feet (full pool), subject to hydrologic conditions and discharge flow requirements and associated temperature constraints defined in ordering paragraph (K). In addition, the licensee shall manage the discharges from the cold water release structure and the Sullivan Lake dam gates: (1) to meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period); (2) to the extent possible given Sullivan Lake temperatures, not cause the combined waters of Outlet Creek and Sullivan Creek, as measured at the "below confluence water temperature gage," to exceed 14 degrees C; and (3) to prevent the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 degree C, when daily average "above confluence water temperature" is less than 14 degree C.

c. *Fall Operations*: Starting the day following Labor Day each year, the licensee shall begin drawing down Sullivan Lake in the following manner: The licensee shall manage the discharges from the cold water release structure and the Sullivan Lake dam low level gates to meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period), and to the extent possible given Sullivan Lake water temperatures, prevent (1) the daily average "below confluence water temperature" from exceeding 14 degrees C, and (2) the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 degrees C, when daily average "above confluence water temperature" is less than 14 degrees C. The licensee shall maintain this operation until such time that Sullivan Creek temperatures fall below Outlet Creek temperatures, such that it is not be possible to maintain a 1-degree C water temperature difference (fall turnover, typically mid-October).

Subject to the temperature constraints described above, the licensee shall maximize discharge flows through the cold water release structure and minimize the use of the low-level gates at the dam during fall drawdown. When low level gates are used, releases shall be made from two gates simultaneously.

Maintain an up-ramping rate not to exceed 80 cfs per day, and a down-ramping rate not to exceed 10 cfs per hour, as measured at the Outlet Creek gaging station No. 12397100.

Subject to discharge requirements and associated temperature constraints, manage the releases to draw down the lake to reach a water surface elevation of 2,577 feet by November 15 and a water surface elevation of 2,570 feet by December 31.

After November 15, all releases from Sullivan Dam up to the capacity of the cold water pipe, shall be made through the pipe.

To the extent consistent with other constraints in this subsection, the fall drawdown shall be managed to provide discharge flows between 180 and 220 cfs on at least 3 weekends in September or October to support whitewater paddling. Discharge flows shall be forecasted and posted on-line one week in advance to support recreational use.

To the extent that there is a conflict between reservoir levels and discharge flows, the licensee shall comply with the discharge flow requirements required by ordering paragraph (K) below; reservoir levels shall be subject to, and subordinate to, all discharge flow constraints in this condition and ordering paragraph (K) below.

The licensee shall comply with the Sullivan Lake water surface elevations and discharge requirements described above at all times. These operations may be temporally modified if required by operating emergencies beyond the control of the licensee (e.g., equipment failures; natural disasters, such as floods; or drought conditions), by Harvey Creek Bedload Mobilization activities required by ordering paragraph (K), and for short periods of time upon mutual agreement with the U.S. Forest Service, U.S. Fish and Wildlife Service, Kalispel Tribe, Washington Department of Fish and Game, and Washington Department of Ecology. If an impoundment water surface elevation or discharge requirement is modified as described in the preceding sentence, the licensee shall notify the Commission as soon as possible, but no later than 10 business days after each such incident. The licensee shall document the modification in the annual operations report to the Commission required by Ordering Paragraph (M), including the reasons for the modifications.

(K) *Sullivan Lake Minimum Discharge Flows*. The licensee shall annually maintain minimum discharge flows in Outlet Creek, as measured at the Outlet Creek U.S. Geological Survey gaging station No. 12397100, as follows:

(1). June 1 through June 30: 30 cubic feet per second (cfs).

(2). July 1 through the end of fall drawdown (when the elevation of Sullivan Lake reaches 2,570 feet mean sea level, or by December 31): 20 cfs.

(3). From the date that Lake Sullivan reaches an elevation of 2,570 feet (expected December 31) until the beginning of spring filling per ordering paragraph (L) (by May 31): outflow shall equal inflow.

(4). From April 1 through May 31: 10 cfs or inflow, whichever is less.

If the licensee releases additional water between June 1 and the day after Labor Day, as contemplated in section 7.15 of the settlement agreement filed on March 29, 2010, the licensee shall manage Sullivan Lake discharges to ensure that any water released does not exceed two (2) times the minimum discharge flow described above, and is released at as steady a rate as possible, as measured by the day-to-day change in daily average cfs. Further, the licensee shall manage the discharges: (1) to meet state water temperature standards (16.0 ºC average daily maximum temperature over a seven day period); (2) to prevent the daily average "below confluence water temperature" from exceeding 14 degrees C; and 3) to prevent the daily average "below confluence water temperature" from deviating from the daily average Sullivan Creek "above confluence water temperature" by more than 1 degree C, when daily average "above confluence water temperature" is less than 14 degrees C.

The above discharge flows may be temporarily modified if required by operating emergencies beyond the control of the licensee and for short periods of time upon mutual agreement with the with the U.S. Forest Service, U.S. Fish and Wildlife Service, Kalispel Tribe, Washington Department of Fish and Game, and Washington Department of Ecology. If minimum discharge flows are modified as described in the preceding sentence, the licensee shall notify the Commission as soon as possible but no later than 10 business days after each such incident. The licensee shall document the modification in the annual operations report to the Commission required by Ordering Paragraph (M), including the reasons for the modifications.

(L) *Harvey Creek Bedload Mobilization Project*. The Licensee shall manage Sullivan Lake surface elevations to facilitate the mobilization of Harvey Creek bedload at the head of Sullivan Lake. The licensee shall operate Sullivan Lake as follows (the decision tree matrix filed as Exhibit 1, Appendix A, of settlement agreement filed on March 29, 2010, also summarizes the following):

(1) The licensee, in consultation with the Resource Committee contained in Appendix G to the settlement agreement, shall begin to examine available regional flow projections, snow pack data, and run-off forecasts by April 1 of each year to determine if the spring run-off can reasonably be expected to be at least 120 percent of the long term average.

(2) If the Resource Committee agrees, by April 20 each year based on the forecasts above, that the forecasts predict it will be a 120-percent or greater spring run-off year, the District shall hold Sullivan Lake level at no more than elevation 2,575 feet

until May 20 of that year, and the operating provisions described below shall be implemented.

(3) Flows shall be measured in Harvey Creek, as required by item 6 below. If before May 20 Harvey Creek reaches a flow of 250 cubic feet per second (cfs) or more, when the flow begins to recede from its peak, lake filling shall resume at its normal rate.

(4) On May 20, regardless of Harvey Creek flows, lake filling shall resume at its normal rate.

(5) After each year that the "lake level hold-down" is attempted as part of the Harvey Creek Bedload Mobilization Project, the licensee shall convene the Resource Committee by July 1 to review the effectiveness of the lake level hold-down, whether or not the forecasts were correct, whether or not a high flow event actually occurred on Harvey Creek, and whether or not the Harvey Creek flow was adequate to move sediments and bedload, thus achieving the goal of reducing sediment buildup at the Harvey Creek stream entrance to the lake. After four lake level hold-down events, the licensee shall convene the Resource Committee to determine if further operating changes are warranted or whether the Harvey Creek Bedload Mobilization Project should be discontinued. If the surrender has not become effective, the licensee shall file the report for Commission approval, with any proposal for continuing or discontinuing the lake level hold-down events.

The licensee shall prepare the report after consultation with the U.S. Fish and Wildlife Service, U.S. Forest Service, Washington Department of Fish and Wildlife, Washington Department of Ecology, and Kalispel Tribe. The licensee shall include with the report documentation of consultation, copies of consulted entities' comments and recommendations on the completed report, and specific descriptions of how the entities' comments are accommodated by the report. The licensee shall allow a minimum of 30 days for the entities to comment and to make recommendations before filing the report with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to Sullivan Lake operations or facilities based on the information contained in the report and any other available information.

6. The licensee shall install a new stream gage on Harvey Creek to U.S. Geological Survey standards, and shall operate and maintain this gage to collect the flow data required to implement the Harvey Creek Bedload Mobilization Project.

(M) *Operation Compliance Monitoring Plan*. Within 90 days of this license surrender order, the licensee shall file with the Commission, for approval, an Operation Compliance Monitoring Plan that would permit the licensee to demonstrate compliance with the Sullivan Lake level operations required by Ordering Paragraph (J), the minimum discharge flows required by Ordering Paragraph (K), the ramping rates required by Ordering Paragraph (J), and the temperature limits specified by Ordering Paragraphs (J) and (K). The plan at a minimum shall include:

(1) a provision for installing, operating and maintaining a flow gage and recording device at the Sullivan dam for the purposes of documenting compliance with lake levels;

(2) a provision for operating and maintaining the U.S. Geological Survey (USGS) gage #12397100 on Outlet Creek, in the event the USGS ceases to operate and maintain the existing gage;

(3) a provision for installing, operating, and maintaining a gage on Harvey Creek for the purposes of monitoring Harvey Creek flows to support the bedload mobilization project required by Ordering Paragraph (L), as well as documenting high flow events and flow peaks.

