FERC/EIS-0263F
POA-2009-1064

FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR HYDROPOWER LICENSE

Sweetheart Lake Hydroelectric Project—FERC Project No. 13563-003

Alaska

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
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May 2016

FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (EIS) for the proposed Sweetheart Lake Hydroelectric Project (No. 13563-003), which would be located in the City and Borough of Juneau, Alaska.

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

Before the Commission makes a licensing 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 June 10, 2016.

Copies of the final 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 final EIS also may be viewed on the Internet at www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Attachment: Final Environmental Impact Statement

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COVER SHEET

a. Title:	Licensing the Sweetheart Lake Hydroelectric Project, FERC Project No. 13563-003
b. Subject:	Final Environmental Impact Statement (EIS)
c. Lead Agency:	Federal Energy Regulatory Commission
d. Cooperating Agency:	U.S. Army Corps of Engineers
e. Abstract:	Juneau Hydropower, Inc. filed an application for original license for the proposed 19.8-megawatt Sweetheart Lake Hydroelectric Project located on Lower Sweetheart Lake and Sweetheart Creek in the City and Borough of Juneau, Alaska. The proposed project would occupy 2,058.24 acres of federal lands within the Tongass National Forest, administered by the U.S. Department of Agriculture, Forest Service. The proposed project would generate an average of about 116,000 megawatt-hours of energy annually. The staff's recommendation is to license the project as proposed, with certain modifications and additional measures recommended by the agencies and staff.
f. Contact:	John Matkowski Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, DC 20426 (202) 502-8576
g. Transmittal:	This final EIS on the application to license the proposed Sweetheart Lake Hydroelectric Project is being made available to the public on or about June 10, 2016, as required by the National Environmental Policy Act of 1969[1] and the Federal Energy Regulatory Commission's Regulations Implementing the National Environmental Policy Act (18 CFR, Part 380 (2015)).

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

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FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[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 adopted…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]

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[2] 16 U.S.C. § 791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

[3] Pub. L. 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a).

[5] 16 U.S.C. § 803(g).

[6] 18 C.F.R. § 385.206 (2016).

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ACRONYMS AND ABBREVIATIONS

Acid Rock Plan	Acid Rock Drainage Contingency Plan
AEL&P	Alaska Electric Light and Power
Alaska DEC	Alaska Department of Environmental Conservation
Alaska DFG	Alaska Department of Fish and Game
Alaska DNR	Alaska Department of Natural Resources
Alaska NHP	Alaska Natural Heritage Program
Alaska SHPO	Alaska State Historic Preservation Office
APE	Area of Potential Effect
APLIC	Edison Electric Institute's Avian Power Line Interaction Committee
applicant	Juneau Hydropower, Inc.
Aquatic Habitat Plan	Aquatic Habitat Restoration and Monitoring Plan
ATU	accumulative thermal unit
BMP	best management practice
°C	degrees Celsius
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CO_2	carbon dioxide
CO_2e/GWh	carbon dioxide equivalent per gigawatt-hour
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibel(s)
DIA	Douglas Indian Association
DPS	Distinct Population Segment
ECM	environmental compliance monitor
EFH	essential fish habitat
EIS	environmental impact statement
ESA	Endangered Species Act
°F	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
Fish Mitigation Plan	Fish Mitigation and Monitoring Plan
Forest Service	U.S. Department of Agriculture, Forest Service

FPA	Federal Power Act
FWS	U.S. Department of the Interior, Fish and Wildlife Service
GHG	greenhouse gas
Interior	U.S. Department of the Interior
Juneau Hydro	Juneau Hydropower, Inc.
kV	kilovolt
LUD	Land Use Designation
μg/L	microgram per liter
μmho/cm	micromhos per centimeter
mg/L	milligram per liter
MIS	Management Indicator Species
MMPA	Marine Mammal Protection Act
MW	megawatt
MWh	megawatt-hour
°N	degrees north
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NTU	nephelometric turbidity unit
Park Service	U.S. Department of the Interior, National Park Service
project	Sweetheart Lake Hydroelectric Project, FERC Project No. 13563
Reservoir Management Plan	Reservoir Management and Inundation Plan
RMS	root mean square
sockeye smolt transport plan	sockeye salmon smolt collection and transport plan
Solid Waste Plan	Solid Waste and Wastewater Plan
Storm Water Plan	Storm Water and Pollution Prevention Plan
tonnes	metric tons
U.S.C.	United States Code
USGS	U.S. Geological Survey
WUA	weighted usable area

EXECUTIVE SUMMARY

Proposed Action

On May 29, 2014, Juneau Hydropower, Inc. (Juneau Hydro or applicant) filed an application for an original license with the Federal Energy Regulatory Commission (Commission or FERC) for its proposed 19.8-megawatt (MW) Sweetheart Lake Hydroelectric Project (project). The project would be located on Lower Sweetheart Lake and Sweetheart Creek, within the City and Borough of Juneau, Alaska. The project would occupy 2,058.24 acres of federal lands within Tongass National Forest, administered by the U.S. Department of Agriculture, Forest Service (Forest Service). The project also would occupy 131.18 acres of tideland and submerged lands of the state of Alaska. The proposed project would generate an average of about 116,000 megawatt-hours (MWh) of energy annually.

Proposed Project Facilities

The proposed project would consist of the following new facilities: (1) a 280-foot-wide, 111-foot-high roller-compacted concrete dam to be constructed at the existing natural outlet of Lower Sweetheart Lake, with a 125-foot-wide ungated overflow spillway at a crest elevation of 636 feet; (2) a 525-foot-long, 10-foot-high, 10-foot-wide arched reservoir outlet tunnel at the right dam abutment; (3) a 45-foot-long, 25-foot-wide, 16-foot-high rectangular concrete intake structure, with six 7-foot-diameter, 10-foot-high cylindrical fish screens adjacent to the right dam abutment; (4) a 9,612-foot-long, 15-foot-wide, 15-foot-high horseshoe-shaped, unlined underground power tunnel; (5) an 896-foot-long, 9-foot-diameter saddle-supported steel penstock installed within the lower portion of the power tunnel; (6) three 160-foot-long (mean length), 7- to 9-foot-diameter buried steel penstocks connecting the lower portion of the power tunnel to the powerhouse; (7) a 160-foot-long, 60-foot-wide, 30-foot-high concrete and steel powerhouse; (8) three 7.1-MW Francis turbines with 6.6-MW generators with a total installed capacity of 19.8 MW; (9) a 541-foot-long, 30- to 90-foot-wide rock tailrace with a fish exclusion structure, discharging to Sweetheart Creek; (10) a 4,400-foot-long coastal road from the powerhouse to a dock/landing site for aerial and marine vehicle access, located on the east shore of Gilbert Bay; (11) an 8.69-mile-long, 138-kilovolt (kV) transmission line traversing Gilbert Bay, the Snettisham Peninsula, and Port Snettisham, consisting of: (a) two buried segments, totaling 4,800 feet in length; (b) two submarine segments, totaling 25,700 feet in length; and (c) one 15,400-foot-long overhead segment; (12) a 22,000-square-foot fenced switchyard adjacent to the powerhouse; (13) a 60-foot by 60-foot switchyard at the end of the transmission line on the north shore of Port Snettisham; (14) a 25-foot-long, 5-foot-wide, 4-foot-deep salmon

smolt re-entry pool[7] located adjacent to the powerhouse and tailrace; (15) a 4,225-square-foot caretaker's facility near the dock; (16) a 4,800-foot-long, 12.47-kV service transmission line and communication cable extending from the powerhouse to the dock and caretaker's facility, providing operational electricity and communications; (17) a 10,000-foot-long, 12.47-kV service transmission line and communication cable extending from the powerhouse to the dam site, providing operational electricity and communications; (18) a 400-square-foot shelter at the dam site for employee use during smolt transport facility operations; and (19) appurtenant facilities.

Construction of the project would raise Lower Sweetheart Lake from a water surface elevation of 551 feet mean lower low water[8] and a surface area of 1,414 acres to a new maximum water surface elevation of 636 feet and surface area of 1,702 acres, and a new minimum water surface elevation of 576 feet and surface area of 1,449 acres.

Project Operation

Water would enter the project at the intake structure, travel through the power tunnel and penstock, through the powerhouse turbines, through the tailrace, and return to the upstream end of Sweetheart Creek about 1,300 feet upstream from the creek mouth on Gilbert Bay. The project would bypass an approximately 2-mile-long reach of Sweetheart Creek from the lake outlet to the impassable fish barrier at the falls near the tailrace outlet. The project would provide a 3-cubic feet per second (cfs) minimum release from the dam and into the 2-mile-long bypassed reach, as well as minimum instream flows as measured in the 1,300-foot-long section of Sweetheart Creek downstream of the project tailrace of: 40 cfs for January through February, 45 cfs for March, 119 cfs for April, 300 cfs for May through October, and 117 cfs for November through December. The powerhouse would have a minimum hydraulic capacity of 55 cfs (one unit) and a maximum hydraulic capacity of 460 cfs (three units).[9] Above the maximum operating reservoir level (> 636 feet), flows would pass over the dam spillway into the bypassed reach.

The additional storage created by the project would be used to re-regulate the natural flows from the Sweetheart Lake watershed to provide continuous year-round flow

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[7] The re-entry pool would provide temporary holding of sockeye salmon smolts collected and transported from Sweetheart Lake, for imprinting and release to the tailrace.

[8] The mean lower low water level is the 19-year average of the lower of the two daily low tides and serves as the reference elevation chosen by Juneau Hydro for project facilities.

[9] The true maximum hydraulic capacity would be 650 cfs, but because of generator limitations, the hydraulic discharge of the powerhouse would be limited to 460 cfs.

to the powerhouse sufficient to meet a firm base-load for two units (13.2 MW) and the minimum instream flows requirements below the project tailrace; the third unit would be operated only when excess water is available. The project would draw on the available storage during the low-flow winter months to reach a normal minimum pool level of 576 feet by April or May and capture flows between June and October to refill the reservoir to the maximum reservoir level of 636 feet, resulting in an annual reservoir fluctuation of about 60 feet.[10]

The project would normally operate under automatic control, but it could also be operated manually.

Proposed Environmental Measures

Construction

- Provide representatives of Alaska Department of Fish and Game (Alaska DFG) access to, through and across project lands and waters, and project works, in the performance of their official duties upon appropriate advance notification and reserve the Forest Service's right to use or permit others to use national forest lands for any purpose, as long as it does not interfere with project purposes specified in a license.
- Implement the Environmental Compliance Plan filed with the license application to include retaining an environmental compliance monitor (ECM) during construction to ensure environmental protection measures are being properly implemented.
- Revise, if necessary,[11] the Erosion Control Plan, Storm Water and Pollution Prevention Plan (Storm Water Plan), and Solid Waste and Wastewater Plan (Solid Waste Plan) filed with the license application to include: site-specific best management practices for controlling erosion and protecting water quality from stormwater runoff, sewage, and fuel spills; site storage and disposal areas at least 100 feet from streams and intertidal areas to protect fish and wildlife; functional design drawings and specific topographic locations of erosion control measures;

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[10] A reservoir elevation of approximately 558 feet is necessary to pass flow through the project. In the unlikely event that the reservoir level drops below this elevation, or a cataclysmic event prevents flows from being passed through the powerhouse, flows would be routed through the project's diversion tunnel at the base of the dam into the bypassed reach.

[11] Juneau Hydropower intends to revise and finalize some of its proposed plans in consultation with the Forest Service and other resource agencies after license issuance and final design of the project.

daily monitoring of turbidity to assess the effectiveness of erosion control measures by an ECM; and procedures for taking corrective actions.

- Revise, if necessary, the Spoil Disposal Plan filed with the license application to include: site-specific measures for handling and disposing of excavated materials; testing for acid rock drainage forming materials; disposing of excavated spoils containing any such acid-forming materials in a designated area with a liner and cap to prevent leaching; and a determination as to whether the spoils would need to be treated onsite with a buffering agent, such as limestone. Final plans for disposing and treating spoils with the potential to create acid leachate would be developed within 90 days of discovery.
- Develop and implement timing windows for instream construction activities and stream crossings in consultation with Alaska DFG.
- Revise, if necessary, the Vegetation Management Plan filed with the license application that includes: salvaging native plants from construction areas and transplanting them to revegetate disturbed sites; monitoring the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; implementing measures to avoid the potential spread of invasive plants associated with project construction; and avoiding the use of pesticides and herbicides within 500 feet of sensitive species and habitats.
- Revise, if necessary, the Wildlife Mitigation and Monitoring and Threatened and Endangered Species Protection Plan filed with the license application and updated on January 27, 2016, that includes: reducing vessel speed or stopping if marine mammals (including the endangered humpback whale and Steller sea lion) are within 100 yards of in-water construction activities to prevent collisions between service boats and marine mammals; ceasing pile driving if a marine mammal is observed within 1,000 meters (1,094 yards) of pile driving activity to minimize noise effects on marine mammals; implementing pile driving ramp-up procedures to minimize sudden exposure of marine mammals to loud noises; using hammer cushions to minimize noise effects on marine mammals during impact pile driving; defining flight paths and marine transportation routes to avoid disturbance of Steller sea lions and mountain goats; developing a wildlife bypass trail upslope of the caretaker's facility to minimize human-animal interaction; posting hunting and fishing regulations onsite; restricting project personnel from hunting, fishing, and trapping during project construction; prohibiting personal firearms onsite to deter project personnel from hunting during project construction and operation; and surveying for nesting bald eagles and taking necessary steps to minimize disturbance if needed during project construction.
- Implement the Bear Safety Plan filed with the license application that includes protocols for minimizing the risk of human-bear interactions.

- Revise, if necessary, the Construction Plan filed with the license application that outlines the location, methodology, and scheduling that would be followed to construct the project facilities to ensure compliance with National Forest land management objectives.
- Establish and maintain, with frequent summer season updates, a web site describing construction progress and any visitor access limitations. Identify a point of contact on the web site and include a provision for receiving public questions or comments regarding project construction-related issues.
- Implement the Heritage Resource Protection Plan filed with the license application to protect cultural, archeological, or historical resources (or human remains associated with the Native American Graves Protection and Repatriation Act of 1990) in the event that they are inadvertently discovered during construction and operation.

Project Design Features and Operation

- Install and maintain a fish exclusion structure in the project tailrace to prevent fish from entering the turbine draft tubes.
- Install and maintain fish screens on power tunnel intake structure according to the National Marine Fisheries Service (NMFS) criteria to prevent entrainment of fish.
- Bury the penstock and construct a 94-foot-wide tailrace overpass and connecting trail to mitigate barriers to wildlife movements.
- Bury the transmission and telecommunication cables along a new coastal access road and install submarine cables across the Gilbert Bay flats to minimize visual impacts and protect migratory birds from collision and electrocution hazards.
- Release a minimum flow of 3 cfs into the Sweetheart Creek bypassed reach.
- Maintain a minimum flow of 40 cfs in the anadromous reach of Sweetheart Creek from January through February, 45 cfs in March, 119 cfs in April, 300 cfs from May through October, and 117 cfs from November through December, as measured at a stream gage installed immediately downstream of the tailrace.
- Develop a pulse flow release and monitoring plan, in consultation with Alaska DFG, that includes conducting a 3- to 5-year evaluation of the effectiveness of releasing at least four pulse flows of up to 486 cfs between July 1 and August 31 of each year, in stimulating returning sockeye salmon to enter Sweetheart Creek from the estuary.
- Revise, if necessary, the Water Management Plan filed October 20, 2014, that includes: (1) a Reservoir Management and Inundation Plan containing procedures for monitoring reservoir levels, monitoring reservoir water quality, and managing reservoir vegetation and floating debris; (2) a Stream Flow Management Plan

describing methods for controlling the minimum flows and ensuring continuous flow when the project is not operating (i.e., synchronous bypass valves on each turbine to provide anadromous reach flow); and (3) a Stream Flow Measurement Plan describing procedures and equipment for measuring minimum flow releases.

- Construct and operate a sockeye smolt collection and transport system and develop an operating plan for the facility (sockeye smolt transport plan) that includes: (1) a description of the procedures that would be used to capture, hold, transport, and release sockeye salmon smolts from Sweetheart Lake into Sweetheart Creek; (2) a description of the protocols for monitoring survival of sockeye salmon; and (3) contingency provisions to ensure sockeye salmon smolts are successfully imprinted and released in Sweetheart Creek if the sockeye smolt collection and transport system fails.
- Revise, if necessary, the Aquatic Habitat Restoration and Monitoring Plan (Aquatic Habitat Plan) filed October 20, 2014, that includes assessing spawning habitat in the anadromous reach of Sweetheart Creek and potentially conducting gravel augmentation based on the results of the spawning habitat assessment.
- Revise, if necessary, the Fish Mitigation and Monitoring Plan (Fish Mitigation Plan) filed October 20, 2014, that includes monitoring rainbow trout and Dolly Varden populations and measuring water temperatures in Sweetheart Lake following project construction. If monitoring results indicate poor recruitment of rainbow trout and Dolly Varden, Juneau Hydro would stock triploid rainbow trout and Dolly Varden in Sweetheart Lake, improve access to potential spawning habitat in tributaries to Sweetheart Lake, or implement offsite mitigation determined in consultation with Alaska DFG and the Forest Service.
- Revise, if necessary, the Hazardous Substances Plan filed with the license application that includes procedures for reporting and responding to releases of hazardous substances.
- Construct and annually inspect the overhead 138-kV transmission line in accordance with the Avian Power Line Interaction Committee guidelines for protecting birds from electrocution and collision hazards.
- Revise, if necessary, the Fire Prevention Plan filed with the license application that defines protocols that would be followed to prevent and control wildfires.
- Revise, if necessary, the Access Management Plan filed with the license application that includes provisions to control public access to the project to ensure public safety, project security, and project consistency with Forest Service roadless area management goals; and monitor the effectiveness of access control measures.
- Revise, if necessary, the Recreation Management Plan filed with the license application that includes installing and maintaining interpretive displays at the

head of Sweetheart Creek Trail; a new trail system that leads fishermen to the traditional fishing areas at Sweetheart Creek and away from prime bear fishing locations; landform berms to provide scenic, sound, and light barriers between the powerhouse/switchyard area and Sweetheart Creek recreational areas; a rock tailrace to increase available fishing area along Sweetheart Creek; a dock and intertidal ramp on the eastern shore of Gilbert Bay and a trail from the boat dock to the powerhouse location that would be available for public use; and at least three mooring buoys in Gilbert Bay.

- Revise, if necessary, the Scenery Management and Monitoring Plan filed with the license application that provides for using exterior colors for the transmission and marine access facilities and fencing that minimize contrast with the surrounding environment; minimizing vegetation removal; using native vegetation to reduce visibility of the project; avoiding use of exterior lighting to minimize light pollution; and monitoring, through photographic documentation, the continued success of scenery management mitigation over a 10-year period.

Alternatives Considered

This final environmental impact statement (EIS) analyzes the effects of project construction and operation and recommends conditions for any license that may be issued for the project. In addition to the applicant's proposal, we consider two alternatives: (1) the applicant's proposal with staff modifications (staff alternative) and (2) no action, meaning the project would not be constructed, and environmental resources in the project area would not be affected.

Staff Alternative

Under the staff alternative, the project would be constructed and operated as proposed by Juneau Hydro with the modifications and additional measures described below. Our recommended modifications and additional environmental measures include, or are based on, recommendations made by federal and state resource agencies that have an interest in resources that may be affected by construction and operation of the proposed project.

The staff alternative includes all of the Forest Service final 4(e) conditions, including: avoiding the use of pesticides on National Forest System (NFS) lands or in areas affecting NFS lands without the prior written approval of the Forest Service; providing a qualified ECM to oversee major construction activities (e.g., vegetative or land disturbing, spoil producing, blasting activities); and developing the following plans: (1) construction plan; (2) spoil disposal plan; (3) access and road management and maintenance plan; (4) reservoir management and inundation plan; (5) erosion control plan; (6) solid waste and wastewater plan; (7) hazardous substances plan; (8) fire prevention plan; (9) heritage resource protection plan; (10) scenery management plan; (11) vegetation management plan; (12) invasive species management plan; (13) wildlife mitigation and monitoring plan; (14) fish mitigation and monitoring plan; (15) threatened,

endangered, proposed for listing, and sensitive species plan; (16) stream flow management plan; (17) stream flow measurement plan; (18) aquatic habitat restoration and monitoring plan; (19) environmental compliance monitoring plan; and (20) storm water and pollution plan.

In addition, the staff alternative would require Juneau Hydro to:

(1) modify the Acid Rock Drainage Contingency Plan (Acid Rock Plan) to include a provision to provide more detailed plans for acid-producing spoil storage, disposal, treatment, and monitoring measures based on geotechnical study results and prior to beginning construction;

(2) file a schedule for in-water construction activities for Commission approval;

(3) modify the proposed Water Management Plan to: (a) remove the provision that requires Juneau Hydro to file annual stream gage data with the Commission by April 1 of each year; (b) define the criteria for determining water quality deviations for turbidity, pH, and temperature during project operation; (c) limit continuous monitoring of water temperature, pH, and turbidity to the first 5 years of project operation and file a report with the Commission for approval at the end of the 5-year monitoring period documenting the results of the water quality monitoring and any recommendations for continuing monitoring; (d) include a provision to notify the Commission in the event that water quality deviations are detected and file a report within 10 days that describes the deviation, corrective actions taken, and proposals to modify procedures; (e) include a description of how Juneau Hydro would document compliance with minimum instream flows, including a detailed description of the gages to be installed, their location, maintenance and calibration procedures, and an implementation schedule; and (f) include a provision to file a report of any deviation from minimum flow or flow continuation requirement with the Commission within 10 days of the deviation and describe the deviation, any observed environmental effect, and corrective actions taken;

(4) prepare an operation and maintenance plan for the proposed draft tube fish exclusion structure;

(5) prepare an operation and maintenance plan for the intake fish screen;

(6) modify the proposed sockeye smolt transport plan to include a provision to file an annual report with Alaska DFG and the Commission on the effectiveness of the collection and transport system in meeting the defined performance criteria and after the third year of operation file a final report summarizing the cause(s) of any system failures and any recommended corrective measures;

(7) modify the proposed Aquatic Habitat Plan in consultation with Alaska DFG, NMFS, and the Forest Service to include additional details on spawning habitat monitoring and mitigation methods, and file a report with the Commission by December 31 of year 3 following implementation of the spawning habitat assessment, summarizing the spawning gravel assessment results and recommendations for continuing the

assessment, or plans to augment spawning gravel, and remove the requirement to monitor salmon spawning in the anadromous reach;

(8) modify the proposed Fish Mitigation Plan to include a requirement to file a report with the Commission by December 31 of year 3 following implementation of the monitoring program, summarizing the monitoring results and recommendations for continuing the monitoring or to implement measures to improve fish recruitment;

(9) modify the proposed Vegetation Management Plan to include: (a) a description of storage and treatment of salvaged plants; (b) a list of plant species that would be imported to revegetate disturbed areas; (c) criteria, based on existing conditions, to determine whether revegetation efforts are successful; (d) a description of data collection and analysis methods for monitoring that corresponds with success criteria; (e) provisions for monitoring and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons, and (f) a provision for salvaging and transplanting the rare twocolor sedge plant that would be inundated by the reservoir;

(10) modify the proposed Invasive Species Management Plan to: (a) include measures to use weed-free fill materials and weed-free erosion control methods; (b) include a monitoring schedule that addresses short-term (first 5 years) and long-term monitoring needs; (c) include a description of proposed eradication measures; and (d) avoid the use of pesticides and herbicides on NFS lands or in areas affecting NFS lands and within 500 feet of rough-skinned newt, western toad, or any other special status or culturally significant plant population without the prior written approval of the Forest Service;

(11) modify the proposed Wildlife Mitigation and Monitoring Plan to remove the proposed wildlife bypass trail around the caretaker's facility and the restrictions on hunting, fishing, and trapping and onsite possession of personal firearms by project personnel, and the posting of hunting and fishing regulations during construction;

(12) modify the proposed Recreation Plan to: (a) consult with the Forest Service, U.S. Department of the Interior, National Park Service, and Alaska DFG to finalize the Recreation Management Plan; (b) file as-built drawings of all completed recreation facilities; (c) review the adequacy of new recreational facilities in consultation with the Forest Service, National Park Service, and Alaska DFG within 4 years of completion of project construction, and every 10 years thereafter; and (d) file recreation monitoring reports with the Commission;

(13) revise the Access Management Plan to allow full public access to the proposed boat ramp and dock, with these revisions also reflected in the revised Recreation Management Plan;

(14) modify the proposed Scenery Management Plan to include protocols for documenting compliance with the plan (e.g., establishing photo points, the time of year to

take the photos), and procedures and a schedule to review and update the plan to address visual issues that may arise during the license term; and

(15) revise the Heritage Resource Protection Plan to include cultural resources training and monitoring protocols.

No-Action Alternative

Under the no-action alternative, the proposed project would not be constructed and would provide no power, and there would be no effect on environmental resources.

Public Involvement and Areas of Concern

Before filing its license application, Juneau Hydro conducted a pre-filing consultation process under the Alternative Licensing Process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues before an application is formally filed with the Commission. On August 8, 2011, staff distributed a Scoping Document to interested parties, soliciting comments, recommendations, and information about the project. Staff held public scoping meetings in Juneau, Alaska, on September 7, 2011, and conducted an environmental site review on September 7 and 8, 2011. A revised scoping document, addressing the written and oral comments received, was issued on February 1, 2012. On May 29, 2014, Juneau Hydro filed its license application. On November 17, 2014, staff issued a notice of intent to prepare an EIS and requested final terms, conditions and recommendations from state and federal resource agencies and other entities.

The primary environmental issues associated with licensing the project are the effects of construction-related erosion and sedimentation on water quality (including acid rock leachate) and fish; construction-related effects on vegetation, wildlife, marine mammals, recreation, and aesthetic resources; instream flows necessary to maintain salmon spawning habitat; and measures needed to address outmigration of stocked sockeye salmon smolts from Sweetheart Lake.

Staff Alternative

Geologic and Soil Resources

Project construction would require land-disturbing activities, including vegetation clearing and excavation, which could cause erosion and sedimentation into Sweetheart Lake, Sweetheart Creek, and Gilbert Bay. Rock excavation could expose rock that has the potential to produce acid leachate because of a chemical weathering reaction with the air and water (i.e., acid rock drainage). Soil erosion and acid leachate could adversely affect water quality and aquatic biota.

Revising, if necessary, the Erosion Control Plan, Storm Water Plan, Spoil Disposal Plan, and Acid Rock Plan, as proposed by Juneau Hydro, to include detailed control measures based on site-specific conditions would allow for a more realistic review of the plans' adequacy for minimizing the potential for erosion and acid leachate production. Monitoring turbidity levels by an ECM as proposed would provide a means to evaluate the effectiveness of erosion control measures during construction and to take timely corrective actions if needed.

Aquatic Resources

Implementing Juneau Hydro's proposed Storm Water Plan and Solid Waste Plan would minimize the likelihood of a discharge of toxic substances, refuse, and other pollutants into project area water bodies.

Instream construction activities and stream crossings could harm or disturb fish during sensitive life stages such as migration and spawning. Juneau Hydro's proposal to establish timing windows for instream construction activities in consultation with Alaska DFG would help minimize effects on aquatic resources.

Project operation would substantially reduce flow in the bypassed reach; however, the steep gradient, coarse substrate, and turbulence from numerous cascades and falls within the bypassed reach limit the existing habitat value of this reach for resident rainbow trout and Dolly Varden out-migrating from Sweetheart Lake. Juneau Hydro's proposed 3-cfs minimum flow from the dam would maintain habitat connectivity for fish, amphibians, aquatic macroinvertebrates, and other aquatic organisms.

Project operation would also alter the timing and amount of flow into the anadromous reach of Sweetheart Creek. Juneau Hydro's operation flows and proposed variable minimum flow releases would provide flow and depth to maintain salmon migration, spawning, and rearing habitat in the anadromous reach. Juneau Hydro's proposal to evaluate the effectiveness of pulse flows in stimulating upstream migration of sockeye salmon would help identify whether project operations are adversely affecting the sockeye salmon personal use fishery in Sweetheart Creek. Because it is unclear whether project operation would interrupt the supply of suitable substrates for spawning salmonids in Sweetheart Creek, Juneau Hydro's proposal to monitor available salmon spawning habitat as part of the Aquatic Habitat Plan would provide a means to determine if project construction and operation are adversely affecting sediment supply and whether gravel augmentation is needed. However, additional details, including monitoring methods, timing, and evaluation metrics are needed to ensure effective implementation of the plan. These details should be developed in consultation with NMFS, Alaska DFG, and the Forest Service. Juneau Hydro's proposed flow continuation measures would protect fish and aquatic habitat from the dewatering effects during sudden powerhouse shutdown or project maintenance activities.

Juneau Hydro's proposed Water Management Plan would enable Juneau Hydro to monitor and maintain compliance with minimum flow requirements and evaluate whether

project reservoir fluctuations are affecting turbidity, pH, and water temperature. Staff recommended modifications to the Water Management Plan would provide a more robust plan, would limit monitoring to the first 5 years of operation when adverse effects are most likely to occur, and enable the Commission to ensure compliance with proposed operational measures for the protection of aquatic resources.

Juneau Hydro's proposal to install fish screens on the project intake in accordance with NMFS' criteria would minimize entrainment of resident rainbow trout and Dolly Varden and stocked sockeye salmon into the diversion tunnel and penstock. Installing a fish exclusion structure in the tailrace near the powerhouse that meets NMFS criteria would prevent salmon attracted to the tailrace flows from entering the turbine draft tubes and being injured or killed. Preparing an operation and maintenance plan as recommended by staff would ensure the facilities are operated and maintained in a manner that minimizes entrainment and injury to fish.

Constructing the proposed dam would block outmigration of stocked sockeye salmon from Sweetheart Lake.[12] If successful, Juneau Hydro's sockeye smolt collection and transport system would capture and release at least 21,000 smolts into Sweetheart Creek, maintaining the personal use fishery[13] established in Sweetheart Creek. Juneau Hydro's proposed contingency plan would provide, imprint and release 21,000 hatchery-reared smolts from the project holding pond during the first 3 years of project operation while the system is being evaluated, and this would prevent any loss of the fishery if the system is unsuccessful during these first 3 years of operation. Documenting the effectiveness of the system and filing a report with recommended corrective measures, if needed, at the end of the 3-year evaluation period, as recommended by staff, would provide a means for the Commission to evaluate any proposals for modifying project operations, facilities, or environmental measures to ensure the personal use fishery is maintained.

Juneau Hydro's proposed Fish Mitigation Plan which includes provisions to monitor recruitment of resident fish in Sweetheart Lake would determine whether project lake level fluctuations are reducing access to available spawning habitat for resident

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[12] Douglas Island Pink and Chum, Inc. stocks Sweetheart Lake with sockeye salmon fry to enhance the local fishery. When the fry develop into smolts, they migrate from the lake and downstream to the ocean using Sweetheart Creek. Following several years in the ocean, adult sockeye salmon migrate back to Sweetheart Creek, where they are caught for personal use in the anadromous reach.

[13] Alaska Statute 16.05.940(26) defines personal use fishing as "the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, long line, or other means defined by the Board of Fisheries."

rainbow trout and Dolly Varden in Sweetheart Lake and whether measures are needed to improve spawning success or supplement fish populations through stocking efforts. Additional details, including monitoring methods, timing, and evaluation metrics would be needed to ensure effective implementation of the plan.

Delivery of materials, installation of the submarine cable, and construction of the boat dock would increase noise levels and vessel traffic near the project site. Implementing Juneau Hydro's marine mammal protection measures contained in the Wildlife Mitigation and Monitoring Plan would minimize disturbance and injury to marine mammals during project construction and operation.

Terrestrial Resources

Construction of project facilities (including the dam, power tunnel, powerhouse, tailrace, coastal access road, dock and landing facility, caretaker's facility, and transmission towers) would result in a long-term loss of about 70 acres of vegetation, including high-volume productive old-growth forest; low-volume productive old-growth forest; forest muskeg; unproductive forest; non-forested, natural young growth; and intertidal and subtidal vegetation, including about 3.2 acres of wetlands near the powerhouse and Gilbert Bay. Raising the elevation of Sweetheart Lake would result in the long-term inundation and loss of an additional 442 acres of vegetation, including about 11.4 acres of wetlands. Reservoir fluctuations between the proposed minimum and maximum water levels would temporarily affect an additional 16.3 acres of wetlands to varying degrees. These areas include habitat for a variety of state and Forest Service sensitive and management indicator species, including brown bear, black bear, bald eagle, mountain goat, and a variety of migratory birds. The project would result in a short-term reduction in wildlife habitat quality and quantity from human activity, construction noise disturbance, and the temporary loss of vegetated habitat until revegetation occurs. Juneau Hydro's proposed Vegetation Management Plan with staff-recommended additional measures would ensure that revegetation of disturbed areas is effective, prevent and control the establishment of invasive weeds that could reduce the quality of wildlife habitats, and protect the rare twocolor sedge by salvaging and relocating the plants prior reservoir inundation. The Wildlife Mitigation and Monitoring Plan would protect bald eagles, mountain goats, bears, and migratory birds from potential disturbance from construction activities by avoiding eagle nesting and goat kidding areas, minimizing the risk of bear interactions with humans, and minimizing the potential for avian electrocution and collision with project transmission lines.

Threatened and Endangered Species

Two federally listed species (humpback whale and western DPS Steller sea lion) are known to occur, or may occur, in the project area. However, critical habitat for the humpback whale has not been designated or proposed, and no critical habitat (major rookery or major haulout) for Steller sea lions is located in the project area. Juneau Hydro's Wildlife Mitigation and Management Plan includes measures for preventing

collisions between service boats and marine mammals, minimizing harassment of marine mammals during project construction, and defining flight paths and marine transportation routes to avoid disturbance of Steller sea lions. These measures would minimize the potential for adverse effects on the humpback whale and western DPS Steller sea lion during construction activities. Further, any elevated in-water noise levels during construction activities would be localized and short term. Because Juneau Hydro's marine mammal protection measures would avoid or minimize disturbance and injury to marine mammals during project construction we conclude that the project may affect but is not likely to adversely affect the humpback whale and western DPS Steller sea lion.

Recreation, Land Use, and Aesthetics

No public recreation facilities are located along the shoreline of Sweetheart Lake or Sweetheart Creek. Fishing is the primary recreational activity at Gilbert Bay, Sweetheart Creek, and surrounding lands, although commercially guided hunters, resident sport hunters, and trappers also use these lands. Implementing the measures in Juneau Hydro's Recreation Management Plan would ensure that visitor use is accommodated in a manner that avoids resource impacts, the potential for conflicts between bears and humans is minimized, and increased visitor use in the project area is adequately managed. Implementing the Access Management Plan, Construction Plan, and Fire Prevention Plan with the staff-recommended modifications would further enhance recreation opportunities in the project area by ensuring that recreational access is adequately maintained and controlled; recreationists are kept informed of access restrictions during construction; and visitors are adequately informed of, and protected from, fire hazards.

The proposed project is located on NFS lands within the 685,704-acre Taku Snettisham Inventoried Roadless Area. Although the proposed project includes specific design considerations to address roadless area concerns, the final determination on whether the project is consistent with the roadless designation will be made by the Chief of the Forest Service.

Proposed project facilities would be constructed within Semi-Remote Recreation, Timber Production, and Old-Growth Land Use Designations. Constructing the project would not meet the scenic integrity objectives specified in the Tongass National Forest Land and Resource Management Plan for these designated areas. Implementing Juneau Hydro's Scenic Management and Monitoring Plan and Spoil Disposal Plan would minimize visual effects by ensuring that project features are designed and screened as much as practicable to blend with the surrounding environment.

Cultural Resources

Project construction and operation would not affect any cultural resources because the only site eligible for listing on the Natural Register of Historic Places would be avoided during construction and operation. Revising Juneau Hydro's Heritage Resource Protection Plan to include cultural resources training and monitoring protocols would

ensure that the ECM is capable of identifying and protecting any cultural resources discovered during project construction and operation.

Socioeconomics

In the short term, construction of the proposed project would contribute additional employment and income, as well as additional sales of supplies and services, to the economy of the City and Borough of Juneau. Most of the construction workers already live in Juneau, so construction of the project would not contribute to an existing housing shortage in the city. Construction activities over 2 years may disrupt some of the commercial and personal use fishing that occurs in the project area, especially while the submarine cable is being installed and the shoreline access road is being constructed.

Direct, long-term economic benefits during project operation would be relatively minor and associated with wages paid to operation and maintenance staff, purchasing supplies and equipment, and payment of taxes and use fees. Indirect benefits to the local economy would include the project's contribution to affordable electricity rates and reliable electricity service. The project would have no long-term, adverse effects on the commercial fishery because fishing could continue as it does currently with only minor adjustments to avoid the submarine cable. The proposed smolt collection system, if successful, would help to maintain the personal use fishery and the subsistence economy of families who live and fish in the project area.

Conclusions

Based on our analysis, we recommend licensing the project as proposed by Juneau Hydro with some staff modifications and additional measures.