(4) a provision for installing, operating, and maintaining a continuous water temperature monitoring device on Sullivan Creek at least 300 feet downstream of the confluence with Outlet Creek, and a continuous water temperature monitoring device on Sullivan Creek upstream of its confluence with Outlet Creek and Sullivan Creek;

(5) a schedule for installing, maintaining, operating, and collecting data from the gages and temperature monitoring device provided for in items (1) through (4) above;

(7) a definition of low, average, and high-water years; and

(8) a provision for filing an operation compliance monitoring report by December 31 of the first complete year following the license surrender order and annually thereafter, until the surrender becomes effective as described in Ordering Paragraph (A). The report shall document the following for the previous water year: (a) Sullivan Lake reservoir daily water surface elevations; (b) daily temperatures from Sullivan Creek both above and below the confluence with Outlet Creek; and (c) if deviations from the targeted water surface elevations or water temperatures occurred, the reasons for the deviations and any proposals for corrective actions to avoid future occurrences, as appropriate.

The licensee shall include with the Operation Compliance Monitoring Plan, documentation of consultation with the U.S. Forest Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, and Washington Department of Fish and Wildlife; copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted entities, and specific descriptions of how the entities' comments are accommodated by the plan. The licensee shall allow a minimum of 30 days for the consulted entities to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing shall include the licensee's reasons based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan shall not begin until the plan is approved by the Commission. Upon Commission approval, the licensee shall implement the plan, including any changes required by the Commission.

(N) *Sullivan Dock and Launch Facility Improvements*. Within one year from the surrender order, the licensee shall, in consultation with Sullivan Lake dock and launch facility owners, evaluate the functionality of existing facilities under the operational regime required by Ordering Paragraph (K) and correct any functional deficiencies in the facilities to ensure that they can continue to be used under this operational program. Improvements to any U.S. Forest Service facilities must meet Forest Service standards and be approved by the Forest Service. Within 30 days of completing the repairs, the licensee shall file a report with the Commission, detailing the identified deficiencies and the repairs made.

(O) *Historical Resources Memorandum of Agreement*. The licensee shall implement the "Memorandum of Agreement Among the Federal Energy Regulatory Commission and the Washington State Historic Preservation Officer for Managing Historic Properties that May be Affected by Public Utility District No. 1 of Pend Oreille County's Surrender for the Sullivan Creek Project in Pend Oreille County, Washington (FERC No. 2225-015)", filed with the Commission on _______, 2011, including but not limited to the associated treatment plan for the project. Pursuant to the requirements of this Memorandum of Agreement, the licensee shall file for the Commission's approval a final treatment plan within 3 months of the issuance of an order accepting surrender of the license for this project. In the event the Memorandum of Agreement is terminated, the licensee shall continue to implement the provisions of its approved treatment plan until the licensee fulfills all of the requirements in the surrender order. The Commission reserves the authority to require changes to the treatment plan at any time until the surrender becomes effective pursuant to Ordering Paragraph A. A copy of the treatment plan shall be sent to the Commission's Division of Dam Safety and Inspections Portland Regional Office Regional Engineer and to the Director, Division of Dam Safety and Inspections.

(P) *Final Report.* Within 90 days after completing the activities required by this surrender order, the licensee shall submit one copy to the Commission's D2SI-PRO Regional Engineer and two copies to the Commission (one of these shall be a courtesy copy to the Director, D2SI) of a final report that demonstrates all the conditions of the surrender have been fulfilled.

## APPENDIX C

## STAFF RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The Commission staff issued its draft environmental impact statement (draft EIS) for the proposed relicensing of the Boundary Project and the proposed surrender of license for the Sullivan Creek Project on April 8, 2011. Staff requested comments on the draft EIS be filed by May 31, 2011. The following entities and individuals filed comments on the draft EIS.

| Commenting Entity | Date Filed |
|---|---|
| U.S. Environmental Protection Agency (EPA) | May 20, 2011 |
| U.S. Department of Agriculture – Forest Service (Forest Service) | May 27, 2011 |
| Washington Depart of Fish and Wildlife (DFW) | May 27, 2011 |
| Seattle City Light Department (Seattle) | May 27, 2011 |
| Pend Oreille County Public Utility District (District) | May 27, 2011 |
| Washington Department of Ecology (Ecology) | May 31, 2011 |
| U.S. Department of the Interior (Interior) | May 31, 2011 |
| Kalispel Tribe of Indians (Kalispel Tribe) | May 31, 2011 |
| Ms. Carol Jean Merrill | May 31, 2011 |
| Sweet Creek Ranch Residents (Sweet Creek residents) | June 6, 2011 |
| Mr. Larry Gragg, *et al*. | June 6, 2011 |
| National Marine Fisheries Service (NMFS) | June 8, 2011 |

Several Metaline Falls and Sweet Creek residents (Ms. Carol Jean Merrill, Ms. Sharon Gragg, Ms. Cory, and Mr. Larsen) provided comments during the May 10, 2011, meeting in Metaline Falls, Washington to discuss the EIS. Several entities also provided comments during the May 11, 2011, meeting in Spokane.

Below, we summarize the substance of the comments received, provide responses to those comments, and explain how the text of the draft EIS was modified, as appropriate, to address the comments. Unless otherwise noted, changes addressing editorial comments were made to the final EIS, but are not described below. Comments are grouped by topic for convenience. Likewise, on July 29, 2011, Ecology filed a letter stating that its comments on the draft EIS relative to the temperature monitoring were moot given the filing of Seattle's July 2011 version the Temperature Attainment Plan which contained revised provisions for temperature monitoring. Therefore, we do not discuss Ecology's comments below and have made no changes to the EIS to reflect Ecology's comments on this issue. However, the EIS has been revised to address the revisions to the Temperature Attainment Plan.

### PROCEDURAL AND GENERAL

***Comment***: Interior and the Washington DFW express concern that staff's recommended measures do not encompass the entirety of the Boundary settlement. The agencies reiterate their belief that the Boundary Project operations caused significant harm to the fish populations and aquatic habitat in the basin, and that the settlement represents a complete package of protection, mitigation, and enhancement measures that adequately offset project effects. They state that the staff-recommended alternative excludes key provisions[192] that may affect "the balance and tradeoffs negotiated for the conservation and development of fish and wildlife resources and associated recreation." As a result, Interior and the Washington DFW request that the Commission adopt the settlement without material modification.

The Kalispel Tribe states that all provisions of the Boundary settlement should be included in any license issued by the Commission, but notes that the Sullivan Lake tributary enhancement fund is of particular importance to the tribe.

***Response***: Staff has considered the comments made by Interior, Washington DFW, and the Kalispel Tribe concerning the measures staff did not adopt in the draft EIS. Staff's specific responses to the agencies' and the Kalispel Tribe's specific concerns are addressed in the requisite sections below.

***Comment***: In the draft EIS, the table of Forest Service's 4(e) conditions included as part of draft Article 401(a) reference to a Tributary Aquatic Habitat Improvement Monitoring Plan. Seattle questions this reference, believing that the reference really should be to the Tributary Management Plan (TMP) required as part of the Fish and Aquatics Management Plan (FAMP). Seattle states that the terminology "Tributary Habitat Improvement Monitoring" is a section heading within the Temperature Attainment Plan, and that no plan was required or contemplated for this monitoring

---

[192] The measures include: (1) the fund for habitat improvements in tributaries to Sullivan Lake; (2) the recreational fish stocking program; and (3) the fish tissue sampling program.

effort. Seattle also states that the proposed TMP would be filed with the Commission within 12 months of license issuance, along with its integrated schedule for implementing the measures identified in the FAMP for each creek.

***Response***: Upon further review of the Temperature Attainment Plan and the FAMP, staff concurs that it misinterpreted the proposed requirements of the two plans. Moreover, notwithstanding Seattle's comments on the draft EIS regarding what would be filed and when, in reviewing the FAMP, it is not clear as to whether the TMP would be filed along with the integrated schedule that would be filed within 12 months of license issuance. To address Seattle's comments and the ambiguity in the section 5.4 of the FAMP, staff has revised Article 401(a) to reference the Tributary Management Plan, and require that it be filed within 1 year of license issuance.

***Comment***: In the draft EIS, draft Article 401(b) required the reports identified in Forest Service 4(e) conditions 3(8) and 3(9) be filed within 1 year of license issuance and by December 31 each year thereafter. Seattle expresses concern that filing the reports by December 31 would result in incomplete reports of activities performed during that calendar year being filed with the Commission. Seattle states that, per the Boundary settlement, review procedures provide for an 80-day review by work groups and a meeting prior to filing the reports with the Commission. Seattle asks that the deadline for filing the reports be moved to March 31.

***Response***: Given the complexity of issues and license requirements, with regard to water quality and fisheries measures at the Boundary Project, the timeframe outlined in the settlement is reasonable. Therefore, draft Article 401(b) has been changed to require the filing of the reports by March 31 each year. However, it should noted that these articles could be further modified in any Commission order.

***Comment***: Draft Article 403 stipulates that Seattle file, within 90 days of license issuance, an Operation Compliance Monitoring Plan. Seattle is concerned that this time frame would not allow it to make the necessary modifications to the software and electrical equipment to facilitate operational monitoring activities at the Boundary Project. Seattle recommends that the plan be filed within 1 year of license issuance.

***Response***: Per the settlement, Seattle would implement the formalized reservoir limits in year 2 of the license, which would make the 90-day requirement unnecessarily restrictive. Therefore, draft Article 403 has been changed to require the Operations Compliance Monitoring Plan be filed within 1 year of license issuance.

***Comment***: In commenting on staff's draft Article 401, Seattle states that it proposes to file the Aquatic Invasive Species Control and Prevention Plan QAPP, the Dissolved Oxygen Attainment Plan QAPP, and the Temperature Attainment Plan QAPP with the

Commission within 9 months of license issuance, not the 6 months specified in the table.

***Response***:  Staff concurs because Seattle would need the additional time to obtain Ecology's approval prior to filing the plans with the Commission.  Therefore,the final EIS and draft Article 401 has been updated accordingly.

***Comment***:  The Forest Service recommends that Commission staff include the Forest Service's cost reimbursement agreement with Seattle in the staff alternative.  The Forest Service states that it annually files reports with FERC about the costs it incurs administering its responsibilities  under Part 1 of the Federal Power Act that are not otherwise reimbursed by project applicants, licensees or other sources.  The Forest Service states that contrary to Commission staff's assertion, Section 10(e)(1) of the Federal Power Act does not preempt agencies from securing reimbursement directly from licensees or new project applicants and that the reimbursement provided in Condition 4 ensures that measures required for the protection and utilization of the Colville National Forest will be reviewed and approved by the Forest Service within the timeframes established in the new license.

***Response***:  This is a legal matter that will be addressed in any order on the license application.

***Comment:***  The Forest Service states that the EIS should describe the potential effects of the following staff-recommended measures on the existing schedules within the settlement agreements and associated plans and measures:  (1) development of an operation compliance monitoring plan, (2) development of a more definitive schedule for implementing proposed capital recreation improvements, (3) development of a Sullivan Lake operation compliance monitoring plan, (4) development of detailed revegetation plan, and (5) completion of cultural resources mitigation documentation for the removal of Mill Pond dam.

***Response:***  As noted above, the schedule for the Boundary operations monitoring plan has been revised to reflect the proposed timeline to in the settlement agreement.  No other modifications are needed as staff's recommendations should be consistent or compatible with timelines proposed in the settlement agreements.

***Comment:***  The Forest Service states that the Executive Summary implies that the District would not be responsible for the operation and maintenance of Sullivan dam once the surrender of the FERC license is effective.

***Response:***  The summary has been revised to clarify that the District would continue to operate and maintain Sullivan Lake dam in accordance with a special use authorization.

***Comment:*** The Forest Service states that the draft surrender conditions for the following plans should include the Forest Service's approval authority as stipulated in the Sullivan Creek settlement agreement: Section C (Removal Plan and Specifications), E (Revegetation Plan), I (Sullivan Lake Cold Water Release Structure), J(1) (Interim Operations), and J(2) (Post Cold Water Release Structure Installation).

***Response:*** The draft surrender conditions require the District to consult with the Forest Service in developing the above plans. The licensee shall also include with each plan filed with the Commission, documentation that the plan has been approved by the Forest Service. The Commission has final approval authority.

**SEATTLE'S PROPOSED PROJECT OPERATIONS**

***Comment:*** Seattle recommends that the EIS be revised to reflect its proposal to continue both the assignment of 48 MW of Boundary Project power to the District (current license article 49) and the compensation to the District for the encroachment of the Boundary reservoir on the District's Box Canyon Project No. 2042 (current license article 48). The District supports the continuation of these requirements in the new license.

***Response***: The EIS as been revised to reflect that these provisions are included in Seattle's proposal. Whether these articles are included in the new license will be address in the Commission's decision on the license application.

**GEOLOGY AND SOILS**

***Comment***: In the draft EIS, the discussion of erosion around the Boundary reservoir shoreline included a statement that the project is responsible for 13.3 miles of the eroding length of the reservoir shoreline and a statement that eroding shorelines and landslides occur along approximately 22 percent of shoreline on Forest Service lands, with over half of the eroding shorelines rated as having a high potential for future erosion. Seattle requested that the total shoreline erosion length be separated into erosion attributable to project-related factors and erosion attributable to a combination of project-related and non-project factors. Seattle also stated that the 2.5 miles of shoreline erosion on Forest Service land is 16 percent of the overall length of erosion sites documented in the study.

***Response:*** The text was modified to separate out shoreline erosion due to project-related factors and a combination of project and non-project factors. The 22 percent shoreline erosion stated in the draft EIS referred to erosion occurring on Forest Service shoreline lands only, as opposed to the overall length of shoreline erosion referenced by Seattle. The text within the final EIS has been revised to clarify overall shoreline erosion and erosion on Forest Service lands only.

***Comment***: The draft EIS documented, on page 335, that there would be 40,000 cubic-yards of sediment disposed off-site. EPA states that the draft EIS does not identify or analyze locations for the disposition of the 40,000 cubic yards of sediment to be removed during the restoration of the creek channel. Seattle states that the 40,000 cubic yards of sediment within the restored stream channel referenced on page 335 would be deposited and graded on-site into the fill areas shown within the McMillan report, as stated on page 7 of the Mill Pond Decommissioning Plan.

***Response***: On page 3 of the decommissioning plan, the District states it would permanently dispose of sediment not left in place or utilized in restoration efforts at a non-Forest Service site. However, the McMillian Report seems to indicate that no off-site disposal will be necessary. The McMillan report referenced in the Mill Pond Decommissioning Plan indicates that sediment would be removed from the restored stream channel using a combination of mechanical removal and natural removal, and that the final Mill Pond dam removal and channel restoration design would determine how much of the 20,000 to 40,000 cubic yards of sediment present in the restored Sullivan Creek channel would be excavated. Those sediments that are excavated would be screened, the gravels removed and redistributed within the channel confines, and the fine sediments graded into the restored upland areas. However, the sediments not excavated from the stream channel are expected to be mobilized by stream flow, with ultimate deposition in Boundary reservoir. The EIS has been revised to include this information and clarify that no off-site disposal is expected. Further details on the volumes of stabilized channel sediments and mobilized channel sediments are expected in the final Mill Pond dam removal plan.

***Comment***: Ecology recommends that Seattle or the District produce a Sediment Assessment, Stabilization, and Management Plan for the Mill Pond dam decommissioning.

***Response***: Appendix B, Draft Sullivan Creek License Surrender Conditions Recommended by Staff, ordering paragraph C, includes a requirement for the District to provide a detailed erosion and sediment control plan to the Commission 60 days prior to the start of the removal of Mill Pond dam.

### WATER QUANTITY AND QUALITY

***Comment***: Ecology points out that the due date for the issuance of a 401 water quality certification for the Boundary Project, as shown in section 1.3.1.2, Clean Water Act, page 9 of the draft EIS, should be changed from September 3, 2010 to September 3, 2011. Ecology, as well as the District, also points out that the District withdrew and refiled its application for water quality certification for the Sullivan Creek Project, and that the new date for issuance is April 1, 2012. Ecology requests that section 1.3.2.1, Clean Water Act, page 12, be revised accordingly.

***Response***: On July 25, 2011, subsequent to the filing of Ecology's comments, Seattle withdrew and refiled its water quality certification for the Boundary Project. The EIS now reflects the due date of July 25, 2012, for the water quality certification for the Boundary Project and April 12, 2012 for the Sullivan Creek surrender.

***Comment***: Mr. Larry Gragg observes that the coldwater release facility proposed for the Sullivan Lake dam is likely to be scheduled and implemented before actions to remove the Mill Pond dam and restore affected reaches of Sullivan Creek are undertaken. Mr. Gragg recommends that Mill Pond dam be removed first. Mr. Gragg asserts that removing Mill Pond dam first would facilitate and expedite restoration of the aquatic habitat in Sullivan Creek by cooling the water flow sooner, which would support salmonid-related environments and salmon survival. Mr. Gragg also asserts that removing the Mill Pond dam ahead of constructing the coldwater release facility would allow the District and others to evaluate whether re-establishing the Sullivan Creek natural flow would "self-correct" the temperature throughout the creek, and determine whether the facility is needed.

***Response***: Staff agree that the removal of Mill Pond and the return of Sullivan Creek to a natural condition would contribute to lower water temperatures in Sullivan Creek. However, this action would not have any effect on water temperature in Outlet Creek or the portion of Sullivan Creek between the confluence of Outlet Creek and Mill Pond. As stated in the draft EIS, the water released from Sullivan Lake dam is the warmest water in the project area and the cold water release facility would have the potential to cool the temperature of these releases between 8º and 15º Celsius. This temperature reduction would have substantial benefits to aquatic life in Outlet Creek and in Sullivan Creek. Therefore, we have not changed our recommendation that the cold water facility be constructed in the time frame and manner proposed.

***Comment***: Mr. Gragg states that he and others are concerned about the possible disruption of the lake bed and associated silting that would result from the construction of the coldwater release facility at Sullivan Lake dam. Mr. Gragg asserts that construction activities associated with building and dismantling a coffer dam and placing and securing the tubing and pump system could adversely affect the habitat of the lake, as well as that of Sullivan Creek.