In section 4.2 of the EIS, we estimate the likely cost of alternative power for each of the two alternatives identified above. Our analysis shows that during the first year of operation under the proposed action alternative, project power would cost $2,770,690, or $23.89/MWh more than the likely alternative cost of power. Under the staff alternative, project power would cost $2,771,840, or $23.90/MWh more 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 (116,000 MWh annually); (2) the 19.8 MW of electric capacity would come from a renewable resource that would not substantially contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by Juneau Hydro, 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.

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FINAL ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, DC

U.S. Army Corps of Engineers District, Alaska
Juneau Regulatory Field Office
Soldotna, Alaska

Sweetheart Lake Hydroelectric Project
FERC Project No. 13563—Alaska

1.0 INTRODUCTION

1.1 APPLICATION

On May 29, 2014, Juneau Hydropower, Inc. (Juneau Hydro or applicant), filed an application for an original license with the Federal Energy Regulatory Commission (Commission or FERC) for the proposed Sweetheart Lake Hydroelectric Project (Sweetheart Lake Project or project). The 19.8-megawatt (MW) hydropower project would be located on 5.4-mile-long, 0.6-mile-wide Lower Sweetheart Lake that flows into Sweetheart Creek, which is located in the City and Borough of Juneau, Alaska (City and Borough; figure 1-1). The proposed project would occupy 2,058.24 acres of federal lands within the Tongass National Forest, administered by the U.S. Department of Agriculture, Forest Service (Forest Service). The proposed project would generate an average of about 116,000 megawatt-hours (MWh) of energy annually.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed project is to provide a new source of hydroelectric power that would provide a renewable source of electric energy to meet the current and future energy demands of the Juneau area, and reduce the area's reliance on non-renewable power generation during peak demand periods. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to Juneau Hydro for the Sweetheart Lake Project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best

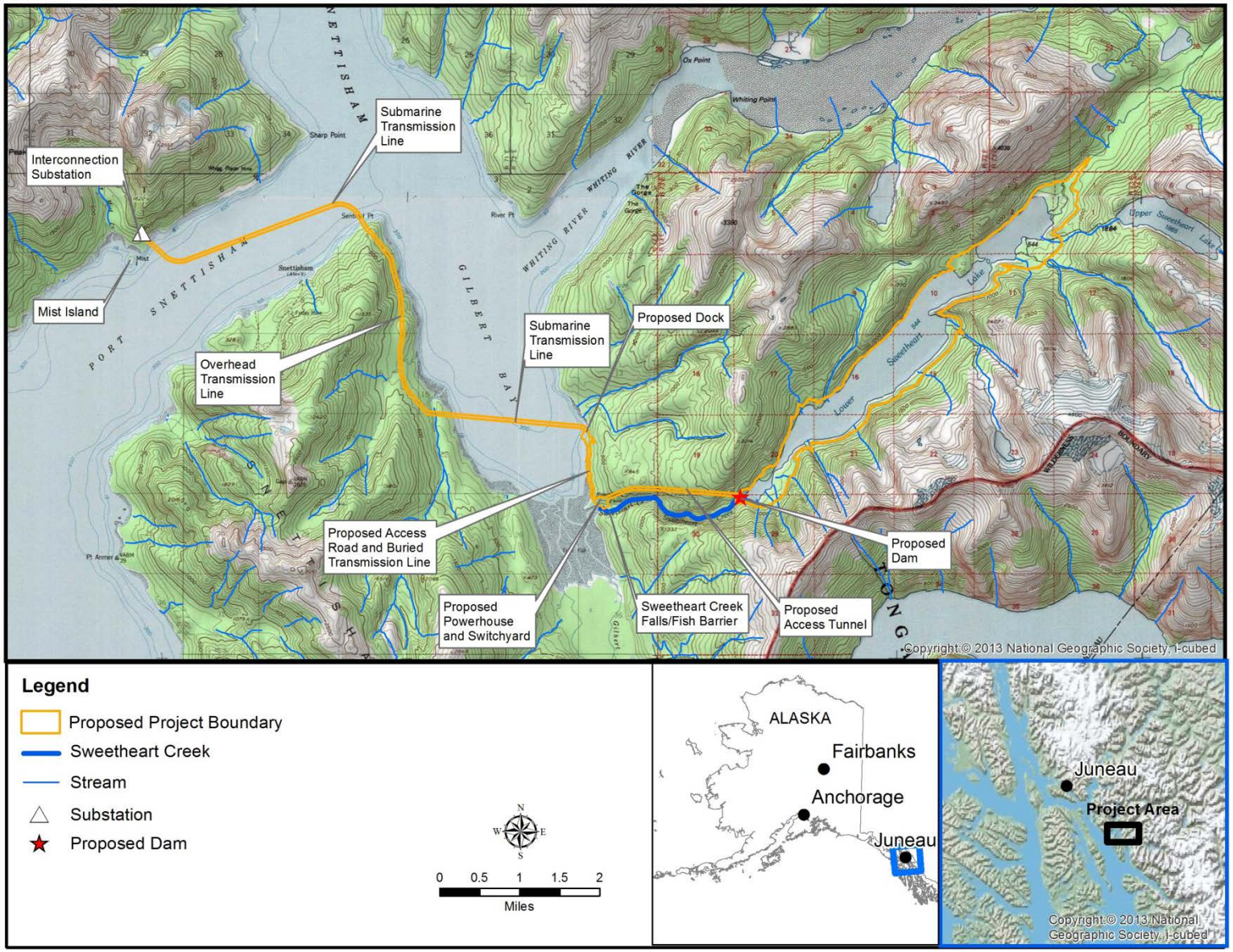

Figure 1-1. Location of the Sweetheart Lake Hydroelectric Project (Source: staff).

adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing an original license for the Sweetheart Lake Project would allow Juneau Hydro to generate electricity at the project for the term of the license, making electrical power from a renewable resource available to its customers.

This final environmental impact statement (final EIS) assesses the effects associated with construction and operation of the project and alternatives to the proposed project. It also includes recommendations to the Commission on whether to issue an original license, and if so, includes the recommended terms and conditions to become a part of any license issued.

In this final EIS, we assess the environmental and economic effects of constructing and operating the project: (1) as proposed by the applicant, and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include effects of construction and operation on geology and soils; water quality; aquatic resources, including effects from submarine cable transmission lines and on downstream fish passage; vegetation and wildlife; federally listed species; and aesthetics. We also assess the effects of the proposed transmission line on recreation; resident and migratory birds, including the bald eagle; and marine mammals.

1.2.2 Need for Power

The Sweetheart Lake Project would provide hydroelectric generation to meet part of Alaska's power requirements, resource diversity, and capacity needs and lower the Juneau area's dependence on non-renewable sources of power generation. The project would have an installed capacity of 19.8 MW and generate about 116,000 MWh per year.

The Juneau area has an isolated electric system, and the only power supplies in the Juneau area are 102.8 MW from hydroelectric facilities and 84.8 MW from diesel-fueled power plants.

According to the Alaska Energy Authority's (2011) *Southeast Alaska Integrated Resource Plan*, between 2015 and 2024 annual energy consumption could increase from 441,237 to 461,494 MWh (4.59 percent), and peak demand could increase from 85.4 to

89.3 MW.[14] This energy consumption estimate assumes continued operation of this isolated system without outside intervention (i.e., business as usual), moderate population growth, and a high cost for diesel and other petroleum fuels. It does not include additional current or future electricity users beyond the assumed population growth.

However, significant additional load growth potential exists in the Juneau area. Currently, several mining operations are fully or partially[15] self-generating, relying on petroleum fuel sources for electricity. For example, Hecla Greens Creek Mine, which is connected to the Juneau electric grid but subject to interruptible service, represents a peak load of approximately 7.5 MW. Coeur Alaska Kensington Mine is located in Berners Bay north of Juneau, and it is fully reliant on self-generated diesel-based power. If the mines were connected to the grid, it would represent a load of approximately 10 MW (Alaska Energy Authority, 2011).

Cruise ships in the port of Juneau are also often required to generate their own electricity due to a lack of generation capacity. Currently there are two public cruise ship docks in Juneau Harbor, with plans to expand the existing public docks to accommodate two additional cruise ships (Juneau, 2015a). However, only one of the existing docks[16] is equipped with a shore power facility, which provides interruptible power service to a docked cruise ship. Ships using the shore power facility represent peak loads of between 8 and 10 MW depending on their size, and such ships have consumed approximately 4,100 MWh annually since the shore power facility's construction. The second dock has not been equipped with a shore power facility because of a lack of grid capacity (Juneau, 2015b). If the additional existing dock and proposed expansion had use of shore power facilities, this could represent a peak load increase of 24 to 30 MW.

Additionally, some homeowners have begun to convert to electricity for home heating as a result of the increasingly volatile cost of heating oil and other fuels. According to the Alaska Energy Authority (2011), estimates of current and forecast load from building electric heating vary widely, and are imprecise because of a lack of adequate data on electric loads, end-users, and the prevalence of electric home heating in Southeast Alaska. Additionally, multiple factors impact future conversion from non-electric to electric heat, including the cost of electricity, heating system conversion to

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[14] Megawatt is a measure of power capacity; megawatt-hour is a measure of energy produced or consumed. Existing capacity does not always translate to available power during peak periods due to system limitations, such as water availability. Hence, a projected peak demand of 89.3 MW may not be fully met by existing hydropower resources, resulting in reliance on diesel and natural gas to meet peak generation needs.

[15] Partially self-generating means they are subject to interruptible service contracts, where they are supplied electricity only when excess is available.

[16] The South Franklin Dock.

electric, and heating system fuel (e.g., heating oil, propane, wood). The variability of these factors and the lack of available data make any estimate of future power use increases from building heating conversion unreliable. However, when oil prices increased in 2008 and 2010, many customers with access to relatively low-cost hydroelectric electricity converted their homes to electric heat (Alaska Energy Authority, 2011). While the United States is currently in a period of low oil prices compared to those of the past, based on the trends of the past few decades it is likely that such low oil prices are temporary. It is therefore likely that additional conversions to electric heat will occur in the future.

In its response to comments on the draft EIS, Juneau Hydro stated that it has two power sales agreements that would cover all of the annual generation from the project. The first agreement is with the Coeur Alaska Kensington Mine and would displace the mine's current diesel power generation. The second agreement is with a large customer for the balance of generation in 2018 that is not already sold to the Coeur Alaska Kensington Mine and would displace that customer's diesel-fueled heating. Additionally, this second power sales agreement allows for additional excess electricity to potentially be sold seasonally to other consumers.

We conclude that power from the project would help meet a need for power, from a clean and renewable source, in the Juneau area in both the short and long term. The proposed project would provide relatively low-cost power that displaces generation from non-renewable diesel sources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Sweetheart Lake Project is subject to requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described in the following sections.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

No fishway prescriptions were filed by the U.S. Department of the Interior (Interior) or National Marine Fisheries Service (NMFS).

1.3.1.2 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 will 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 preliminary conditions by letter dated January 7, 2014, and final terms and conditions by letter filed December 24, 2015, pursuant to section 4(e) of the FPA. These conditions are described under section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*.

1.3.1.3 Section 10(j) Recommendations

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

Alaska Department of Fish and Game (Alaska DFG) timely filed, on January 16, 2015, recommendations under section 10(j), as summarized in table 5-1, in section 5.4.1, *Fish and Wildlife Recommendations*. In section 5.4.1, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. By letter dated May 7, 2014, the Alaska Department of Environmental Conservation (Alaska DEC) waived its right to issue a Certificate of Reasonable Assurance for licensing the Sweetheart Lake Project, in accordance with section 401 of the CWA.[17]

1.3.3 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.[18] Federally listed species known to occur, or that may occur, in the vicinity of the project include the humpback whale and the western distinct population segment (DPS) Steller sea lion.

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[17] In addition, on January 25, 2016, Juneau Hydro filed a second letter from Alaska DEC dated December 31, 2015, which again waived its right to issue a Certificate of Reasonable Assurance for licensing the Sweetheart Lake Project.

[18] When project planning began in 2009, the eastern DPS Steller sea lion was a federally listed species; however, the eastern DPS Steller sea lion was delisted on December 4, 2013.

Our analyses of project impacts on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations are in section 5.2, *Comprehensive Development and Recommended Alternative*. This analysis serves as the biological assessment for compliance with section 7 consultation.

Noise from proposed construction activities, including noise from pile driving and vessel operations, could exceed noise thresholds known to disturb the humpback whale and western DPS Steller sea lion. Implementing Juneau Hydro's proposed measures to reduce noise disturbance, including ceasing pile driving when a marine mammal is observed within 1,000 meters (1,094 yards) of in-water pile driving activity, and the short-term and localized nature of the construction activities, would minimize potential adverse effects on humpback whales and Steller sea lions. Further, Juneau Hydro's additional protection measures, including employing a dedicated marine mammal monitor; implementing pile driving ramp-up procedures to minimize sudden exposure of marine mammals to loud noises; using hammer cushions to minimize noise effects on marine mammals during impact pile driving; monitoring for marine mammals during construction; reducing vessel speeds or stopping when marine mammals are present; and defining flight paths and marine transportation routes to avoid disturbance of Steller sea lions would reduce the potential for vessel collisions and disturbance to humpback whales and Steller sea lions to discountable and insignificant levels.

Therefore, we conclude that licensing of the Sweetheart Lake Project, with conditions to implement the aforementioned measures, may affect but is not likely to adversely affect the humpback whale and the western DPS Steller sea lion. A letter requesting concurrence with this determination was sent to NMFS on October 29, 2015. On November 4, 2015, NMFS filed a request for additional information on the estimated distances to the 120-decibel (dB) and 160-dB isopleths for any in-water activities that may approach or exceed these sound levels, and the 100-dB isopleths for any in-air activities that may approach or exceed that sound level. On November 16, 2015, Commission staff issued a letter providing the additional information requested by NMFS. On December 30, 2015, NMFS filed a letter stating that the estimated distances did not use measurements from comparable pile driving activities and provided information on the marine mammal mitigation measures proposed for pile-driving activities for the Ketchikan Ferry Dock Project. Based on this additional information, we have updated the proposed mitigation measures and analysis of effects in this EIS and will be seeking NMFS concurrence.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code [U.S.C.] § 1456(3)(A), 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.

On July 7, 2011, by operation of state law, the federally approved Alaska Coastal Zone Management Plan expired, resulting in a withdrawal from participation in the CZMA's National Coastal Management Program. The CZMA federal consistency provision, section 307, no longer applies in Alaska.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

In response to Juneau Hydro's August 12, 2010, request, the Commission designated Juneau Hydro as a non-federal representative for the purposes of conducting section 106 consultations under the NHPA on August 24, 2010. Pursuant to section 106, and as the Commission's designated non-federal representative, Juneau Hydro consulted with the Alaska State Historic Preservation Office (Alaska SHPO) and affected Indian tribes to locate, determine National Register eligibility, and assess potential adverse effects on historic properties associated with the project. Juneau Hydro and the Commission consulted with the Douglas Indian Association (DIA), and no specific concerns about the project's effect on such sites were identified. The Alaska SHPO responded in a letter dated March 28, 2014, filed with Juneau Hydro's final cultural resources report on June 20, 2014, concurring with Juneau Hydro's findings, and ultimately concluded that no historic properties would be affected by the federal licensing action. Commission staff also concurs with this finding, and as a result, the section 106 process has been completed for the undertaking.

At the request of the Forest Service and the Alaska SHPO, Juneau Hydro prepared a Heritage Resource Protection Plan to address any cultural resources that may be discovered during project construction and operation. In such a case, the plan includes the necessary procedures to comply with section 106, including stopping all activities at the discovery site; consulting with the SHPO, Forest Service, and DIA on what particular measures are needed to resolve any adverse effects on the historic properties; and preparing a historic properties management plan, if needed. Revising the plan to include cultural resources training and monitoring protocols as specified in the Forest Service's December 24, 2015, comments, would ensure that the environmental compliance monitor (ECM) is capable of identifying and protecting cultural resources.

1.3.6 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NMFS on all actions that may adversely affect essential fish habitat (EFH). The proposed project area includes habitats that have been designated as EFH for various life-history stages of pink salmon, chum salmon, and sockeye salmon.

Based on our analysis in section 3.3.2, *Aquatic Resources*, and recommended measures in section 5.2, *Comprehensive Development and Recommended Alternative*, we concluded in the draft EIS that issuing a license for the proposed project would not adversely affect pink and chum salmon EFH in lower Sweetheart Creek, or sockeye, pink and chum salmon EFH in Gilbert Bay. On October 29, 2015, Commission staff informed NMFS of staff's conclusion.

By letter filed December 30, 2015, NMFS notified staff that it did not agree that the project would not affect EFH for spawning and incubating pink and chum salmon, but it provided conservation recommendations to address its concerns. NMFS recommended that Juneau Hydro consult with NMFS on the development of the Aquatic Habitat Restoration and Monitoring Plan (Aquatic Habitat Plan) to ensure the timely identification of any reduction in spawning gravels and timely and effective replacement of spawning habitat to avoid adverse effects on EFH. As explained in sections 3.3.2.2 and 5.2.2, we recommend that any license issued to Juneau Hydro include this measure.

1.3.7 Marine Mammal Protection Act

The 1972 Marine Mammal Protection Act (MMPA) prohibits, with certain exceptions, the "take" (defined under statute to include harassment)[19] of marine mammals in U.S. waters and the high seas. In 1986, Congress amended the MMPA, under the incidental take program, and the ESA, to authorize incidental takings of depleted, endangered, or threatened marine mammals, provided the "taking" (defined under the statute as actions which are or may be lethal, injurious, or harassing) was small in number and had a negligible impact on marine mammals. With this relationship between the MMPA and the ESA, NMFS cannot complete section 7 consultation and

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[19] Under the 1994 amendments to the MMPA, "harassment" is statutorily defined as "any act of pursuit, torment, or annoyance that has the potential to: (a) injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or (b) disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or mammal stock in the wild (Level B Harassment)" (MMPA Amendments of 1994, Pub. L. No. 103-238, 108 Stat. 432 [1994]; see also 50 CFR, section 216.3 [2010]).

issue an Incidental Take Permit for listed marine mammals until an Incidental Harassment Authorization[20] has been issued.

The humpback whale and western DPS Steller sea lion are federally listed endangered species and may occur in the vicinity of the proposed project. Additional non-listed marine mammals that are known to occur in the vicinity of the proposed project include the eastern DPS Steller sea lions and harbor seals. Implementing the following measures would avoid or minimize potential adverse effects of construction-related activities on marine mammals, including the humpback whale and Steller sea lion, to insignificant or discountable levels: employing a dedicated marine mammal monitor, ceasing pile driving when a marine mammal is observed within 1,000 meters of in-water pile driving activity, implementing pile driving ramp-up procedures to minimize sudden exposure of marine mammals to loud noises, using hammer cushions to minimize noise effects on marine mammals during impact pile driving, slowing vessel speed or stopping movement when a marine mammal is within 100 yards of vessels to prevent collisions between service boats and marine mammals, and defining flight paths and marine transportation routes to avoid disturbance of Steller sea lions at their haulout sites. Juneau Hydro's proposal to bury portions of the submarine cable and cover the cable with rock where it comes ashore would help reduce the extent of the magnetic field during project operation to negligible levels.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], Part 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. Scoping Document 1 was distributed to interested agencies and others on August 8, 2011. It was noticed in the Federal Register on August 17, 2011. Two scoping meetings, both advertised in the *Juneau Empire*, were held on September 7, 2011, in Juneau, Alaska, to request oral comments on the project. A court

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[20] In 1994, MMPA section 101(a)(5) was amended to establish an expedited process by which citizens of the United States can apply for an authorization, referred to as an Incidental Harassment Authorization, to incidentally take small numbers of marine mammals by harassment.

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, the following entities provided written comments:

Commenting Entity	Date Filed
State Representative Cathy Munoz	October 3, 2011
Forest Service	October 7, 2011
Alaska DFG	October 7, 2001
U.S. Department of the Interior, National Park Service (Park Service)	October 7, 2011
U.S. Department of the Interior, Fish and Wildlife Service (FWS)	October 11, 2011
NMFS	October 11, 2011

A revised scoping document (Scoping Document 2), addressing these comments, was issued on February 1, 2012.

1.4.2 Interventions

On July 31, 2014, the Commission issued a notice that Juneau Hydro had filed an application for an original license for the Sweetheart Lake Project. This notice set September 29, 2014, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

Intervenor	Date Filed
Forest Service	July 31, 2014
Alaska Electric Light and Power (AEL&P)	August 15, 2014

1.4.3 Comments on the Application

A notice requesting comments, final terms, conditions, and recommendations was issued on November 17, 2014. The following entities commented:

Commenting Agency and Other Entity	Date Filed
Alaska Energy Authority	December 23, 2014
State Representative Cathy Munoz	January 15, 2015
Alaska DFG	January 16, 2015
Forest Service	January 16, 2015
Interior	January 20, 2015

Commenting Agency and Other Entity	Date Filed
Alaska Department of Natural Resources (Alaska DNR)	January 20, 2015
U.S. Environmental Protection Agency	January 26, 2015
U.S. Senator Lisa Murkowski	January 26, 2015
U.S. Representative Don Young	January 26, 2015
State Senator Dennis Egan	February 11, 2015

The applicant filed reply comments on February 28, 2015.

1.4.4 Comments on the Draft Environmental Impact Statement

The draft EIS for the Sweetheart Lake Project was issued on October 29, 2015. Comments on the draft EIS were due by December 29, 2015. Written comments on the draft EIS were filed by the following entities:

Commenting Entity	Date Filed
U.S. Environmental Protection Agency	December 22, 2015
Interior	December 23, 2015
Representative Cathy Muñoz	December 23, 2015
Forest Service	December 24, 2015
Carol Bookless	December 28, 2015
Alaska DFG	December 29, 2015
Alaska DNR	December 29, 2015
Alaska Electric Light and Power Company	December 29, 2015
NMFS	December 29, 2015
Scott Spickler	December 29, 2015
International Union of Operating Engineers	January 6, 2016

In addition, the Commission accepted oral testimony on the draft EIS at two public meetings, both held on December 2, 2015, in Juneau, Alaska. The transcripts from these meetings were filed in the administrative record for the project.

The applicant filed reply comments on January 20, 2016.

Appendix A summarizes the oral and written comments, includes our responses to those comments, and indicates where we made modifications to the draft EIS.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the proposed project would not be built, and the environmental resources in the proposed project area would not be affected.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

The proposed project would consist of the following new facilities: (1) a 280-foot-wide, 111-foot-high roller-compacted concrete dam to be constructed at the existing natural outlet of Lower Sweetheart Lake with a 125-foot-wide ungated overflow spillway at a crest elevation of 636 feet; (2) a 525-foot-long, 10-foot-high, 10-foot-wide arched reservoir outlet tunnel at the right dam abutment; (3) a 45-foot-long, 25-foot-wide, 16-foot-high rectangular concrete intake structure with six 7-foot-diameter, 10-foot-high cylindrical fish screens adjacent to the right dam abutment; (4) a 9,612-foot-long, 15-foot-wide, 15-foot-high horseshoe-shaped, unlined underground power tunnel; (5) an 896-foot-long, 9-foot-diameter saddle-supported steel penstock installed within the lower portion of the power tunnel; (6) three 160-foot-long (mean length), 7- to 9-foot-diameter buried steel penstocks connecting the lower portion of the power tunnel to the powerhouse; (7) a 160-foot-long, 60-foot-wide, 30-foot-high concrete and steel powerhouse; (8) three 7.1-MW Francis turbines with 6.6-MW generators with a total installed capacity of 19.8 MW; (9) a 541-foot-long, 30- to 90-foot-wide rock tailrace with a fish exclusion structure, discharging to Sweetheart Creek; (10) a 4,400-foot-long coastal road from the powerhouse to a dock/landing site for aerial and marine vehicle access, located on the east shore of Gilbert Bay; (11) an 8.69-mile-long, 138-kilovolt (kV) transmission line traversing Gilbert Bay, the Snettisham Peninsula, and Port Snettisham, consisting of: (a) two buried segments, totaling 4,800 feet in length; (b) two submarine cable segments, totaling 25,700 feet in length; and (c) one 15,400-foot-long, overhead segment; (12) a 22,000-square-foot fenced switchyard adjacent to the powerhouse; (13) a 60-foot by 60-foot switchyard at the end of the transmission line on the north shore of Port Snettisham; (14) a 25-foot-long, 5-foot-wide, 4-foot-deep salmon smolt re-entry pool[21] located adjacent to the powerhouse and tailrace; (15) a 4,225-square-foot caretaker's facility near the dock; (16) a 4,800-foot-long, 12.47-kV service transmission line and communication cable extending from the powerhouse to the dock and the caretaker's facility, providing operational electricity and communications; (17) a 10,000-foot-long, 12.47-kV service transmission line and communication cable extending

[21] The re-entry pool would provide temporary holding of sockeye salmon smolt collected and transported from Sweetheart Lake, for imprinting and release to the tailrace.

from the powerhouse to the dam site, providing operational electricity and communications; (18) a 400-square-foot shelter facility at the dam site for employee use during smolt transport facility operations; and (19) appurtenant facilities.

Construction of the project would raise Lower Sweetheart Lake from a water surface elevation of 551 feet mean lower low water[22] and a surface area of 1,414 acres to a new maximum water surface elevation of 636 feet and surface area of 1,702 acres, and a new minimum water surface elevation of 576 feet and surface area of 1,449 acres.

The tailrace would enter Sweetheart Creek approximately 1,300 feet upstream from the creek mouth on Gilbert Bay, bypassing an approximately 2-mile-long reach of Sweetheart Creek from the lake outlet to the impassable fish barrier at the falls near the tailrace outlet.

The project would occupy 2,058.24 acres of federal lands located within the Tongass National Forest. The proposed project boundary would also include 131.18 acres of tideland and submerged lands of the state of Alaska.

2.2.2 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after construction. Inspection during construction would concentrate on adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operation, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.3 Proposed Project Operation

Water would enter the project at the intake structure, travel through the power tunnel and penstock, through the powerhouse turbines, through the tailrace, and return to the upstream end of Sweetheart Creek about 1,300 feet upstream from the creek mouth on Gilbert Bay. The project would bypass an approximately 2-mile-long reach of Sweetheart Creek from the lake outlet to the impassable fish barrier at the falls near the tailrace outlet. The project would provide a 3-cubic feet per second (cfs) minimum

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[22] The mean lower low water level is the 19-year average of the lower of the two daily low tides and serves as the reference elevation chosen by Juneau Hydro for project facilities.

release from the dam and into the 2-mile-long bypassed reach, as well as minimum instream flow as measured in the 1,300-foot-long section of Sweetheart Creek downstream of the project tailrace of: 40 cfs for January through February, 45 cfs for March, 119 cfs for April, 300 cfs for May through October, and 117 cfs for November through December. The powerhouse would have a minimum hydraulic capacity of 55 cfs (one unit) and a maximum hydraulic capacity of 460 cfs (three units).[23] Above the maximum operating reservoir level (> 636 feet), flows would pass over the dam spillway into the bypassed reach.

The additional storage created by the project would be used to re-regulate the natural flows from the Sweetheart Lake watershed to provide continuous year-round flow to the powerhouse to meet a firm base-load for two units (13.2 MW) and the minimum instream flow requirements below the project tailrace; the third unit would be operated only when excess water is available. The project would draw on the available storage during the low-flow winter months to reach a normal minimum pool level of 576 feet by April or May and capture flows between June and October to refill the reservoir to the maximum reservoir level of 636 feet, resulting in an annual reservoir fluctuation of about 60 feet.[24]

2.2.4 Proposed Environmental Measures

Construction

- Provide representatives of Alaska DFG access to, through, and across project lands and waters and project works in the performance of their official duties upon appropriate advance notification, and reserve the Forest Service right to use or permit others to use National Forest System (NFS) lands for any purpose, as long as it does not interfere with project purposes specified in a license.
- Implement the Environmental Compliance Plan filed with the license application to retain an ECM during construction to ensure environmental protection measures are being properly implemented.
- Revise, if necessary, the Erosion Control Plan, Storm Water and Pollution Prevention Plan (Storm Water Plan), and Solid Waste and Wastewater Plan (Solid

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[23] Although the true maximum hydraulic capacity would be 650 cfs, because of generator limitations, the hydraulic discharge of the powerhouse would be limited to 460 cfs.

[24] A reservoir elevation of approximately 558 feet is necessary to pass flow through the project. In the event that the reservoir level drops below this elevation, or flows are prevented from being passed through the powerhouse, flows would be routed through the project's diversion tunnel at the base of the dam into the bypassed reach.

Waste Plan) filed with the license application to include site-specific best management practices (BMPs) for controlling erosion and protecting water quality from stormwater runoff, sewage, and fuel spills; site storage and disposal areas at least 100 feet from streams and intertidal areas to protect fish and wildlife; functional design drawings and specific topographic locations of erosion control measures; daily monitoring of turbidity to assess the effectiveness of erosion control measures by an ECM; and procedures for taking corrective actions.

- Revise, if necessary, the Spoil Disposal Plan filed with the license application to include site-specific measures for handling and disposing of excavated materials, testing for acid rock drainage forming materials, disposing of the excavated spoils containing such acid-forming materials in a designated area with a liner and cap to prevent leaching, and determining whether the spoils would need to be treated onsite with a buffering agent, such as limestone. Final plans for disposing and treating spoils with the potential to create acid leachate would be developed within 90 days of discovery.
- Develop and implement timing windows for instream construction activities and stream crossings in consultation with Alaska DFG.
- Revise, if necessary, the Vegetation Management Plan filed with the license application that includes salvaging native plants from construction areas and transplanting them to revegetate disturbed sites; monitoring the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; implementing measures to avoid the potential spread of invasive plants associated with project construction; and avoiding the use of pesticides and herbicides within 500 feet of sensitive species and habitats.
- Revise, if necessary, the Wildlife Mitigation and Monitoring and Threatened and Endangered Species Protection Plan filed with the license application and updated on January 27, 2016, that includes: reducing vessel speed or stopping if marine mammals (including the endangered humpback whale and Steller sea lion) are within 100 yards of in-water construction activities to prevent collisions between service boats and marine mammals; ceasing pile driving if a marine mammal is observed within 1,000 meters (1,094 yards) of pile driving activity to minimize noise effects on marine mammals; implementing pile driving ramp-up procedures to minimize sudden exposure of marine mammals to loud noises; using hammer cushions to minimize noise effects on marine mammals during impact pile driving; defining flight paths and marine transportation routes to avoid disturbance of Steller sea lions and mountain goats; developing a wildlife bypass trail upslope of the caretaker's facility to minimize human-animal interaction; posting hunting and fishing regulations onsite; restricting project personnel from hunting, fishing, and trapping during project construction; prohibiting personal firearms onsite to deter project personnel from hunting during project construction and operation;

and surveying for nesting bald eagles and taking necessary steps to minimize disturbance if needed during project construction.

- Implement the Bear Safety Plan filed with the license application that includes protocols to minimize the risk of human-bear interactions.
- Revise, if necessary, the Construction Plan filed with the license application that outlines the location, methodology, and scheduling that would be followed to construct the project facilities to ensure compliance with National Forest objectives.
- Establish and maintain, with frequent summer season updates, a web site describing construction progress and any visitor access limitations. Identify a point of contact on the web site and include a provision for receiving public questions or comments regarding project construction-related issues.
- Implement the Heritage Resource Protection Plan filed with the license application to protect cultural, archeological, or historical resources (or human remains associated with the Native American Graves Protection and Repatriation Act of 1990) in the event that they are inadvertently discovered during construction and operation.

Project Design Features and Operation

- Install and maintain a fish exclusion structure in the project tailrace to prevent fish from entering the turbine draft tubes.
- Install and maintain fish screens on power tunnel intake structure according to NMFS criteria to prevent entrainment of fish.
- Bury the penstock and construct a 94-foot-wide tailrace overpass and connecting trail to mitigate barriers to wildlife movements.
- Bury the transmission and telecommunication cables along a new coastal access road and install submarine cables across the Gilbert Bay flats to minimize visual impacts and to protect migratory birds from collision and electrocution hazards.
- Release a minimum flow of 3 cfs into the Sweetheart Creek bypassed reach.
- Maintain a minimum flow of 40 cfs in the anadromous reach of Sweetheart Creek from January through February, 45 cfs in March, 119 cfs in April, 300 cfs from May through October, and 117 cfs from November through December, as measured at a stream gage installed immediately downstream of the tailrace.
- Develop a pulse flow release and monitoring plan, in consultation with Alaska DFG, that includes conducting a 3- to 5-year evaluation of the effectiveness of releasing at least four pulse flows of up to 486 cfs between July 1 and August 31 of each year, in stimulating returning sockeye salmon to enter Sweetheart Creek from the estuary.

- Revise, if necessary, the Water Management Plan filed October 20, 2014, that includes: (1) a Reservoir Management and Inundation Plan (Reservoir Management Plan) containing procedures for monitoring reservoir levels, monitoring reservoir water quality, and managing reservoir vegetation and floating debris; (2) a Stream Flow Management Plan that describes methods for controlling the minimum flows and ensuring continuous flow when the project is not operating (i.e., install conduit and gated diversion tunnel to provide bypassed reach flow and synchronous bypass valves on each turbine to provide anadromous reach flow); and (3) a Stream Flow Measurement Plan that includes procedures and equipment for measuring minimum flow releases.
- Construct and operate a sockeye smolt collection and transport system and develop an operating plan (sockeye smolt transport plan) that includes: (1) a description of the procedures that would be used to capture, hold, transport, and release sockeye salmon smolts from Sweetheart Lake into Sweetheart Creek; (2) a description of the protocols for monitoring survival of sockeye salmon; and (3) contingency provisions to ensure sockeye salmon smolts are successfully imprinted and released in Sweetheart Creek if the sockeye smolt collection and transport system fails.
- Revise, if necessary, the Aquatic Habitat Plan filed October 20, 2014, that includes assessing spawning habitat in the anadromous reach of Sweetheart Creek and potentially conducting gravel augmentation based on the results of the spawning habitat assessment.
- Revise, if necessary, the Fish Mitigation and Monitoring Plan (Fish Mitigation Plan) filed October 20, 2014, that includes monitoring rainbow trout and Dolly Varden populations and measuring water temperatures in Sweetheart Lake following project construction. If monitoring results indicate poor recruitment of rainbow trout and Dolly Varden, Juneau Hydro would stock triploid rainbow trout and Dolly Varden in Sweetheart Lake, improve access to potential spawning habitat in tributaries to Sweetheart Lake, or implement offsite mitigation determined in consultation with Alaska DFG and Forest Service.
- Revise, if necessary, the Hazardous Substances Plan filed with the license application that includes procedures for reporting and responding to releases of hazardous substances.
- Construct and annually inspect the overhead 138-kV transmission line using the Edison Electric Institute's Avian Power Line Interaction Committee (APLIC) guidelines for protecting birds from electrocution and collision hazards.
- Revise, if necessary, the Fire Prevention Plan filed with the license application that defines protocols that would be followed to prevent and control wildfires.
- Revise, if necessary, the Access Management Plan filed with the license application that includes provisions to control public access to the project to

ensure public safety, project security, and project consistency with Forest Service roadless area management goals; and monitor the effectiveness of access control measures.

- Revise, if necessary, the Recreation Management Plan filed with the license application that includes installing and maintaining interpretive displays at the head of Sweetheart Creek Trail; a new trail system that leads fishermen to the traditional fishing areas at Sweetheart Creek and away from prime bear fishing locations; landform berms to provide scenic, sound, and light barriers between the powerhouse/switchyard area and Sweetheart Creek recreational areas; a rock tailrace to increase available fishing area along Sweetheart Creek; a dock and intertidal ramp on the eastern shore of Gilbert Bay and a trail from the boat dock to the powerhouse location that would be available for public use; and at least three mooring buoys in Gilbert Bay.
- Revise, if necessary, the Scenery Management and Monitoring Plan filed with the license application that provides for using exterior colors for the transmission and marine access facilities and fencing that minimize contrast with the surrounding environment; minimizing vegetation removal; using native vegetation to reduce visibility of the project; avoiding use of exterior lighting to minimize light pollution; and monitoring, through photographic documentation, the continued success of scenery management mitigation over a 10-year period.

2.2.5 Modifications to Applicant's Proposal—Mandatory Conditions

The following mandatory conditions have been provided and are evaluated as part of Juneau Hydro's proposal.