***Response***: As stated in the draft EIS, the construction of the cold water release facility could have negative effects on water quality, mainly from the disturbance of sediment on the lake bottom. These negative effects would likely be short term, as the sediment would settle back to the lakebed soon after construction is completed.

***Comment***: The Selkirk Conservation Alliance (Alliance) states that the final EIS should include a discussion of the geologic lift at the juncture of Lake Pend Oreille and the beginning of the Pend Oreille River. The Alliance notes that this lift could contribute to the notion that the water of the Pend Oreille River is already at an elevated temperature before it enters the project area.

***Response***: The data on record and presented in the draft EIS are sufficient to describe the temperature regime in the project area prior to the project's construction. While geologic lift at Lake Pend Oreille could be a contributing factor to natural water temperatures in the project area exceeding 20º C, it does not alter our analysis of project effects on water temperature in the Pend Oreille River.

***Comment***: The Alliance notes that according to the Aquatic Invasive Species Control and Prevention Plan, the nearest occurrences of zebra and quagga mussels to the project are in Utah, not in Southern California as the draft EIS states.

***Response***: Staff has corrected this in the final EIS.

***Comment***: The Alliance notes that the number and size of macrophtye beds in the Boundary reservoir reported in Table 3-14 are inconsistent with the numbers reported in the Aquatic Invasive Species Control and Prevention Plan.

***Response***: Seattle reports (see e-mail correspondence filed on June 30, 2011) that the numbers reported in the Aquatic Invasive Species Control and Prevention Plan are correct. Table 3-14 has been updated accordingly.

***Comment***: The Alliance states that in section 5.2.3, *Unavoidable Adverse Effects*, the wording is such that the statement that the conversion of "1,200 feet of Sullivan Creek to a natural stream/riparian habitat" could be construed as a negative effect. The Alliance recommends that the sentence read: Removal of the Mill Pond dam would result in the permanent loss of 63 acres of lake habitat.

***Response***: Staff concurs. The final EIS has been revised accordingly.

***Comment***: Washington DFW, Interior, and Ecology urge Commission staff to reconsider its recommendation not to include the proposed Fish Tissue Sampling Plan as part of the new license. The commenters state that the fish species, benthic organisms, and contaminated sediment depositional areas found in the project reservoir exist because of the impoundment created by the project. They further note that the project promotes recreational fishing in the project reservoir; therefore, it is reasonable to monitor the health of these fish.

***Response***: As noted in the draft EIS, the available data do not show that project operation affects the bioavailability of toxins in the project reservoir. However, as stated in the draft EIS, the Fish Tissue Sampling Plan is a Forest Service section 4(e) mandatory condition (Condition 3[8]) and would be made part of any new license issued for the Boundary Project.

***Comment***: The Forest Service and Ecology clarify that Ecology does have a state-wide fish tissue sampling program for the purpose of establishing consumption advisories. However, Ecology does not sample fish from the project area as the draft EIS suggests. Therefore, it is inappropriate to suggest that Seattle's efforts would be duplicative and unnecessary.

***Response***: The reference to Ecology's monitoring program has been removed from the final EIS. Nonetheless, staff's recommendation stands for the reasons noted above.

***Comment***: Seattle points to the statement on page 65 of the draft EIS that "pH measurements are on average 0.4 units higher in macrophyte beds than in the main channel of the Pend Oreille River." Seattle states that it does not disagree with this statement; however, it can not confirm this number as it did not calculate the value.

***Response***: This value was reported in a study from 2001 conducted by Duke Engineering and Services for Pend Oreille PUD. The study was conducted as part of the relicensing effort for the Box Canyon project (No. 2042).

***Comment***: Seattle states that we incorrectly cite the data from table 3.2, as well as the source of the statement that "Ecology's (2007) analysis for the Temperature TMDL indicates that areas of the Pend Oreille River in the Boundary Project area are not in compliance with the water quality standard for temperature (see table 3.2)."

***Response***: The source of that statement is Ecology's 2007 "Pend Oreille River Total Maximum Daily Load for Temperature Draft," so the citation on page 74 of the draft EIS is correct. The reference to Table 3.2 directs the reader to the table where they can find the state water quality standard for temperature.

***Comment***: Seattle notes that the schedule for filing a final TDG Annual Report and a quality control inspection program with Ecology and the Commission, as presented on pages 79-80 of the draft EIS, has been revised.

***Response***: Staff has updated the final EIS to reflect this new schedule.

***Comment***: In footnote 178, on page 318 of the draft EIS, staff states that any potential future modifications that may be made to address dissolved oxygen issues in the reservoir would require an amendment of the license. In response, Seattle states that the Dissolved Oxygen Attainment Plan does not identify future modifications to project operations or facilities.

***Response***: On page 6 of the Dissolved Oxygen Attainment Plan, Seattle states "Seattle will report DO data to Ecology on an annual basis, and after five-years of monitoring, in consultation with Ecology, determine if any further actions are needed." Staff interprets "further actions" to potentially include future modifications to project operations or facilities.  If modifications such as these were proposed in the future they would likely require an amendment of the license.

***Comment***:  The Forest Service states that the discussion in the draft EIS about Sullivan Lake surface elevations and discharges is confusing.  In particular, the Forest Service points to pages in the draft EIS where the reported values for maximum flows are inconsistent.

***Response***:  The only maximum flow proposal from Sullivan Lake is that the District would not release more than 200 cfs during dry and average water years, and 225 cfs during wet water years, until the construction of the cold-water release facility is complete.  Staff has revised the final EIS accordingly.

***Comment***:  The District points out that the cold-water release pipe does not act as a siphon, as the draft EIS would suggest, but as a gravity feed system.

***Response***:  Staff has corrected this characterization in the final EIS.

***Comment***:  The District states that the recommendation that it release all water from Sullivan Lake from the cold-water release pipe after November 15 annually is not consistent with the terms of the settlement agreement and would be impossible.  It explains that at times of high inflow, the cold-water release pipe would not have the capacity to pass all of the water needed to hold the lake level constant.  For that reason, the District suggests that the draft EIS be revised in four places to read "After November 15, all releases from Sullivan Dam, up to the capacity of the cold-water pipe, shall be made through the pipe.

***Response***:  Staff concurs that this modification to the language would be appropriate, and has revised the final EIS accordingly.

***Comment***:  The District states that Table 3-9 is misleading in that it identifies 10 cfs as the proposed discharge flow from Sullivan Dam in April and May, and that 10 cfs is actually a proposed minimum flow.  It also notes that this is the same flow regime in place currently at the project during these months.  The District also states that the text of the draft EIS incorrectly states "the proposed flow could result in less water in Outlet Creek in April, May, and June during average and wet water years."

***Response***:  The referenced text and table have been modified to better clarify proposed operational releases as recommended.

***Comment***:  The District states that table 3-9 shows historical monthly mean flows that are slightly high for the months of April and May, which could be misleading.  The District reports its calculated weekly average flow for each week in April and May based on 47 years of daily data from the Outlet Creek gage.  The District concludes that average monthly flow at the gate was 22.1 cfs in April (versus 24 shown in Table 3-9), and 32 cfs in May (versus 37 cfs shown in Table 3-9). However, in May, the average flow the first 3 weeks of month is only 18.3 cfs, and the monthly average is skewed upward by data from the last week of the month (average weekly flow 73 cfs) due to heavy snowmelt that typically hits the system starting in late May. The District suggests showing the actual weekly average flows in this table.

***Response***: Staff created Table 3-9 in the draft EIS, using available data from USGS stream gage No. 12397100, for water years 1959-2004, which reported monthly mean flows for April and May to be 23.5 and 37.4 cfs, respectively. To respond to the Districts comment, staff accessed all of the data from USGS 2010 water data report for stream gage No. 12397100 (found at: http://wdr.water.usgs.gov/wy2010/pdfs/12397100.2010.pdf). This report includes data from 1959-2010. The report shows that monthly mean flows for April and May are 22.8 and 37.5 cfs, respectively. Staff has updated Table 3-9 with these figures.

***Comment***: The District points out that staff states on page 98 of the draft EIS that the cold-water release facility would cool the water so much that it "would be possible to meet and even exceed state water quality standards for temperature." The District asks if we meant "going below" instead of "exceeding."

***Response***: The District's assumption is correct in that by "exceeding state water quality standards for temperature," staff does mean to "go below" the temperature limit set by the state. The final EIS has been revised to clarify staff's conclusion.

***Comment***: The District comments that FERC staff has placed some significance on the requirement for the proposed release of water from the Sullivan Lake dam to not exceed two times the proposed minimum flow release. The District states that this "two times" value is arbitrary and provides no benefit to fish and wildlife and hinders their operational flexibility. The District continues by asking FERC staff to re-consider this recommendation so that it is consistent with the Forest Service Special Use Authorization and the settlement agreement.

***Response***: Page 8 of Appendix A to the Sullivan Lake Settlement Agreement states that "the PUD shall release water at a rate…not to exceed 2.0 times the minimum discharge flow regime." On the same page, table 1 lays out the discharge flows for every week in June and July for both normal and wet water years. For 7 of the 8 weeks listed, the proposed discharge flow does not exceed two times the proposed minimum flow. However, for the first week of July when the proposed minimum flow is 20 cfs, the proposed releases for the water supply program would be 45 cfs in wet years. The proposal for this week violates the earlier requirement not to exceed "2.0 times" the minimum flow regime. Staff's recommendation to apply the "2X" maximum to all the weeks between the start of June and Labor Day was simply a continuation of the District's proposal. This recommendation would provide a benefit to fish in Outlet Creek by protecting them from sudden, high flows that may wash them from the system.

The District has provided no compelling argument as to why they should not comply with this "2X" proposal, which is part of the Settlement Agreement. Therefore, we have not changed our recommendation.

***Comment***: Ecology states that the description of measures outlined in the Boundary Project settlement agreement, as shown in the Abstract on the cover sheet of the draft EIS, fails to mention measures to address water quality issues.

***Response***: Staff added water quality to its description of resources affected by the proposed action.

***Comment***: Ecology comments that Table 3-2 should be updated to reflect that the water quality standard for Sullivan Creek downstream from Sullivan Dam should be a 7-day daily maximum daily average temperature of 16º C (Chapter 173-201A Washington Administrative Code) because waters on the Colville National Forest are to be protected for summer salmonid habitat and extraordinary primary contact recreation. It also points out that the final EIS should be updated to reflect this in multiple places.

***Response***: Staff has revised the final EIS accordingly.

***Comment***: Ecology comments that the TDG TMDL goal for the Boundary Project only applies "if conditions upstream of a dam exceed allocations and prevent meeting allocations downstream." Ecology also points out that the TMDL for TDG allocation in the Boundary tailrace is 69 mm of mercury above saturation.

***Response***: Staff has revised the final EIS accordingly.

***Comment***: Ecology points out that Seattle, as part of the Boundary Project settlement, proposes to collect temperature and pH data concurrently with DO measurements, as part of the Dissolved Oxygen Attainment Plan. Ecology notes that the draft EIS fails to mention these two other parameters.

***Response***: Staff has revised the final EIS accordingly.

***Comment***: Ecology comments that our description of the Boundary Project's cooling effect on water temperature in the tailrace in the second paragraph on page 74 of the draft EIS should be clarified. Ecology points out that, although the project does have a slight cooling effect on water released to the tailrace, water in the project area still sometimes exceeds state water quality criteria for temperature.

***Response***: The EIS acknowledges that water temperatures in the Pend Oreille River in the project area are not always in compliance with the TMDL.

***Comment***:  Ecology comments that additional temperature analyses and/or measures may be required in the future to comply with water quality standards and the Pend Oreille River TMDL.

***Response***:  Any future modifications that would alter project operations likely would require an amendment to any license the Commission may issue for the project, and would be considered at that time.

***Comment***:  Ecology comments that it has not been past Commission practice to approve Quality Assurance Project Plans for water quality monitoring programs.

***Response***:  Staff has revised draft Article 401.  The QAPPs for the Aquatic Invasive Species Control and Prevention Plan, the Dissolved Oxygen Attainment Plan, and the Temperature Attainment Plan have been moved to subsection (b), Requirement to File Reports.

***Comment***:  Ecology comments that our Scope of Cumulative Effects Analysis should acknowledge that Seattle declined Ecology's request to conduct bioassays on benthic and water column species.

***Response***:  The fact that Seattle declined this request from Ecology is already a part of the public record and the measures that Seattle proposes are clearly delineated in section 2.1.2 of the EIS.  Therefore, staff sees no reason to modify the discussion in section 3.2, *Scope of Cumulative Effects Analysis* as requested.

**AQUATIC RESOURCES**

***Comment***:  In the DEIS, staff did not recommend the $2.5 million dollar Sullivan Lake Tributary Fund because (1) the description of the measures that would be implemented in the tributaries to Sullivan Lake lacked sufficient specificity to evaluate the benefits, and (2) the habitat enhancements would not benefit resources affected by the continued operation of the Boundary Project and would serve no project purpose.  Interior, the Forest Service, and the Washington DFW believe there is sufficient nexus between the operation of the Boundary Project and enhancing aquatic habitat in watershed tributaries not directly connected to the Boundary Project's effect on aquatic habitat and organisms.[193]

---

[193] Interior notes that the Boundary settlement was clear in articulating that the off-site tributary enhancements were developed to address the ongoing effects of Boundary Project operations on about 17.5 miles of mainstem fish habitat upstream of the dam and about 1.5 miles of habitat downstream from the dam.  The Forest Service also comments on the loss of 17.5 miles of "formerly excellent coldwater sport fishing river."

Interior and the Washington DFW explain that the District's studies show that fish spawning in Sullivan Lake tributaries out-migrate, or get flushed out of tributaries, to stream reaches downstream of Sullivan Lake dam, which is expected to continue in the future because fish will continue to be entrained through the gates in Sullivan Creek dam into Outlet Creek when spring runoff and fall discharge flows exceed the capacity of the screened cold-water release facility. The agencies further explain that native salmonids from the Sullivan Lake tributaries contribute to the genetic diversity and overall strength of other native fish stocks in accessible tributaries below Sullivan Lake dam and other tributaries associated with the Boundary Reservoir. Finally, they state that the fund is for the specific purpose of improving aquatic habitat conditions in Sullivan Lake tributaries for salmonid use. Tributary restoration efforts will focus on restoring fish passage, reducing sediment input, increasing riparian and instream habitat complexity, streambank stabilization, and large woody debris placement. The agencies believe these measures will (a) improve fish habitat in the tributaries, (b) help increase cutthroat trout and kokanee populations in Sullivan Lake and elsewhere in the drainage, (c) reduce recreational fishing pressure on Boundary tributary streams, and (d) through out-migration, help strengthen native fish populations in the lower river and other Boundary tributaries. The Washington DFW considers the $2.5 million fund limited and focused on mitigation of impacts caused by the Boundary Project, and both agencies urge the Commission to reconsider its inclusion as part of the new license.

The Forest Service contends that there is sufficient clarity provided in the Boundary settlement for staff to adequately assess how the fund would be utilized. For example, the Forest Service notes that distributions from the fund would by made by the Fish an Aquatics Working Group (FAWG), and would be used to implement measures for improving connectivity in Harvey Creek, as well as reducing sediment input, increasing riparian and instream habitat complexity, streambank stabilization, and large woody debris placement in Noisy, Onata, and Jungle creeks, tributaries to Harvey Creek. The Forest Service states that the purpose of the fund is to improve stream habitats to produce more robust populations of westslope cutthroat trout, kokanee, mountain whitefish, and other species. This is intended to improve the sport fishing opportunities and experiences in the general area that have been lost due to the Boundary Project and its operation.

The Kalispel Tribe recommends Commission staff include the $2.5 million tributary enhancement fund in its recommended alternative for licensing the Boundary Project. The Kalispel Tribe comments that the habitat improvement measures will improve fisheries habitat within the tributaries, and contribute to more robust populations of cutthroat trout and kokanee populations in the Sullivan Lake. The Tribe believes that, through out-migration, this will have downstream benefits.

***Response***: Section 2.1.2.3, *Seattle's Proposal – Proposed Project Environmental Measures* of the EIS has been revised to include a general description of the types of measures that would be implemented in the tributaries to Sullivan Lake.

As explained in the draft EIS, improving habitat conditions in Sullivan Lake tributaries would benefit native fish populations in the Sullivan Lake drainage. The EIS also acknowledges that fish using, or that are produced in, Sullivan Lake tributaries can, and would continue to, move through the Sullivan Lake dam to downstream stream reaches, albeit on a more limited basis than under current operations due to the screening of the coldwater release facility. It is clear, though, that recruitment to stream reaches downstream from Sullivan Lake, and ultimately the Boundary Reservoir and its fishery, was not the intended objective of the resource agencies. This is evidenced by the recommended screening of the cold water release facility to prevent the loss of fish from the lake and the off-license agreement between the District and Washington DFW for compensation of those losses.

The intended benefits of the Sullivan Lake tributary enhancement fund to the fishery at the Boundary Project, however tenuously connected to project effects or purposes, would be difficult, at best, to discern. In contrast, the measures Seattle intends to implement for the tributaries directly connected to the Boundary Reservoir, which are to be further defined and filed for Commission approval, would have a clear nexus to the project and would provide significant enhancement to the fish resources and fishery in the Boundary Reservoir.

Therefore, the final EIS has not been revised to include the $2.5 million tributary enhancement fund as part of the staff-recommended alternative. Nonetheless, the tributary enhancement fund is a Forest Service section 4(e) mandatory condition (Condition 3[9I]), and would be included any new license issued for the Boundary Project.

***Comment***: In the draft EIS, staff states that Seattle proposes to establish a $2.5 million fund for habitat improvement measures in tributaries of Sullivan Lake, in lieu of opening up habitat upstream of the Sullivan Lake dam. Seattle comments that this is a mischaracterization of why the fund was proposed. Seattle notes that it proposed the fund as part of its comprehensive settlement package, and suggests that the "in lieu of" language be removed.