Section 4(e) Land Management Conditions

The Forest Service filed preliminary 4(e) conditions on January 9, 2014, and final 4(e) conditions on December 24, 2015. The final conditions provided by the Forest Service under section 4(e) and considered in the EIS are as follows: conditions 1 through 14, and 16 through 20 are standard, administrative, or legal in nature and not specific environmental measures. We therefore do not analyze these conditions in detail in this final EIS. They would include the following: condition 1 requires Juneau Hydro to obtain a Forest Service special-use authorization; condition 2 requires Forest Service approval of final design plans for project components deemed to be affecting or potentially affecting NFS resources; condition 3 requires Forest Service approval of changes in project facilities or operation from approved exhibits filed with the Commission; condition 4 requires annual consultation with the Forest Service regarding measures needed to ensure the protection and development of the natural resource values of the project area; condition 5 requires compliance with the U.S. Department of Agriculture regulations for activities occurring on NFS lands and applicable federal, state, county, and municipal laws, ordinances, and regulations; condition 6 establishes conditions that would need to be met if the license is surrendered or transferred;

condition 7 has been deleted; condition 8 requires indemnification of the United States for actions of Juneau Hydro related to its authorized use and occupancy of NFS lands; condition 9 requires protection of the land, property, and interests of the United States from damage arising from the construction, maintenance, or operation of project works; condition 10 requires identification and reporting of all known or observed hazardous conditions on or directly affecting NFS lands within the project boundary that would affect the improvements or resources, or would pose a risk of injury to individuals; condition 11 requires protection of Forest Service special status species by preparing and submitting a biological evaluation for Forest Service approval prior to any new construction; condition 12 reserves the Forest Service's right to use or permit others to use NFS lands for any purpose, as long as such use does not interfere with project purposes specified in a license; condition 13 requires maintenance of all improvements and premises on NFS lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Forest Service; condition 14 requires avoiding disturbance to all public land survey monuments, private property corners, and forest boundary markers; condition 16 reserves the right of the Forest Service to modify 4(e) conditions after NMFS or FWS issues any biological opinion or the state of Alaska issues any certification; condition 17 requires consultation with and obtaining approval from the Forest Service prior to erecting signs on NFS lands; condition 18 requires consultation with the Forest Service on any ground-disturbing activities on or directly affecting NFS lands that were not specifically addressed in the Commission's National Environmental Policy Act processes and providing funding as applicable for the necessary environmental analysis; condition 19 precludes the licensee from commencing implementation of habitat or ground-disturbing activities on NFS lands pending completion of the Forest Service pre-decisional administrative review process and reserves the right of the Forest Service to modify its 4(e) conditions; and condition 20 requires that, when using explosives, Juneau Hydro comply with federal, state, and local laws and ordinances and contact the Forest Service prior to blasting to obtain its requirements.

Environmental conditions stipulated by the Forest Service that are analyzed in the final EIS include: condition 15 that requires avoiding the use of pesticides on NFS lands or in areas affecting NFS lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, and non-native fish without the prior written approval of the Forest Service; condition 21 that requires Juneau Hydro to provide a qualified ECM to oversee the project during major construction activities (e.g., vegetative or land disturbing, spoil producing, blasting activities); and condition 22 that requires the development and implementation, within 1 year of license issuance and in consultation with the Forest Service and applicable federal and state agencies, the following plans: (1) construction plan; (2) spoil disposal plan; (3) access and road management and maintenance plan; (4) reservoir management and inundation plan; (5) erosion control plan; (6) solid waste and wastewater plan; (7) hazardous substances plan; (8) fire prevention plan; (9) heritage resource protection plan; (10) scenery management plan;

(11) vegetation management plan; (12) invasive species management plan; (13) wildlife mitigation and monitoring plan; (14) fish mitigation and monitoring plan; (15) threatened, endangered, proposed for listing, and sensitive species plan; (16) stream flow management plan; (17) stream flow measurement plan; (18) aquatic habitat restoration and monitoring plan; (19) environmental compliance monitoring plan; and (20) storm water and pollution plan.

2.3 STAFF ALTERNATIVE

The staff alternative includes Juneau Hydro's proposal, the Forest Service's 4(e) conditions, and the following modifications to Juneau Hydro's proposed measures based on resource agency recommendations to better protect water resources, wetlands, vegetation, wildlife, recreation, and visual resources during construction and operation:

(1) modify the Acid Rock Drainage Contingency Plan (Acid Rock Plan) to include a provision to provide detailed plans for acid-producing spoil storage, disposal, treatment, and monitoring measures based on geotechnical study results and prior to beginning construction;

(2) file a schedule for in-water construction activities for Commission approval;

(3) modify the proposed Water Management Plan to: (a) remove the provision that requires Juneau Hydro to file annual stream gage data with the Commission by April 1 of each year; (b) define the criteria for determining water quality deviations for turbidity, pH, and temperature during project operation; (c) add continuous monitoring of water temperature, pH, and turbidity for the first 5 years of project operation, and file a report with the Commission for approval at the end of the 5-year monitoring period documenting the results of the water quality monitoring and any recommendations for continuing monitoring; (d) include a provision to notify the Commission in the event that water quality deviations are detected, and file a report within 10 days that describes the deviation, corrective actions taken, and proposals to modify procedures; (e) include a description of how Juneau Hydro would document compliance with minimum instream flows, including a detailed description of the gages to be installed, their location, maintenance and calibration procedures, and an implementation schedule; and (f) include a provision to file a report of any deviation from minimum flow or flow continuation requirement with the Commission within 10 days of the deviation, and describe the deviation, any observed environmental effect, and corrective actions taken;

(4) prepare an operation and maintenance plan for the proposed draft tube fish exclusion structure;

(5) prepare an operation and maintenance plan for the intake fish screen;

(6) modify the proposed sockeye smolt transport plan to include a provision to file an annual report with Alaska DFG and the Commission on the effectiveness of the collection and transport system in meeting the defined performance criteria, and after the

third year of operation, file a final report summarizing the cause(s) of any system failures and any recommended corrective measures;

(7) modify the proposed Aquatic Habitat Plan in consultation with Alaska DFG, NMFS, and the Forest Service to include additional details on spawning habitat monitoring and mitigation methods, and file a report with the Commission by December 31 of year 3 following implementation of the spawning habitat assessment summarizing the spawning gravel assessment results and recommendations for continuing the assessment, or plans to augment spawning gravel, and remove the requirement to monitor salmon spawning in the anadromous reach;

(8) modify the proposed Fish Mitigation Plan to include a requirement to file a report with the Commission by December 31 of year 3 following implementation of the monitoring program summarizing the monitoring results and recommendations for continuing the monitoring or to implement measures to improve fish recruitment;

(9) modify the proposed Vegetation Management Plan to include: (a) a description of storage and treatment of salvaged plants; (b) a list of plant species that would be imported to revegetate disturbed areas; (c) criteria, based on existing conditions, to determine whether revegetation efforts are successful; (d) a description of data collection and analysis methods for monitoring that corresponds with success criteria; (e) provisions for monitoring and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons; and (f) salvaging and transplanting a rare twocolor sedge plant that would be inundated by the reservoir;

(10) modify the proposed Invasive Species Management Plan to: (a) include measures to use weed-free fill materials and weed-free erosion control methods; (b) include a monitoring schedule that addresses short-term (first 5 years) and long-term monitoring needs; (c) include a description of proposed eradication measures; and (d) avoid the use of pesticides and herbicides on NFS lands or in areas affecting NFS lands and within 500 feet of rough-skinned newt, western toad, or any other special status or culturally significant plant population without the prior written approval of the Forest Service;

(11) revise the proposed Wildlife Mitigation and Monitoring Plan to remove the proposed wildlife bypass trail around the caretaker's facility and the restrictions on hunting, fishing, and trapping and onsite possession of firearms by project personnel, and the posting of hunting and fishing regulations during construction;

(12) modify the proposed Recreation Plan to: (a) consult with the Forest Service, Park Service, and Alaska DFG to finalize the Recreation Management Plan; (b) file as-built drawings of all completed recreation facilities; (c) review the adequacy of new recreational facilities in consultation with the Forest Service, Park Service, and Alaska DFG within 4 years of completion of project construction, and every 10 years thereafter; and (d) file recreation monitoring reports with the Commission;

(13) revise the Access Management Plan to allow full public access to the proposed boat ramp and dock with these revisions also reflected in the revised Recreation Management Plan;

(14) finalize the proposed Scenery Management Plan to include protocols to document compliance with the plan (e.g., establishing photo points, the time of year to take the photos), and procedures and a schedule to review and update the plan to address visual issues that may arise during the license term; and

(15) revise the Heritage Resources Protection Plan to include cultural resources training and monitoring protocols.

The staff alternative would also include all the final 4(e) conditions specified by the Forest Service.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

2.4.1 Alternative Sites

In developing its license application, Juneau Hydro reviewed alternative sites in the Juneau area for the development of its hydroelectric project. These sites included repairing or replacing existing dams on Sheep Creek and Tease Lake and developing new projects on the Whiting River and Taku River. Juneau Hydro eliminated these alternatives from further consideration because development would result in greater adverse environmental effects (e.g., would require blocking salmon migration routes) or would not be economically feasible.

Juneau Hydro also considered the eventual development of phase II of AEL&P's Lake Dorothy Hydroelectric Project No. 12379 (Lake Dorothy Project). In developing the Lake Dorothy Project, AEL&P contemplated and planned for its potential expansion. Initial planning efforts suggest that Lake Dorothy Phase II[25] would consist of a lake tap on Lake Dorothy, a short power tunnel, a 3.2-mile-long penstock, and two 15-MW turbines installed in the existing Lake Dorothy Phase I powerhouse. If developed, Lake Dorothy Phase II would annually generate 154,500 MWh. However, much of the flow used to generate electricity for Lake Dorothy Phase II would no longer be available for use by Lake Dorothy Phase I. Thus, after construction of both project phases, Lake Dorothy Phase I's annual power generation would reduce to approximately 14,300 MWh, resulting in a net annual generation for both project phases of 168,800 MWh (AEL&P,

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[25] The Commission issued a license for Phase I of the Lake Dorothy Hydroelectric Project (Lake Dorothy Phase I) on December 24, 2003. The project has a single 14.3-MW turbine/generator, and an average annual generation of 74,500 MWh. Project operation commenced on August 31, 2009.

2002). However, AEL&P has not filed an application with the Commission to develop phase II, and there is no further information to suggest if or when AEL&P might develop the project; therefore, it is too speculative to be a reasonably foreseeable action alternative to be considered in the EIS.

Further, in comparison to the proposed Sweetheart Lake Project, Juneau Hydro found that no other site investigated within the Juneau market would be sufficient to provide reliable year-round power. Therefore, no reasonable action alternatives have been identified, other than Juneau Hydro's proposal and the staff alternative recommended in this final EIS.

2.4.2 Alternative Project Design

Juneau Hydro also considered and rejected various alternative project feature designs. Alternative dam designs included a traditional concrete dam and a concrete-faced rockfill dam, which were eliminated as alternatives based on economic and safety considerations, and because they would not provide any additional environmental benefits. Juneau Hydro also considered an upland access road sited inland from Gilbert Bay as an alternative to the selected coastal access road. This access road alternative was rejected because it would have affected 646 additional feet of ephemeral streams and 0.82 additional acre of wetlands. Juneau Hydro rejected locating the powerhouse on Gilbert Bay at tidewater because it would have impacted anadromous fish by eliminating return flows to the anadromous reach of lower Sweetheart Creek. Various transmission line alternatives were considered, including an alternative interconnection location, and differing segments of overhead, buried, and marine transmission cables. These alternatives were rejected because of increased adverse environmental effects from additional forest clearing, greater potential for avian electrocution and collision hazards, and potential interference with fishermen in Gilbert Bay.

Based on these considerations, these alternatives were eliminated from further detailed analysis in the EIS.

2.5 U.S. ARMY CORPS OF ENGINEERS' 404(b)(1) ALTERNATIVES ANALYSIS[26]

The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental effects of, and a reasonable range of alternatives to, their proposed actions. FERC is the NEPA lead federal agency for Juneau Hydro's proposed Sweetheart Lake Project. However, the proposed action would involve the discharge of dredged or fill material into waters of the U.S. and would require a CWA section 404

[26] This section was prepared by the Corps and was submitted to the Commission for inclusion as part of the final EIS. The information in this section is to be used for the Corps' 404 permitting process.

permit from the U.S. Army Corps of Engineers (Corps). Therefore, the Corps must ensure compliance with the CWA and with NEPA in order to issue a CWA permit.

The actions required by the Corps under the CWA provide them the opportunity to be a cooperating agency in the development of this EIS. Because the Corps is serving as a cooperating agency they have the ability to adopt the FERC NEPA document for their own NEPA compliance and have a more formal role and input into project development, which will assist them in determining whether the proposed project is in compliance with section 404 of the CWA.

The Corps is evaluating this project to ensure compliance with the requirements of CWA section 404(b)(1) guidelines for consideration of alternatives (40 CFR 230.10(a)). These guidelines are the substantive environmental standards by which all section 404 permit applications are evaluated. The fundamental precept of the guidelines is that discharges of dredged or fill material into waters of the U.S., including wetlands, shall not occur unless it can be demonstrated that such discharges, either individually or cumulatively, will not result in unacceptable adverse effects on the aquatic ecosystem. The guidelines specifically require that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (40 CFR 230.10(a)). Based on this provision, the applicant is required in every case to evaluate opportunities for use of non-aquatic areas and other aquatic sites that would result in less adverse impact on the aquatic ecosystem. A permit cannot be issued, therefore, in circumstances where a less environmentally damaging practicable alternative for the discharge exists. This is what is commonly referred to as the LEDPA.

The Corps recognizes that NEPA documents prepared by other lead federal agencies may not contain sufficient detail to comply with the guidelines. The Corps requested the applicant provide a 404(b)(1) alternatives analysis sufficient to evaluate compliance with section 404 of the CWA. The 404(b)(1) alternatives analysis provided by the applicant is included as an appendix to this EIS (Appendix B).

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3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity, (2) an explanation of the scope of our cumulative effects analysis, and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historical and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.2, *Comprehensive Development and Recommended Alternative*.[27]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Sweetheart Lake Project would be located on Lower Sweetheart Lake and Sweetheart Creek in the Sweetheart Creek Basin, about 30 miles southeast of the City of Juneau, Alaska. The entire Sweetheart Creek Basin is located in the Tongass National Forest and drains approximately 36 square miles.

The Sweetheart Creek Basin includes Upper Sweetheart Lake, Lower Sweetheart Lake (hereafter, Sweetheart Lake), and Sweetheart Creek. The upper basin consists of high peaks and ridges ranging in elevation from 2,500 to 4,500 feet, many containing glaciers and ice fields that drain down steep canyon walls and avalanche chutes into Upper Sweetheart Lake and tributaries that flow into Sweetheart Lake. Sweetheart Lake is a 5.4-mile-long, 0.6-mile-wide, narrow, glacially formed lake with a surface area of 1,223 acres at a normal elevation of 551 feet. The watershed surrounding the lake is remote, undeveloped, and predominately covered with spruce-hemlock forest. Sweetheart Creek flows approximately 2.2 miles from the outlet of Sweetheart Lake to its mouth at Gilbert Bay. Gilbert Bay is a deep water bay that extends from the mouth of Sweetheart Creek northward to Port Snettisham and the Whiting River confluence.

The project is within the area of maritime influence that prevails over coastal Southeast Alaska and is in the path of most storms that cross the Gulf of Alaska. Consequently, the area has infrequent sunshine, generally moderate temperatures, and abundant precipitation, much of which occurs as snowfall at higher elevations in the winter. The rugged terrain of the area is an important influence on local temperature and precipitation distribution, creating a variety of microclimates within short distances.

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[27] Unless otherwise indicated, our information is taken from the license application (Juneau Hydro, 2014a) and additional information filed by Juneau Hydro (Juneau Hydro, 2015a, 2014b).

Sunshine occurs about 30 percent of the year, and day length ranges from 6 hours and 21 minutes in the winter to 18 hours and 18 minutes in the summer.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Register (40 CFR, Part 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact 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 impacts 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. Through scoping, agency consultation, and our independent analysis, we did not identify any resources that would be cumulatively affected by constructing and operating the Sweetheart Lake Project. The project would be located in a small watershed with little existing or planned future development other than the proposed hydroelectric project.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific site-specific and cumulative environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EIS. We present our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative.*

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

Geology and Soils

The Sweetheart Lake Project is located on the west slope of the Coastal Range that forms the mainland of Southeast Alaska. Bedrock in the project area includes igneous rock along much of Sweetheart Lake (upstream of the proposed dam site) and metamorphic rocks in the proposed dam, tunnel, and powerhouse locations. Two belts of metamorphic and igneous rocks dominate the bedrock geology of the area—a western belt and an eastern belt. The western metamorphic belt underlies the proposed project access road, powerhouse, lower power tunnel, and the cable corridor on Snettisham Peninsula; this belt is of Upper Paleozoic to early Mesozoic age. Rock types in the western belt consist predominantly of biotite schist, hornblende schist, and amphibolite. Prior to metamorphosis, these rocks probably consisted of clastic and volcanic materials with smaller amounts of chert, graywacke, and carbonate rocks. The eastern belt is of

Cretaceous to Lower Tertiary age and underlies the proposed dam, intake, upper power tunnel, and Sweetheart Lake. Rock types in the eastern belt consist of biotite hornblende tonalite. Tonalite is an igneous rock consisting largely of quartz and plagioclase feldspar.

Glaciers shaped the larger geomorphological features in the project area. Sweetheart Lake Valley has steep bedrock slopes broken by colluvial[28] avalanche slopes, landslides, and alluvial[29] fans. The largest of these alluvial and colluvial features are concentrated at the outlet of the lake and at the head of the lake to the northeast of the project. While landslides do occur in the project vicinity because of the steep topography in the area, evidence of prior landslides along Sweetheart Lake is found at least 4,000 feet from the dam site. Closer to Gilbert Bay, a smaller landslide is located just north of the proposed powerhouse location.

Soil series along the shoreline of Sweetheart Lake have a wide range of characteristics. Typically on low to moderate slopes (< 35 percent), the soils consist of peat, muck, silt loam, sand, sandy loam, gravelly silt loam, and gravelly sandy loam. These soils are poorly to well drained and range in depth from moderately deep (20 to 40 inches) to very deep (more than 60 inches). Soils on steep slopes (> 35 percent) consist of muck, peat, silt loam, sandy loam, gravelly loams, gravelly silt loam, gravelly sandy loam, and exposed bedrock. These soils are generally very poorly to well drained and range in depth from very shallow (less than 10 inches) to very deep (more than 60 inches).

Soils in the vicinity of the proposed dam site at the southwest end of Sweetheart Lake are colluvial silt loams or loams on hill and mountain slopes, and alluvial soils on fans and terraces along Sweetheart Lake. The colluvial soils are moderately well to well drained and are located on very steep slopes. The alluvial soils are subject to occasional inundation, are moderately to well drained, and are located on low to moderate slopes.

The geomorphological features of Gilbert Bay in the project area are more muted than those of the Sweetheart Lake area described above, where the landscape is steeper and more active. Relatively large areas of alluvial/estuarine features occur at the mouth of Sweetheart Creek. No large avalanche tracks are located in Gilbert Bay.

The Gilbert Bay area near the outlet of Sweetheart Creek and in the vicinity of the proposed powerhouse consists of soils that are alluvial, colluvial, or glaciofluvial[30] in nature. Typically, soils in this area that are found on moderate slopes (< 35 percent), steep slopes (> 35 percent to < 55 percent), and very steep slopes (> 55 percent) are

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[28] Gravity-transported deposits.

[29] River-transported deposits.

[30] Material that was moved by glaciers and was subsequently sorted and deposited by streams flowing from the melting ice.

somewhat poorly drained, poorly drained, and well to moderately well drained, respectively.

The marine geology along the transmission line alignment crossing Gilbert Bay includes shallow bedrock overlain with sediment and cobbles at both shorelines with deep, soft sediment in the deep water areas. The Port Snettisham crossing has bedrock and fractured bedrock on both shorelines that extend steeply to depths of up to 750 feet. The gradual sloping bottom consists of dense glacial till covered with some silt.

Seismicity

The two geologic belts underlying the project area are tectonically complex and are separated by the Sumdum Fault, a thrust fault that dips eastward and is of Cretaceous age.

Two persistent major linear features[31] are located in the area. The largest, the Coast Range megalineament, is a zone of closely spaced prominent joints, foliation surfaces,[32] and small faults that parallel the contact of the two geologic belts and the north-northwest striking lineament that extends through the center of Gilbert Bay. The other linear feature is the northeast-trending Whiting River-Sweetheart Lake lineament that consists of two nearly parallel northeast striking lineaments, one of which passes through the center of Sweetheart Lake.

The Alaska coastline experiences seismic events because of the active boundary between the Pacific and North American plates. Where this boundary is closest to the project site it is marked by the Fairweather Fault (at a distance of approximately 110 miles). Here the Pacific plate moves in a northwestward direction relative to the North American plate, creating a transform boundary. The closest published Quaternary fault is approximately 45 miles west of the project site.

Between 1899 and 2013, 168 earthquakes that ranged in magnitude from 4 to 8 on the Richter scale occurred in an area within about 100 to 150 miles of the project site, including six moderate to large earthquakes in this period. These earthquakes ranged from the largest, a magnitude 8.1 event in August 1949 that was approximately 300 miles

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[31] Linear features or lineaments in a landscape are expressions of an underlying geological structure, such as faults or fracture zones. Often, a lineament will be composed of one or a series of fault-aligned valleys. Lineaments are often apparent in geological or topographic maps, and on aerial or satellite photographs.

[32] Foliation refers to repetitive layering in metamorphic rocks. The thickness of each layer may vary from less than a millimeter to greater than a meter. Foliation is common in rocks affected by the regional metamorphic compression typical of areas of mountain belt formation.

south of the project site, to the closest, a magnitude 7.1 event in October 1927 that was about 90 miles west of the project site.

Seismic events have the potential to damage project features and to create slope stability issues at the project. However, according to the 2014 U.S. Geological Survey (USGS) simplified hazard map, the project is located in only a moderate seismic hazard area, and is removed from active fault zones. Regardless, in the event that a license is issued for the project, the Commission's Division of Dam Safety and Inspections would evaluate the stability of the dam under all probable loading conditions, including seismic loading. The Division of Dam Safety and Inspections would review geotechnical studies provided in support of the project's final design to ensure that project features are designed to safely withstand all credible loading conditions. Furthermore, an independent Board of Consultants would be required to perform a peer-review of the final project design. The Board of Consultants would comprise qualified professionals with expertise in the design and construction of dams of commensurate size. The Board of Consultants would review the geology of the project site and surroundings, the project design, the plans and specifications, and would oversee construction of the project. The Commission would not allow construction to begin until the dam satisfactorily meets the criteria of the Commission's Engineering Guidelines and the design is shown to be safe and adequate.

Minerals and Mining

The western metamorphic belt of Southeast Alaska has been recognized for its mineral resources since the late 1800s and includes minerals from which gold, copper, zinc, and silver have been extracted. Two current mining claims are located near the project area. Near Sweetheart Creek, current claims are on the slope above the outlet of Sweetheart Lake (Claims SG and SI in figure 3-1). The closest active mining claim in this group (Claim SI) is located about 1,200 feet south of the project boundary. The Sweetheart Lake area claims have historically been accessed from the ridge top between Sweetheart Lake and Tracy Arm, not from the lake itself. Current mining claims at Sentinel Point include multiple Snettisham iron ore claims (figure 3-2). These claims are accessed from the Port Snettisham side (i.e., the northwest-facing shore) rather than from Gilbert Bay side where the transmission line route is proposed. All other claims in the area are listed as "closed" or "closed without action" as of October 2013 according to the U.S. Bureau of Land Management Mining Claim Summary for each claim.

3.3.1.2 Environmental Effects

Acid Rock Drainage

Juneau Hydro visually examined samples from rock outcrops at the project and observed the mineral pyrite in some locations. Pyrite and other sulfur-containing minerals can react with water and oxygen to form a weak sulfuric acid, which can leach from the rocks and elevate the pH levels of the surrounding water and soil, and is referred

to as acid rock drainage. This leachate with elevated pH levels may also mobilize metals or other toxic materials from rocks and soil, which can reach concentrations in native soil and water that are harmful to organisms. Disturbance of rocks by excavating, blasting, or crushing during project construction would increase the surface area available for chemical reactions and thus could accelerate the production of acid rock drainage. This would increase the potential for harmful compounds to migrate into Sweetheart Lake, Sweetheart Creek, and Gilbert Bay and adversely affect aquatic biota.

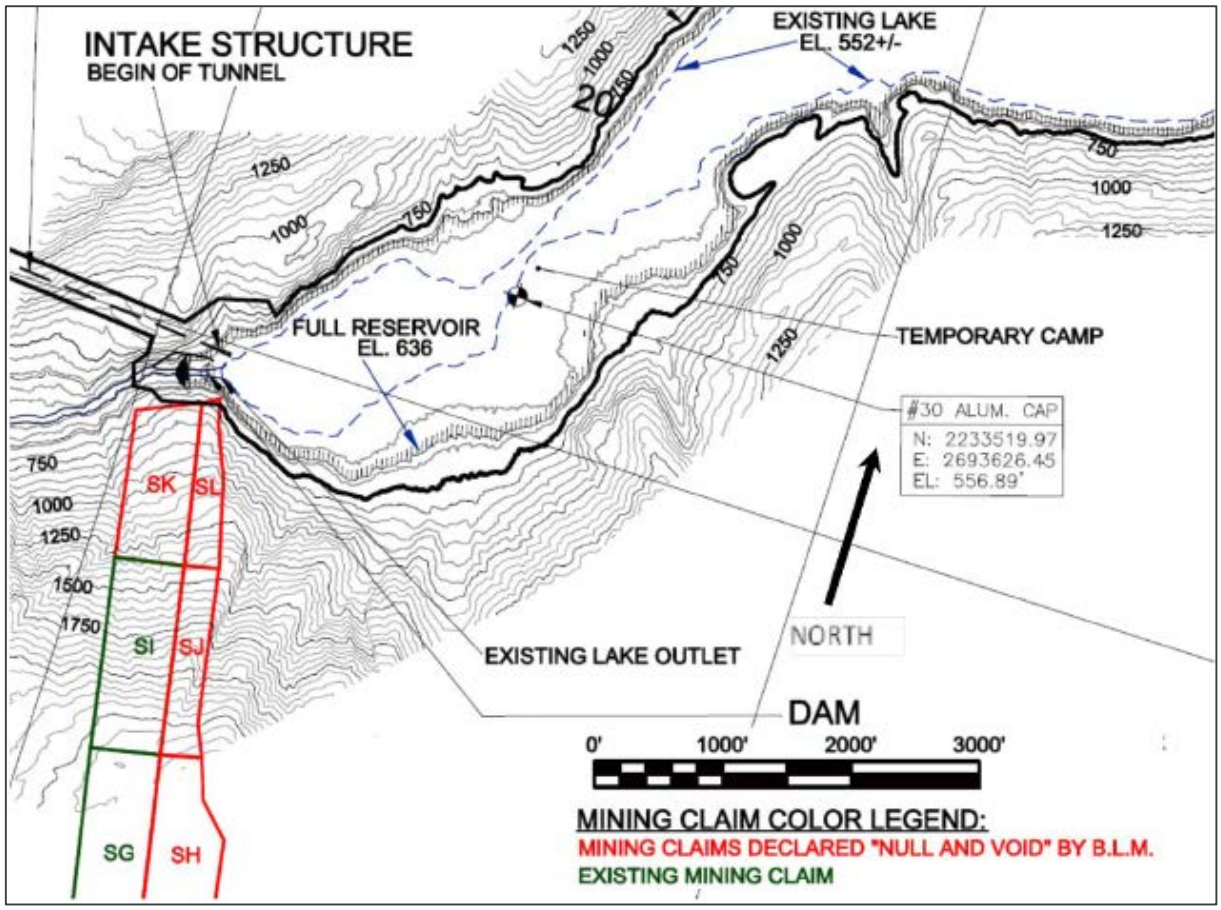

Figure 3-1. Sweetheart Lake area mining claims (Source: U.S. Bureau of Land Management, 2014, not seen, as cited in Juneau Hydro, 2014a).

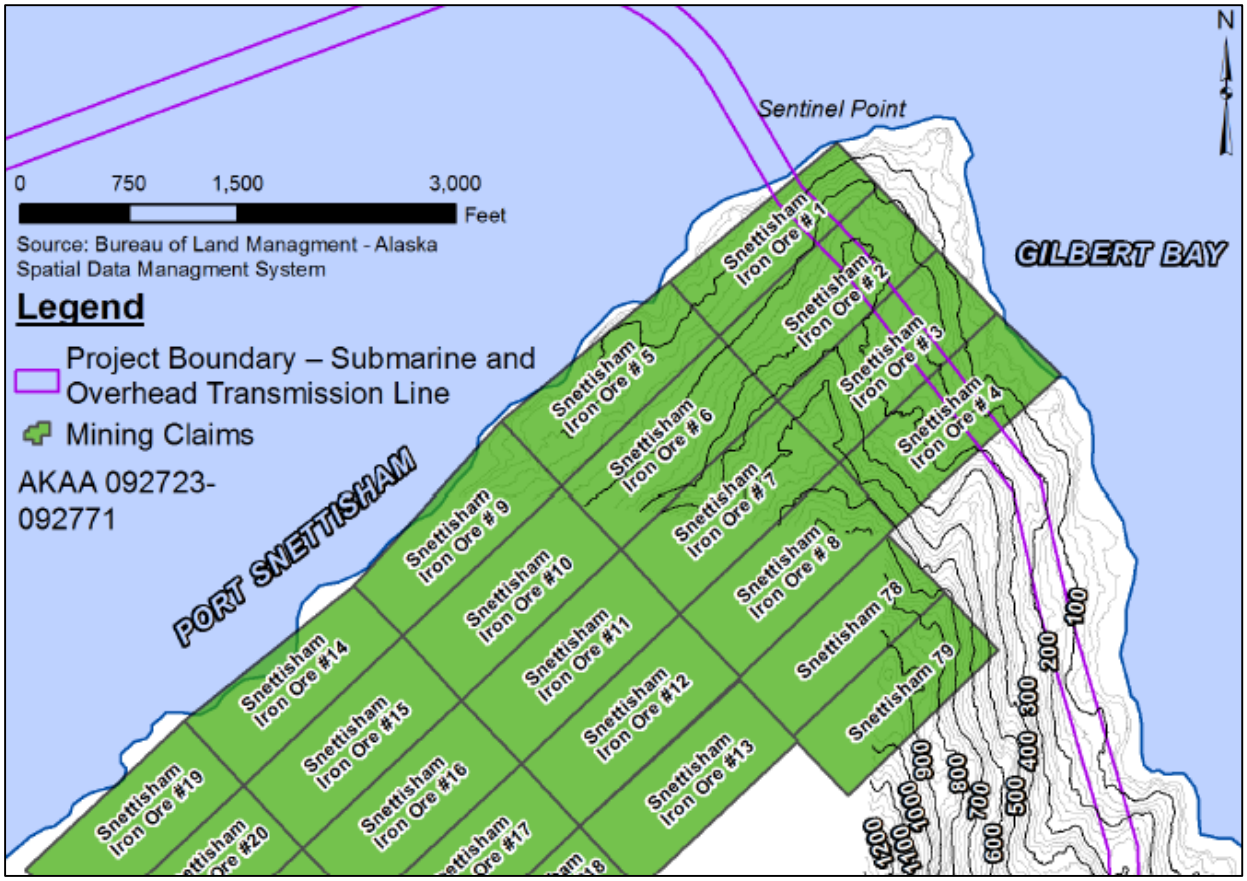

Figure 3-2. Sentinel Point area mining claims (Source: U.S. Bureau of Land Management, 2014, not seen, as cited in Juneau Hydro, 2014a).

Based on its observations at surface outcrops, Juneau Hydro does not believe there is a significant potential for acid rock drainage to occur. However, to determine whether the potential exists for acid rock drainage, Juneau Hydro plans to implement its Acid Rock Plan filed with its license application. The plan is a component of its Spoil Disposal Plan. The plan includes provisions to conduct geochemical tests on the rock cores collected as part of its final geotechnical investigation. If rock is found that would result in acid rock drainage, Juneau Hydro would not use it in project construction and would take special precautions for its disposal, including to: (1) isolate excavated spoils containing acid-forming materials; (2) immediately dispose of the acid-forming material in a designated area with a liner and cap to prevent the formation and leaching of acid rock drainage; and (3) determine whether the acid-forming material would need to be treated with a buffering agent, such as limestone, to neutralize it onsite.

If onsite geotechnical drilling and sampling indicate a potential for creating acid rock drainage from the excavated materials, Juneau Hydro proposes to develop a final Acid Rock Plan in consultation with the Forest Service and the Alaska DFG and submit it to the Commission within 90 days of discovery of the potentially acid-producing rock.

Juneau Hydro provides only those specific measures discussed above in its proposed Acid Rock Plan.

No comments on Juneau Hydro's proposed Acid Rock Plan were filed in response to the Commission's ready for environmental analysis notice. Forest Service condition 22 requires Juneau Hydro to file a spoil disposal plan with the Commission within 1 year of license issuance that is developed in consultation with the Forest Service and applicable federal and state agencies. Because the Acid Rock Plan was included as a component of the Spoil Disposal Plan, we assume the Forest Service intends to review the final Acid Rock Plan as well.

Our Analysis

As discussed further below regarding spoil disposal, project construction would result in a significant amount of rock excavation and incorporation of that rock in project facilities (e.g., structure foundations, berms, and coastal road construction). The geochemical testing of the rock bores would allow Juneau Hydro to assess the potential hazard of acid rock drainage at the project and determine the quantity of excavated rock that would require special disposal, if any.

As stated previously, Juneau Hydro does not propose specific measures in its Acid Rock Plan. The following information would be beneficial to include in the final plan, if a final plan is necessary: (1) the specific location of spoil storage and disposal sites; (2) detailed spoil storage and disposal site design plans, including cap and liner type and composition; (3) leachate monitoring protocols, including sample collection methodology and a sample result reporting schedule; (4) detailed leachate collection and treatment system design plans; (5) disposal methods for treated leachate and/or sludge, as appropriate, (6) and unanticipated leachate release cleanup procedures. These elements of the Acid Rock Plan should cover both the construction and operation periods of the proposed project, until the spoil is stabilized. With the inclusion of these measures, the provisions in Juneau Hydro's final Acid Rock Plan are anticipated to adequately protect geologic, soil, and aquatic resources if acid producing minerals are encountered during the geotechnical investigation because the plan would provide for the proper handling, treatment, and disposal of acid producing minerals.

Spoil Disposal

The extensive drilling, blasting, and excavation, anticipated during project construction, would produce significant amounts of spoil. If not properly disposed of, this spoil has the potential for erosion and the production of acid rock drainage. This erosion would result in an increased sediment load to Sweetheart Lake, Sweetheart Creek, and Gilbert Bay, which could harm aquatic biota. Potential hazards associated with acid rock drainage are analyzed above.

Juneau Hydro proposes to use the resulting spoil rock, predominantly from the powerhouse, power tunnel, and diversion tunnel, as the aggregate for concrete structures, including the dam. Such rock would also be used to construct the coastal road. In order

to ensure the proper handling and disposal of spoil, Juneau Hydro proposes to implement the Spoil Disposal Plan filed with its license application, which includes provisions to: (1) place silt containment measures downslope of all spoil sites to minimize erosion potential; (2) test rock for possible acid rock drainage potential prior to excavation as part of the proposed geotechnical investigation discussed above and per the Acid Rock Plan; (3) contour unused soil spoil on disturbed slopes, and use it as planting media for revegetation[33] at the caretaker's facility site, for the visual landform barrier,[34] and in small amounts adjacent to the coastal road; and (4) contour unused rock spoil to the existing terrain in the dam staging area and for the visual landform barrier.

Forest Service 4(e) condition 22 specifies that Juneau Hydro file a Spoil Disposal Plan within 1 year of license issuance and that Juneau Hydro file a draft plan for Forest Service review and approval prior to submitting to the Commission. Juneau Hydro filed a draft Spoil Disposal Plan with its final license application. On January 16, 2015, the Forest Service filed comments in response to the Commission's ready for environmental analysis notice reiterating that geotechnical drilling and testing for acid-production potential would be necessary prior to any large-scale excavation.

Our Analysis

Based on Juneau Hydro's estimates, most of the excavated materials likely would be used in constructing the project. In the plan, Juneau Hydro estimates a total of 281,000 cubic yards of excavated material would be generated constructing the project, including 264,000 cubic yards of rock and 17,000 cubic yards of organic material. Juneau Hydro projects the spoils to be used in the following manner: road and barge dock site (201,000 cubic yards), dam and cofferdams (22,000 cubic yards), tailrace and powerhouse (8,000 cubic yards), submarine cable armor (7,000 cubic yards), and visual landform barrier (28,000 cubic yards). The remaining approximately 15,000 cubic yards (presumably predominantly rock) would be distributed on temporary construction areas, stabilized, and revegetated.

The provisions of the Spoil Disposal Plan include commonly accepted engineering practices, would adequately stabilize the spoil areas, and would minimize the potential for erosion of spoil materials and their concomitant release to surface waters in the project vicinity.

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[33] Juneau Hydro proposes to conduct revegetation in accordance with its Erosion Control Plan.

[34] The visual landform barrier is a large, vegetated berm located at the powerhouse site and is proposed as a protective measure by Juneau Hydro and accepted by staff. It would mitigate the effects of powerhouse construction on aesthetic resources by preventing views of the powerhouse.

Soil Erosion

Construction of project facilities, including the dam, diversion tunnel, power tunnel, powerhouse, tailrace, coastal road and dock, transmission line, and staging and stockpiling areas, has the potential to cause soil erosion and elevated suspended sediment concentrations in Sweetheart Lake, Sweetheart Creek, Gilbert Bay, and Port Snettisham resulting from the removal of protective vegetation and the loss of soil by means of wind, water, and construction vehicle traffic.