***Response***: The Forest Service (letter filed August 24, 2010) and the Washington DFW (letter filed September 3, 2010) point out that the parties to the Boundary settlement agreed that the need to protect habitat and refugia for native species upstream of the Sullivan Lake dam outweigh the passage of fish at the dam. Staff interpreted this to mean that the $2.5 million fund for habitat improvements was an "in lieu of" tradeoff.

Nonetheless, staff has modified the language in the final EIS to address Seattle's concern.

***Comment***: Interior and the Washington DFW comment that the purpose of the recreational fish stocking program is to mitigate for continuing project effects of water level fluctuations and fish entrainment on the fish community in the Boundary reservoir and Pend Oreille River downstream from the dam. Interior and the Washington DFW comment that the Settlement Parties agreed to stock trout in 18 lakes within a 15-mile radius of the project. The program would include monitoring at least six of the lakes each year, creel surveys on two lakes per year, and reporting.

The agencies question the assumptions made in the draft EIS that led staff to not recommend including the recreational fish stocking program as part of a new license. The agencies argue that staff's assumption that the measures included in the FAMP, including measures to reduce fish entrainment, would provide a native salmonid recreational fishery in the Boundary reservoir within a reasonable period of time is not correct. The agencies state that many of the measures would not be implemented within a reasonable time frame to yield such a fishery, particularly the measures designed to reduce fish entrainment. Moreover, Interior notes that the draft EIS recognizes a number of project effects that are either unavoidable or can not be completely addressed by the recommended measures. Interior and the Washington DFW point out the intent of the program is to direct fishing pressure away from native fish restoration efforts in the tributaries until a later time when recovery efforts have been fully achieved. The agencies point to input from Pend Oreille County citizens and County Commissioners that an adequate level of recreational angling opportunities needs to be supported in the vicinity of the project. For the aforementioned reasons, Interior and the Washington DFW urge the Commission to reconsider inclusion of the recreational fish stocking program as part of the license.

The Alliance also states that removal or reduction of non-native predators and competitors to native salmonids, necessary to the successful recovery efforts for native salmonids, reduces the recreational opportunity for fisherman. To compensate for this reduction and to avoid or reduce the probability of such fisherman from deliberately re-introducing such species into the mainstem and/or its tributaries, it is important to provide enhanced fishing opportunity in nearby lakes/ponds/streams.

***Response***: Staff does not dispute the fact that establishing a new fishery, based on native fish stocks, is likely to take time. While it may take some time, staff's recommended measures are expected to improve the fishery consistent with the management objectives of the Washington DFW.[194] In the EIS, staff recommend a variety of measures to improve the fish populations and the angling experience in Boundary Reservoir. For example, staff recommend measures that would improve (a) boat access to the reservoir (*see* Recreation Resource Management Plan and operational constraints between Memorial Day and Labor Day), and (b) water quality in the project area, as well as in the larger tributaries flowing into the reservoir (*see* unit operation to improve total dissolved gas and elements of the Water Quality Plan). In addition, staff recommends Seattle implement its FAMP, which include measures to: (1) improve spawning habitat for whitefish in the headwater of Boundary Reservoir; (2) reduce fish stranding during reservoir drawdowns; (3) improve fish passage and protection at the Boundary dam; (4) enhance aquatic habitat and passage conditions in tributaries that flow into the reservoir; and (5) facilitate the restoration of native fish to project waters through suppression and eradication of non-native trout in tributaries stocking native trout.

In their comments, the agencies indicate that the purpose of the recreational fish stocking program is to address the on-going effects associated with water level fluctuations and fish entrainment on the fish community in the Boundary reservoir and Pend Oreille River downstream from the dam. The Washington DFW could have continued to support Seattle's past stocking efforts to address these effects. However, the Washington DFW, for a number of reasons, elected to no longer support stocking in the Boundary Reservoir, and shift its focus, instead, to native fish restoration. Staff understands the agency's desire to manage for native fish, while also providing recreational angling opportunities in the project area. There would be a public benefit to stocking fish in area lakes that have the habitat and other conditions to support a recreational fishery. However, providing a non-native fishery in non-project lakes is not the responsibility of a licensee.

The underlying argument(s) advanced by the agencies remains the same, and the agencies provided little, if any, new information in this regard. Therefore, the final EIS has not been revised to include the fish stocking program as part of the staff-recommended alternative. Nonetheless, the recreational fish stocking program is a Forest Service section 4(e) mandatory condition (Condition 3[9H]), and would be part of any new license issued for the Boundary Project.

---

[194] The Washington DFW states that it no longer plans to support Seattle's 10-year-old program of planting triploid rainbow trout in Boundary reservoir. The Washington DFW cites a number of reasons for this change (*see* License Application at E-29, E-30, and E-161), including: (a) low catch rates; (b) poor salmonid habitat conditions in the reservoir; (c) low survival and retention in the reservoir; and (d) competition with native species.

***Comment***: The U.S. Environmental Protection Agency (EPA) comments that it is not opposed to the placement of 1,500 cubic yards of screened gravels between river mile 29.1 and the Box Canyon dam to increase potential mountain whitefish spawning habitat. EPA clarifies, though, that this action would constitute a discharge into waters of the United States and, thereby, require a section 404 permit under the Clean Water Act. EPA requests that the final EIS document make note of Seattle's need to obtain this permit.

***Response***: Staff agrees, and has revised the language in the final EIS accordingly.

***Comment***: Several entities comment that the draft EIS presents conflicting information with regard to the presence of bull trout in Sullivan Creek. Interior, the Washington DFW, and the Kalispel Tribe comment that bull trout have been found in lower Sullivan Creek, and statements in the draft EIS to the contrary are inaccurate. The District, however, comments that no bull trout have been found in Sullivan Creek or its tributaries, and requests that statements to the contrary be corrected.

***Response***: Staff has reviewed the information in the record on this issue, and finds that bull trout are known to occur in portions of Sullivan Creek. For instance, McLellan (2001), and Seattle (2009b; *Fish Distribution, Timing, and Abundance Study Final Report*) report that bull trout are present, and have been found in, lower Sullivan Creek. To date, no studies or surveys have found bull trout in the mid- to upper Sullivan Creek drainage. Therefore, staff has revised the final EIS to clarify the bull trout's current distribution in Sullivan Creek.

***Comment***: Seattle notes that staff, on pages 239 and 242-243 of the draft EIS, uses language that suggests that bull trout are known to occur in Sullivan Lake and its tributaries. Seattle states that using such language is misleading, in that bull trout have not been found in Sullivan Lake or its tributaries. Seattle questions whether it is appropriate to include a discussion related to entrainment at the Sullivan Lake dam under the Effects and Findings section for bull trout.

***Response***: Staff concurs that there is currently no evidence of bull trout occupying habitat in Sullivan Lake or its tributaries. However, releases from Sullivan Lake dam have the potential to affect bull trout using Sullivan and Outlet creeks downstream from the dam. Thus, staff revised this discussion in the final EIS to be more reflective of the fact that bull trout currently do not exist upstream of the Sullivan Lake dam.

***Comment***: Interior and the Washington DFW note that the draft EIS states that "Sullivan Lake is formed by the impoundment of Harvey, Noisy, and Hall creeks." The agencies clarify that Sullivan Lake was a natural lake prior to the construction of the Sullivan Lake dam, which raised the elevation of the lake about 26 feet. The agencies request that the final EIS make this correction.

***Response***:  Staff has revised the final EIS to clarify this element of the project area description.

***Comment***:  Interior and the Washington DFW comment on the membership of the Resource Committee (*see* Appendix G of the Sullivan Creek Project settlement agreement), as constituted in footnote 104, on page 164, of the draft EIS.  The Washington DFW states that it should be listed as a represented agency.  Interior indicates that the membership, as referenced in the footnote, is not complete, and requests that the footnote be revised to include all listed parties on the Resource Committee.

***Response***:  Staff agrees, and has revised the final EIS accordingly.

***Comment***:  The District comments on staff's conclusion that the Sullivan Lake dam is a complete barrier to fish passage.  The District states that when the gates at the dam are opened, downstream passage occurs, and fish are entrained to areas of Outlet and Sullivan creeks downstream from the dam.

***Response***:  Staff recognizes that downstream movement of fish occurs, and will continue to occur, through the Sullivan Lake dam.  However, the dam will continue to pose a barrier to upstream movement of fish, which is the context in which the original statement about the dam being a barrier was made.  Nonetheless, staff has clarified the language in question in the final EIS, accordingly.

***Comment***:  The District notes that there is a discrepancy in the draft EIS regarding the design criteria for the cold water pipe inlet screens at the Sullivan Lake dam.  The District states that on page 243, footnote 149, of the draft EIS, staff observed that the screens would be designed to meet a maximum approach velocity of 0.4 fps, whereas on page 338, table 5-4, and in Appendix B, page B-3, the design criteria includes an approach velocity of 0.2 fps.  The District observes that this discrepancy appears to be an artifact of changes in the design that are associated with an automated cleaning system.  The District states that the correct criteria is 0.4 fps, and requests that staff change the references in the final EIS to 0.4 fps.

***Response***:  Staff has reviewed the information on the design of the cold water release facility and agrees that the appropriate design value is 0.4 fps.  This change has been made in the final EIS.

***Comment***:  Seattle states that staff's characterization of the abundance for mountain whitefish and burbot in the Canyon and Upper Reservoir reaches, respectively, are incorrect.  Seattle notes, as depicted in table 3-11 of the draft EIS, whitefish and burbot are both "occasionally observed" in their respective reservoir reaches.

***Response***:  Staff has made the requisite changes to the language in the final EIS.

***Comment***:  Seattle comments that staff's use of the terminology "downstream passage facility(ies)" is inaccurate.  Seattle notes that it proposes to implement a fish entrainment reduction program, not construct downstream fish passage facilities at the project.

***Response***:  Staff has revised the language in the final EIS accordingly.

***Comment***:  Seattle comments that staff's statement that bull trout migrate from streams a few weeks after emerging from the gravel is inconsistent with the literature.  Seattle states that migratory bull trout typically live in stream for 2 to 3 years prior to outmigrating into larger streams, lakes, or reservoirs.

***Response***:  Staff has revised the language in the final EIS accordingly.

***Comment***:  Footnote 117, on page 200 of the draft EIS, states that the Boundary Project *typically* operates with a 20-foot drawdown, from elevation 1,994.0 to 1,974.0 feet NAVD 88.  Seattle notes that operating the project as it currently operates would result in forebay water elevations *generally* fluctuating between 1,994.0 and 1,974.0 feet NAVD 88, which led to the proposed restrictions to the drawdown between Memorial Day weekend through Labor Day weekend.  In addition, Seattle states that using "*typically*" implies a "daily" drawdown of 20 feet, which is not the case.

***Response***:  Staff revised this footnote in the final EIS by providing a better description of the operating parameters of the project.

***Comment***:  Seattle indicates that the draft EIS, on page 209, makes reference to the species captured during the fyke net study and that salmonids represent less than 5 percent of the total number of fish captured.  Seattle clarifies that no native salmonids were captured to the fyke net effort, and all salmonids captured were non-native or of hatchery origin.

***Response***:  Staff revised this discussion in the final EIS accordingly.

***Comment***:  On page 215 of the draft EIS, staff indicates that Northern pikeminnow, burbot, cutthroat trout, and bull trout are native to the Pend Oreille River system. Seattle notes that, to its knowledge, burbot are not native to the Pend Oreille system.

***Response***:  Staff reviewed the historical distribution of burbot and northern pikeminnow in the Pend Oreille River.  Staff agrees that burbot is not a native species to the Pend Oreille system.  Thus, staff revised this discussion in the final EIS accordingly.

***Comment***: The Sweet Creek Ranch residents, represented by Sharron and Larry Gragg (herein referred to as the Sweet Creek residents), commented on four aspects of Seattle's proposed FAMP. First, the Sweet Creek residents note that under the FAMP several areas along Sweet Creek could be improved through riparian planting. The Sweet Creek residents state that before granting access, they would want to know the specific areas to be planted and what the riparian planting would encompass. Second, the Sweet Creek residents note that Sweet Creek floods during the spring run-off, and that the large woody debris (LWD) placed in the upper delta area of the creek is likely to be washed away; potentially making this habitat improvement a waste of time and money. The Sweet Creek residents request that this be further studied. Third, the Sweet Creek residents state that they do not believe that improvements to the culvert for Highway 31 would cause problems with their domestic water wells adjacent to the creek. Nonetheless, the Sweet Creek residents ask to be informed prior to, and when, the culvert improvements taking place. Fourth, the Sweet Creek residents express concern regarding the proposed suppression or eradication activities that target non-native fish in the Boundary watershed. The Sweet Creek residents note that Sweet Creek provides drinking water and domestic use water for the ranch residents, as well as water used by the Selkirk school complex. The Sweet Creek strongly request that no chemicals be introduced into Sweet Creek or its adjacent areas.

***Response***: As stated in the EIS, the proposed FAMP includes conceptual plans for the habitat improvements to be made on Sweet Creek, which include riparian buffer protections and plantings, large woody debris placement, and culvert improvements for Highway 31. Moreover, the FAMP recognizes the existing uses of the creek, and the consultation process laid out in the FAMP should address many, if not all, the concerns of the Sweet Creek residents. Nonetheless, staff addresses the Sweet Creek resident's concerns below. Specific to the measures implemented for Sweet Creek,[195] staff anticipates that Seattle would discuss its plans for Sweet Creek with the Sweet Creek residents, and staff expects Seattle to provide the completed plan to the residents for their review and comment prior to it being filed with the Commission for approval. Staff has modified the language in Article 401(a), accordingly.

The Sweet Creek residents seek more information regarding the specific areas where riparian planting would occur, and what such planting would entail. Given that the residents own a good portion of the riverbank area and riparian land in question, this is a reasonable request on the part of the residents. Staff anticipates that Seattle would

[195] Seattle proposes to develop and file with the Commission, within 12 months of license issuance, an integrated schedule, which has been approved by the FAWG, for the completion of the tributary aquatic habitat enhancements outlined in section 5.4 of the FAMP. Seattle proposes to develop a TMP that would include a section specific to each tributary where habitat enhancements are proposed.

discuss such matters with the residents as it develops and finalizes its habitat restoration plan for Sweet Creek.

Under the FAMP, LWD would be placed from the mouth of Sweet Creek up to river mile (RM) 0.6, and would include the upper end of the Sweet Creek delta. As stated in the FAMP, the specific location and design of the LWD jams would be determined during implementation planning by Seattle, in consultation with and subject to approval by, the FAWG. The orientation and construction of each LWD jam would be based on site-specific hydraulic and channel conditions. Thus, staff sees no reason why the habitat improvements (e.g., log jams) designed for, and placed in, Sweet Creek would not be capable of withstanding the full range of hydraulic and channel conditions experienced in Sweet Creek, including flooding and high flow conditions.

Staff recognizes that, under the FAMP, Seattle proposes to use chemicals as part of its non-native fish eradication efforts, specifically rotenone,[196] antimycin,[197] or an equivalent fish toxicant. Staff notes that rotenone and antimycin are commonly used as fish toxicants in fishery management applications. These chemicals are registered by EPA, and their use is strictly regulated. If used and applied in accordance with requisite guidelines, there should be little, if any, risks associated with the proposed use of the chemicals.[198]

To ensure that the Sweet Creek residents' issues are addressed, however, Seattle should consider the residents' concerns as it develops the TMP. The FAMP states that the details of the program, including the specific chemicals to be used, their concentration, and the number of treatment and detoxification stations would be determined during the planning process and would be subject to approval of the FAWG. In addition to these details, the final TMP filed with the Commission for approval should also address (a) any potential health risks associated with the proposed

---

[196] Rotenone is water soluble and can last up to six months in water. It is used in solution as a pesticide and insecticide, or in emulsified liquid form as a piscicide (or fish poison). It is considered mildly toxic, with minor and transient environmental side-effects. It's found naturally in certain plants. *See* http://en.wikipedia.org/wiki/Rotenone and http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35133.

[197] Antimycin is only slightly soluble in water. It is the active ingredient in Fintrol, a piscicide used in fisheries management and in the catfish industry. There is no consensus as to its toxicity. Antimycin is produced by *Streptomyces* bacteria. *See* http://en.wikipedia.org/wiki/Antimycin_A; http://www.angelfire.com/ak2/chemists/rod9.html; and http://www.pesticideinfo.org/Detail_Chemical.jsp?Rec_Id=PC35392.

[198] There is little, if any, evidence to suggest that either or both chemicals proposed for use in the eradication program would be a groundwater contaminant.

treatments, and (b) the potential for any chemical used to affect an individual's or entities' water supply. Finally, Seattle should address these issues with not only the members of the FAWG, but also the appropriate state entity tasked with protecting public health; in this case, the Washington Department of Health.

***Comment:*** In footnote 178 of the draft EIS, staff alert Seattle and other interested parties that the term of any future license is a matter for the order on the license application, thus measures that contemplate actions beyond 30 years (e.g., entrainment mortality reduction measures) may require adjustments in the implementation schedule depending on any future license term set by the Commission. The Alliance states this conflicts with other statements in the draft EIS that acknowledges actions beyond the 30-year timeframe.

***Response:*** The EIS evaluates the actions and timeframes proposed by settlement parties. However, as noted above, this footnote is merely to alert the parties that adjustments in the various implementation schedule may be required if the license term is shorter than the 50 years sought by Seattle.

## TERRESTRIAL RESOURCES

***Comment:*** The Shoreline Management Program (SMP), an element of the Terrestrial Resources Management Plan, identifies the need to define and map appropriate shoreline land use designations, to develop and implement guidelines for permitting private and public (non-federal) shoreline development, to manage debris accumulation and removal, and to create and implement a project public safety and education program. Ecology recommends that Seattle coordinate closely with Pend Oreille County and Ecology to assure that its "Plan" is compliant with the Shoreline Management Act and the Pend Oreille County's Shoreline Master Program, which is currently being updated and is jointly administered by the county and Ecology. Ecology also advises against using the acronym "SMP" because this is the common acronym of regulatory programs that are mandated by the Shoreline Management Act.