At the initiation of construction, Juneau Hydro proposes to move equipment and supplies to the powerhouse site and the lower end of the power tunnel by means of a primitive pioneer road. The 4,400-foot-long coastal road would then be developed and hardened using excavated rock from the tunnel. Because the rock for the marine ramps and the 4,400-foot-long coastal access road would come from spoil produced during excavation of the powerhouse and power tunnel and because Juneau Hydro does not propose to use borrow areas, Juneau Hydro would develop the pioneer road into the proposed coastal road as spoil becomes available. Therefore, there is the potential for soil erosion and loss to the coastal waters of Gilbert Bay due to the action of heavy construction equipment movement, wind, and rain on this unfinished road.

Forest Service 4(e) condition 22 requires that Juneau Hydro file an Erosion Control Plan within 1 year of license issuance and that Juneau Hydro file a draft plan for Forest Service review and approval prior to submitting to the Commission.

Juneau Hydro filed an Erosion Control Plan to reduce the potential for erosion and sedimentation impacts from construction with its final license application. The plan includes the following measures: (1) limit ground disturbance to only areas needed for construction, and stabilize and revegetate them; (2) route the overland flow of water around exposed soils; (3) implement sediment barrier BMPs, such as brush barriers, check dams, and silt fencing, to minimize offsite sediment migration; (4) install cofferdams to isolate construction areas from surface waters and prevent increases in turbidity; (4) assess the effectiveness of the BMPs through daily monitoring of turbidity by the ECM; and (5) implement good housekeeping BMPs for material handling, waste management, and equipment fueling and maintenance practices to prevent spills of contaminants such as oil and gasoline.

Alaska DFG recommends in its 10(j) recommendation 17 that Juneau Hydro file a final Erosion Control Plan with the Commission at least 6 months before the start of any land disturbance or land clearing activities. The final Erosion Control Plan should include: (1) site characteristics, including soils, landscape, vegetation, topography, and nearby waters; (2) preventive measures based on site-specific conditions; (3) locations of areas for storage or disposal of soil spoil, including BMPs to be used and inclusion of a 100-foot stream setback for such areas; (4) functional design drawings and specific topographic locations of all control measures, including: (a) riprap placement; (b) stream setback and proposed stabilization measures for spoil material; and (c) prescriptions for treatment of all disturbed areas; (5) consultation with resource agencies regarding the

final Erosion Control Plan, allowing resource agencies a 60-day review and comment period; (6) submittal of the final Erosion Control Plan to the Commission at least 30 days before initiation of construction with documentation of agency consultation; and (7) inclusion of Juneau Hydro's reasons for non-acceptance if it does not accept an agency recommendation.

Alaska DFG also makes 10(j) recommendation 11 to provide stream buffers (i.e., facility setbacks) around project facilities and construction areas. It states that construction activities should be sited at least 100 horizontal feet from the ordinary high water of Sweetheart Creek, its tributaries, and all other waterways identified in Alaska DFG's *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes*. The only other waterway to which this recommendation would apply is an unnamed stream on the Snettisham Peninsula, which would be crossed by the overhead transmission line. The recommendation also includes exemptions from this requirement for clearings and road/trail corridors for the powerhouse and appurtenant facilities, penstock, and tailrace, as well as recreational trails and transmission line stream crossings. Based on Juneau Hydro's design drawings, it seems that all non-exempted project facilities meet this requirement, except the staging areas along the coastal road and Sweetheart Lake. Additionally, temporary and permanent spoil disposal sites are proposed at the lower power tunnel portal/powerhouse site, coastal road, dock/landing site, caretaker's facility, and dam construction staging areas. While the exact nature and locations of the spoil sites within these potential areas are unknown at this time, potentially they would be subject to the setback recommendation.

Per Alaska DFG's 10(j) recommendation 18 and Forest Service's 4(e) condition 21, the ECM proposed by Juneau Hydro must be employed at least 30 days before the start of any land disturbance or land-clearing activities. Alaska DFG further recommends in 10(j) recommendation 18 that the ECM: (1) be employed through the duration of project construction; (2) have the authority to issue cease work orders; (3) document Juneau Hydro's compliance with the conditions of the license; (4) be responsible for preparation of construction reports to be filed; and (5) have a background in the biological sciences with experience in water quality monitoring and erosion/sediment control measures. Additionally, Alaska DFG recommends that Juneau Hydro allow at least 30 days for the agencies to review the qualifications of a proposed ECM candidate for acceptance.

In 10(j) recommendation 19, Alaska DFG recommends that: (1) turbidity be monitored by the ECM throughout the construction period; (2) monitoring occur upstream and downstream of all construction activities and/or discharge points for overland flows that cross construction areas and discharge into Sweetheart Creek; (3) samples should be analyzed for turbidity as soon as possible or on a daily basis; (4) turbidity measurements should be made using equipment identified in the Erosion Control Plan; and (5) if turbidity 100 feet downstream of the construction area exceeds Alaska water quality standards, related construction activities should cease immediately, sediment sources located, and appropriate sediment control measures implemented.

Upon commencement of project operation, Juneau Hydro's proposed dam would increase the Sweetheart Lake normal maximum water surface elevation, and simultaneously the reservoir surface area and the lateral extent of the reservoir shoreline. Certain areas of soil at the shoreline and above the shoreline may be susceptible to instability because, over a long period of operation, those soils that lie within the reservoir's fluctuating water surface range could be eroded. Such erosion could undercut the soils farther upslope, destabilizing the soils above the reservoir pool elevation. In addition, Juneau Hydro expects that some initial turbidity would occur as the reservoir fills for the first time and inundates the construction areas. There is also expected to be flushing of fines from the power tunnel and tailrace into Sweetheart Creek and Gilbert Bay upon commencing operation, which have the potential to impact aquatic species in those water bodies.

To mitigate effects on Sweetheart Lake from increased erosion during project operation, Juneau Hydro proposes to implement its Reservoir Management Plan, which is part of its Water Management Plan. The Reservoir Management Plan includes measures during construction to: (1) minimize vegetation removal along the perimeter of Sweetheart Lake to avoid loosening of soil and rock; (2) implement BMPs along the lake shore to minimize soil erosion from disturbed soils, per the Erosion Control Plan; (3) use cofferdams and the diversion tunnel to isolate construction and limit the amount of necessary in-water work; (4) perform weekly site inspections, turbidity sampling, and pH sampling to ensure the proper functioning of BMPs; (5) install and maintain automated monitoring devices for turbidity, pH, and temperature in Sweetheart Lake; (6) install a floating boom across Sweetheart Lake near the project intake and dam to collect floating debris, and periodically remove this debris from the lake; and (7) provide yearly compliance reports to demonstrate compliance with plan inspection, monitoring, and corrective action prescriptions. Although not proposed as a plan measure, Juneau Hydro states that the slow filling and draining of Sweetheart Lake would help to maintain inundated vegetation in place, thereby stabilizing soils. No comments on Juneau Hydro's proposed Reservoir Management Plan were filed in response to the Commission's ready for environmental analysis notice.

With the implementation of its plan, Juneau Hydro anticipates increased turbidity in Sweetheart Lake only during the initial year of operation, except in areas where deeper soils may exist. In areas of deeper soils, increased turbidity may persist for several years, especially on windy days when wave action can stir the shoreline soil. If water quality is affected to such a degree that it is out of compliance with parameters established by Alaska DEC, Juneau Hydro proposes to consult with agencies for input on the effectiveness of the above proposed measures and to determine if additional measures are necessary to stabilize shoreline soils. This anticipated increase in turbidity has the potential to affect fish and other aquatic species in Sweetheart Lake.

Juneau Hydro also states that the initial start-up of the project could cause some turbidity increase in flows entering Sweetheart Creek and Gilbert Bay due to surface flushing of the power tunnel and tailrace channel. Juneau Hydro expects that an initial

turbidity spike would occur for only a matter of hours until the power tunnel and tailrace are washed clean of residual surface fines.

Our Analysis

Steep slopes, high precipitation rates, erodible soils, and extensive excavation and clearing required to construct the project make Sweetheart Lake, Sweetheart Creek, Gilbert Bay, and Port Snettisham prone to added erosion effects if a control plan is not in place and properly implemented. Sources of erosion may result from the following activities: clearing and excavation of sites for project facilities; building a primitive pioneer road, and moving equipment and supplies along this road to the powerhouse site and the lower end of the power tunnel prior to construction of the coastal road; constructing two cofferdams at the outlet of Sweetheart Lake and a cofferdam at the junction of the tailrace and lower Sweetheart Creek; and drilling/boring into the subsurface to install anchor points and construct concrete pads for the overhead transmission line. Installation of the submarine cable would also cause some increase in turbidity from trenching and may affect benthic and pelagic organisms, but the effects would be minor because the increased turbidity would be localized and temporary.

Juneau Hydro's Erosion Control Plan filed with its license application includes specific BMPs that would be employed to control erosion, such as silt fencing, check dams, and brush barriers to prevent the overland flow of sediment-laden stormwater into surface waters, and the revegetation of disturbed areas to stabilize soils and prevent erosion. The plan also includes detailed site plans indicating the location of site-specific BMPs. The detailed plan elements requested by Alaska DFG are largely included in the filed plan, with the exception of: (1) spoil storage and disposal locations, (2) inclusion of a stream setback around construction areas on site-specific drawings, (3) the identification of specific plant species and their planting locations, and (4) site-specific drawings for the transmission line on the Snettisham Peninsula and the northern shore of Port Snettisham. Juneau Hydro's Erosion Control Plan does not propose a 100-foot setback for all construction areas as recommended by Alaska DFG. Its plan does propose to perform turbidity monitoring upstream and downstream of construction areas. However, it does not include a number of details recommended by Alaska DFG for turbidity monitoring, such as: mandating that such samples be analyzed as soon as possible but at least daily, stating the equipment to be used for sample analysis, and immediately ceasing construction activities if samples 100 feet downstream of construction areas exceed water quality standards and implementing corrective actions. The inclusion of these additional elements in the Erosion Control Plan, as well as BMPs and site-specific drawings for the construction and use of the pioneer road, would improve Juneau Hydro's plan and would minimize environmental effects.

Further, the use of an ECM and turbidity monitoring during project construction as recommended by Alaska DFG would allow Juneau Hydro to ensure the continued proper operation of BMPs and to quickly identify and respond to any increases to turbidity, thus ensuring that any effects from the construction of the project on erosion and

sedimentation would be minimized (see additional discussion on turbidity monitoring in section 3.3.2.2, *Aquatic Resources, Environmental Effects*).

With the implementation of the measures outlined in Juneau Hydro's Reservoir Management Plan, erosion and resulting elevated suspended sediment concentrations in Sweetheart Lake are anticipated to be minor and occur only temporarily after initial filling of the project reservoir. Suspended sediment is expected to largely settle within Sweetheart Lake rather than be discharged by the project into Gilbert Bay, and any effects on water quality in Sweetheart Lake, Sweetheart Creek, or Gilbert Bay would be temporary and minor.

A significant volume of fines is not expected to be mobilized from the power tunnel or tailrace upon beginning project operation. The inner surface of the power tunnel is anticipated to be predominantly free of fines and soil because the blasting's violent nature would minimize accumulation of such material. While there may be some fines remaining after excavation and construction of the tailrace, Juneau Hydro's proposed design calls for protecting the tailrace using cobbles or other stone to create a "natural" appearance. Such tailrace protection is expected to minimize the mobilization of residual fines upon commencement of project operation. Therefore, the total volume of soil washed from the power tunnel and tailrace into Gilbert Bay is expected to be minor and brief in nature.

Mining Claims

The current mining claims near Sweetheart Creek are on the slope above the outlet to Sweetheart Lake (figure 3-1), and the closest current mine claim in this group is located about 1,200 feet south of the project boundary. Current mining claims near the above-ground transmission line near Sentinel Point on the Snettisham Peninsula are accessed from the west of the project (figure 3-2). Juneau Hydro states in its final license application that the construction, operation, and maintenance of the project would not affect the claims, the subsurface ore deposits, or access to the claims; therefore, Juneau Hydro did not propose any measures to mitigate or protect the use of these claims. No one recommended any measures to address effects on the mining claims.

Our Analysis

Mining claims in the vicinity of the project are not accessed from within or across the project boundary, as stated by Juneau Hydro. Therefore, there is no evidence that the project would affect any existing mining claims.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Resources

Water Quantity

A USGS stream flow gaging station, Sweetheart Creek near Juneau, Alaska (gage no. 15030000), was established and operated from 1915 through 1927. USGS extended the period of record for this stream by estimating the monthly runoff for the 1928–1932 and 1949–1956 water years through correlation with the nearby USGS station, Long River near Juneau, Alaska (gage no. 15034000), for the period of overlapping records. In developing data for the proposed project, Juneau Hydro installed a stream flow gage at the outlet of Sweetheart Lake, which began to record flows in October 2011. Juneau Hydro reported flows from October 2011 to May 2013 in its license application.

Table 3-1 shows the monthly average and related flow statistics of Sweetheart Lake outflows from the gaged (historical USGS and recent Juneau Hydro gaging data) and the synthetic flow record.

Table 3-1. Outflow from Sweetheart Lake 1915–1933, 1958–1968, and 2011–2013 (Source: Juneau Hydro, 2014a, as modified by staff).

	Monthly Average Flows											
Year[a]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1915	--	--	--	--	--	--	--	486	508	399	163	98
1916	37	37	42	151	357	764	486	565	617	602	188	85
1917	55	123	48	79	340	628	566	659	564	514	557	92
1918	79	41	19	83	332	730	604	646	600	364	381	187
1919	248	52	41	142	331	519	595	560	586	475	149	132
1920	220	91	38	49	230	603	551	620	406	339	267	51
1921	62	92	62	111	383	611	465	415	412	580	158	283
1922	88	29	24	112	406	657	557	535	509	336	391	112
1923	56	91	129	223	460	608	468	351	689	480	473	197
1924	65	39	72	112	568	804	751	567	797	439	278	158
1925	37	29	43	82	463	672	618	360	410	295	342	476
1926	557	140	255	409	352	438	334	292	231	474	304	216
1927	105	36	75	94	384	744	467	331	574	301	121	48
1928	184	126	122	248	550	708	605	437	511	434	326	316

	Monthly Average Flows											
Year[a]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1929	194	42	98	97	353	715	506	409	464	808	422	143
1930	11	45	51	157	323	638	514	541	504	439	478	331
1931	142	234	43	143	490	801	545	547	503	541	168	82
1932	38	54	51	126	362	661	472	427	596	525	119	71
1933	30	40	34	338	538	792	--	--	--	--	--	--
1952	24	38	41	172	440	653	591	474	671	836	388	119
1953	42	65	40	99	568	794	530	510	540	688	137	137
1954	54	244	51	60	325	668	470	297	552	390	409	372
1955	69	54	51	80	291	605	587	577	517	297	191	53
1956	18	30	32	83	488	554	578	691	412	322	377	353
1957	107	45	27	102	473	702	477	390	623	466	385	116
1958	180	68	41	172	547	859	556	492	329	583	229	140
1959	52	68	51	116	428	771	679	438	362	461	249	199
1960	71	54	64	169	474	632	591	482	597	639	293	294
1961	116	118	93	230	506	842	754	776	444	702	190	53
1962	174	75	87	100	309	695	516	406	671	477	350	305
1963	135	194	104	132	391	657	537	364	751	587	123	218
1964	109	102	61	180	317	829	674	414	305	546	247	203
1965	231	111	122	127	256	626	498	429	365	703	145	110
1966	36	45	57	150	387	697	530	526	677	548	207	53
1967	35	54	37	57	389	927	495	551	800	342	322	119
1968	42	125	237	128	435	600	516	320	774	343	168	90
2011	--	--	--	--	--	--	--	--	--	429	201	212
2012	117	85	70	122	518	927	711	603	1,085	133	52	391
2013	138	176	51	149	900	984	--	--	--	--	--	--
Statistics												
Min	11	29	19	49	230	438	334	292	231	133	52	48
Mean	107	84	69	140	423	706	554	486	554	482	269	179
Max	557	244	255	409	900	984	754	776	1,085	836	557	476
10%	204	154	122	226	548	849	677	633	763	694	414	340

	Monthly Average Flows											
Year[a]	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Exceed												
90% Exceed	33	37	33	80	314	602	469	341	364	314	131	53

[a] Juneau Hydro estimated data for 1915–1916, 1919–1924, and 1926 from USGS gage no. 15030000, Sweetheart Falls Creek below Sweetheart Falls; data for 1917 and 1918 included both data from gage no. 15030000 and Juneau Hydro's synthetic record for Sweetheart Creek based on data from USGS gage no. 15034000, Long River near Juneau; and data for 1925 and 1927–1933, and 1952–1968 were based on the synthetic record data. Staff computed statistics information.

Sweetheart Creek flows are variable depending on season. Runoff generally recedes gradually through the winter months after fall storms become less frequent and precipitation accumulates as snow in the upper basin. Flows in Sweetheart Creek generally reach their minimum levels for the year in February or March (March flows: minimum = 19 cfs, mean = 69 cfs, and maximum = 255 cfs), before significant inflow occurs, usually by mid-May (May flows: minimum = 230 cfs, mean = 423 cfs, and maximum = 900 cfs) associated with spring runoff. June and July (June flows: minimum = 438 cfs, mean = 706 cfs, and maximum = 984 cfs) consistently have high average flows as accumulated snow melts and consistently keeps stream levels moderately high, even during extended periods of dry weather. Late summer and fall months have moderately high runoff (August flows: minimum = 292 cfs, mean = 486 cfs, and maximum = 776 cfs), but flows during these months are at more variable levels than early summer because precipitation (falling as rain) increases during these months, while runoff from snowmelt, which makes up the bulk of the flow in the preceding months, simultaneously decreases because most of the snowpack has melted. Fall months have high flows with frequent and often heavy precipitation (September flows: minimum = 231 cfs, mean = 554 cfs, maximum = 1,085 cfs) before stream flows and lake levels recede to winter base flows (December flows: minimum = 48 cfs, mean = 179 cfs, and maximum = 476 cfs) at the close of the annual hydrologic cycle for the watershed.

Water Rights

No known domestic, commercial, or industrial uses of water are known in the Sweetheart Lake Basin. Alaska DFG filed an application on October 12, 2006 (Land Administration System 25882), for non-consumptive water rights on Sweetheart Creek that would maintain flows of 40 cfs in January and February, 45 cfs in March, 119 cfs in April, 406 cfs in May, 605 cfs in June, 518 cfs in July, 410 cfs in August, 456 cfs in September, 324 cfs in October, and 117 cfs in November and December (Alaska DNR, 2015a). The proposed reservation of water applied to stream flows within Sweetheart Creek and its floodplain, from the stream's mouth (stream mile 0) at mean lower low water upstream to a fish passage barrier that marks the upper extent of Anadromous

Waters Catalog stream number 111-35-10200 (Alaska DNR, 2015a) (referred to as Reach 1 or the anadromous reach of Sweetheart Creek).[35]

The purpose of the proposed Alaska DFG Application for Reservation of Water was as follows:

> The primary purpose of the proposed reservation is to sustain fish production within this reach of Sweetheart Creek and its watershed. Sweetheart Creek produces a variety of fish species and serves as a fish passage corridor to the marine environment. This reach of Sweetheart Creek has been specified as important to anadromous fish under Alaska state statute AS 41.14.870, as stream number 111-35-10200 by the Alaska Department of Fish and Game. Pink salmon (*Oncorhynchus gorbuscha*), chum salmon (*Oncorhynchus keta*), and sockeye salmon (*Oncorhynchus nerka*) utilize this reach of Sweetheart Creek for a portion of, or all of their spawning, incubation, rearing, and passage life phases. These species contribute to sport, personal-use[36] and commercial fisheries in the area and provide recreational opportunities and values as well (Alaska DNR, 2015a).

On August 7, 2012, Juneau Hydro submitted an Application of Water Right for Sweetheart Creek for the purpose of a hydroelectric project with Alaska DNR (Alaska DNR, 2015b), which requested a right to use more than 1,000,000 gallons of water annually and noted the use of 300 to 335 cfs for normal operations and up to 486 cfs for high water events and during periods of emergency power demands.

Water Quality

Alaska DEC sets water quality criteria to protect existing and potential beneficial uses, including water supply for domestic, agriculture, aquaculture, and industrial purposes; recreation; and the growth and propagation of fish and other aquatic life. Table 3-2 presents a summary of designated uses and the numeric water quality criteria applicable to project-influenced water bodies.

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[35] Staff has estimated that the length of the anadromous fish reach to the first impassable barrier is about 1,400 feet.

[36] Alaska Statute 16.05.940(26) defines personal use fishing as "the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, long line, or other means defined by the Board of Fisheries."

Table 3-2. Selected Alaska numeric water quality criteria for freshwater and marine environments applicable to the proposed project area (Source: Alaska DEC, 2012).

Parameters	Criteria	Designated Use(s)
Freshwater		
Temperature	≤20ºC; following maximum temperatures where applicable: Migration routes: ≤ 15ºC Spawning areas: ≤ 13ºC Rearing areas: ≤ 15ºC Egg and fry incubation: ≤ 13ºC For all other waters, the weekly average temperature may not exceed site-specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms	Domestic water supply, aquaculture water supply and aquatic life
Dissolved oxygen	> 7 mg/L in surface waters used by fish; > 5 mg/L in intergravel waters to a depth of 20 centimeters; in no case > 17 mg/L	Aquatic life
Total dissolved gas	Must not exceed 110% of saturation at any point of sample collection	Aquatic life
pH	May not be less than 6.5 or greater than 8.5; may not vary more than 0.5 pH units from natural conditions	Aquatic life
Turbidity	≤ 25 NTU above natural conditions; ≤ 5 NTU above natural conditions for lakes	Aquaculture water supply and aquatic life
Total dissolved solids	≤ 1,000 mg/L; a concentration of total dissolved solids may not be present in water if that concentration causes or reasonably could be expected to cause an adverse effect on aquatic life	Aquaculture water supply and aquatic life
Petroleum, hydrocarbons, oils, and grease	< 15 μg/L as total aqueous hydrocarbons in the water column; < 10 μg/L as total aromatic hydrocarbons in the water column; surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration	Aquaculture water supply

Parameters	Criteria	Designated Use(s)
Marine		
Temperature	May not cause the weekly average temperature to increase more than 1°C; maximum rate of change may not exceed 0.5°C per hour; normal daily temperature cycles may not be altered in amplitude or frequency	Domestic water supply, aquaculture water supply and aquatic life
Dissolved oxygen	Concentrations in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed; concentrations may not exceed 17 mg/L	Aquaculture water supply and aquatic life
Total dissolved gas	May not exceed 110% of saturation at any point of sample collection	Aquaculture water supply and aquatic life
pH	May not be less than 6.0 or greater than 8.5; may not vary more than 0.2 pH unit outside the naturally occurring range	Aquaculture water supply and aquatic life
Turbidity	May not reduce the depth of the compensation point for photosynthetic activity by more than 10%; may not reduce the maximum Secchi disk depth by more than 10%	Aquatic life
Total dissolved solids	Human-induced alteration may not cause a change in the water's isohaline patterns of more than + 10% of the natural variations. Maximum allowable variation above natural salinity: natural salinity (parts per thousand): — human-induced salinity (parts per thousand): 0.0 to 3.5 — 1 3.5 to 13.5 — 2 13.5 35.0 — 4	Aquaculture water supply and aquatic life

Parameters	Criteria	Designated Use(s)
Petroleum, hydrocarbons, oils, and grease	< 15 μg/L as total aqueous hydrocarbons in the water column; < 10 μg/L as total aromatic hydrocarbons in the water column; surface waters and adjoining shorelines must be virtually free from floating oil, film, sheen, or discoloration	Aquaculture water supply and aquatic life

Notes: °C – degrees Celsius, mg/L – milligrams per liter, μg/L – micrograms per liter, NTU – nephelometric turbidity unit

Juneau Hydro collected continuous water temperature data from four tributaries to Sweetheart Lake and continuous water temperature and water quality data from three sites in Sweetheart Lake and two sites from Sweetheart Creek (figure 3-3). Tributary and lake water temperatures were monitored hourly from September 2011 through August 2012. Sweetheart Lake water quality was monitored in September 2011; June, July, and August 2012; and August 2013; and Sweetheart Creek water temperature and water quality were monitored in June, July, and August 2012. Water quality monitoring focused on five parameters—temperature, dissolved oxygen, pH, conductivity, and turbidity. In addition, Juneau Hydro measured salinity at tidewater sampling locations in Sweetheart Creek, Gilbert Creek, Gilbert Bay, and the Whiting River. This tidewater sampling was conducted during June through August 2012, and included measuring salinity during both spring and neap tides in Gilbert Bay.

Sweetheart Lake—

Water Temperature. Water temperature measured at depths of about 15 feet in Sweetheart Lake ranged from 0 to 10°C seasonally (Aquatic Science Inc., 2012). In September 2011, water temperatures in Sweetheart Lake generally ranged between 7.0 and 9.4°C at depths less than 85 feet (table 3-3). Near the lake outlet, water temperatures at a depth of 60 feet were similar to surface water temperatures from September through November, indicating the lake generally remains isothermal through the end of May. According to Yanusz and Barto (1995), the lake thermally stratifies in June with the thermocline forming at a depth of 49 feet. Minimum water temperatures reported for Sweetheart Lake are attributed to the presence of ice cover on the lake that persists from winter into the summer.

In tributaries to Sweetheart Lake, water temperature ranged from 0°C during the winter to 12°C during the summer, with relatively small diurnal fluctuations occurring throughout the spring and summer.

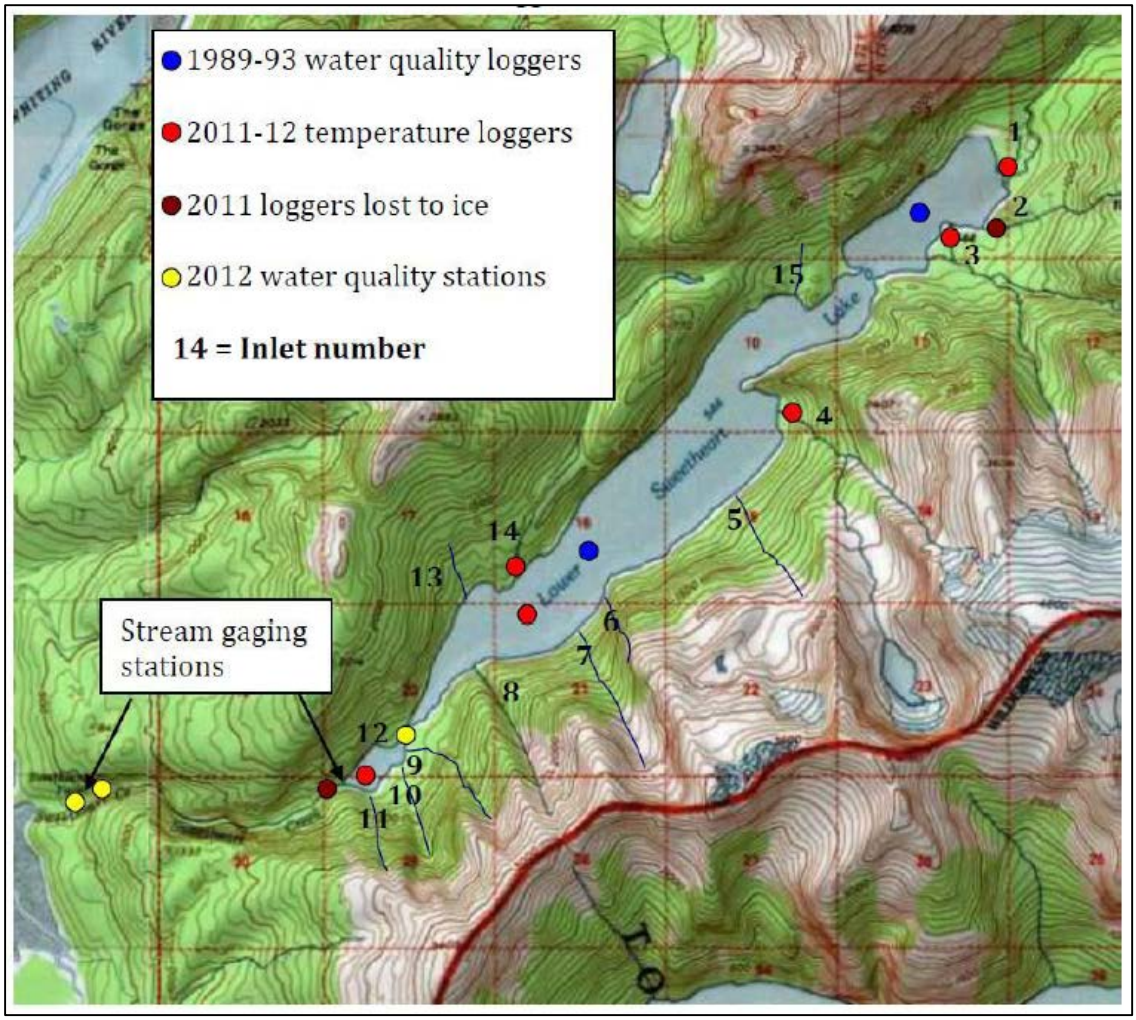

Figure 3-3. Juneau Hydro's water temperature and water quality monitoring sites in Sweetheart Lake and the major inlets to Sweetheart Lake (Source: Juneau Hydro, 2014a).

Table 3-3. Water quality vertical profile data collected from the upper, middle, and lower sections of Sweetheart Lake, September 2011 (Source: Juneau Hydro, 2014a).

Depth (feet)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH
Upper section of Sweetheart Lake				
0	8.3	9.7	82.6	7.4
25	8.1	10.7	90.7	7.5
50	7.9	10.4	87.7	7.4

Depth (feet)	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH
75	7.7	10.4	87.7	7.6
100	6.3	8.0	71.4	7.2
125	5.4	5.3	42.9	7.2
135	5.3	5.2	40.7	7.1
Middle section of Sweetheart Lake				
0	9.4	10.8	94.4	7.6
25	9.4	10.4	94.8	7.6
50	8.5	10.8	92.6	7.5
75	8.7	9.5	86.0	7.3
85	7.0	10.6	84.6	7.3
Lower section of Sweetheart Lake				
0	8.9	10.7	90.3	7.6
5	8.0	9.9	89.0	7.4
15	8.4	10.4	84.6	7.5
25	8.1	10.7	89.4	7.5
35	8.7	9.7	83.7	7.5
45	8.6	10.2	89.7	7.4
55	8.7	9.9	85.2	7.4
65	8.7	9.7	83.9	7.4

Dissolved Oxygen. Dissolved oxygen concentrations measured in Sweetheart Lake in September 2011 were typically greater than 7.0 milligrams per liter (mg/L) at depths less than 85 feet but were slightly lower at depths greater than 100 feet (table 3-3).

pH and Conductivity. The observed mean pH value in Sweetheart Lake ranged from 6.9 in 1989 to 1993 to 7.1 in 2013. All pH values met state water quality criteria (pH $\geq$ 6.0), except for one measurement (pH = 5.6) recorded at a depth of 50 meters in 1990. Conductivity values were very similar during all sampling periods at around 30 micromhos per centimeter (μmhos/cm).

Turbidity. Turbidity of surface waters in Sweetheart Lake in 2012 (0.15 nephelometric turbidity unit [NTU]) was lower than that observed from 1989 through 1993, which ranged from 0.85 to 0.95 NTU at a depth of 3.3 feet. All turbidity values met state water quality criteria.

Nutrients. In support of the sockeye salmon stocking program, Alaska DFG conducted a multi-year water quality sampling program at two sites in Sweetheart Lake from 1989 through 1993 (May through October) (Yanusz and Barto, 1995). To supplement these data, Juneau Hydro monitored the same 12 parameters in Sweetheart Lake in August 2013. Table 3-4 summarizes the seasonal mean values for the 12 general water quality and nutrient parameters monitored during this effort.

Table 3-4. Seasonal means for general water quality and nutrient parameters measured in Sweetheart Lake between May through October (1989 to 1993) and in August 2013 (Source: Aquatic Science Inc., 2012; Huntington, 2013, as modified by staff).

Parameter	**May to October, 1989–1993**	**August 2013**
Conductivity (μmho/cm)	30	31.0
pH	6.97	7.1
Alkalinity (mg/L)	12.7	12.6
Turbidity (NTU)	0.75	0.15
Color (Pt units)	7.8	10.0
Calcium (mg/L)	5.7	3.9
Magnesium (mg/L)	0.52	0.52
Iron (μg/L)	45	<50.0[a]
Total phosphorus (μg/L)	3.44	<26.0[a]
Total Kjeldahl nitrogen (μg/L)	36.3	<500[a]
Ammonia (μg/L)	4.6	21.0[b]
Nitrate + nitrite (μg/L)	79.5	91.0[b]

Notes: mg/L – milligrams per liter, μg/L – micrograms per liter, μmho/cm – micromhos per centimeter, NTU – nephelometric turbidity unit

[a] Measured value is below reporting limit.

[b] Measured value is between quantitative and method detection limit.

The levels of dissolved minerals in Sweetheart Lake in 1989 to 1993 were found to be low; however, this is typical of oligotrophic systems and other Southeast Alaska lakes, which have high precipitation, impermeable bedrock drainages, and short water residence times. Phosphate limitation was identified from the ratio to other nutrients present. The observed silicon:nitrate:phosphate ratio of 233:34:1 contrasts greatly with the ratio desired for high productivity of sockeye salmon, which is 17:16:1 (Yanusz and Barto, 1995). Chlorophyll-*a* levels (an indicator of algal standing crop), turbidity, pH, and conductivity were all typical of coastal Southeast Alaska lakes with high flushing rates.

Sweetheart Creek—Daily water temperatures in lower Sweetheart Creek follow a typical warming trend in the spring and summer and cooling trend through the fall and winter, ranging from 2 to 11°C from May through August (figure 3-4). In July 2012, mean monthly water temperatures in the lower bypassed reach and lower Sweetheart Creek were 7.2°C (table 3-5).

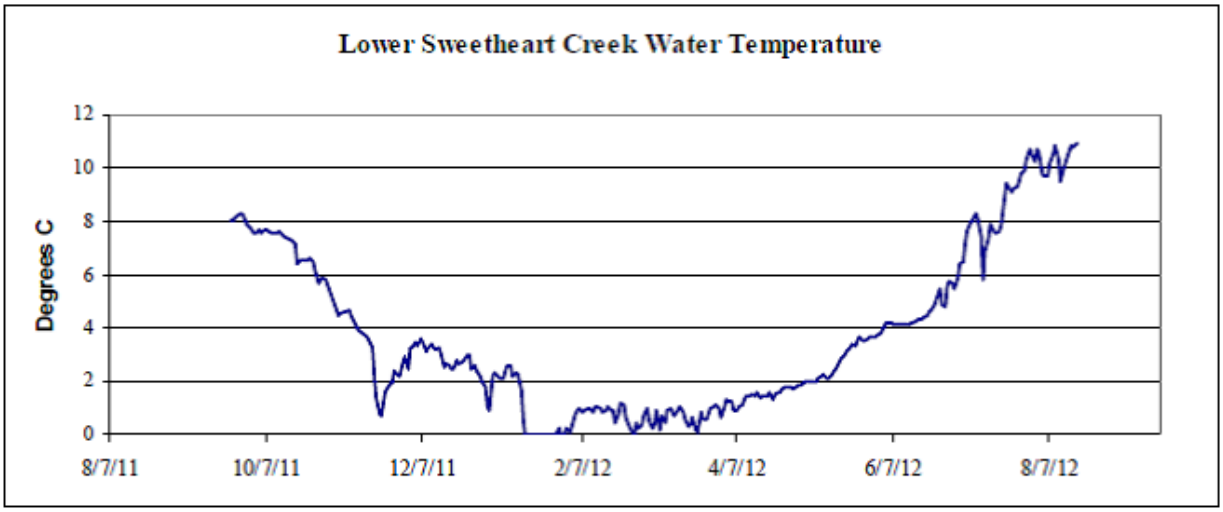

Figure 3-4. Sweetheart Creek mean daily water temperature from October 2011 through August 2012 (Source: Aquatic Science Inc., 2012).

Table 3-5. 2012 monthly means of water quality data collected from the bypassed reach and lower Sweetheart Creek (Source: Aquatic Science Inc., 2012, as modified by staff).

Parameter	June	July[a]	August
Sweetheart Creek Bypassed Reach (lower section)			
N	2	3	0
Temperature (°C)	4.1	7.2	–
Dissolved oxygen (mg/L)	12.4	12.6	–
pH	7.4	7.1	–
Conductivity (µmho/cm)	30	40	–
Turbidity (NTU)	0.34	0.22	–
Lower Sweetheart Creek			
N	2	3	1
Temperature (°C)	4.3	7.2	–
Dissolved oxygen (mg/L)	13.5	13.2	–
pH	7.3	7.1	7.1
Conductivity (µmho/cm)	30	20	10
Turbidity (NTU)	0.32	0.25	0.13

Note: – No data were collected for the water quality parameter; °C – degrees Celsius, mg/L – milligrams per liter, μg/L – micrograms per liter, μmho/cm – micromhos per centimeter, N – sample size, NTU – nephelometric turbidity unit

[a] Two measurements of temperature and dissolved oxygen were taken.