***Response:*** Section 3.8.2.1 has been revised to indicate that the Shoreline Management Program is structured to be consistent with the Pend Orielle County Shoreline Master Program and that Seattle would coordinate with Ecology and Pend Orielle County during its development.

***Comment:*** The Forest Service states that Commission staff misrepresented how land acquisition targets will be achieved. The DEIS says that the 13,022 lineal feet of varying habitats immediately adjacent to water features are to be contained in the 158 acres of diverse riparian and upland habitats. The Forest Service says that the targets may be accomplished and applied to the same parcel of land, provided that the parcel meets the described criteria (see Section 5.2 Habitat Management, Enhancement and Protection Program of the Terrestrial Resource Management Plan).

***Response:*** The FEIS has been revised to clarify the proposed requirements.

### RECREATION, LAND USE, AND AESTHETICS

***Comment***: The DEIS states that the existing project boundary encloses about 2,720 acres based on the approved Exhibit K drawings on file with the Commission. Seattle stated that it has updated its calculations to state that the land within the project boundary is 2,684 acres. Seattle also states that various staff estimates of acreages, numbers of roads, and road lengths listed in the DEIS have not been confirmed by Seattle.

***Response***: Acreages for the existing project boundary are based on the approved Exhibit K drawings on file with the Commission. Upon approval of the revised exhibit G drawings, the acreages for the approved project boundary, and the acreage of all federal lands for the purpose of calculating federal land use and occupancy charges will be updated. In areas where Commission staff was not provided with an acreage or length necessary for a description of the project area, Commission staff estimated the value based on Seattle's proposed exhibit G maps or the GIS files provided by Seattle. The FEIS has been updated to include the word "estimated" or "approximately" with all lengths, acreages, or road numbers that were not explicitly provided by Seattle or on file with the Commission. Commission staff expect Seattle to file revised exhibit G maps that conform to sections §4.39 and §4.41 of Commissions regulations enclosing the revised project boundary as proposed by Seattle, and enumerating overall acres within the project boundary and acres of federal lands.

***Comment***: The Alliance states that for many long-term residents of Metaline Falls , WA, area and others who have visited the area over many years, the removal of Mill Pond dam will prove a dramatically, but very localized change in vista. These concerns were also expressed by Ms. Merrill at the draft EIS meeting in Metaline Falls.

***Response***: Section 3.9.2.2 has been revised to reflect the localized change in the viewshed that would result from the removal of Mill Pond dam and the perception of those visitors to Mill Pond dam.

### CULTURAL RESOURCES

***Comment:*** The Forest Service recommends that the final EIS disclose the potential effects to cultural and historical resources associated with the construction of the cold water release structure and the procedural steps that should be taken to protect such resources.

***Response:*** Section 3.10.2 of the EIS has been revised to address possible effects from construction activities in the vicinity of the cold water release facility and to reflect staff's recommendation for the District to conduct a cultural resource inventory in the area prior to beginning any land-disturbing activity. The EIS has also been revised to reflect staff's recommendation that the District consult with the FS and SHPO to ensure that the final design of the cold-water release facility appropriately considers and protects the integrity of the existing Ranger District and Depression-era Civilian Conservation Campground in order to retain the district's National Register character.

**SOCIOECONOMICS**

***Comment:*** The District states that the EIS should contain a review of the adverse economic consequences to the District of the decision to grant the Boundary license to Seattle, which lead to the Commission decision to include Article 49 in the Boundary license requiring Seattle to assign 48 MW to the District. The District agrees that a decision to continue the assignment of 48 MW of Boundary power to the District would not result in environmental impacts as it would be a continuation of the existing environment. However, a decision to terminate the assignment would have socioeconomic implications related to the District resorting to alternative power sources. The District states that the EIS should acknowledge that the District would be required to seek alternative sources of power at much higher costs, that these costs would result in higher rates to its Pend Orielle County customers, and the imposition of such higher costs would in turn have serious consequences on the future development of the county—an area of that is already economically distressed. Seattle states that the draft EIS's analysis of Boundary's socioeconomic effects expressly assumes the continued assignment of 48 MW to the District. Both Seattle and the District recommend that the Commission include a requirement in the new license to continue to assign 48,000 kW of Boundary Project power to the District.

***Response:*** As stated in section 2.1.2.2, the allocation of power is a matter for Commission consideration in any order on the license application and silence on any such future action in the EIS should not be assumed to reflect future Commission action. The allocation of power to either Seattle or the District would cause either entity to seek alternative sources of energy to meet its customer's demand. The effects of whether or not specific power sales contracts are renewed in the future was not addressed because we don't know which contracts will or will not be renewed. Nor do we need to know. While we agree that if a particular entity's contract is not renewed that entity could be adversely affected; however, that amount of project power would presumably go to another entity(s) which would benefit.

***Comment:*** The District recommends that the socioeconomic analysis address the District's recommendation that Seattle's obligation in Article 48 to compensate the

District for encroachment on Box Canyon be carried over to the new license. The District summarizes the existing agreements between Seattle and the District for said compensation which is to remain in effect until the earlier of (a) the date on which the Boundary license expires (including annual licenses), without renewal or extension; or (b) the license is transferred to another entity by Seattle. The District notes that section 3 of the 2005 Encroachment Agreement provides that by compensating the District under such agreement Seattle satisfies its obligations under Article 48 of the license, "or under a comparable article of a successor FERC license held by Seattle for Boundary". Seattle states that because the draft EIS is silent as to any change to Seattle's obligation to compensate the District for encroachment, it implicitly also assumes the continuation of that obligation. Both the Seattle and the District recommend that the new license include a requirement to compensate for the District for encroachment on Box Canyon.

***Response:*** The EIS was revised to indicate that this is a condition of the existing license and its continuation a proposal by Seattle. However, continuation of such a requirement is a matter for Commission consideration in any order on license application and would not result in environmental effects; thus it is not considered further in the EIS. As note above, silence on any such future action in the EIS should not be assumed to reflect future Commission action.

***Comment:*** Ms. Merril commented that instead of removing Mill Pond dam we should keep it to provide water to support irrigators and salmon. As a popular camping spot, she noted that its removal would result in the loss of tourism and much needed money to the county.

***Response:*** As stated in section 2.2.1.3, Mill Pond dam has an open, unregulated spillway and no storage, so flow out the project is about equal to inflow. Without modification, Mill Pond dam would not be capable of providing the water storage suggested by Ms. Merril. The District does not wish to obtain a new operating license for the project and proposes to remove Mill Pond dam. The Commission can not compel a licensee to seek a new license or continue to operate the project. It can only require measures to ensure that the surrender is done in a manner that is consistent with its public interest responsibilities. The EIS recognizes the lost recreational opportunities associated with the removal of Mill Pond as well as the benefits that would be achieved to other environmental resources.

#### DEVELOPMENTAL ANALYSIS

***Comment***: Seattle stated that the values presented by the Commission and referenced to Seattle in table 4-1 differ than the values presented by Seattle in addendum D to the license application. Seattle also states that the Commission should have used the cost value of $51.75 used by Seattle in their economic analysis of the project.

***Response***:   Staff has modified table 4-1 and footnotes to reflect where Commission staff modified Seattle's submissions to make the analysis consistent with Commission policy for economic analysis.  To obtain the value for project power, Commission staff used a weighted average of $32.92, comprised of an on-peak value of $35.70 and an off-peak value of $28.62, as reported by Seattle in its exhibit D addendum.  The Energy Infrastructure Agency in their Annual Energy Outlook for 2011 report (available at http://www.eia.doe.gov/oiaf/aeo/index.html) reported that the 2009 total cost for electric power generated by natural gas in the Pacific region for 2010 was estimated to be $36.30/MWh.  As this value is close to the value reported by Seattle in their addendum to exhibit D, Commission staff have no basis for changing this value in the final EIS to the significantly higher value of $51.75.

***Comment***:  In the DEIS, Commission staff used a value of 3,572,750 MWh for annual generation under the no-action alternative and a value of 3,612,588 MWh as the anticipated generation after the completion of efficiency upgrades to turbines 55 and 56. Seattle stated that they used a model based on the optimization of project operations for the average year (2002) using the Scenario Tool to calculate a value of 4,110,505 MWh generated.

***Response***:  As previously stated in the DEIS, the value used by Commission staff was an average calculated from Seattle's submissions to the Commission of their reported MWh generated at the Boundary project over the last 10 years.  Therefore, Commission staff used this value to establish the existing energy production under the no-action alternative evaluated in the DEIS and the FEIS.

***Comment***:   Seattle states that some of the costs presented in the EA for alternative power costs and annual project costs differ from the costs presented in their addendum D to the license application.

***Response***:   Seattle provided their costs for proposed measures over a 50-year license term; however, the Commission uses a 30-year term of analysis when estimating the costs and benefits of a given project.  When costs for the individual protection, mitigation and environmental measures, which were used to generate the annual project costs, were stated to occur within the first 30 years of any license issued or when Commission staff were unable to determine if costs would extend beyond the first 30 years of any license issued, staff used the value for the measure as provided by Seattle. For those measures that were stated to occur beyond the first 30 years of any license issued, Commission staff estimated a 30-year cost estimate for that measure based on the value provided by Seattle.