Tidewater—In 2012, Kai Environmental Consulting Services, LLC (Kai Environmental, 2012a) conducted a tidewater study to evaluate the potential effects of proposed project operation on salinity, temperature, turbidity, and currents. The tidewater study area focused on the major sources of discharge into Gilbert Bay and included sampling locations in the mouth of Sweetheart Creek, when accessible based on tides; the outflow of Sweetheart and Gilbert Creeks into the bay; a point in Gilbert Bay approximately 0.5 mile from the mouth of the creek; and at the mouth of the Whiting River (figure 3-5).

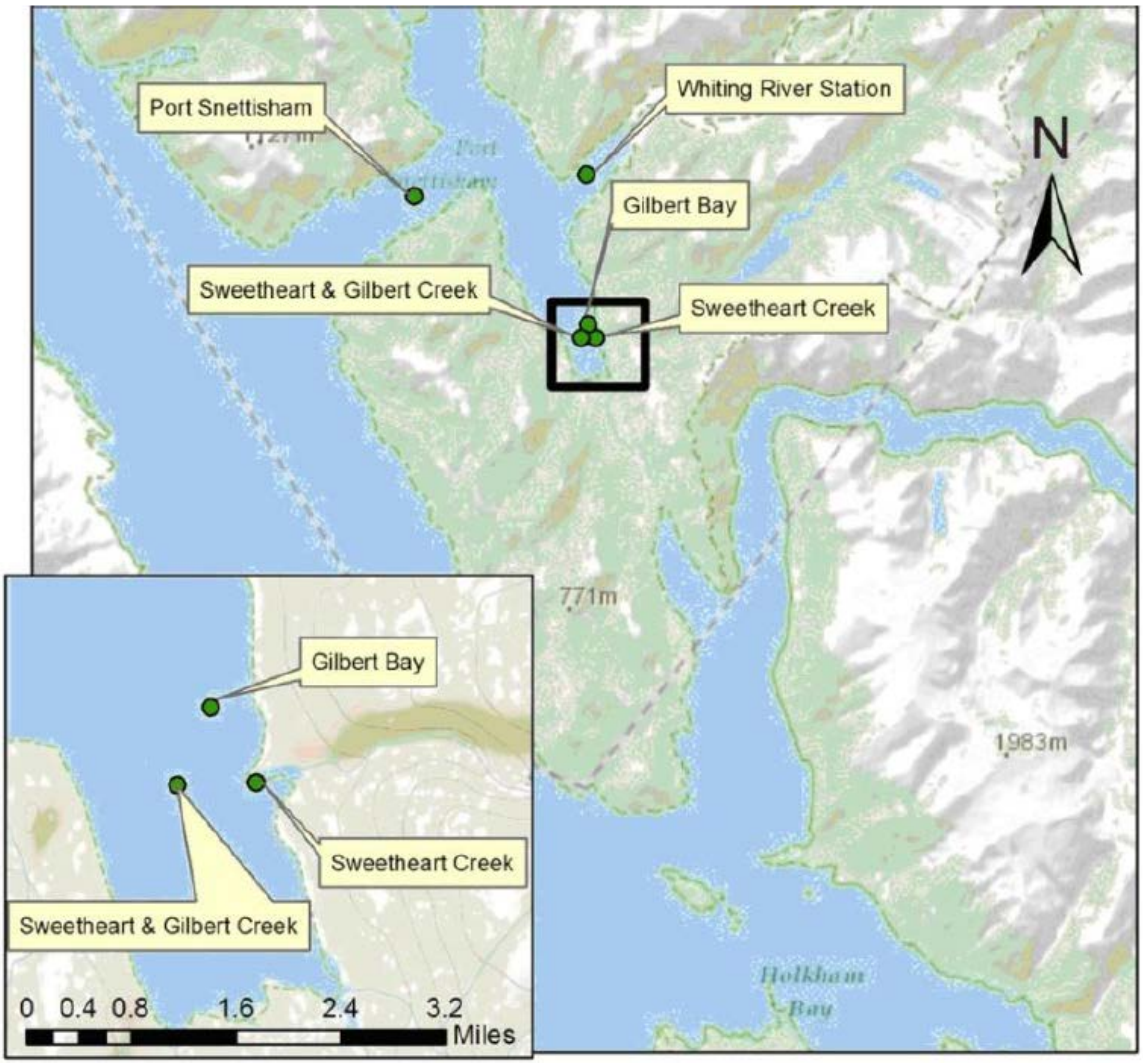

Figure 3-5. Tidewater sampling sites in Gilbert Bay (Source: Juneau Hydro, 2014a).

Salinity. Salinity measured at the sample location at the mouth of Sweetheart Creek ranged from 0 to 0.1 part per thousand indicating that Gilbert Bay does not affect the salinity of this freshwater area. The sample locations at the outflow of Sweetheart and Gilbert Creeks into Gilbert Bay were found to have a much greater influence on salinity. During both sampling events, the salinity was significantly higher near the bottom of the sampling depth (15 feet) during high tide, and a noticeable halocline[37] was present between the 3- and 5-foot-deep samples. The Whiting River sampling location also had a distinct halocline where surface waters were comprised of freshwater, and

[37] A halocline is a vertical zone in the marine water column in which salinity changes rapidly with depth, normally located below a well-mixed, uniformly saline surface water layer.

salinity increased substantially at a depth of about 5 feet. At sample depths greater than 10 feet, salinity was consistently above 20 parts per thousand across the tide cycle. The Gilbert Bay sample location had the highest salinity measurement recorded during the study (27.8 parts per thousand).

Temperature. Water temperature measured at the mouth of Sweetheart Creek in June was consistently between 4 and 5°C (39.2 to 41°F) at all depths throughout the tidal cycle, and in July the creek temperature increased to 7 to 8°C (44.6 to 46.4°F) at all depths throughout a full tidal cycle. However, no consistent trends attributable to depth or tide cycle were observed. Water temperature measured in Gilbert Bay in June showed minor variability at the surface, and consistent temperatures across the tide cycle between 5 to 30 feet, ranging from 6.6 to 7.6°C (43.9 to 45.7°F). In July, temperatures were variable at each depth with temperatures ranging between 6.7 and 12.4°C (44.1 to 54.3°F). The outgoing tide was consistently warmer with temperatures above 10°C in the first 20 feet of the water column and dropping to 7.2° C (44.9°F) at a depth of 30 feet. At the Gilbert Bay sampling location, more mixing of water temperatures was observed to occur during the neap tide, while temperatures remained consistent across the spring tide cycle. The same trend was noted for salinity. At the Whiting River sampling location, June temperatures were consistently between 6.6 and 7.6°C (43.87 to 45.86°F) at all depths during the entire tide cycle except for the high-tide surface measurement of 8.5°C (47.3°F). In July, temperatures decreased with depth across the tidal cycle, with an average of 9°C (48.2°F) from 0 to 5 feet and 7°C (44.6°F) at 30 feet. Surface temperatures were slightly warmer in July than June.

Turbidity. Turbidity measured in Sweetheart Creek was consistently below 1 NTU during all sampling events. Similarly, turbidity at the mouth of Sweetheart Creek and Gilbert Creek was below 4 NTU, except in June, when turbidity was measured at 6.7 NTU at a 9-foot depth on an incoming tide. In June, surface waters at the Gilbert Bay sampling location were more turbid (ranging from 2.9 to 8.1 NTU across the tide). Turbidity measured at the 18-foot sampling depth in Gilbert Bay was less than 1.08 NTU. In July, turbidity was more variable across tides but showed little variability across depths, and all measurement were less than 5.19 NTU. The Whiting River sample location showed higher turbidity measurements in all sample events. In June, the measurement of turbidity in surface waters was substantially higher across all tidal stages than the other sampling depths, ranging from 21.5 to 32.6 NTU. In July, turbidity measured in samples collected at surface water and at 9-foot-depth were both substantially higher than the 18- foot-depth. The deeper samples for both sampling events were all less than 7.2 NTU.

Fishery Resources

Aquatic Habitat

Tributaries to Sweetheart Lake—In 2011 and 2012, Aquatic Science Inc. (2012) documented 15 tributaries and numerous ephemeral streams entering Sweetheart Lake, all of which are formed from spring and summer snowmelt (figure 3-6). Seven high-gradient tributaries enter Sweetheart Lake along the northern and southern shore of the larger, middle portion of the lake, while lower-gradient streams empty into upper and lower sections of the lake (Aquatic Science Inc., 2012). The predominant habitat types in the tributaries were riffles, pools, cascades, and waterfalls. Substrate generally consisted of gravel, pebble, cobble, and boulder complexes. Gravel- and pebble-size substrate was predominate in riffle and pool areas and cobble- and boulder-size substrate occurred in cascades and high-gradient areas. Table 3-6 summarizes the habitat type and area for each low- and moderate-gradient tributary (Aquatic Science Inc., 2012). The dominate habitat types in the low- and moderate-gradient tributaries were riffles and cascades with some waterfalls and pools. The pools were generally found adjacent to riffles, at the bottom of waterfalls, or between cascades. Large woody debris was also sparsely present in the tributaries.

Juneau Hydro's benthic macroinvertebrate samples collected near the mouth of the inlet 1 and upstream of the inundation area of inlet 1 also indicate good stream health and water quality (Civil Science, Inc., 2013).

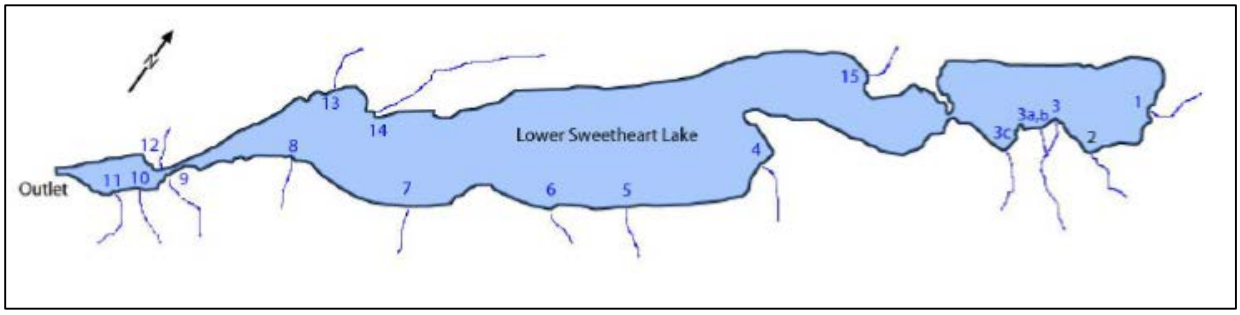

Figure 3-6. Lower Sweetheart Lake tributary inlets (Source: Juneau Hydro, 2014a).

Table 3-6. Habitat type and area of surveyed Sweetheart Lake tributaries (Source: Aquatic Science Inc., 2012).

Inlet/Tributary	Distance (feet)[a]	Elevation (feet)[b]	Habitat Type and Area (square feet)			
			Riffle	Pool	Cascade	Waterfall
1	4,836	155	136,465	26,813	37,910	11,248
2	1,358	153	7,341	1,378	7,922	8,181
3a	1,650	43	29,063	1,679	10,689	0
3c	328	26	2,164	24	0	0
4	820	134	1,292	0	12,163	0
9	492	45	3,294	0	0	0
12	709	136	3,810	0	420	0
Total			**183,428**	**29,894**	**69,104**	**19,429**

[a] Distance surveyed, as measured from the mouth of the tributary.

[b] Elevation as measured from the surface of Sweetheart Lake (0 foot).

Sweetheart Lake—The 5.4-mile-long, 0.6-mile-wide Sweetheart Lake consists of three basins: the upstream basin, which is 1 mile long and has a maximum depth of 131 feet; the middle basin, which is 3.5 miles long with mostly steep sides and a maximum depth of 509 feet; and the lower basin, which is 0.5 mile long and has a maximum depth of 72 feet. The surface area of the lake at the current normal elevation of 551 feet is 1,223 acres. Sweetheart Lake is oligotrophic[38] with very clear water and deep light penetration.

Steep, cascading tributaries and avalanche chutes form small alluvial fans or cones supporting wetland habitats along the shoreline of Sweetheart Lake. Because of the steep terrain and glacial scouring, little developed soil exists. The canyon walls surrounding the lake are covered with spruce-hemlock forest. The watershed provides habitat for a variety of wildlife species; however, tributary fish habitat is limited because of the steepness of the streams.

[38] A lake that is oligotrophic is generally low in nutrient concentrations and plant growth, and is high in transparency.

A mixture of shallow shoreline areas, inlets at tributary mouths, and deep water areas provide suitable spawning, rearing, and foraging habitat for fish in Sweetheart Lake (Aquatic Science Inc., 2012). In 2012, Juneau Hydro's habitat survey of Sweetheart Lake indicated the lakebed is primarily composed of a gravel, pebble, cobble, and boulders. Water temperature is suitable for salmonid species and is not thought to be a limiting factor for sockeye salmon growth. The narrow pinch-point that separates the lower and middle sections of the lake ranged in depth from 2 to 3 feet and is dominated by pebble and cobble substrate with larger boulders intermixed. Flows in this area were approximately 2 feet-per-second. It is estimated that approximately 18,290 square feet of potential rainbow trout spawning habitat occurs in this narrow area of the lake (Aquatic Science Inc., 2012).

Sweetheart Creek—Sweetheart Creek flows westward 2.0 miles from the outlet of Sweetheart Lake to its confluence with Gilbert Bay through steep, V-shaped canyons (USGS, 1962). The narrowest section was about 300 feet downstream from the lake outlet, where the width of the creek was less than 40 feet. The steepest part of the reach was between elevation 200 and 400 feet. In 2012, Aquatic Science Inc. (2012) surveyed aquatic habitat in three reaches of Sweetheart Creek from the outlet of Sweetheart Lake to the intertidal areas of Gilbert Bay. The aquatic habitat characteristics in the three reaches are summarized in table 3-7.

Table 3-7. Aquatic habitat characteristics of lower Sweetheart Creek (Source: Aquatic Science Inc., 2012).

Reach	Length (miles)	Gradient (percent)	Habitat Types	Depth Range (feet)	Substrate
3	1.8	> 6	Cascades and waterfalls	–	Cobble, boulder, and bedrock
2	0.2	3.5	Riffles and pools	0.9 to 7.9	Coarse gravel, cobble, boulder, and bedrock
1	0.08	–	Riffles, pools, and cascade	2.0 to 23.0	Bedrock and boulder
Intertidal	0.2	< 1	Riffle	< 6.6	Gravel

Note: – information is not available.

Reach 3: Reach 3 of Sweetheart Creek extends from the Sweetheart Lake outlet approximately 1.8 miles downstream to the upstream end of Reach 2. The channel in this reach is bordered by steep valley walls and has a high to moderate gradient that results in swift water velocities and prevents the accumulation of fine sediment (Aquatic Science Inc., 2012). Substrate at the lake outlet and immediately downstream of the outlet is comprised of large boulder and bedrock complexes. Substrate throughout Reach 3 is predominately comprised of large boulders and bedrock intermixed with cobble. Aquatic habitat features in Reach 3 include cascades, waterfalls, and bedrock knickpoints.

Reach 2: The lower end of Reach 2 begins at a large barrier falls where the narrow canyon starts to widen and extends 0.2 mile upstream to the lower end of Reach 3. Reach 2 is composed of approximately 87 percent fast riffles and 13 percent pools, and it has a channel width that ranges from 65 to 80 feet (Aquatic Science Inc., 2012). The reach has a coarse gravel to bedrock substrate with some large woody debris interspersed. This lower gradient reach, with slower water velocities and the presence of large woody debris, generally provides suitable spawning and rearing habitat for Dolly Varden (Forest Service, 2010).

Reach 1: Reach 1 of Sweetheart Creek, which Alaska DFG classifies as an anadromous reach (Alaska DFG, 2015a),[39] extends 0.08 mile from its confluence with the intertidal area of Gilbert Bay to the base of a 40-foot-high waterfall. Channel widths in this reach range from 130 to 200 feet, and aquatic habitat consists of pools, riffles, cascades, and waterfalls with bedrock and gravel substrate. Pools vary in depth and contain mostly gravel-size substrate. Several waterfalls are present in this reach, which may hinder upstream passage of anadromous and resident fish. However, the farthest upstream waterfall in the reach prevents the upstream passage of all fish.

Intertidal Reach: The intertidal reach of Sweetheart Creek extends from the downstream end of Reach 1 for 0.2 mile downstream into Gilbert Bay. The reach is low gradient (<1 percent) and has shallow riffles over gravel and cobble substrate (table 3-7). Water depths vary with the tidal cycle, but average 7 feet in depth with an average channel width of 130 feet (Aquatic Science Inc., 2012).

Intertidal Flats and Gilbert Bay—Marine areas, such as Gilbert Bay, that have open bays with intertidal flats provide complex habitat that supports a diverse community of fish species, including salmon and several species of ground fish and shellfish. The shoreline, except on the south shore, has a coastal class of mixed rock cliffs and platforms with gravel and gravel/sand beaches. Aerial photography shows that sandy

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[39] Alaska Statute 16.05.871(a) requires Alaska DFG to specify rivers, lakes, and streams, or parts of them that are important for spawning, rearing, or migration of anadromous fishes. Reach 1 provides a migration corridor for sockeye salmon, and supports spawning and rearing of pink and chum salmon.

beaches are found where drainages meet the bay (Kai Environmental, 2012a). Along shoreline areas between drainages, the intertidal substrate is rocky with gravel, cobble, and boulder. The southern shoreline of Gilbert Bay is a low-lying tidal flat area classified as a rock platform with sand beaches and estuarine sedges and grasses, creating a protected estuary environment (Kai Environmental, 2012a). Multiple, sinuous tidal channels are present in the low-lying tidal flat area.

Fish Communities

Tributaries to Sweetheart Lake—Data describing the fish species in the Sweetheart Lake tributaries are limited; however, during its aquatic habitat survey effort, Juneau Hydro observed rainbow trout and Dolly Varden in the lower 1,000 feet of the tributary reach flowing into inlet 1 (figure 3-6) (Aquatic Science Inc., 2012). It is not known whether Dolly Varden or rainbow trout are present in any of the other tributaries to Sweetheart Lake; however, spawning and rearing habitat suitable for these species was observed, in the low- to moderate-gradient streams.

Sweetheart Lake—Alaska DFG conducted surveys from 1989 to 1993 (Yanusz and Barto, 1995) that indicated Dolly Varden and rainbow trout are the only resident fish species inhabiting Sweetheart Lake. Dolly Varden are the only fish native to Sweetheart Lake. Rainbow trout became established in Sweetheart Lake following stocking of eggs and fry by Alaska DFG in 1954 and 1955 (Yanusz and Barto, 1995). In an effort to enhance the local fishery, Douglas Island Pink and Chum, Inc., annually stocks Sweetheart Lake with up to 500,000 sockeye salmon fry during the summer (Aquatic Science Inc., 2012). The sockeye salmon rear for 1 to 2 years in Sweetheart Lake prior to their downstream migration to the ocean in May. Adult sockeye salmon are unable to return to Sweetheart Lake because of a natural migration barrier located approximately 430 feet upstream from the mouth of Sweetheart Creek (Aquatic Science Inc., 2012).

In September 2011 and summer 2012, Juneau Hydro snorkeled, trapped, and angled in Sweetheart Lake (in the lake outlet and lacustrine portion of Inlets 1 through 14) to examine fish species composition and size distributions. Dolly Varden was the most frequently captured fish species and was the most widely distributed (table 3-8). Rainbow trout were also captured, mainly in the lower portion of the lake.

Table 3-8. Summary of Sweetheart Lake fish trapping efforts (Source: Aquatic Science Inc., 2012).

Location	Number of Traps Set	Number of Fish Captured		
		Rainbow Trout	Dolly Varden	Total
Lake Outlet	9	18	97	115
Inlet 1	17	4	249	253
Inlet 2	8	0	15	15
Inlet 3	13	0	44	44
Inlet 4	4	0	5	5
Inlets 7, 8	3	0	1	1
Inlets 9, 10, 11, 12	14	27	324	351
Inlet 14	4	0	28	28

Alaska DFG conducted a limnological assessment of Sweetheart Lake from 1989 to 1993 in support of its sockeye salmon fry stocking program (Yanusz and Barto, 1995). As a part of that assessment, Alaska DFG sampled zooplankton densities to evaluate the available prey base for sockeye salmon fry. Sampling results determined the zooplankton community was composed primarily of *Daphnia*, *Cyclops*, and *Holopodium* species. During more recent licensing studies in 2013, Juneau Hydro determined that *Cyclops* were the most abundant zooplankton species. *Holopodium*, *Ergasilus* and *Bosmina* species were also present.

Sweetheart Creek—Fish surveys conducted in the proposed bypassed reach of Sweetheart Creek in 2012, only collected resident rainbow trout and Dolly Varden.

In 2012, fish surveys in the anadromous reach of Sweetheart Creek collected resident rainbow trout, sockeye salmon, pink salmon, and coastrange sculpin. The sockeye salmon, pink salmon, and coastrange sculpin were collected within the intertidal area of Sweetheart Creek. Other fish species thought to occur in the anadromous reach of Sweetheart Creek, but were not collected during the 2012 survey, include cutthroat trout and steelhead.

Escapement data collected by Alaska DFG from 1960 to 2010 indicate the salmon begin to migrate into the anadromous reach of Sweetheart Creek beginning in early to mid-July, peaking in late-July and August, and generally concludes by the end of September (Aquatic Science Inc., 2012). Of the three salmon species known to occur in this reach, escapement data indicate pink salmon are the most abundant, followed by sockeye salmon and chum salmon. From 1960 to 2010, the annual run size of pink and chum salmon ranged from 0 to 118,000 and 0 to 500, respectively. As a result of the

Alaska DFG and Douglas Island Pink and Chum, Inc. sockeye salmon stocking efforts in Sweetheart Lake from 1991 to 2010, between 0 and 9,800 adult sockeye salmon return annually to Sweetheart Creek (Aquatic Science Inc., 2012). The large variability in salmon counted by Alaska DFG is likely attributed to the frequency and timing of counts performed by Alaska DFG, which varied each year.

In 2011 and 2012, tissue samples were collected from rainbow trout and Dolly Varden inhabiting Sweetheart Creek and Sweetheart Lake for genetic analysis to determine whether populations of these fishes were distinct between the two waterbodies. Observed heterozygosities[40] for creek and lake rainbow trout were 0.54 and 0.53, respectively, indicating a high amount of genetic variability. Genetic distance was measured using Nei's genetic distance[41] and determined to be 0.073 for Dolly Varden and 0.065 for rainbow trout, indicating the samples collected from Sweetheart Creek and Sweetheart Lake for the two species are genetically similar. Gene flow[42] between the lake and creek was 5.95 and 6.39 immigrants per generation for rainbow trout and Dolly Varden, respectively, indicating that the fish sampled in the Sweetheart Creek and Sweetheart Lake are not likely isolated or distinct populations.[43]

Gilbert Bay—Within Gilbert Bay, Juneau Hydro identified Dolly Varden, rainbow trout, sockeye salmon, pink salmon, Pacific halibut, Dungeness crab, tanner crab, butter clams, Pacific littleneck clams, and spot prawns as important species in the project vicinity. Pacific herring have been documented in Gilbert Bay and may periodically enter the bay to spawn; however, little is known about their occurrence in the bay. Personal use fishermen target pink salmon and sockeye salmon, but primarily focus on the stocked sockeye fishery originating from Sweetheart Lake. Personal use and commercial Dungeness crab and commercial shrimp harvest occurs in the vicinity of the proposed submarine cable.

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[40] Heterozygosity is the proportion of individuals in a population that have two different alleles at a particular locus, loci, or entire genome and is a measure of genetic variability in a population (Hallerman, 2003).

[41] Nei's genetic distance is a metric used to determine genetic similarity among populations (Hallerman, 2003).

[42] Gene flow is the movement of genes among populations of a species.

[43] Generally, if the number of immigrants per generation is much less than 1, populations will diverge. Genetic divergence may occur when populations becomes reproductively isolated.

Essential Fish Habitat

The anadromous reach of Sweetheart Creek contains EFH for pink and chum salmon, specifically for spawning, incubation and migration. The near-shore areas of Gilbert Bay contain EFH for migration of sockeye, pink, and chum salmon.

Sockeye Salmon (Oncorhynchus nerka)—Sockeye salmon,also called red salmon or blueback salmon, is an anadromous species of salmon found throughout the northern Pacific Ocean, spawning in rivers from western North America to Asia. Sockeye salmon commonly spawns in lakes, where juveniles remain for 1 to 2 years before migrating to the ocean. The juveniles' freshwater diet consists primarily of zooplankton and aquatic insects. Migrations of up to 1,000 miles can occur. Adult sockeye salmon may grow up to 34 inches in length and weigh an average of 8 pounds. Sockeye salmon are semelparous, dying after they spawn. Some populations, referred to as kokanee, do not migrate to the ocean and live their entire lives in freshwater (National Oceanic and Atmospheric Administration [NOAA], 2014).

Pink Salmon (Oncorhynchus gorbuscha)—Pink salmon is an anadromous species of salmon found throughout the northern Pacific Ocean, spawning in rivers from western North America to Asia. The pink salmon is the most abundant of the seven species of Pacific salmon and has a short, 2-year lifespan. Pink salmon migrate to their home stream from July to October, and while some go a considerable distance upstream, the majority spawn in waters close to the sea. Immediately after they emerge from the gravel in the spring, pink salmon fry enter the ocean and after a few days to several months in the estuary and nearshore zone, they move into the open ocean in large schools. Pink salmon migrations are extensive, covering thousands of miles from their home streams. During ocean feeding and maturing, pink salmon are dispersed throughout the Pacific Ocean from northern California to the Bering Sea. Asian stocks are widely distributed in the western north Pacific (Fisheries and Oceans Canada, 2013). Adult pink salmon typically range from 20 to 25 inches in length and weigh 3.5 to 5 pounds.

Chum Salmon (Oncorhynchus keta)—Chum salmon, also called dog salmon, is an anadromous species of salmon found throughout the northern Pacific Ocean, spawning in rivers from western North America to Asia. Chum salmon are the most widely distributed Pacific salmon capable of spawning up to 2,000 miles inland on the Yukon River, although most chum salmon spawn in rivers only a short distance upstream from the ocean. Juvenile chum salmon migrate to the sea in the spring soon after hatching, so have a limited freshwater residency period. Chum salmon are distributed from Alaska south to California on the North American coast, and as far south as Japan on the Asian coast of the north Pacific. Adult chum salmon typically average 24 to 28 inches in length and weigh 10 to 13 pounds, although may reach up to 20 pounds (Alaska DFG, 2015b).

Aquatic habitat in the EFH reach of Sweetheart Creek consists of small to coarse gravel, cobble, boulders, and bedrock, which transitions into sand and mud within the intertidal zone. Pink and chum salmon are not estuarine-resident species and therefore use the EFH area on a seasonal basis. The intertidal area is typically used for spawning

in the summer and fall, incubation during the winter, and smolt migration during the early spring. Sockeye salmon use Sweetheart Creek as a migratory corridor for smolt migration from Sweetheart Lake, and use the Gilbert Bay EFH for smolt and adult migration to and from Sweetheart Creek.

Special Status Species

Pacific herring that periodically occur within Gilbert Bay belong to the Southeast Alaska DPS. The segment extends from the Dixon Entrance strait, which forms the boundary between Alaska and British Columbia, Canada, north to Cape Fairweather and Ice Point, Alaska. The Southeast Alaska DPS was found to be considered a candidate species for protection under the ESA in 2008, but in 2014, NMFS determined listing was not warranted at this time due to rebounding stocks (Speegle, 2014).

Marine Mammals

All marine mammals are protected under the MMPA, and several species are known to occur in Alaskan waters. We describe below only those species that may occur near the project. Marine mammals listed as federally threatened or endangered, including humpback whale and Western DPS Steller sea lion, are described in section 3.3.4, *Threatened and Endangered Species*, and are not included in this section.

Cetaceans

Baird's Beaked Whale (Berardius bairdii)—Baird's beaked whales prefer cold, deep oceanic waters 3,300 feet or greater and may occur occasionally near shore along narrow continental shelves. This species is often associated with steep underwater geologic structures, such as submarine canyons, seamounts, and continental slopes. Baird's beaked whales occur throughout the North Pacific Ocean and adjacent seas (Bering Sea, Sea of Cortez, Sea of Japan, Sea of Okhotsk, and occasionally in the Gulf of California), and can be found in U.S. waters off the West Coast from California to Alaska. In the eastern North Pacific, they can be found virtually everywhere north of 35 degrees north (°N) latitude (NOAA, 1997). The Baird's beaked whale may be encountered along the shipping route that would be used to transport project materials from Seattle, Washington, to the Gilbert Bay dock/landing facility. However, encountering Baird's beaked whales is unlikely in the narrow confines of the straits and passages used to access the proposed project.

Cuvier's Beaked Whale (Ziphius cavirostris)—Cuvier's beaked whales can be found in temperate, subtropical and tropical waters. They have occasionally been sighted in boreal waters as well. They prefer deep pelagic waters (usually greater than 3,300 feet of the continental slope and edge), as well as around steep underwater geologic features like banks, seamounts and submarine canyons. Recent surveys suggest that beaked whales, like this species, may favor oceanographic features such as currents, current boundaries, and core ring features (NOAA, 2012). This whale species ranges widely but is primarily a pelagic species. In the Pacific, they range north to Southeast Alaska, the

Aleutian Islands, and the Commander Islands (NOAA, 1997). It is possible that Cuvier's beaked whales could be encountered along shipping routes from Seattle, but the probability and potential based on previous sightings is unlikely.

Gray Whale (Eschrichtius robustus)—Gray whales are found mainly in shallow coastal waters in the North Pacific Ocean (NOAA, 2015a). Two isolated geographic distributions of gray whales occur in the North Pacific Ocean: the Eastern North Pacific stock, found along the west coast of North America, and the Western North Pacific or "Korean" stock, found along the coast of eastern Asia. Most of the Eastern North Pacific stock spends the summer feeding in the northern Bering and Chukchi Seas, but gray whales have also been reported feeding along the Pacific coast during the summer, in waters off Southeast Alaska, British Columbia, Washington, Oregon, and California. In the fall, gray whales migrate from their summer feeding grounds, heading south along the coast of North America to spend the winter in their breeding and calving areas off the coast of Baja California, Mexico. Calves are born in shallow lagoons and bays from early January to mid-February. From mid-February to May, the Eastern North Pacific stock of gray whales can be seen migrating northward with newborn calves along the west coast of the United States (NOAA, 1997). This species of whale may be encountered by vessels shipping materials and personnel between Seattle and Juneau and in Port Snettisham and Gilbert Bay.

Killer Whale (Orcinus orca)—Killer whales are most abundant in colder waters, including Antarctica, Norway, and Alaska. However, killer whales can also be abundant in temperate waters. Killer whales also occur, though at lower densities, in tropical, subtropical, and offshore waters (NOAA, 2015b). Killer whales are the most widely distributed marine mammals. They are found in all parts of the oceans and in most seas from the Arctic to the Antarctic. In the North Pacific Ocean, killer whales are often sighted in all parts of Alaska, including the Bering Sea, Aleutian Islands, Prince William Sound, and Southeast Alaska. They are also often sighted in other areas of the North Pacific Ocean, such as nearshore and intercoastal waterways of British Columbia, Canada, and Washington State; along the U.S. Pacific coast in Washington, Oregon, and California; along the Russian coast in the Bering Sea and the Sea of Okhotsk on the eastern side of Sakhalin; and the Kuril Islands. Although not observed in Port Snettisham or Gilbert Bay during project studies, killer whales could occur in these areas, as well as along the shipping route from Seattle.

Minke Whale (Balaenoptera acutorostrata)—Minke whales prefer temperate to boreal waters, but are also found in tropical and subtropical areas. Minke whales feed most often in cooler waters at higher latitudes. These whales can be found in both coastal/inshore and oceanic/offshore areas (NOAA, 2015c). The distribution of minke whales is considered cosmopolitan because they can occur in polar, temperate, and tropical waters in most seas and areas worldwide. Minke whales, like some other species of cetaceans, migrate seasonally and are capable of traveling long distances. Some animals and stocks of this species have resident home ranges and are not highly migratory. The distribution of minke whales varies by age, reproductive status, and sex.

Older mature males are commonly found in the Polar Regions in and near the ice edge, and often in small social groups during the summer feeding season. Mature females will also migrate farther into the higher latitudes but generally remain in coastal waters. Immature animals are more solitary and usually stay in lower latitudes during the summer. In U.S. waters, minke whales in Alaskan waters are migratory, but animals in the inland waters of California/Oregon/Washington are considered residents because they establish home ranges (NOAA, 2015c). Minke whales may be encountered along the shipping route from Seattle and in the waters of Port Snettisham and Gilbert Bay.

Pinnipeds

Dall's Porpoise (Phocoenoides dalli)—This species prefers temperate to boreal waters that are more than 600 feet deep and with temperatures between 36 degrees Fahrenheit (°F) and 63°F. They can be found in offshore, inshore, and nearshore oceanic waters (NOAA, 2015d). Dall's porpoises occur throughout the North Pacific Ocean. This species is also found in the adjacent Bering Sea, Sea of Japan, and Sea of Okhotsk. In the eastern North Pacific, they occur from around the U.S./Mexico border (Baja California) (28–32°N) to the Bering Sea (65°N); in the central North Pacific (above 41°N); and in the western North Pacific from central Japan (35°N) to the Sea of Okhotsk. In the Bering Sea, they occur in higher abundance near the shelf break. These porpoises are usually found in groups averaging between 2-20 individuals, but have been occasionally seen in larger, loosely associated groups in the hundreds or even thousands of animals (NOAA, 2015d). This dolphin species is found in areas along the shipping routes from Seattle and would also likely to be encountered by vessels transporting materials to the project site in Gilbert Bay.

Harbor Porpoise (Phocoena phocoena)—Harbor porpoises inhabit northern temperate and subarctic coastal and offshore waters. They are commonly found in bays, estuaries, harbors, and fjords less than 650 feet deep (NOAA, 2015e), though relative to the waters off of the west coast of the continental U.S., the harbor porpoise does not occur in high densities in Alaskan waters (NOAA, 1997). In the North Pacific, they are found from Japan (34°N) north to the Chukchi Sea and from Monterey Bay, California, to the Beaufort Sea (NOAA, 2015e). Port Snettisham and Gilbert Bay do provide suitable habitat for this species. However, no observations have been reported in either of these areas.

Harbor Seal (Phoca vitulina)—Harbor seals live in temperate coastal habitats and use rocks, reefs, beach, and drifting glacial ice as haulout and pupping sites. Harbor seals haul out on land for rest, thermal regulation, social interaction, and to give birth. Seals also haul out to avoid predators. Studies have shown that seals in groups spend less time scanning for predators than those that haul out alone (NOAA, 2015f). Harbor seals are generally non-migratory and occur on both the U.S. east and west coasts. On the east coast, harbor seals are found from the Canadian Arctic to New York and occasionally in the Carolinas. On the west coast, harbor seals are found in the coastal and estuarine waters from British Columbia, Canada to Baja, California. They are found further west

through the Gulf of Alaska and in the Bering Sea (NOAA, 2015f). Harbor seals are common residents in Gilbert Bay, and the mouth of Whiting River (approximately 3.5 miles north of the project site) is locally known as a harbor seal nursery, where seals haul out on the sandbar. Harbor seals have also been observed feeding throughout Gilbert Bay including near Sweetheart Creek. Pacific salmon, cod, sculpin, and flatfish are common prey items, which may be found with the project area.

Pacific White-Sided Dolphin (Lagenorhynchus obliquidens)—Pacific white-sided dolphins are found in temperate waters of the North Pacific. They inhabit waters from the continental shelf to the deep open ocean (NOAA, 2015g). This pelagic species ranges in the western Pacific Ocean from the South Bering Sea to southern Japan. In the eastern Pacific Ocean, they range from the Gulf of Alaska to the Gulf of California. They are most common between the latitudes of 38°N and 47°N (NOAA, 2015g). Pacific white-side dolphins are primarily pelagic species, but the animals are known to enter the inshore passes of Alaska, British Columbia, and Washington (NOAA, 1997). Therefore, they could occur not only along the shipping routes from Seattle, Washington, but also could occur in Port Snettisham and Gilbert Bay.

Steller Sea Lion (Eumetopias jubatus) Eastern DPS—Steller sea lions prefer the colder temperate to sub-arctic waters of the North Pacific Ocean. Haulouts and rookeries usually consist of beaches (gravel, rock, or sand), ledges, and rocky reefs. In the Bering Sea and Sea of Okhotsk, sea lions may also haul out on sea ice, but this is considered atypical behavior (NOAA, 2015h). Steller sea lions are distributed mainly around the coasts to the outer continental shelf along the North Pacific Ocean rim from northern Hokkaido, Japan through the Kuril Islands and Sea of Okhotsk, Aleutian Islands and central Bering Sea, southern coast of Alaska, and south to California. The population is divided into western and eastern DPSs at 144° west longitude (Cape Suckling, Alaska). The western DPS is federally listed as endangered and is further discussed in section 3.3.4, *Threatened and Endangered Species*, because some migrants from the western DPS have been documented in Southeast Alaska (Gelatt et al., 2007; Jemison et al., 2013). The eastern DPS, which was delisted in December 2013, includes sea lions living in Southeast Alaska, British Columbia, California, and Oregon. In Southeast Alaska, most Steller sea lions are considered to be part of the eastern DPS.

Steller sea lions are considered opportunistic predators because they switch prey items and relocate based upon seasonal prey availability (Sigler et al., 2009). They forage and feed primarily at night on spawning fish, such as salmon and eulachon in the spring, and various other species, such as capelin, cod, herring, pollock, mackerel, squid, and octopus throughout the year. Steller sea lions likely visit Gilbert Bay while pursuing prey species such as salmon (Kai Environmental, 2012b). During field studies for the project, no Steller sea lions were directly observed in Gilbert Bay; however, sea lions were heard near Port Snettisham during the June 2012 northern goshawk surveys.

Critical habitat for Steller sea lions include a terrestrial zone, an aquatic zone, and an air zone that extends 3,000 feet landward, seaward, and upward, respectively, from each major rookery and major haulout in Southeast Alaska (58 Federal Register 45269). The closest critical habitat to Gilbert Bay is Sunset Island to the south of the project (31.5 miles) and Benjamin Island to the north of the project area (57 miles).

A non-major haulout for eastern DPS Steller sea lions is located on the northern shore of Port Snettisham, east of Mist Island. It is commonly known as the Mist haulout. Data provided by Alaska DFG include counts and brand sightings.[44] Sea lions were documented occupying the haulout from January through May, with June through December occupancy being unknown because surveys did not occur during those months. Based on count data and branded sea lion sightings, the minimum number of sea lions observed at the haulout was 134 in April 2006, 57 in May 2006, 50 in May 2007, and more than 100 in April 2009. During monthly surveys conducted by Womble et al. (2009) from March 2001 to May 2004, Steller sea lions were found at the Mist haulout during all months except July, August, and September. During the months when they were present, mean monthly counts ranged from 12.0 in June to 206.3 in May. Anecdotal information from local crab and gillnet fishermen who use Port Snettisham from February through July of every year report that sightings of Steller sea lions are very rare given the poor quality of the area shoreline habitat as a haulout location, and they are not present during the summer months.

3.3.2.2 Environmental Effects

Construction Effects on Water Quality and Aquatic Resources

Construction of the proposed dam, reservoir outlet works, diversion tunnel, cofferdams, powerhouse, tailrace, coastal road/trail, overhead transmission line, and submarine cable may affect water quality and aquatic resources in Sweetheart Lake, Sweetheart Creek, Gilbert Bay, and an unnamed stream on the Snettisham Peninsula. To protect aquatic resources and water quality during construction, Juneau Hydro proposes to implement its Erosion Control Plan and Storm Water Plan (see section 3.3.1, *Geologic and Soil Resources*), which includes site-specific BMPs to minimize erosion and sedimentation. These BMPs would include minimizing disturbed areas and protecting natural features and soil, controlling storm water flowing onto and through the project site, stabilizing exposed soils to prevent erosion, protecting exposed slopes that may erode using a combination of rock riprap and vegetation, establishing perimeter controls

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[44] In 2000, the Steller Sea Lion Recovery Team recommended that researchers begin branding and marking Steller sea lion pups throughout their range as a means to estimate vital population parameters in the future. Pup branding and marking in Southeast Alaska is conducted by Alaska DFG (Gearin, undated).

and sediment barriers, and stabilizing, placing as fill, and covering all sediment collected onsite with topsoil and vegetation.

To prevent or minimize accidental introduction of petroleum or other hazardous substances to project waters during project construction, Juneau Hydro proposes to implement its Hazardous Substances Plan. The plan addresses storage, spill prevention, and cleanup of hazardous substances and establishes procedures for reporting and responding to accidental releases.

Juneau Hydro's proposed Environmental Compliance Plan includes designating an onsite ECM that would oversee and enforce environmental compliance monitoring for the project.

To address the disposal of solid waste, wastewater, and organic waste, Juneau Hydro proposes to implement a Solid Waste Plan. Under its Solid Waste Plan, Juneau Hydro would collect all solid waste and construction debris generated onsite and store it in bear-proof containers (if applicable) until it can be removed by boat to the Juneau disposal facility or another approved uplands disposal facility. Juneau Hydro would also construct a wastewater treatment plant for Gilbert Bay and Sweetheart Lake construction camps and caretaker's facility. At other construction sites, portable toilets would be used for human waste and would be maintained as necessary.

Forest Service 4(e) condition 21, specifies that Juneau Hydro provide a qualified ECM to oversee the project during major construction activities (e.g., vegetative or land disturbing, spoil producing, and blasting activities). The ECM would be a liaison between the Forest Service and Juneau Hydro and would have the authority to stop work or issue change orders if conditions warrant. Items to be monitored would include, but are not limited to, those stated in the resource management plans, as listed in 4(e) condition 22.

Forest Service 4(e) condition 22 specifies that Juneau Hydro consult with the Forest Service and applicable federal and state agencies, and file with the Commission, 20 plans addressing specific resource issues covered by the Tongass National Forest Land and Resource Management Plan. Plans closely associated with water quality protection include an Erosion Control Plan, Solid Waste Plan, Hazardous Substances Plan, and Storm Water Plan.

In its 10(j) recommendation 17, Alaska DFG recommends that Juneau Hydro develop a final Erosion Control Plan that provides specific descriptions of features incorporated into the final project design, and measures that would be employed during construction to limit project effects on environmental resources. In its 10(j) recommendations 18 and 19, Alaska DFG further recommends Juneau Hydro employ a qualified ECM for the duration of project construction whose duties would include turbidity monitoring in compliance with the Erosion Control Plan, providing notice in the event noncompliance is detected, and filing reports specified in the Environmental Compliance Plan.

In its 10(j) recommendation 10, Alaska DFG recommends Juneau Hydro work with its habitat biologist to establish timing windows for instream construction and crossing activities.

Juneau Hydro agreed to work with resource agencies to finalize the proposed resource management plans and comply with the agency recommendations.

Our Analysis

As described above in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects,* ground-disturbing construction activities would not begin until sediment control devices specified in the Erosion Control Plan have been designed, approved, installed, and placed into operation. However, as explained previously, additional details are needed to develop an effective and implementable plan.

Once these measures have been established, a qualified ECM would oversee the project during major construction activities, and perform turbidity monitoring and reporting as outlined in the Erosion Control Plan. These measures would help to ensure that erosion control devices are effective in protecting water quality and minimizing effects on aquatic resources, and that Juneau Hydro and contractors are following all environmental plans.

Even with Juneau Hydro's proposed erosion control measures, it is likely that fish and other aquatic organisms would be subject to short-term, temporary increases in turbidity as a result of project construction. Short-term increases would likely occur in Sweetheart Lake, in Sweetheart Creek near the dam, and in the vicinity of the powerhouse and its access road.

Construction of the proposed project would require the use and onsite storage of fuel (diesel and gasoline), motor oil, hydraulic fluid, and other lubricants. The use and storage of these substances could result in an accidental release resulting in adverse effects on water quality and aquatic resources. Juneau Hydro's proposed Hazardous Substances Plan, which follows Alaska State BMPs for storage and clean-up, would ensure that fuel and other hydrocarbons would be stored in areas away from waterways, that appropriate primary and secondary containment would be provided for all fuel and hydrocarbons stored onsite, that emergency response and notification procedures are available onsite, and that equipment and clean up materials are readily available onsite. Implementing the measures described in the plan filed with the Commission would reduce the likelihood of an accidental release directly or indirectly contaminating drainage ways or streams and ensure that any spills are quickly contained, avoiding or minimizing adverse effects on water quality and aquatic resources

Implementation of the measures included in Juneau Hydro's proposed Solid Waste Plan, coupled with regular compliance monitoring, would ensure project construction activities do not result in the accumulation of solid waste or the release of wastewater. As a result, it is unlikely that any waste generated during construction would have an adverse effect on water quality and aquatic resources.

Submarine cable construction would disturb the seabed and could result in displacement or disturbance of flora and fauna, increased turbidity, and alteration of sediments. These effects would mainly be restricted to the installation phase and would be temporary, with their spatial extent limited to the cable corridor (about 30-feet in width if the cable is ploughed into the seabed, such as across Gilbert Bay). Some mobile benthic organisms (e.g., crabs) would likely be able to avoid disturbance, although sessile species (bivalves, tubeworms, etc.) could be buried or killed. However, it is expected that following installation of the submarine cable, benthic organisms would recolonize the disturbed area.

Alaska DFG's recommendation that timing windows be established for instream construction activities and stream crossings could minimize harm or disturbance to fish during sensitive life stages such as migration and spawning during project construction and maintenance. Establishing the timing windows for instream activities in consultation with Alaska DFG and filing a schedule of the proposed timing windows with the Commission for approval would ensure the timing windows are adequate to protect aquatic resources while providing some accommodation to project construction requirements.

Operational Effects on Water Quality in Sweetheart Lake

Initial reservoir filling and operation of the project would result in inundation of soil and terrestrial vegetation around Sweetheart Lake. Erosion of soil and decomposition of inundated vegetation and could affect water quality including turbidity and pH. Further, project operation would alter existing water levels in Sweetheart Lake and could affect water temperature.

To address potential effects on water quality during project operation, Juneau Hydro included a provision in its Reservoir Management Plan (which is part of its Water Management Plan) to install automated devices near the power intake structure to monitor and record turbidity, pH, and water temperature in Sweetheart Lake. Juneau Hydro also proposes to investigate any occurrence of abnormal deviations in water quality and determine if actions would be warranted.

Our Analysis

Juneau Hydro's proposal to continuously monitor turbidity, pH, and water temperature near the proposed power intake structure during project operation would allow Juneau Hydro to identify any abnormal deviations in these water quality parameters that could result from shoreline inundation and seasonal fluctuations in lake levels and take appropriate corrective actions in a timely manner to prevent adverse effects on aquatic resources. However, the plan does not describe what threshold would constitute an abnormal deviation for each of the monitored parameters or what corrective actions may be possible. The plan also does not include any reporting requirements. Notifying the Commission, the Forest Service, and Alaska DFG in the event of an abnormal deviation and filing a report including any proposed corrective actions to prevent future

deviations in water quality would assist the Commission in the administration of the license and further protect aquatic resources. Although we assume Juneau Hydro proposes to conduct water quality monitoring for the term of license, monitoring for the first few years of project operation likely would be sufficient because any changes to water quality would primarily occur during initial reservoir filling and drawdown.

Operational Effects on Temperature in the Anadromous Reach of Sweetheart Creek

Operation of the proposed project would involve diverting natural flow from Sweetheart Lake through a screened intake; routing water through a tunnel, penstock, and powerhouse; and returning it to the lower 1,300 feet of Sweetheart Creek (i.e., the anadromous reach) via a tailrace immediately below the anadromous fish barrier. Diverting up to 486 cfs from Sweetheart Lake and the upper reaches of Sweetheart Creek (the bypassed reach) and returning it to lower Sweetheart Creek has the potential to affect the water temperature in the anadromous reach of Sweetheart Creek as the elevation of the surface water relative to the intake changes during normal lake drawdown and refill periods.

In its 10(j) recommendation 2, Alaska DFG recommends Juneau Hydro operate the project to maintain instantaneous instream flows in the anadromous reach of Sweetheart Creek, as measured at a stream gage in the project tailrace, pursuant to the following schedule:

Dates	Minimum Flow (cfs) Measured at Gage
January through February	40
March	45
April	119
May through October	300
November through December	117

Juneau Hydro agreed with this recommendation.

Our Analysis

During project operation, Juneau Hydro would divert up to 486 cfs from Sweetheart Lake and release it directly into the upstream end of the anadromous reach. Because Juneau Hydro would maintain a minimum instream flow of 300 cfs in the anadromous reach from May through October, flows in this reach would typically range from 300 to 486 cfs during this period. Depending on lake levels, the proposed intake would withdraw water from depths ranging from 25 to 85 feet below the surface of Sweetheart Lake. Based on data collected in September 2011, water temperatures at the

intake are expected to range between 7.0 and 9.4°C in September, as a result of potential variation in lake levels.

Juneau Hydro evaluated the effects of the proposed project's flow regime, along with its associated lake level changes (intake depth) on water temperatures in the anadromous reach of Sweetheart Creek. Changes in water temperature were predicted using lake levels modeled during 10 years of discharge measurements for average, wet, and dry year scenarios during that period. This evaluation projected a 0.17°C rise in the average annual water temperature in the anadromous reach during an average precipitation year (table 3-9). Monthly differences during the average precipitation year ranged from a decrease of 4.4°C in August to an increase of 2.9°C in December.

Table 3-9. Pre-project and projected operational water temperatures in the anadromous reach of Sweetheart Creek during an average precipitation year (Source: Juneau Hydro, 2014a, as modified by staff).

Month	**Lake Elevation**	**Water Depth above Intake (feet)**	**Operational Power Tunnel Intake Temperature (°C)**	**Pre-Project Sweetheart Creek Temperature (°C)**	**Projected Difference (°C)**
Jan	620	67	2.8	0.9	1.9
Feb	611	58	2	0.7	1.3
Mar	601	48	2	0.6	1.4
Apr	592	39	3.2	1.4	1.8
May	589	36	4	2.7	1.3
Jun	599	46	4	4.5	-0.5
Jul	609	56	6	8.3	-2.3
Aug	615	62	6.5	10.9	-4.4
Sep	620	67	7	9.0	-2
Oct	626	73	5	6.0	-1
Nov	627	74	4	2.4	1.6
Dec	626	73	3.2	0.3	2.9
Average			**4.14**	**3.97**	**0.17**
Standard Deviation			**1.67**	**3.71**	**2.10**

To evaluate the effects of potential temperature changes on pink and chum salmon egg incubation, Juneau Hydro calculated accumulative thermal units (ATUs) by month during the incubation period for each of their predicted average, wet, and dry operational scenarios. An ATU is the total heat an egg receives over a period of time. To calculate ATUs, the water temperature each day is added to the total for the previous days.[45]

ATUs calculated in the anadromous reach for 2012 using measured daily water temperatures totaled 1,457. ATUs estimated for the average, wet and dry water scenarios during proposed project operation were 1,469, 1,313, and 1,605, respectively. During average precipitation years, total ATUs were similar between existing conditions and proposed project operation; however, the wet year scenario resulted in cooler water temperatures by drawing water from consistently greater depths; the dry year scenario resulted in warmer annual water temperatures by drawing water from shallower depths. Juneau Hydro did not calculate expected ATUs for wet and dry years under existing conditions and therefore it is not possible to compare the difference in ATUs to the estimates for proposed project operation scenarios.

According to Sheridan (1962), pink salmon require approximately 100 to 162 ATUs to hatch and about 890 to 1,000 ATUs from spawning to emergence. Chum salmon require about 400 to 600 ATUs to hatch and about 700 to 1,000 for yolk absorption (Burgner, 1991). Based on the estimated ATU requirements for pink salmon (990 to 1,162 ATUs) and chum salmon (1,100 to 1,600 ATUs), water temperatures during project operation (for average, wet, and dry water years) are expected to exceed the minimum required ATUs for pink salmon and are expected to be within the range of required ATUs for chum salmon. The results also indicate that proposed project operation could result in early or delayed hatching of salmon fry, depending on flow conditions and the depth at which water is withdrawn from Sweetheart Lake. Although Juneau Hydro indicated that the majority of pink and chum salmon spawn in the intertidal reach of Sweetheart Creek, their analysis did not consider the influence of tidal inundation on water temperatures in the anadromous reach. According to Groot (1989), water temperature changes associated with inundation of freshwater streams with warmer tidal water may provide significant accumulation of thermal energy to salmon eggs over the incubation period. Further, Juneau Hydro's estimates of changes in water temperature did not consider intragravel temperatures which may differ from surface water temperatures. For instance, studies of coastal streams in the Pacific Northwest indicated that intragravel water temperatures were generally 0.5 to 1.0°C warmer in winter and 0.5 to 1.5 cooler in summer, compared to surface water temperatures (Shepherd et al., 1986).

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[45] For example, if the water temperature is 8ºC on the first day, the ATUs are 8. If the temperature is 8ºC again on the second day, the ATUs are 16. If the temperature falls to 6ºC on the third day, the ATUs are 22.

However, based on the average monthly stream temperatures collected in Sweetheart Creek in 2012 during the winter incubation period, stream temperatures are below the optimal temperatures for incubation of eggs for pink and chum salmon. For instance, temperatures ranging from 4 to 12°C tend to produce relatively high salmonid survival to hatching and emergence (McCullough et al., 2001). Although incubation of chum salmon eggs occur at water temperatures of 0 to 15°C (Pauley et al., 1988), mortality of eggs have been shown to be significantly higher at temperatures below 1.5°C (Burgner, 1991). The upper lethal temperature and lower lethal temperature for young chum salmon has been noted to be 23.8 and 0°C, respectively (Pauley et al., 1988). For incubation of pink salmon eggs, optimum water temperature range from 4.4 to 13.3°C (Bell, 1986). The upper lethal temperature and lower lethal temperature for pink salmon is 25.6 and 0°C, respectively. Based on this thermal tolerance and temperature preference information, changes in the estimated monthly water temperatures for incubation periods would not be expected to adversely affect survival of eggs and fry of pink and chum salmon. Further, while we find that optimal temperatures do not seem to be necessary for successful incubation of pink and chum salmon eggs in Sweetheart Creek under existing conditions, it is expected that slightly warmer temperatures that could result from project operation during winter would be closer to the optimal range for the egg incubation period and could increase survival to hatching and emergence.

During project operation, reduced water temperatures during July through September also have the potential to delay the onset of pink salmon spawning. Juneau Hydro estimated that during normal runoff years, water temperatures in Sweetheart Creek during July through September would range from 6 to 7°C during project operation, which would reduce existing water temperatures for the same period by 2.3 to 3.9°C. Although salmonids have been noted to spawn at temperatures ranging from 1 to 20°C (Bjornn and Reiser, 1991), optimum water temperatures for pink salmon spawning are reported to range from 7.2 to 12.8°C (Bell, 1986). Outside this optimum range, Raleigh and Nelson (1985) documented pink salmon spawning at temperatures between 5 and 19°C. Chum salmon tend to spawn at water temperatures above 4°C. Regardless, observations indicate that the majority of pink and chum salmon returning to Sweetheart Creek spawn in the intertidal zone, where tidal waters influence water temperatures. During studies of intertidal spawning of chum salmon in Alaskan streams, Groot (1989) noted that during tidal inundation, stream temperatures increased by as much as 2 to 5.6°C. Because pink and chum salmon are intertidal spawners that are likely adapted to variable temperature conditions caused by tidal and freshwater interactions, and the expected water temperatures during project operation would likely be within the range necessary for spawning, it is unlikely that project operations would cause temperature changes sufficient to alter the timing of spawning for these species.

Bypassed Reach Instream Flows

Operation of the proposed project would result in a substantial reduction of flow into the bypassed reach and could adversely affect aquatic communities.

Juneau Hydro proposes to release a minimum flow of 3 cfs from the dam into the Sweetheart Creek, as measured from the toe of the dam to protect ecological functions, processes, and connectivity important for non-fish aquatic resources in the bypassed reach.

In its 10(j) recommendation 1, Alaska DFG recommends that Juneau Hydro continuously release 3 cfs from the dam site into the downstream bypassed reach. Alaska DFG states that the flow may be modified temporarily, if required, by operating emergencies beyond the control of the licensee, or for short period upon agreement between the licensee, Alaska DFG, and other requesting agencies. If so modified, Juneau Hydro would notify the agencies as soon as possible, but no later than 10 days after the modification.

Juneau Hydro agreed with Alaska DFG's minimum flow recommendation.

Our Analysis

Juneau Hydro's proposed and Alaska DFG's recommended 3-cfs minimum instream flow release in the proposed bypassed reach would result in a flow in the reach, including natural inflow from precipitation and snowmelt, ranging from approximately 5 cfs in February and March to 15 to 23 cfs from May through October. During periods of low natural inflow, the 3-cfs minimum flow from the dam would constitute almost all the available flow in the bypassed reach.

The effects of reducing flows in the bypassed reach on fish and aquatic habitats are expected to be minor because of poor habitat conditions created by the high to moderate gradient, coarse substrate dominated by boulder and bedrock, and high water velocity. Although the bypassed reach likely provides some potential rearing and spawning habitat during low flow periods, it is unlikely this habitat would persist under high flow conditions because of the predominately confined and high to moderate gradient stream channel and limited holding areas for fish. Further, the lack of a continuous sediment supply and the occurrence of high flow events likely limit the availability of suitable spawning substrate for Dolly Varden and rainbow trout. These characteristics make it unlikely that the bypassed reach supports a self-sustaining spawning population of resident fish. Although rainbow trout and Dolly Varden were collected in the lower-most reaches of the proposed bypassed reach (i.e., just above the anadromous fish barrier), where the gradient decreases slightly and the aquatic habitat comprises primarily coarse gravel to bedrock dominated fast riffles and pools, available data indicate that the fish found in this segment of the bypassed reach consists of individuals that moved downstream from Sweetheart Lake and do not represent genetically distinct populations and are not likely self-sustaining. Further, because construction of the project would eliminate the potential for fish originating from

Sweetheart Lake from accessing the bypassed reach, the number of fish in the reach would likely be reduced, and the proposed minimum flows should be adequate to maintain habitat connectivity for instream populations (i.e., fish, amphibians, aquatic macroinvertebrates, and other organisms) in the bypassed reach.

Anadromous Reach Instream Flows

Project storage and operation would alter the timing and amount of flow into the anadromous reach of Sweetheart Creek, which in turn could affect available spawning, rearing, and foraging habitat for native salmonids.

In its 10(j) recommendation 2, Alaska DFG recommended a minimum flow in the anadromous reach of Sweetheart Creek, as measured at a stream gage in the project tailrace, pursuant to the following schedule: January through February—40 cfs, March—45 cfs, April—119 cfs, May through October—300 cfs, and November through December—117 cfs.

Juneau Hydro agreed with Alaska DFG's minimum flow recommendations for the anadromous reach of Sweetheart Creek.

Our Analysis

During project operation, flows in the anadromous reach would include the flows from the bypassed reach and any discharge from the powerhouse. During normal and wet years, flows of 300 to 486 cfs typically would be maintained in the anadromous reach of Sweetheart Creek. This represents a substantial reduction in flow during the spring and summer months when adult pink and chum salmon are accessing the creek to spawn. Under existing conditions, monthly average flows in May, June, July, August and September are 423, 706, 554, 486, and 554, respectively, and can range from a high of 1,085 in September to a low of 231 in September.

To evaluate the effects of its flow proposal on salmon habitat in lower Sweetheart Creek, Juneau Hydro conducted an instream flow study using the Instream Flow Incremental Methodology including the Physical Habitat Simulation Model (PHABSIM). The focus of the analysis was to determine the change in weighted usable area (WUA)[46] for spawning and egg incubation of pink salmon, chum salmon, and steelhead[47] that may

[46] Weighted usable area is an index of habitat suitability.

[47] While the instream flow study included steelhead as an evaluation species, steelhead have not been documented in Sweetheart Creek. The creek, however, does contain resident rainbow trout.

occur under an estimated average monthly flow of 335 cfs.[48] The PHABSIM results indicated that a flow of 335 cfs in the anadromous reach of Sweetheart Creek (294 cfs in the main channel and 41 cfs in the side channel) would increase the WUA for pink salmon, chum salmon, and steelhead spawning, compared to existing conditions, during the May through September spawning season.[49] Specifically, the study indicated that reducing existing average monthly flows from 554 cfs in July and September and 486 cfs in August to 335 cfs would increase WUA by an average of about 20 percent for pink and chum salmon. Reducing the existing average monthly flows from 423 cfs in May and 706 cfs in June to 335 cfs would increase WUA by an average of about 27 percent for steelhead (figure 3-7). Further, the study indicated that an average monthly flow of 335 cfs would increase the WUA for egg incubation during winter compared to existing flows.

Because Juneau Hydro did not specifically evaluate Alaska DFG's recommended minimum instream flows[50] on WUA in the anadromous reach of Sweetheart Creek, we used the PHABSIM results to estimate WUA for pink salmon, chum salmon, and steelhead spawning and egg incubation.[51,52] This estimate indicated that WUA for spawning and incubation for pink salmon, chum salmon, and steelhead under the proposed minimum flows generally increased or remained similar to WUA under existing average monthly flows from April through October (figure 3-8).

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[48] Juneau Hydro used 335 cfs as the estimated average monthly based on gaged discharge; however, the average monthly flow for the complete flow record, including synthetic flow data, is 336 cfs.

[49] Pink and chum salmon spawn from July through September, and steelhead spawn in May or June.

[50] In its 10(j) recommendations, Alaska DFG explained that its minimum instream flow recommendations for November through April were based on flows requested in its Reservation of Water application on file with Alaska DNR and were developed to protect fish habitat, migration, and propagation in the anadromous reach of Sweetheart Creek. The flow recommendations from May through October were developed based on the hydrology of the system and the results of Juneau Hydro's instream flow study.

[51] WUA for the proposed minimum flows was estimated using linear interpolation.

[52] The PHABSIM results provided by Juneau Hydro were based on flows in the main channel of Sweetheart Creek anadromous reach that ranged from 80 to 986 cfs; therefore, to calculate the WUA for the proposed minimum flows for January, February, or March (40 to 45 cfs) we assumed the slope of the WUA curve between 40 and 80 cfs was the same as the slope between 80 and 294 cfs (294 cfs is the amount of flow estimated in the main channel at a proposed flow release of 335 cfs).

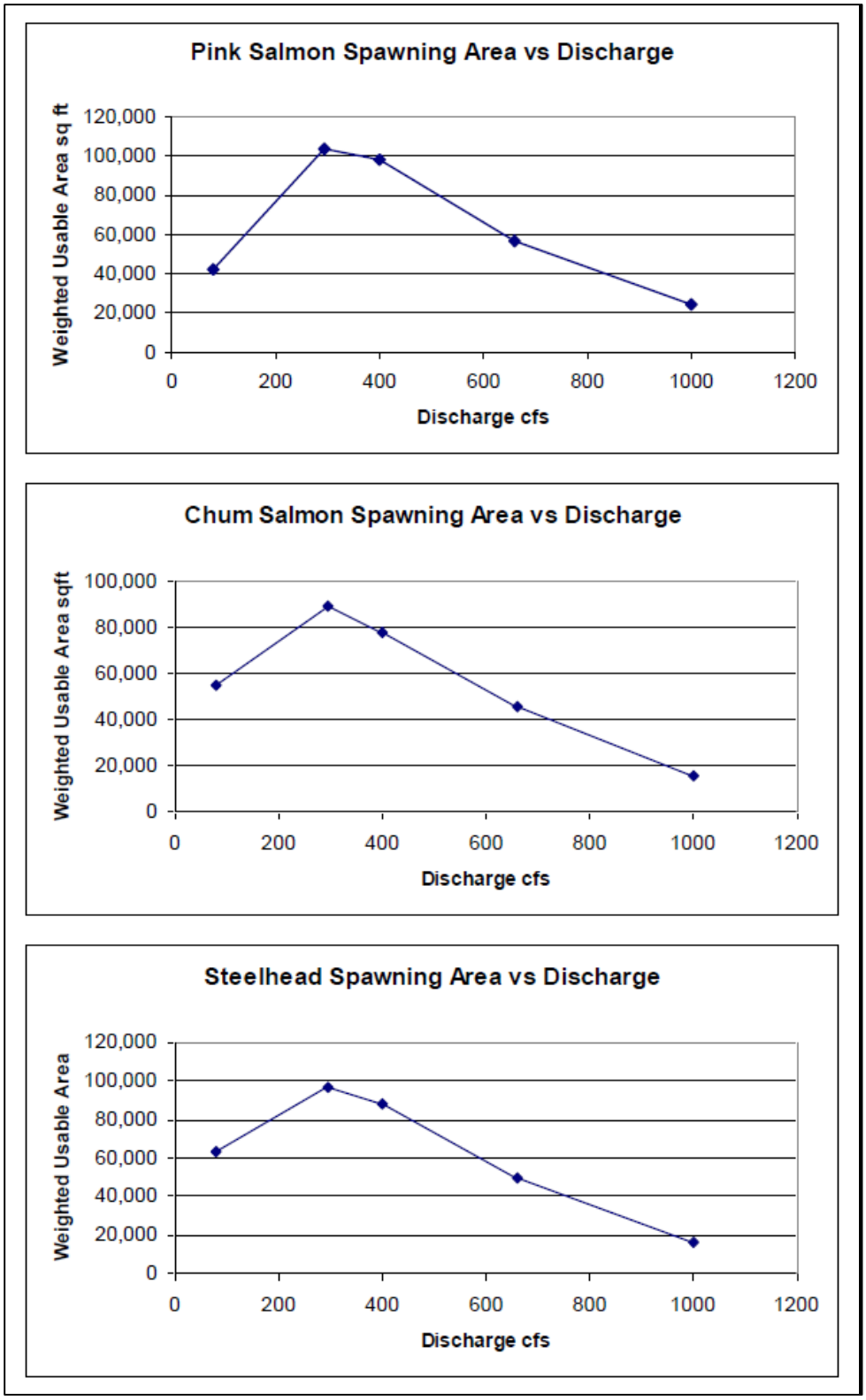

Figure 3-7. Spawning weighted usable area for pink and chum salmon and steelhead (spawning habitat area versus discharge) (Source: Aquatic Science Inc., 2012).

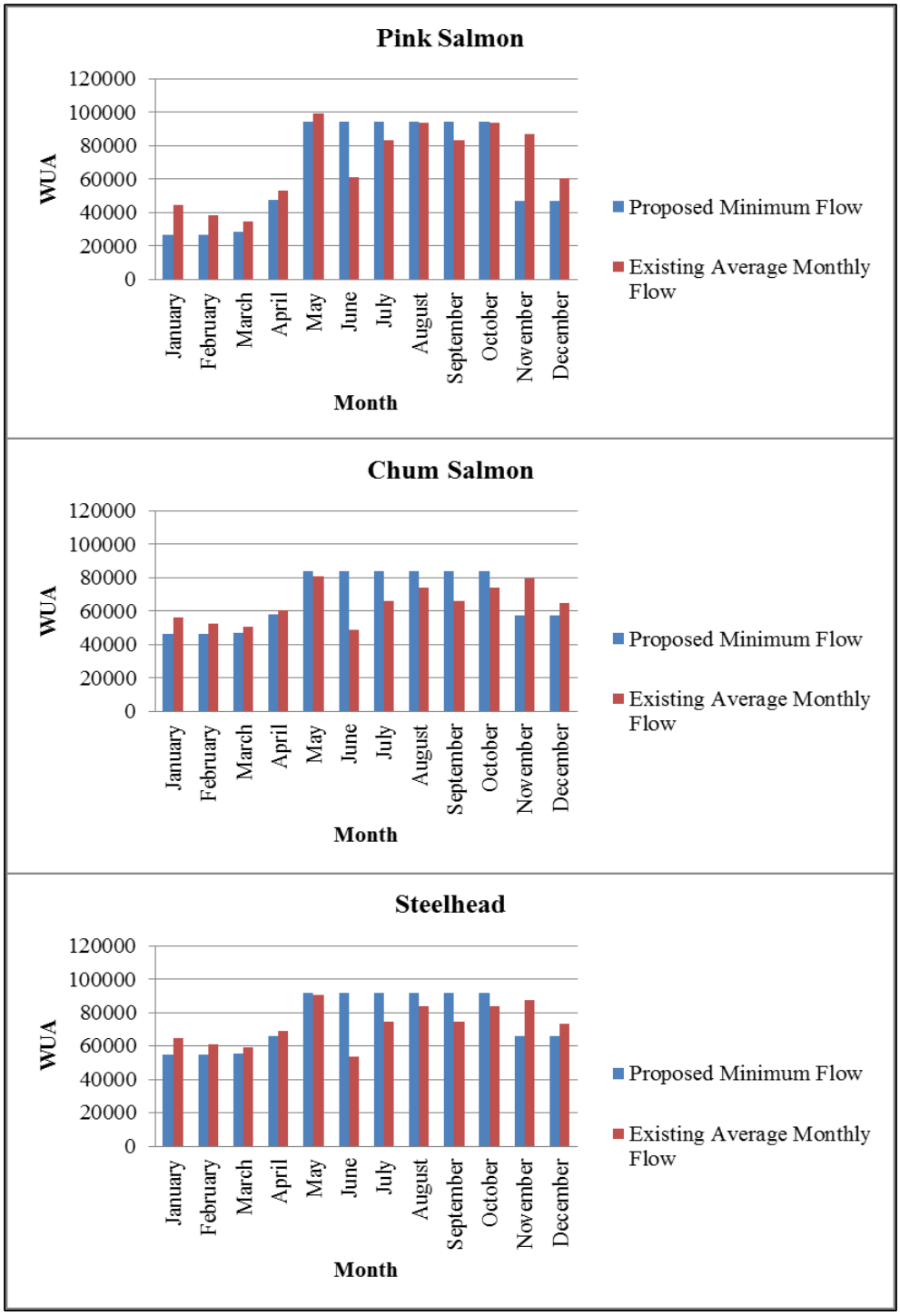

Figure 3-8. Estimated weighted usable area for pink salmon, chum salmon, and steelhead spawning and incubation under proposed minimum flows and existing average monthly flows in the main channel of the Sweetheart Creek anadromous reach (Source: staff).

In winter and early spring months (November through March), during the typical egg incubation period for these species, WUA decreased under the proposed minimum flows compared to the existing average monthly flows. However, this decrease in WUA was generally not substantial and was typical of changes to WUA that occur under existing conditions where lower flows during winter incubation months typically result in decreased WUA compared to the summer and fall spawning period for these fish species. Further, the proposed minimum flows during the incubation period are within the range of flows that could occur under natural conditions and would likely only occur during adverse operating conditions (e.g., low runoff/storage years, project maintenance, and emergency shutdown). Therefore, we expect implementation of the proposed minimum flows would adequately protect and maintain spawning and incubation habitat for pink salmon, chum salmon, or steelhead.

Pulse Flow Evaluation

Operation of the proposed project would reduce the variability of stream flow in Sweetheart Creek, potentially eliminating pulse flows that may be necessary to stimulate the movement of migrating salmon from the estuary into Sweetheart Creek.

Alaska DFG initially recommended in 10(j) recommendation 2 that Juneau Hydro work with Alaska DFG to develop a plan to evaluate the need for releasing pulse flows from the powerhouse to stimulate adult pink and sockeye salmon to migrate upstream during July and August into the Sweetheart Creek anadromous reach. The evaluation would define the timing, duration, and magnitude of any needed pulse flows. Alaska DFG expects any pulse flows to be less than a day and would involve increasing flows from the typical operational flow of 300 up to 486 cfs. Depending on the study results, the proposed instream flow provisions may be modified accordingly. In the draft EIS, we concluded that the importance of pulse flows as triggers for upstream migration of salmonids is not well understood. We also concluded that it was not apparent how providing pulse flows would benefit fisheries resources at the project given the limited range of proposed operating and evaluation flows (300 to 486 cfs), the lack of physical and thermal barriers in the anadromous reach, the availability of appropriate stream velocities and depths necessary for spawning, and the relatively short migration distance within the anadromous reach. Furthermore, neither Juneau Hydro nor Alaska DFG explained how such an evaluation might be done, when, or what criteria would determine whether a pulse flow would be needed.

In response to staff's analysis in the draft EIS, Alaska DFG clarified that the purpose of 10(j) recommendation 2 was to stimulate sockeye migration into the pools within the anadromous reach to support the personal use fishery, not pink salmon spawning. Alaska DFG also provided additional details for the proposed pulse flows. Specifically, Alaska DFG recommended that Juneau Hydro release pulse flows of up to 486 cfs between July 1 and August 31 of each year and that the pulse flow releases be made a minimum of four times during this period, depending on sockeye salmon return timing. In addition, Alaska DFG recommended that Juneau Hydro develop a pulse flow

release and monitoring plan, in consultation with the resource agencies, that would include: (1) a pulse flow release schedule that identifies the timing in relationship to day of week and environmental conditions, time of day, tidal stage, recommended pulse flow volume, and duration of pulse flows; (2) visual monitoring of the effectiveness of pulse flows for five spawning seasons following the start of project operation, with consideration of the need to continue monitoring after the first three complete sockeye salmon spawning seasons; (3) an annual report on pulse flow observations that includes the date, time, and duration of each provided pulse flow, supported by a description of flows recorded at a gage in the project tailrace before, during, and after the pulse flow release event; (4) submittal of the annual report to Alaska DFG and other interested resource agencies, allowing a 30-day comment period; and (5) submittal of the annual report to the Commission, with documentation of agency comments and responses to agency comments.

In its response to comments on the draft EIS filed on January 20, 2016, Juneau Hydro agreed to collaboratively work with Alaska DFG to release occasional pulse flows during the sockeye spawning season.

Our Analysis

In unregulated river systems, pulse flows, which are characterized by short-duration, higher-magnitude flows, occur as result of snowmelt or other high runoff events within a watershed. These pulse flows coupled with changes in water temperature and other environmental factors have been identified as cues for upstream migration of some anadromous fish. Pulse flows are also thought to limit straying of salmon to other river basins and to facilitate swimming past natural barriers (especially during drought years).

New information provided by Alaska DFG indicates that local sockeye salmon do respond to pulse flows in the range recommended by Alaska DFG. These data include observations of sockeye responding to freshets (short-term pulse flows) at the Auke Creek weir, located approximately 10 miles north of Juneau. Here, upstream movement response of sockeye salmon to increasing flows was almost immediate even under small increases in stream stage, suggesting that the low range of pulse flows recommended by Alaska DFG for the Sweetheart Lake Project could be sufficient to stimulate sockeye salmon movement into Sweetheart Creek.

Because proposed project operations would alter the magnitude, timing, and duration of peak flow events in lower Sweetheart Creek, efforts to recreate these "natural" short-term, high-flow events could stimulate salmon to move into the anadromous reach. Evaluating the response of sockeye salmon to pulse flow releases from the project would determine whether pulse flows are effective in stimulating movement of sockeye salmon from estuarine waters to freshwater pools located in the upstream portion of the Sweetheart Creek anadromous reach, where the personal use fishery occurs. Developing a plan, in consultation with Alaska DFG, that describes the environmental conditions, a specific pulse flow release and monitoring schedule, and reporting requirements would help identify a pulse flow that is effective in stimulating

sockeye salmon migration into the anadromous reach. The proposed 3- to 5-year evaluation period should be adequate to document any relationship between pulse flow releases and sockeye migration into reaches of Sweetheart Creek. Filing annual reports with the Commission would assist the Commission in administering compliance with license requirements for the pulse flow evaluation.

Instream Flow Compliance and Flow Continuation

In 10(j) recommendation 4, Alaska DFG recommends that Juneau Hydro operate and maintain a stream gage in the project tailrace according to USGS standards, and record flow data at a frequency not greater than 15 minute intervals. Recorded data would be filed with the Commission by April 1 of each year, documenting the previous year. Alaska DFG also recommends that Juneau Hydro develop a plan in consultation with resource agencies at least 6 months before the start of land clearing activities that describes how instream flows would be monitored to ensure compliance with minimum flows in the bypassed reach and anadromous reach of Sweetheart Creek.

Juneau Hydro agreed with Alaska DFG's recommendation and included Alaska DFG's recommendation as a component of its Water Management Plan. Other provisions included in Juneau Hydro's Water Management Plan include: (1) installation of permanent gaging instrumentation on the inner face of the dam to obtain and measure reservoir water levels; (2) maintenance of a permanent gage in Sweetheart Creek just below the exit of the tailrace to monitor flow entering the anadromous reach; (3) monitoring water releases in the tailrace; (3) measuring and monitoring flow releases at the base of the dam using a gage or metering device; (4) updating and issuing water data from the gages every 3 years; and (5) filing an annual report with the Forest Service by December 31 that documents the condition and effectiveness of all measures. As part of the Water Management Plan, Juneau Hydro also included a Stream Flow Management Plan with provisions to maintain minimum flows in the bypassed reach and anadromous reach and a Stream Flow Measurement Plan with provisions to measure the Sweetheart Creek flow at the barrier falls using a calibrated stream gage installed near the existing Lower Sweetheart Creek gage station, and to measure the release at the dam into the bypassed reach using a calibrated flow measuring system installed into the release system.

Forest Service 4(e) condition 22 specifies that Juneau Hydro develop and implement a Stream Flow Management Plan and Stream Flow Measurement Plan that are consistent with Forest Service resource management objectives tied to the Tongass National Forest Land and Resource Management Plan

To maintain a minimum flow of 3 cfs in the bypassed reach, Juneau Hydro proposes to install a conduit in the diversion tunnel, extending from the intake screen to Sweetheart Creek.

To provide flow continuation to the Sweetheart Creek anadromous reach, Juneau Hydro proposes to install three synchronous bypass valves at the powerhouse (one for

each turbine). Each bypass valve would automatically open whenever a turbine shuts down to ensure continuation of flow to the tailrace.

To maintain flows in the bypassed reach and the anadromous reach of Sweetheart Creek during a prolonged shutdown event, Juneau Hydro proposes to install a manually operated gate to the diversion tunnel in the right dam abutment to route flow past the dam into the bypassed reach.

In 10(j) recommendation 5, Alaska DFG recommends the inclusion of bypass flow fail-safe provisions in the project design and operation to ensure that the recommended minimum flow releases are provided continuously to the bypassed and anadromous reaches of Sweetheart Creek during routine maintenance periods, emergency shutdowns, and interruptions to the power grid.

Juneau Hydro agreed with this recommendation to include bypass flow fail-safe provisions in the project design and operation.

Our Analysis

Alaska DFG's recommendation, and Juneau Hydro's proposal, to monitor minimum flows in the bypassed reach and anadromous reach of Sweetheart Creek would provide a means for documenting compliance with operational requirements. However, although we find Juneau Hydro's Water Management Plan to be generally consistent with Alaska DFG's recommendation for an instream compliance plan, the plan does not clearly describe: (1) the number, specific location, and type of monitoring equipment to be installed; (2) procedures for maintenance of the proposed monitoring equipment; (3) the frequency at which instream flow data would be recorded at all streamflow monitoring locations; and (4) the requirements for instream flow documentation, reporting, and consultation. Modifying the Water Management Plan to include these specific components would ensure that flow monitoring is clearly defined and that compliance could be demonstrated. Forest Service did not provide any detail on what it would require Juneau Hydro to include in its Stream Flow Management Plan and Stream Flow Measurement Plan. Therefore, we do not have sufficient information to analyze potential environmental benefits or effects of implementing these required plans.

Alaska DFG's recommendation, and Juneau Hydro's proposal, to provide failsafe provisions to allow for continuous instream flows to the bypassed reach and anadromous reach of Sweetheart Creek in the event of project shutdown would ensure a stable amount of flow to protect fishery resource during project shutdown events; however, Alaska DFG did not specify what provisions would be sufficient to provide continuous instream flows at the project. Juneau Hydro is already proposing to construct and operate a conduit in the diversion tunnel to deliver minimum flows to the bypassed reach that would include: (1) intake screens and a water cleaning system that would operate as necessary to prevent debris clogging or fouling; (2) a flow release valve in the conduit that could be controlled by either automatic or manual operation; and (3) an inline flow meter that would monitor and record flows in the conduit. We expect these proposed design features would be

sufficient to ensure flows are continuously delivered from Sweetheart Lake to the bypassed reach to maintain some ecological functions and habitat connectivity. To provide flow continuation in the anadromous reach, Juneau Hydro's project design already includes installation of synchronous bypass valves at the powerhouse that would automatically open if a turbine shuts down. This automatic flow bypass system would ensure that sudden flow reductions would not occur during important fish life stages (spawning, incubation, and hatching), and would help to prevent dewatering of aquatic habitat and potential adverse effects on adults, eggs, and fry in the anadromous reach of Sweetheart Creek. Further, Juneau Hydro's proposal to install manually operated gates on the diversion tunnel would also ensure that minimum flow requirements are maintained in both the bypassed reach and the anadromous reach of Sweetheart Creek during a prolonged shutdown event and would help to prevent any adverse effects on fish and aquatic habitat.

Fish Exclusion Structure and Tailrace Design

The discharge of a hydroelectric facility turbine can create artificial hydraulic conditions that may attract fish away from appropriate passage routes or spawning areas. Fish attracted to these discharges could also swim into the project's turbines through the draft tubes where they could be injured or killed from turbine blade strike. Fish exclusion devices installed downstream of a powerhouse discharge can be used to physically block upstream migrating fish from these undesirable passage routes and guide fish to ladders or other preferred routes of migration.

Juneau Hydro proposes to install a fish exclusion structure in the proposed tailrace channel approximately 30 feet downstream of the powerhouse to prevent fish from reaching the powerhouse. Juneau Hydro states that its fish exclusion structure would be designed to meet NMFS standards and would include four panels of high-density polyethylene bar screen with 1-inch bar clear spacing and a maximum approach velocity of 1 foot per second. In addition, Juneau Hydro proposes to design the tailrace channel to resemble a natural creek and provide approximately 250 linear feet of additional channel for personal use fishermen. However, Juneau Hydro would not use large boulders, gravel, or other sediment types that would provide suitable spawning habitat for salmon.

Alaska DFG recommends in 10(j) recommendation 6 that the proposed project's tailrace be designed and constructed to exclude fish from entering the powerhouse and to avoid or minimize the potential for fish injury or mortality. Alaska DFG further recommends that the tailrace be designed to provide unsuitable habitat for pink and chum spawning. Alaska DFG recommends that Juneau Hydro consult with the resource agencies on the final design, that the agencies be provided 60 days after license issuance to review the design and provide comments, and that the final designs be filed with the Commission for approval at least 30 days before the start of construction.

Juneau Hydro agreed to Alaska DFG's recommendation.

Our Analysis

Installation of a fish exclusion barrier downstream of the proposed powerhouse, as proposed by Juneau Hydro and recommended by Alaska DFG, would protect upstream migrating fish—notably adult sockeye, chum, and pink salmon—from entering the turbine draft tube and potentially suffering injury or mortality. In addition, designing and constructing the tailrace using substrate not suitable for spawning would discourage pink and chum salmon from entering and spawning in the tailrace channel where there is the potential they could displace sockeye salmon and adversely affect the personal use fishery.

Although Juneau Hydro provided a conceptual drawing and design specifications indicating the fish exclusion structure would meet NMFS fish passage criteria, it did not provide a description how the fish exclusion structure would be operated and maintained to ensure the design is effective over the term of the license. If Juneau Hydro finalizes its fish exclusion structure design consistent with NMFS criteria, in consultation with Alaska DFG and NMFS, and implements operation and maintenance procedures, installation of such a fish exclusion structure would prevent adverse effects on fish that enter the project tailrace.

Fish Entrainment

Fish entrained into intakes at hydropower projects can be subject to injury or mortality resulting from turbine-blade strike, pressure changes, sheer forces, and water velocity accelerations. Alternatively, entrained fish may survive and interact with fish populations located downstream of the powerhouse. Small fish, especially newly emerged fry, have the greatest potential for entrainment because they have poor swimming ability, whereas adult salmonids have a much greater swimming ability and generally can avoid entrainment, unless fish desire to migrate downstream. Although project-specific entrainment studies were not conducted to estimate fish mortality through the project's turbines, mortality rates for fish that pass through Francis turbines can vary from 5 to 90 percent depending on turbine design, head, and fish size.

Juneau Hydro proposes and in 10(j) recommendation 7, Alaska DFG recommends, Juneau Hydro install a fish screen in front of the power tunnel intake structure in Sweetheart Lake to exclude salmonid fry. The intake screen would be designed based on NMFS fish screening criteria, including an approach velocity of no more than 0.4 foot per second and screen mesh no larger than 3/32 inch. Alaska DFG states that these screens are needed to protect the 500,000 sockeye salmon fry that are stocked annually in Sweetheart Lake to support a popular personal use fishery at the mouth of Sweetheart Creek, as well as the resident Dolly Varden and rainbow trout fry.

Our Analysis

Juneau Hydro indicates its proposed screen would be designed as an actively cleaned system for the protection of fry-size fish. It would be composed of six fixed-position, vertically oriented wedge-wire cylinders that would operate between 300 and

485 cfs and draw at a fixed invert elevation that is about 42 feet below the proposed low pool elevation of 576 feet. The submerged vertical cylinder design would be protected below the ice during winter and would likely not be subject to a significant debris or biofouling conditions due to the deep lake intake. While the potential for screen clogging at this depth is limited, Juneau Hydro proposes to incorporate a water jetting system at the base of each screen unit that would be connected to a pressurized back-flushing system. The proposed external water jets would direct water upwards from the base to loosen debris from the screen surface as necessary. A log boom would also be installed upstream of the intake to help protect the screens from floating debris.

Consistent with Alaska DFG's recommendation, Juneau Hydro's proposed screen design would meet or exceed the design guidance of the NMFS' Northwest Region's Anadromous Salmonid Passage Facility Design (NMFS, 2011). The NMFS guidance provides specific criteria for designing fish screens that maintain appropriate hydraulics (e.g., approach velocities, sweeping velocities, and screen size) necessary to minimize screen contact and/or impingement of juvenile fish. Installing and operating an appropriately designed and maintained fish screening system in Sweetheart Lake, would reduce the potential for entrainment of fish into the proposed project's intake and would minimize potential loss of rainbow trout, Dolly Varden, and sockeye salmon populations as a result of project operation. Conducting a thorough post-construction evaluation of the screening facility and developing operation and maintenance procedures for screen operation would verify performance of all components of the system and ensure that the facilities are operated and maintained in a manner that minimizes entrainment of fish.

Sockeye Salmon Smolt Collection and Transport Plan

Since 1997, Douglas Island Pink and Chum, Inc. has annually planted approximately 500,000 sockeye salmon fry into Sweetheart Lake. The fry rear in the lake for 1 to 2 years before migrating down Sweetheart Creek and into Gilbert Bay. Salmon that survive the outmigration and ocean environment return to lower Sweetheart Creek and are available for harvest. The adult sockeye salmon that return to Sweetheart Creek contribute to a personal use fishery that results in a harvest of between 1,000 and 6,000 sockeye annually. Construction of the proposed dam at the outlet of Sweetheart Lake would block the natural outmigration of stocked sockeye salmon smolts into the Sweetheart Creek bypassed reach. As such, downstream passage would be necessary to sustain the fishery.

To maintain the sockeye salmon fishery, Juneau Hydro proposes to develop and operate a sockeye salmon smolt collection and transport system to provide downstream passage to sockeye salmon using attraction, trapping, hauling, and holding facilities located on Sweetheart Lake and near the tailrace in Sweetheart Creek. To collect seaward migrating sockeye salmon smolts, a collection barge would be placed in Sweetheart Lake each year, after the lake is clear of ice (figure 3-9). An outlet pipe connecting the collection barge to the proposed project intake would produce flows of up to 35 cfs to attract fish to the collection barge. Fish that swim into the collection barge

would be collected in a screening module. When fish densities in the module reach 1 pound per cubic foot (monitored using underwater cameras), or their time in the module reaches 24 hours, the screening module containing the fish would be lifted from the collection barge using a crane, winches on the collection barge, or a helicopter. When lifted, the module would concentrate the fish into the bottom foot of the screening module. A valve in the bottom of the screening module would then be activated to release fish into a hopper that would be transported by helicopter from Sweetheart Lake to the proposed acclimation pool near the proposed powerhouse/switchyard area. Sockeye salmon smolts in the acclimation pool would be monitored for health and mortality before they are released into the tailrace area, which flows into Sweetheart Creek and Gilbert Bay. Following termination of the sockeye salmon outmigration (approximately 1 month of operation), the fish collection barge would be hauled out of the lake and stored on the northern lakeshore near the intake area. A ramp with a winch would be used to remove the fish collection barge system when not in use.

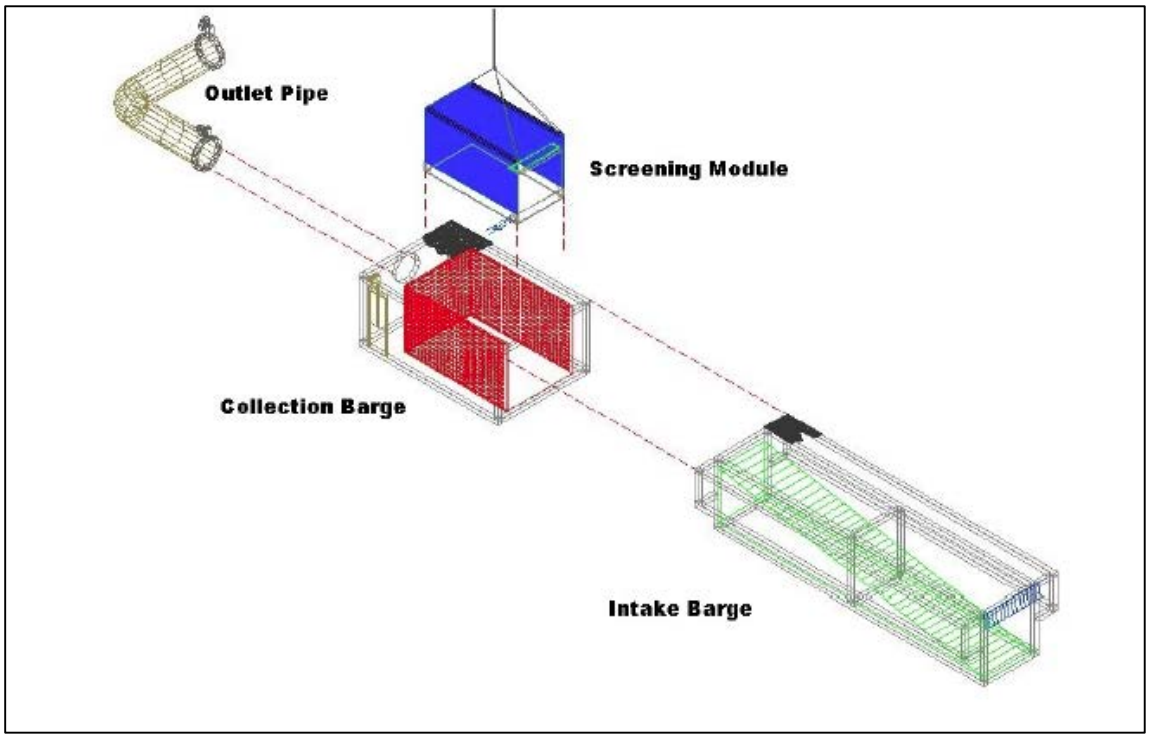

Figure 3-9. Juneau Hydro's proposed fish collection barge (Source: All Points North Engineering and Surveying, 2014).

Juneau Hydro estimates the number of smolts that survive the outmigration from Sweetheart Lake to Gilbert Bay ranges from 20,000 to 60,000 individuals annually; therefore, it proposes a performance criterion of successful collection and downstream release of at least 21,000 live sockeye salmon smolts annually. If the smolt collection and transport system is unsuccessful based on a performance criteria of releasing at least 21,000 live sockeye smolts to Sweetheart Creek, Juneau Hydro proposes to implement a

contingency plan that includes having additional hatchery-reared smolts readily available for imprinting directly in the project's acclimation pool.

In its 10(j) recommendation 8, Alaska DFG recommends Juneau Hydro consult with the resource agencies to prepare a sockeye smolt transport plan. The plan would include: (1) a description of the methods and facilities that would be used to capture, hold, transport, and release sockeye salmon smolts; (2) a description of how the survival rate of smolts would be monitored at each step in the collection and transportation process; and (3) contingency provisions to ensure that sockeye smolts are successfully released and imprinted to Sweetheart Creek if the smolt collection and transport system is unsuccessful.

Juneau Hydro agreed with Alaska DFG's recommendation to develop a sockeye smolt transport plan.

Our Analysis

Operation of Juneau Hydro's proposed sockeye salmon smolt collection and transport system, although innovative and untested, could ensure continued downstream passage of sockeye salmon smolts to sustain the fishery in the anadromous reach of Sweetheart Creek. The sockeye fishery on Sweetheart Creek is a well-established and used personal use fishery, and taking steps to ensure that smolt outmigration survival is maintained at existing levels would help ensure that existing fishery demands continue to be met during project operation. Further, based on available information, Juneau Hydro's proposed performance criteria appears to be a reasonable metric for determining if the downstream fish passage system is successful.

Sockeye salmon that are not collected and transported during the approximately 1-month-long migration period could potentially spawn in the inlets to the lake or along the lake margins. However, because of the lower productivity in freshwater, in comparison to the ocean, resident sockeye are usually smaller than anadromous sockeye at maturity. Competition with the existing rainbow trout population is expected to be minimal because sockeye and rainbow trout spawning periods do not overlap and resident sockeye are primarily plankton feeders, while rainbow trout typically feed on drifting insects, earthworms, beetles, spiders, and fish eggs.

Juneau Hydro's proposed smolt collection and transport system design is similar in concept to other downstream surface collection facilities, thus it may be successful in collecting the smolts. However, a number of factors may prevent successful implementation, including weather which may prevent the timely transfer of smolts to the acclimation pool. Therefore, monitoring collection levels would be necessary.

Juneau Hydro's contingency plan would ensure that during the first 3 years of commercial operation, additional hatchery-reared sockeye salmon smolts[53] are available for imprinting directly in the acclimation pool. This would ensure that sockeye salmon smolts would be still be available for release to sustain the fishery if the performance criteria are not met. Three years should be a reasonable period of time to determine if the collection system works. However, Juneau Hydro does not specify how the sockeye fishery would be sustained if the downstream fish passage system is not successful after the third year of operation. In the event the downstream fish passage system does not meet performance criteria after the third year of operation, a reevaluation of the system and alternatives would need to be completed to ensure that the fishery is sustained. Alternatives might include continuing to stock smolts directly in the acclimation pool for imprinting and release. Whether there is a sufficient supply of smolts for such a long-term endeavor and at what cost is unknown.

The sockeye smolt collection and transport system would also involve substantial continuous efforts to operate and maintain the system. This would include activities such as collection, transportation, acclimation, monitoring, and release of collected fish into the Sweetheart Creek anadromous reach. Alaska DFG's recommendation, and Juneau Hydro's proposal to develop a sockeye transport plan, in consultation with the resource agencies, that addresses operation and monitoring procedures, would ensure that the system is operated and maintained in a manner that provides for effective downstream passage of sockeye salmon.

Aquatic Habitat Plan and Fish Mitigation Plan

Project operation would result in reduced flows in the bypassed reach and could potentially reduce the rate and volume of sediment transported into the anadromous reach of Sweetheart Creek. The reduction in sediment transport could affect the distribution and availability of suitable spawning substrate for pink and chum salmon. Project operation would also result in fluctuation in lake levels in Sweetheart Lake that could adversely affect access to suitable spawning areas and rearing success of resident rainbow trout and Dolly Varden.

To minimize effects on spawning habitat from reduced flows in the bypassed reach and the potential reduction of sediment transported to the anadromous reach, Juneau Hydro proposes to implement its Aquatic Habitat Plan, which includes provisions

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[53] In its license application, Juneau Hydro states that, as part of its contingency plan, additional hatchery-reared sockeye salmon smolts would be provided based on an agreement with Douglas Island Pink and Chum, Inc.; however, because the Commission only has control over its licensee, it would look to Juneau Hydro to provide the smolts if a license is issued and the measure is required. How Juneau Hydro complies with the license requirements would be at the discretion of Juneau Hydro.

to assess spawning gravel availability in the anadromous reach of Sweetheart Creek. The spawning gravel assessment would be conducted annually for the first 5 years after the start of commercial operation. At the end of the third year after the start of commercial operation, Juneau Hydro proposes to review the monitoring results in consultation with Alaska DFG to determine whether there has been a reduction in the area of suitable spawning habitat. If it is determined that there is a net reduction in the area of available spawning habitat, Juneau Hydro proposes to prepare a plan in consultation with Alaska DFG that would potentially include provisions to identify areas with hydrology suitable for spawning and conduct gravel augmentation to restore the area of spawning habitat to baseline conditions. Upon the sixth and every successive fifth-year anniversary of the start of commercial operation, Juneau Hydro and Alaska DFG would meet to analyze the spawning habitat assessment and prescriptive gravel augmentation program and determine the necessity of continuing these actions for the next 5 years.

To monitor the effects of lake level fluctuations on fish recruitment in Sweetheart Lake, Juneau Hydro proposes to implement its Fish Mitigation Plan. The Fish Mitigation Plan would include monitoring Dolly Varden and rainbow trout recruitment in Sweetheart Lake and its inlet streams. Monitoring would continue for 5 years or less if Alaska DFG and other resource agencies determine that project operation has not been shown to adversely affect aquatic resources. If results of the monitoring indicate poor recruitment in the first 3 years after project operation, Juneau Hydro proposes to implement mitigation measures that could include: (1) stocking triploid rainbow trout and Dolly Varden in Sweetheart Lake; (2) improving access to potential spawning habitat in tributaries to Sweetheart Lake; or (3) conducting offsite mitigation determined in consultation with Alaska DFG and Forest Service.

In its 10(j) recommendation 9, Alaska DFG recommends Juneau Hydro consult with resource agencies regarding its recommended biotic monitoring plan.[54] Alaska DFG also recommends Juneau Hydro's biotic monitoring plan include provisions to monitor:

- pink and chum salmon spawning in the anadromous reach and intertidal areas of Sweetheart Creek; and
- resident Dolly Varden char and rainbow trout spawning and young of year recruitment in Sweetheart Lake and the inlet streams.

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[54] Although Alaska DFG refers to Juneau Hydro's Biotic Monitoring Plan in its 10(j) recommendation 9, Juneau Hydro did not propose a Biotic Monitoring Plan but instead an Aquatic Habitat Plan and Fish Mitigation Plan that included biotic monitoring components. We assume Alaska DFG is referring to these plans.

Each component of the biotic monitoring plan would include defined sampling protocols, methods, schedules, and effort, as well as evaluation metrics. Monitoring would continue for a minimum of 5 years post construction, with annual reporting and review, and evaluation of potential study plan modifications, as necessary.

Without elaboration, Forest Service 4(e) condition 22 specifies that Juneau Hydro develop and implement a Fish Mitigation Plan and an Aquatic Habitat Plan that are consistent with Forest Service resource management objectives tied to the Tongass National Forest Land and Resource Management Plan. In comments on the final license application, Forest Service requested that it be included in review of the Aquatic Habitat Plan assessment reports.

In its comments on the draft EIS, NMFS recommends that the Aquatic Habitat Plan be improved to ensure timely identification of any reduction in spawning gravels and ensure timely and effective replacement of any lost spawning habitat to avoid adverse effects on EFH. To address these improvements, NMFS provided an EFH conservation recommendation that Juneau Hydro develop the Aquatic Habitat Plan in consultation with NMFS. Juneau Hydro filed its Fish Mitigation and Aquatic Habitat Plans with its license application as described above.

Our Analysis

Proposed project operations have the potential to reduce the amount of gravel entering the anadromous reach of Sweetheart Creek and could adversely affect the quality and quantity of spawning habitat for pink and chum salmon.

Juneau Hydro's proposal to monitor available spawning substrate in the anadromous reach following project construction and operation would determine if substantial changes to available spawning substrate are occurring as a result of project operations and would provide a means to identify corrective actions, if appropriate. However, Juneau Hydro's plan does not define sampling methods or evaluation metrics for the spawning habitat assessment to ensure that the plan can be effectively implemented. These methods and metrics should be developed in consultation with Alaska DFG, NMFS, and Forest Service to ensure monitoring methods are effective. If changes in available spawning substrate are detected, the plan includes provisions for augmenting gravel in Sweetheart Creek which could minimize effects on spawning salmon. If necessary, gravel augmentation, in consultation with Alaska DFG, NMFS, and Forest Service, would help in identifying gravel sources, appropriate substrates size, quantity of substrate, and locations for augmentation. Monitoring after any gravel augmentation activities, would ensure that efforts to improve spawning habitat are effective.

Alaska DFG's 10(j) recommendation 9 to monitor spawning of pink and chum salmon in the anadromous reach and intertidal reach of Sweetheart Creek could provide information on the number of salmon spawning in the project area; however, based on escapement data in the record, run sizes of pink and chum salmon are highly variable

from year to year. This variability could result from ocean conditions, harvest, predation, disease, stock differences within species, or other non-project related effects on salmon escapement. Therefore, it is unclear how such monitoring might be used to determine whether the project, specifically, is adversely affecting pink and chum spawning and what measures beyond those identified and discussed in this EIS, may be appropriate to address a reduction in the number of spawning salmon. Conversely, Juneau Hydro's proposal to monitor the availability of spawning substrate would provide a discrete set of habitat conditions that could be monitored to determine project-induced changes that may be influencing spawning.

Juneau Hydro's proposal to monitor recruitment of rainbow trout and Dolly Varden in Sweetheart Lake and its inlet streams would aid in determining whether lake level changes are affecting fish communities. However, Juneau Hydro's proposal lacks sufficient detail to implement the plan, including a specific sampling schedule and level of effort. Developing these elements in consultation with Alaska DFG and Forest Service would ensure a robust monitoring plan. In the event of a finding of poor recruitment of Dolly Varden or rainbow trout, Juneau Hydro's proposal to provide stocking, improve access to suitable spawning habitat, or conduct offsite mitigation could provide some benefits to native resident fish; however, we have insufficient information on these potential mitigation measures to assess their benefits and costs or their relationship to project effects or purposes. Further, the plan does not provide for any oversight or approval of proposed mitigation measures by the Commission.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NMFS on all actions that may adversely affect EFH. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in Alaska, except areas upstream of certain impassable human-made barriers, and longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for several hundred years). Lower Sweetheart Creek is EFH for pink and chum salmon, for spawning, incubation, and migration. Gilbert Bay also contains EFH for sockeye, pink, and chum salmon migration.

Our Analysis

During project construction, EFH in the 1,400-foot-long anadromous reach of Sweetheart Creek and Gilbert Bay could be subjected to occasional short-term increases in turbidity. Construction activities would also increase the potential for spills of fuel and/or other hazardous substances that could adversely affect EFH. Juneau Hydro's proposal to implement the proposed resource protection plans (Erosion Control Plan, Storm Water Plan, Environmental Compliance Plan, and Solid Waste Plan) which include provisions to control erosion, avoid or reduce the discharge of pollutants, and

conduct turbidity monitoring would minimize effects on EFH during project construction(see *Construction Effects on Water Quality and Aquatic Resources*).

As discussed above, during project operation, reduced flows in the bypassed reach could affect EFH in the anadromous reach of Sweetheart Creek through a reduction in both sediment transport and the replenishment of spawning gravels. Revising Juneau Hydro's Aquatic Habitat Plan to include more detailed monitoring and mitigation methods, in consultation with Alaska DFG, NMFS, and the Forest Service, would help identify any reduction in spawning substrate and take actions to mitigate a reduction in spawning substrate through gravel augmentation.

During project operation, Juneau Hydro's proposed and Alaska DFG's recommended instream flow release would reduce existing May through September flows in the anadromous reach of Sweetheart Creek, which includes the primary spawning period of July through September. Based on Juneau Hydro's instream flow study, reducing existing mean flows from 554 cfs in July and September and 486 cfs in August to 335 cfs (estimated average monthly flow) would likely increase spawning habitat area (based on available flow and depth over existing substrate) for pink and chum salmon in the anadromous reach. The proposed flow regime would also increase the amount of habitat suitable for egg incubation during the winter, as existing flows in February and March are 70 to 80 cfs, which provide only 40 percent of the incubation area that would be available at 335 cfs. Reduced peak flows during winter may also serve to improve pink and chum salmon egg survival by reducing the potential for scour of redds. While lower water temperatures in the anadromous reach during the winter may slightly delay pink and chum emergence during some years, it is unlikely that temperature changes would alter the onset of spawning. Based on these findings, we conclude that issuing a license for the proposed project would not adversely affect pink and chum salmon EFH in Sweetheart Creek. Proposed monitoring and adaptive mitigation measures that would be implemented over the term of any license would also ensure that project operation is not adversely affecting EFH in Sweetheart Creek.

Gilbert Bay EFH for pink, chum, and sockeye salmon migration would also not be adversely affected by the project. Because Sweetheart Creek represents only 2 percent of the total freshwater drainage into Gilbert Bay, changes in proposed instream flows would have a negligible effect on the hydrology of the Sweetheart Creek estuary and marine zone of Gilbert Bay Flats (i.e., on an annual basis all the runoff from the basin would reach the estuary, none would be lost or permanently stored by the proposed project). Therefore, salmon migration into Sweetheart Creek would not be affected by project operation.

Marine Mammals

Potential effects on marine mammals could be both wide-ranging and local to the project area. Wide-ranging effects could occur in the shipping routes from Seattle, Washington, to the project site, with the primary threats being collisions with ships. In

the project area of Port Snettisham and Gilbert Bay, potential effects could also include collisions with ships during construction and operation activities; disturbance and noise impacts from blasting, pile driving, submarine transmission cable installation, vessel and aircraft operation during project construction and operation; and entanglement during the placement of the submarine cable. Impacts could also occur from magnetic fields produced during the operation of the submarine cable.

Construction activities are expected to occur over a 2-year period with a peak of activity during May through October of each year. Juneau Hydro indicates that the majority of noise generated by construction activities would occur in the first year between April and June. During this time, noise would be generated for the first 3 weeks from blasting and excavation at the quarry near the proposed docking facilities at the eastern side of Gilbert Bay, to start construction of the dock and road. Pile driving for the construction of the dock would occur as soon as the initial blasting and material extraction are complete and is expected to occur for 8-hours a day for 4 to 5 days. The coastal road/trail would be constructed using heavy machinery delivered to the site by barge. Tunnel excavation near Sweetheart Creek, using the drill blast method, would also begin during the first construction season. Tug and barge operations would include laying of the submarine cable and staging a tug and barge in Gilbert Bay for helicopter sling-loading of the transmission line bases and towers.

Approximately 9,700 feet of submarine transmission cable would be placed across Gilbert Bay at a depth of approximately 288 feet and buried to a depth of 2 to 3 feet. An additional 16,000 feet of submarine cable would be placed across Port Snettisham at an average depth of 618 feet. Unlike Gilbert Bay, the cable would not be buried in this location; it would just be placed on the bottom. While Juneau Hydro has not fully identified the specifics of the cable, the cable would be 138-kV alternating current with three lines sheathed together and deployed as a single armored cable bundle. Submarine power cables generate both electric and magnetic fields. Because marine mammals are able to detect electric and magnetic fields and they use magnetic fields for behavior, such as migration, those fields produced by the submarine power cable could affect marine mammals.

Juneau Hydro proposes to implement its Wildlife Mitigation and Monitoring Plan, which includes measures to avoid or minimize potential effects on marine mammals. Table 3-10 provides the measures that Juneau Hydro would implement.

Table 3-10. Proposed protection measures for marine mammals (Source: Juneau Hydro, 2014a; 2015 letter from Juneau Hydro to NMFS, filed December 29, 2015).

Purpose	Effect	Proposed Protection Measure
Marine mammals	Construction and operation potential for collision with marine mammals	Establish a marine mammal safety zone of 100 yards around in-water construction activities for the protection of marine mammals from effects caused by in-water construction of laying submarine transmission line. Prepare and implement an in-house awareness program to prevent collisions between service boats and marine mammals and to minimize harassment of marine mammals. Boat captains conducting Juneau Hydro business are responsible to spot marine mammals within the safety zone and notify construction management of marine mammals within the safety zone. If marine mammals are in the direct path of a boat and unavoidable, the boat shall either go to “slow-safe speed” or stop until the marine mammal is clear or can be avoided by a minimum of 100 yards. A slow-safe speed is defined in the International Regulations for Preventing Collisions at Sea 1972 (72 COLREGS Rule 6) and the Inland Navigational Rules (33 CFR, Part 3.06). Both regulations define operation such that “every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.” Although, vessels laying cable are exempt from the approach distance regulations for marine mammals, trained

Purpose	Effect	Proposed Protection Measure
		observers on the cable-laying vessels would notify the vessel captain of marine mammal presence within the 100-yard safety zone and advise a safe-slow speed. In the unlikely event of a vessel colliding with a marine mammal, NMFS would be notified within 48 hours of the event.
	Noise from in-water pile driving activities could alter natural marine mammal behavior	In-water pile driving for the marine dock and landing facilities would stop if marine mammals enter a 1,000-meter safety zone, as determined by a dedicated marine mammal monitor; construction would resume only after the animal leaves the zone. All vibratory and impact pile driving activities would include ramp-up procedures. For vibratory driving, the procedure would include initiating the driver for 15 seconds at reduced energy, followed by a 60-second waiting period. This procedure would be repeated two additional times before continuous vibratory driving is initiated. For impact driving, an initial set of three strikes would be made by the hammer at 40 percent energy, followed by a 3-second waiting period. This procedure would be repeated two additional times before continuous impact driving is initiated.
Steller sea lions	Construction and operation potential for disturbance of Steller sea lions	Marine transportation routes and flight pathways crossing Port Snettisham would be located at least 3,000 feet from the Steller sea lion haulout located east of Mist Island. Weather and sea conditions may dictate the necessity to vary from these routes in the interest of safety of the vessel or aircraft and passengers.

Our Analysis

Ship Collisions

Collisions with ships are one of the primary threats to marine mammals, particularly large whales, along the U.S. west coast and around the world. Blue, fin, humpback, and gray whales are most vulnerable to ship strikes because they migrate along the coast and many use areas along the coast for feeding (NOAA, undated a). During the delivery of materials along shipping routes from Seattle, Washington, the main threat to whales would be collisions. Based on historical ship strike information, it is estimated that less than 1 ship strike per 10,000 ship transits occurs along the west coast of the United States (CH2M Hill, 2008). The number of project ship transits from Seattle to Juneau would be small compared to the 10,000 ship transits that result in 1 ship strike; therefore, it is unlikely that there would be a collision between project ships and whales, resulting in no effect on marine mammal species associated with offshore shipping.

During the 2-year construction period, vessel traffic would increase locally in Stephens Passage, Port Snettisham, and Gilbert Bay. Juneau Hydro indicates that most of the project related vessel traffic would occur during the beginning of the first construction season and end of the second construction season for the mobilization and demobilization of the project. Some vessel traffic would continue during project operation but would be greatly reduced from that occurring during the construction period.

Existing vessel traffic in Port Snettisham includes commercial fishing vessels, personal use fishing traffic, and recreation vessel traffic such as yachts and other vessels transiting the inside passage and overnighting in Port Snettisham. During project construction, Juneau Hydro estimates it would make approximately 104 trips per year which would account nearly 10 percent of the total estimated vessel traffic in Port Snettisham during the 2-year construction period (see section 3.3.4, *Threatened and Endangered Species*, for more detailed discussion). Implementation of Juneau Hydro's Wildlife Mitigation and Monitoring Plan, which includes measures to identify the occurrence of marine mammals in the vicinity of project construction and to slow down if present would avoid or minimize potential disturbance or injury from potential collision with marine mammals.

Noise

Anticipated noise levels generated from construction activities are presented in table 3-11.

Table 3-11. Anticipated noise levels from construction activities from project construction near Gilbert Bay, Alaska (Source: Juneau Hydro, 2014a, as modified by staff).

Action	Anticipated Airborne Noise (dB) (at 50 feet from source)[a]	Anticipated Underwater Noise (dB SEL)
Noise from blasting at quarry	94	Not applicable
Noise from blasting at tunnel	94	Not applicable
Noise from impact pile driving at dock	101	189 dB RMS (at 33 feet)[b]
Noise from vibratory pile driving at dock	96	120 (at 2,625 feet)[c]
Noise from tug maneuvering barge	87	125–149 (at 328 feet)[d]
Noise from drilling at dam site	85	Not applicable
Noise from ballasting at dam site	94	Not applicable
Noise from heavy machinery	82–87	Not applicable

Notes: dB – decibel, SEL – sound exposure level, RMS – root mean square

[a] U.S. Department of Transportation (2006)

[b] WSDOT (2010)

[c] URS (2007)

[d] Blackwell and Greene, Jr. (2002)

Generic sound exposure thresholds for cetaceans and pinnipeds have been defined in NMFS regulations and include two levels of criteria: Level A—causing injury and Level B—causing disturbance (70 CFR, Part 1871). For cetaceans, there is no exposure threshold defined for airborne noise, while for pinnipeds the airborne noise exposure threshold for harbor seals is 90 dB root mean square (RMS) and 100 dB RMS for sea lions and all other pinnipeds. The Level A underwater noise threshold for cetaceans is 180 dB RMS, while it is 190 dB RMS for pinnipeds (70 CFR, Part 1871). Level B underwater noise thresholds for both cetaceans and pinnipeds include 160 dB RMS for impulse noise (e.g., impact pile driving) and 120 dB RMS for continuous noise (e.g., vibratory pile driving) (70 CFR, Part 1871). Possible impacts on marine mammals exposed to loud underwater or in-air noise include mortality, injury, or disturbance responses that may range from abandonment from vital habitat (severe response) to startling (mild response).

Proposed in-water construction primarily involves driving fourteen 24-inch steel pilings for the project's dock on Gilbert Bay, just north of Sweetheart Creek. The steel pilings would be driven with a vibratory hammer to the extent practicable, while final

proofing would require the use of an impact hammer with a hammer cushion. These pile driving activities would generate underwater noise and pressure that have the potential to harm or harass marine mammals occurring in the area. As the distance from the pile driving activity increases, underwater noise levels would dissipate. The distance at which marine mammals could be exposed to disturbing or harassing noise levels from pile driving activity also varies based on factors such as pile driving hammer type and size, piling size, and the substrate into which the piling is being driven. For example, sound dissipates more rapidly on seafloors comprised of soft substrate compared to hard substrates. Because the substrate in the proposed pile-driving area primarily consists of silts deposited by the Whiting River, it is expected that this soft substrate would aid in absorption of noise energy and help reduce the travel distance of underwater sound. Other factors that may affect the travel distance of underwater noise levels include water depth, shoal areas, and underwater obstacles.

Impact pile driving can produce underwater peak pulsed sound pressure levels of 237 dB (Hildebrand, 2009). However, impact pile driving of 24-inch steel pilings is commonly assumed to generate 189 dB RMS measured at 10 meters (WSDOT, 2010).

Juneau Hydro estimates that noise level production would be similar to noise levels expected during proposed construction of Alaska Department of Transportation's Ketchikan Ferry Terminal Improvements project,[55] which found that a 1,000-meter safety zone for the installation of larger 30-inch steel pilings would protect marine mammals from non-injurious (i.e., Level B harassment) noise exposure for both impact and vibratory pile driving. Because a 1,000-meter safety zone around pile driving activities for installing 30-inch pilings would be sufficient to avoid or minimize Level B and Level A harassment to marine mammals at the Ketchikan Ferry Project,[56] it is expected that

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[55] In a study of pile driving sounds in Port MacKenzie, Alaska, it was determined that impact driving of 36-inch steel pilings resulted in approximately 1,500-meter distance to the 160-dB isopleth for Level B harassment, and vibratory driving of 36-inch steel pilings resulted in approximately 1,600-meter to 4,000-meter distances to the 120 dB isopleth for Level B harassment. Based on this analysis, the Alaska Department of Transportation estimated that pile driving 30-inch steel pilings for its Ketchikan Ferry Terminal Project would result in a lesser sound source during vibratory and impact hammer driving compared to Port McKenzie, and NMFS concurred that its proposed 1,000-meter safety zone around pile driving activities would likely prevent injury or exposure to humpback whales. Juneau Hydro proposes the implement the same 1,000-meter safety zone around pile driving activities to drive smaller 24-inch steel pilings during construction of its dock.

[56] *See* letter from J. Balsiger, PhD, Administrator, Alaska Region NMFS, Juneau, AK, to J. Gendron, Southcoast Region Environmental Manager, Alaska Department of Transportation & Public Facilities, Juneau, AK, July 31, 2015.

implementing a 1,000-meter safety zone centered on installing 24-inch pilings at the proposed project would also be sufficient to protect marine mammals. Installation of 30-inch pilings would produce greater noise levels than the 24-inch steel pilings that would be installed during the construction of the proposed dock. Further, Juneau Hydro's proposal to conduct pile driving ramp-up procedures (i.e., initial impact strikes would be with less energy, thus producing lower levels of underwater sound) would discourage marine mammals from approaching the pile driving area prior to using full energy impact strikes. This would help ensure that marine mammals would avoid the disturbance associated with full energy impact strikes. In the event that the vibratory hammer is not able to advance the pile and the impact hammer must be used, the impact hammer would be used in conjunction with a hammer cushion. Hammer cushions consist of blocks of material placed atop a piling during pile driving to minimize the noise generated by the impact hammer. Materials typically used for cushion blocks include wood, which can reduce sound levels by 11 to 26 dB, micarta blocks, which can reduce sound levels 7 to 8 dB, and nylon, which can reduce sound levels 4 to 5 dB (ICF Jones & Stokes and Illingworth and Rodkin, Inc., 2009).

Tug and barge operations include placing the submarine cable and staging a tug and barge in Gilbert Bay for helicopter sling-loading of the transmission line bases and towers. Underwater noise from tug and barge operations range from 125 dB for towing a barge through water to 149 dB for maneuvering a loaded barge with multiple tugboats (Blackwell and Greene, Jr., 2002). Both sources of underwater noise levels are expected to exceed the 120 dB threshold for Level B disturbance for marine mammals and therefore could affect individuals if they are close enough to the source of the noise by altering their behavior or use of Gilbert Bay. Such disturbance effects would be temporary, short-term, and localized because marine mammals could return to the area once the noise stops.

During project construction, overhead noise would occur from project-related fixed-wing and helicopter traffic. Juneau Hydro's proposal to have all marine vessel routes and aircraft fight paths avoid known Steller sea lions haulout sites by 3,000 feet to the extent possible, would avoid or minimize disturbance to Steller sea lions at the Mist Island haulout site located approximately 1.4 miles from the submarine cable landing on the northern shore of Port Snettisham, 1.5 miles from the submarine cable landing on the southern shore of Port Snettisham, and approximately 5.1 miles from the submarine cable landing on the eastern shore of Gilbert Bay.

Blasting noise during construction would be short in duration and largely located away from the shoreline, with blasting at the downstream portal of the power tunnel located approximately 500 feet from the shoreline and the upstream portal located over 9,000 feet from the shoreline. Noise from blasting is not expected to have an effect on marine mammals, including the Steller sea lion and harbor seal haulout sites, which are both located 5.1 miles and 3.5 miles away from the project area, respectively. Additionally, the reservoir (more than 9,000 feet away), tunnel, and powerhouse (both approximately 500 feet from the shoreline) are located far enough away from the

shoreline of Gilbert Bay that noise generated from construction of these facilities would not likely affect marine mammals.

Employing the mitigation measures that Juneau Hydro has proposed, such as implementing a 1,000-meter safety zone around pile driving activities and a 100-yard safety zone around other in-water construction activities, would avoid or minimize any effects from noise because activities would cease if a marine mammal enters these zones.

Entanglements

Marine mammals could become entangled in the proposed submarine cable if there were loops in the line or gaps between the ocean floor and the cable. This is unlikely because the submarine cable consists of a single cable with a diameter of 6 to 7 inches. The cable would be very stiff and heavy, and that stiffness and size of the cable would make entanglement virtually impossible. Deployment of the cable bundle would occur on flood tides over the course of 4 to 5 days in separate locations within Gilbert Bay and Port Snettisham. After deployment, the submarine cable would rest on the sea floor in deep water within Port Snettisham and is expected to be buried in bottom sediments over time. In Gilbert Bay, the submarine cable would be buried approximately 2 to 3 feet in the sediment. Entanglement is unlikely to occur and would have no effect on marine mammals.

Electric and Magnetic Fields

Submarine cables emit both electric fields and magnetic fields, and in some cases the magnetic field generates a secondary induced electric field (Huang, 2005; Slater et al., 2010). Although sheathing and/or insulating two or more lines together blocks generated electric fields; magnetic fields would still be present (Normandeau et al., 2011; Slater et al., 2010; Woodruff et al., 2013). The total magnetic field intensity outside a power-transmission cable is a function of current flow on the cable conductors, distance from the cable, and the arrangement of the conductors within the cable system. Burying cables increases the separation from the source and the marine environment and serves to help reduce how far the magnetic fields extend within the marine environment (Normandeau et al., 2011).

While marine mammals appear to exhibit sensitivity to magnetic fields, no evidence for sensitivity to electric fields in marine mammals has been reported (Normandeau et al., 2011; Schroeder and Scarborough Bull, 2011). Most studies indicate that cetaceans can sense the earth's magnetic field and may use it to migrate long distances. They appear to use it in two ways: as a map by moving parallel to the contours of the local field topography, and as a timer based on the regular fluctuations in the field allowing animals to monitor their progress on this map. They do not appear to use the earth's magnetic field for directional information (Normandeau et al., 2011). Schroeder and Scarborough Bull (2011) indicated that marine mammals are more likely to detect direct current cables than alternating current cables.

Although information is lacking regarding the effects of magnetic fields associated with submarine cables on marine mammals, potential risks are related to the animals' proximity to the cables. Therefore, bottom feeding species (i.e., benthopelagic feeding dolphins or benthic feeding beluga and gray whales) may have a greater potential for exposure than those species that forage elsewhere in the water column (Normandeau et al., 2011).

The responses of marine mammals exposed to cable-induced magnetic fields are likely to vary depending on the geographic region, available habitat, intensity of the magnetic field, cable orientation, direction, and local geomagnetic intensity. Potential responses from exposure to magnetic fields may include a temporary change in swim direction, migration delay, and shoreline stranding if magnetic fields from undersea cables results in a magnetic minimum in the area (Normandeau et al., 2011). Fisher and Slater (2010) indicated that whales are known to use geomagnetic fields for navigation and there is statistical evidence to suggest that marine mammals are susceptible to stranding as a result of increased magnetic field levels.

Magnetic fields from project operation would be expected to have negligible effects on marine mammals. While the specifics of the submarine cable have not yet been identified, the cable would be 138-kV alternating current with the three lines sheathed together and deployed as a single armored cable bundle, minimizing the magnetic field. Armoring and bundling the cables minimizes the magnetic field by both blocking the magnetic field (armoring) and partially canceling each other (bundling) (Normandeau et al., 2011). Though not conclusive in the literature, marine mammals may experience some minimal effects from the magnetic fields produced by the submarine cable, likely limited to small temporary changes in swimming direction. Additionally, in Gilbert Bay, the cable would be buried 2 to 3 feet in the sediment and would be covered by rock where the cable comes ashore; both mechanisms would help to reduce the extent of the magnetic field. In Port Snettisham, it is anticipated that over time, the cable would become buried by sediment and the shoreline sections would also be covered by 3 to 5 feet of rock, helping to reduce the extent of the magnetic field. Therefore, effects on marine mammals would be minimal.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Upland Vegetation

Vegetation patterns in the project boundary and the surrounding area correspond with the age and the geomorphic, hydrologic, and soils patterns of specific sites and the overall area. The well-drained alluvial and colluvial sediments and steep bedrock slopes support mostly upland vegetation. The finer lakeshore and beaver-pond edge sediments, flatter basin, hill slope, and terrace areas have wetland vegetation of various types.

Rock and ice landforms dominate the Sweetheart Lake Watershed, which primarily consists of alpine tundra and coastal rainforest with limited occurrences of muskeg that dominate the balance of the remaining area. The lakes within the watershed are deep and have steep shorelines that provide limited opportunity for the development of riparian or wetland vegetation. At tidewater, near the proposed powerhouse, plant communities include coniferous forest, forest edge, rocky outcrops, and stream banks. The predominant vegetation community is Sitka Spruce-Western Hemlock Forest. Common trees occurring in these areas include Sitka spruce, western hemlock, and mountain hemlock. Less common species in the project area include Alaska cedar and subalpine fir. A variety of tall and low shrubs grow in the project area, including common types such as Sitka alder, devil's club, thimble berry, salmonberry, Alaska blueberry, creeping willow, clubmoss cassiope, and dwarf blueberry. An assortment of forbs, sedges, rushes, grasses, ferns, and mosses also occur in the area.

Juneau Hydro used Geographic Information System data from the Tongass National Forest to quantify existing vegetation composition within the three forest management units surrounding the project. Staff used the same data and classification to narrow the geographic extent of this analysis to areas within 1 mile of the proposed project boundary (figure 3-10). The following sections describe these units.

Productive Forest

Productive forests in the project area are predominately northwest temperate rain forest. These forests accumulate as much as 1,000 to 2,000 metric tons of organic matter (e.g., wood, foliage, leaf litter, moss, and organic soil) per acre, making them one of the most productive ecosystems in the world (Forest Service, 2015). About 7,900 acres of productive old-growth forest occur within 1 mile of the proposed project boundary.

Old and typically larger diameter trees are a distinguishing feature of productive old-growth forest ecosystems; most old-growth stands are more than 150 years old. At the landscape scale, old-growth forests on the Tongass National Forest include heterogeneous stands of productive forests within a mosaic of unproductive forests and non-forested areas composed of shrub and herbaceous plant communities. Various levels of natural and human-caused disturbances have affected these areas.

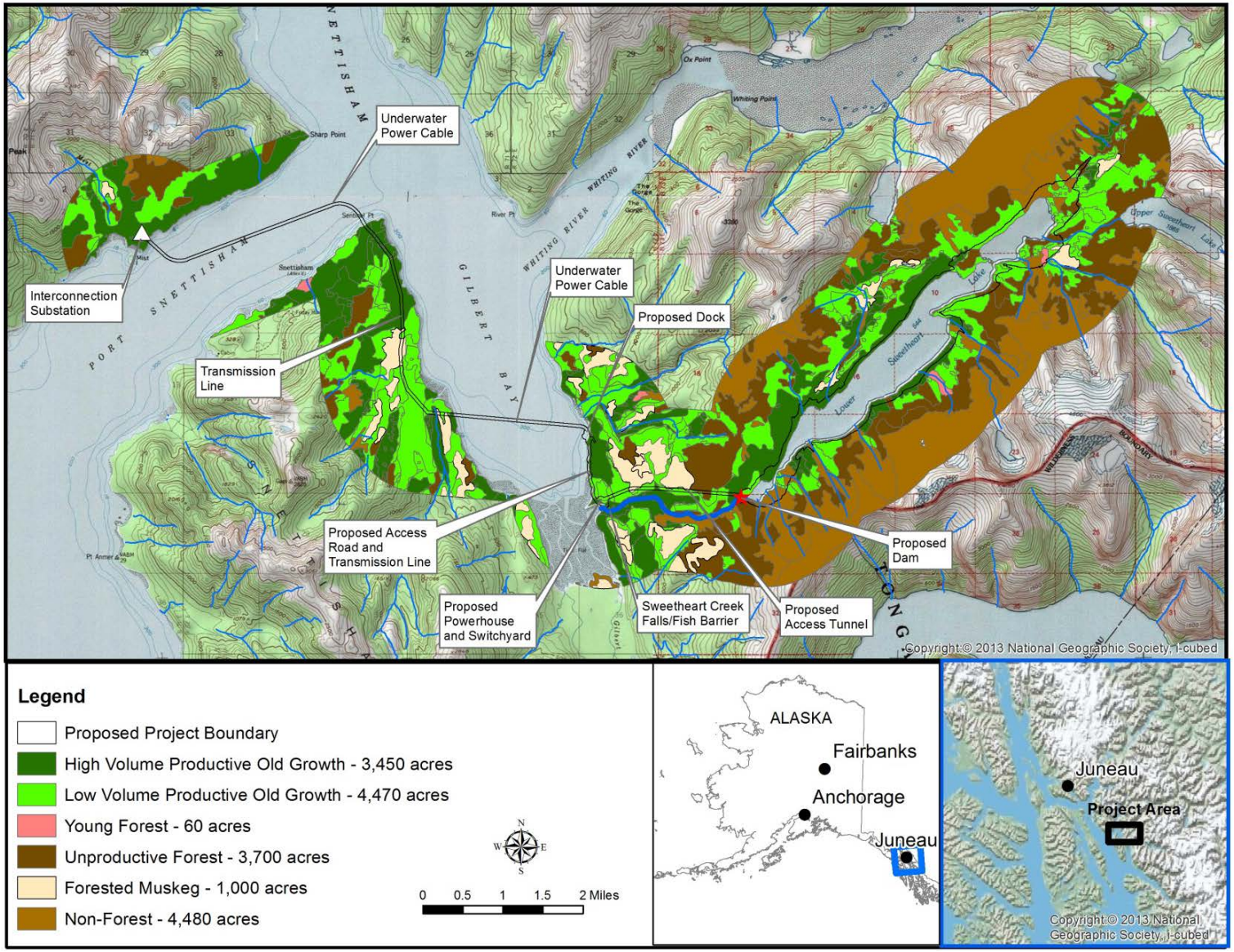

Figure 3-10. Vegetation map of Sweetheart Lake Project area (Source: staff).

Productive old-growth communities include high-volume and low-volume forest stands, differentiated by the volume of biomass in the stand. Environmental factors regulating site productivity include soil drainage, soil depth, soil types, and landscape position. Higher site quality generally translates into taller trees and higher volume per acre. Higher site quality also results in faster changes in tree characteristics and stand structure, producing high biomass volume. Tree height to diameter ratios increase faster on high volume sites and live crown ratios tend to decrease faster because of the effects of high canopy density. Site quality influences species composition. For example, Sitka spruce and western hemlock tend to have a greater competitive advantage on the high-volume sites' quality areas, while cedars are generally better represented on mid- to lower volume sites. Of the 7,920 acres of productive old-growth within 1 mile of the proposed project boundary, about 45 percent is high volume and 55 percent is low volume.

Young-growth forest in the project area is limited to several stands on northwest facing slopes on the southeast shore of Sweetheart Lake. These stands likely result from avalanches. About 60 acres of young forest occur within 1 mile of the proposed project boundary.

Unproductive Forest

The Forest Service classifies about 4,700 acres within 1 mile of the proposed project boundary as unproductive forest or forest with low biomass accumulation and slow biogeochemical processes of growth and decay. About 20 percent of these areas is forested muskeg. Although some areas are relatively sparsely forested, they have at least 10 percent tree cover. Many unproductive forest stands are consistent with old-growth definitions in that they have not been harvested, but the trees are typically small and stunted (under 40 feet in height) and the canopy is open (10 to 40 percent canopy closure). Hemlock, cedar, and lodgepole pine are the most common trees; blueberry and rusty menzesia are the most common shrubs. Near wet bogs or muskegs, heath family plants and grasses increase in dominance.

Non-Forest Lands

Non-forest ecosystems, areas with less than 10 percent tree cover, provide unique and valuable habitat types, including vegetated wetlands, shrublands, and herbaceous habitats (e.g., muskegs, alpine, estuaries); non-vegetated areas (e.g., snow, rock, ice); and aquatic sites (e.g., streams, ponds, and lakes). These habitats contribute greatly to the species diversity because they support unique microsites and openings that contain shrub and herbaceous vegetation that is often uncommon elsewhere under forest canopies. These areas typically occur at higher elevations than forest stands. About 4,480 acres of non-forested vegetation occur within 1 mile of the proposed project boundary.

Wetlands

Juneau Hydro conducted preliminary jurisdictional surveys for wetlands following the *Corps Wetland Delineation Manual* (Corps, 1987) and the *Regional Supplement to the Corp of Engineers Wetland Delineation Manual: Alaska Region, Version 2* (Corps, 2008). The delineations occurred in September 2011 and July and August, 2012. During these surveys, delineators covered the entire proposed facility footprint, inundation area, and transmission line corridor on foot. Juneau Hydro collected LiDAR data during the summer of 2012 and provided detailed topography to correlate with field surveys. On April 5, 2013, Juneau Hydro submitted a request for a Preliminary Jurisdictional Determination to the Juneau Office of the Corps, Alaska District. On March 26, 2014, Juneau Hydro received the Preliminary Jurisdictional Determination, which indicated that Juneau Hydro would need authorization from the Corps for dredging and filing wetlands or working in navigable waters of the United States.

The following describes the wetlands found in the project area.

Forested Wetlands

Around Sweetheart Lake, forested wetlands occur on the edges of the Boulderfield Creek floodplain and the Wishbone delta. The hydrologic regime in these areas is characterized by a very sluggish flow with a wide undefined channel. Soils are a mucky peat. The dominant vegetation is usually skunk cabbage and enchanter's nightshade, often with Sitka spruce on the better-drained stream edges. Along Sweetheart Creek, forested wetlands are dominated by western hemlock, yellow-cedar, blueberry, and skunk cabbage.

Along Gilbert Bay, forested wetlands occur in large areas on the hillside along the proposed transmission line route. These wetlands transition from open peatlands to forested wetlands to upland forest. This ecotone between the peatlands and the uplands is dominated by scrubby western and mountain hemlock and yellow-cedar, blueberry, false azalea, deer cabbage, and skunk cabbage. In total, the wetland surveys identified 30.4 acres of forested wetlands in the project area.

Hillslope Peatlands

Around Sweetheart Lake, open wetlands on the slopes above Boulderfield Creek, upper Lake Creek, Contact Creek, and behind Paleo Point are peatlands that grade from relatively open forest to open bog communities. Dominant species in the forested areas include scrubby yellow-cedar, mountain hemlock, Labrador tea, deer cabbage, crowberry, and several species of sphagnum. Dominant species in the bog include several small sedge species, cloudberry, round-leafed sundew, and several species of sphagnum. The presence of relatively large numbers of healthy, reproducing yellow-cedar in these wetlands is important in the light of the serious, Southeast Alaska-wide decline in this species. The wetland surveys identified 25.8 acres of peatland wetlands in the Sweetheart Lake maximum inundation area.

Beaver Pond Marsh/Scrub Shrub Wetlands

The project area has numerous active and inactive beaver ponds. The ponds occur most frequently on the two large delta/alluvial surfaces at Boulderfield and Contact Creeks and on some finer alluvial sediments along the lakeshore. The younger ponds tend not to have much fringing palustrine vegetation and are mostly Palustrine Unconsolidated Bottom Mud/Organics (PUB3/4), but as the ponds age and the original upland vegetation dies off, a wetland fringe of Sitka alder, Sitka sedge, and skunk cabbage develops. Not including the unconsolidated bottom areas, the wetland survey identified 3.1 acres of emergent wetlands associated with beaver ponds in the Sweetheart Lake maximum inundation area.

Early Seral Wetlands

Several old stream-overflow areas are located where Boulderfield Creek enters Sweetheart Lake. In these places, a layer of fine silt has perched the water table, causing wetlands to form. The youngest is just north of the mouth of Boulderfield Creek's main channel and the other is south of the old Boulderfield Creek channel. The younger wetland is dominated by variegated horsetail and yellow sedge. Single spike sedge, green sedge, Northwest Territory sedge, and tufted bulrush dominate the older wetland. These areas occupy 2.0 acres within the Sweetheart Lake maximum inundation area.

Estuarine Wetlands

Estuarine wetlands occur in the intertidal zone within the Sweetheart Creek delta. Lyngbye's sedge and several grass species dominate these salt marsh areas. The wetland survey identified 11.2 acres of estuarine wetlands in the project area.

Invasive Species

The Alaska Natural Heritage Program's (Alaska NHP's) Alaska Exotic Plants Information Clearinghouse database shows no records of invasive species in the greater Port Snettisham/Gilbert Bay area. The closest records are at the mouth of Endicott Arm, approximately 15 miles away, at several old homestead and fox farm sites. These records are for small numbers of dandelion, sheep's sorrel, white clover, and perennial rye grass, none of which are on the Tongass National Forest High Priority Invasive Plants List or Invasive Plants Watch List (table 3-12).

Table 3-12. Tongass National Forest invasive plants (Source: Juneau Hydro, 2014a).

Scientific Name	Common Name	Rank[a] 0–100 (low–high)
High Priority Invasive Plants (actively controlled where feasible)		
Alliara petiolate	Garlic mustard	70
Centaurea biebersteinii	Spotted knapweed	86
Cirsium arvensis	Canada thistle	76
Hieracium aurantiacum and *H. pitosum*	Orange hawkweed, devil's paintbrush and meadow hawkweed	79
Hieracium lachenalii	Common hawkweed	57
Linaria vulgaris	Yellow toadflax, butter and eggs	69
Senecio jacobaea	Ragwort, stinking willie	63
Sonchus arvensis	Perennial sowthistle, moist sowthistle	73
Polygonum cuspidatum	Japanese knotweed	87
High Priority Invasive Plants (actively controlled in certain areas)		
Brassica rapa and *B. rapa var. rapa*	Field mustard	50
Cotula coronopifolia	Common brassbuttons	42
Crepis tectorum	Narrow-leaf hawk's beard	56
Galeopsis bifida G. tetrahit	Split-lip hemp-nettle	50
Hieracium umbellatum	Narrow-leaved hawkweed	51
Leucanthemum vulgare	Oxeye daisy, white daisy	61
Melilotus alba	White sweetclover	81
Melilotus officinalis	Yellow sweetclover, king's crown	69
Phalaris arundicacea	Reed canarygrass, canarygrass	83
Polygonum convolvulus	Black bindweed	50
Tanacetum vulgare	Common tansy	60

Scientific Name	Common Name	Rank[a] 0–100 (low–high)
Watch List (not known to occur on Tongass National Forest, but occur elsewhere and are highly invasive)		
Brachypodium sylvaticum	False-brome	70
Carduus nutans, C. acanthoides, C. pycnocephalus, C. tenuiflorus	Musk thistle, plumeless thistle, Italian thistle, slender-flowered thistle	61
Heracleum mantegazzianum	Giant hogweed	81
Hydrilla verticillata	Hydrilla	80
Lythrum salicaria and *L. virgatum*	Purple loosestrife, spike loosestrife	84
Potentilla recta	Sulphur cinquefoil	57
Rubus discolor	Himalayan blackberry	77
Spartina alterniflora, S. angelica, S. densiflora, and *S. patens*	Atlantic cordgrass, saltmarsh grass, smooth cordgrass	86
Zostera japonica	Dwarf eelgrass	53

[a] Ranking designated by the Alaska NHP.

Juneau Hydro conducted surveys for invasive plants in the project area in association with wetland surveys and rare plant surveys. Despite past natural disturbances in the project area, including avalanches, active floodplain deposition and erosion, tree falls associated with wind throw, and tidal fluctuations—all of which create suitable habitats for weed establishment—Juneau Hydro observed no invasive species during the vegetation surveys.

Sensitive and Rare Plant Species

Generally, the Juneau Ranger District Rare Plant List is based on the Alaska NHP's Rare Plant Tracking List, and includes species with state ranks of S1, S2, and in some cases S3 (see table 3-13 for explanation of ranking). The Forest Service and other agencies contribute rare plant occurrence information to Alaska NHP for database inclusion. The plants considered sensitive on the Tongass National Forest are also on the Alaska NHP Plant Tracking List. Alaska DFG does not maintain a special status plants list.

Juneau Hydro consulted with the Juneau Ranger District botanist and Alaska NHP to identify sensitive plant species that could occur in the project area. Juneau Hydro then conducted potential habitat surveys and rare species surveys covering all areas of project

disturbance, including the proposed inundation area around Sweetheart Lake. Surveys occurred in September 2011, as well as in June, July, and August 2012. Three Tongass National Forest rare plant species were found along the shores of Sweetheart Lake: twocolor sedge (*Carex bicolor*), northern golden saxifrage (*Chrysosplenium tetrandrum*), and boreal bedstraw (*Galium kamtschaticum*). Additionally, the surveys identified potential habitat for Alaska mistmaiden (*Romanzoffia unalaschensis*), inundated clubmoss (*Lycopodellia inundata*), mountain lady's slipper (*Cypripidium montanum*), Henderson's checker mallow (*Sidalcea hendersonii*), and two species of moonwort (*Botrychium* spp.) (table 3-13).

Table 3-13. Sensitive and rare species with potential to occur in the project area (Source: Juneau Hydro, 2014a).

Common Name (Scientific Name)	**Rank**	**Habitat and Occurrence in the Project Area**
Spathulate moonwort, Spoon-leaf moonwort (*Botrychium spathulatum*)	S1–S3	Occurs in areas of human disturbance, historic well-drained, maritime beach, upper beach meadow, well-drained open areas, alpine/subalpine, calcareous. Known on Kruzof Island and West Chichagof Island.
Tunux moonwort, grapefern (*Botrychium tunux*)	S1–S3	Occurs in open sand, dunes, well-drained meadows with sandy substrate. Potential habitat identified in the beach meadow along the coastal access road.
Twocolor sedge (*Carex bicolor*)	TNF-R	Occurs in moist to wet meadows, stream sides, seepage slopes, and sandy river bars. Open or shaded habitats. One plant located along tributary floodplain in the proposed Sweetheart Lake inundation area. Plant in poor condition on highly erodible substrate.
Northern golden saxifrage (*Chrysosplenium tetrandrum)*	TNF-R	Occurs in moist to wet shady banks, rock crevices, mossy seeps, and shorelines in montane and subalpine zones. Four small populations located in the proposed Sweetheart Lake inundation area.

Common Name (Scientific Name)	Rank	Habitat and Occurrence in the Project Area
Mountain lady's slipper (*Cypripidium montanum*)	S2	Occurs in semi-shady to open edge and can be found under or near coniferous trees or hardwoods such as aspen or dogwood. Potential habitat identified in Sitka spruce forest habitats along the coastal access road and in the powerhouse construction area.
Boreal bedstraw (*Galium kamtschaticum*)	TNF-R	Occurs in moist stream banks, thickets, forests and talus slopes in the lowlands and montane zones. Three small populations located in the proposed Sweetheart Lake inundation area.
Inundated clubmoss (*Lycopodellia inundata*)	S3	Occurs in wet habitat, such as bogs and ponds. Potential habitat identified in the proposed Sweetheart Lake inundation zone.
Alaska mistmaiden (*Romanzoffia unalaschkensis*)	S3S4	Occurs in wet habitats with partial shade. Potential habitat identified along Sweetheart Creek.
Henderson's checker mallow (*Sidalcea hendersonii*)	S1	Occurs in tidal marshes and meadows. Potential habitat identified in the beach meadow along the coastal access road.

Notes: S1 – Critically imperiled within the state; at very high risk of extirpation because of very few occurrences, declining populations, or extremely limited range, and/or habitat.

S2 – Imperiled within the state; at high risk of extirpation because of few occurrences, declining populations, limited range, and/or habitat.

S3 – Rare within the state; at moderate risk of extirpation because of restricted range, narrow habitat specificity, recent population decline, small population sizes, a moderate number of occurrences.

TNF-R – Tongass National Forest Rare plant.

Wildlife

The project area contains wildlife species typical of the Southeast Alaska habitat types, as identified in figure 3-10. Juneau Hydro surveyors observed the following mammals in the project vicinity: brown bear, black bear, Sitka black-tailed deer, mountain goat, moose, beaver, porcupine, American martin, river otter, mink, wolverine, red squirrel, and deer mouse. The Alexander Archipelago wolf, a subspecies of gray wolf, is known to occur in Southeast Alaska and may occasionally travel through the project area, but Juneau Hydro did not record any sign of wolves during its surveys.

Juneau Hydro recorded the presence of 37 bird species in the project vicinity, including 20 species of song birds, 3 raptor species, and 17 species of waterfowl or shorebirds. Song birds included chestnut-backed chickadee, common yellowthroat, dark-eyed junco, flycatchers, warblers, and jays. The three raptor species were bald eagle, northern harrier, and one unidentified species. Waterfowl included ducks, loons, terns, seagulls, great blue heron, marbled murrelet, greater yellowlegs, and scoter. Migratory birds primarily nest in Southeast Alaska from April 15 through July 15 in forested areas and May 1 through July 15 in treeless habitats (FWS, 2009).

Surveyors also determined that four amphibian species could occur in the project vicinity—wood frog, western toad, rough-skinned newt, and Columbia spotted frog. However, western toad was the only amphibian species encountered during the surveys.

Special Status Wildlife

Special status wildlife species include Forest Service Management Indicator Species, and Tongass National Forest sensitive species (see table 3-14). Alaska DFG no longer manages species of concern. Species listed as threatened, endangered, or proposed under the ESA are discussed in section 3.3.4, *Threatened and Endangered Species*.

Table 3-14. Special status wildlife species with potential to occur in the project area (Source: Juneau Hydro, 2014a).

Common Name (Scientific Name)	Status	Habitat	Potential to Occur in Project Area
Terrestrial Mammals			
Alexander Archipelago wolf (*Canis lupus ligoni*)	MIS	Wolves have large home ranges and occupy various habitats.	The project area has suitable habitat. Project surveys did not record any signs of wolves in the project area.
American marten (*Martes americana*)	MIS	Marten are found in lower elevation old-growth forest. They are dependent on ground structure for cover and denning.	The project area has suitable habitat, and American marten are likely to occur throughout the project area. Project surveys recorded sign of American martin in the project area.
Black bear (*Ursus americanus*)	MIS	Black bears use estuarine, riparian, and forested coastal habitats. Prefer areas near anadromous fish streams.	Black bears are known to inhabit the Sweetheart Lake area and Gilbert Bay has suitable habitat. Project surveys recorded observations of black bear in the project area.
Brown bear (*Ursus arctos*)	MIS	Brown bears use a variety of habitats and prefer areas near anadromous fish streams, estuaries, and riparian areas.	Brown bears are common in the project area, especially near the mouth of Sweetheart Creek. Project surveys recorded observations of brown bear in the project area.

Common Name (Scientific Name)	Status	Habitat	Potential to Occur in Project Area
Mountain goat (*Oreamnos americanus*)	MIS	Mountain goats occupy cliffs in alpine and subalpine habitats and old-grown forests.	The area around Sweetheart Lake is suitable habitat for goats. Project surveys did not record any signs of mountain goats in the project area. However, habitat models indicate high-value wintering and kidding habitat is present on the northern shore of Sweetheart Lake near the proposed dam site.
Red squirrel (*Sciurus vulgaris*)	MIS	Red squirrels are found in productive old-growth forest and young-growth stands. They require cone-producing trees for foraging and cavities and snags for nesting and denning.	The project area has suitable habitat for red squirrels in the project area. Project surveys recorded observations of red squirrel in the project area.
River otter (*Lontra canadensis*)	MIS	River otters are associated with coastal and freshwater environments immediately adjacent (within 100 to 500 feet) upland habitats.	There is suitable habitat for river otters in the project area. Project surveys recorded sign of river otter in the project area.
Sitka black-tailed deer (*Odocoileus hemionus sitkensis*)	MIS	Deer use low-elevation, high-volume, old-growth forest, especially during the winter. Available winter habitat is their limiting factor.	The project area has suitable habitat for Sitka black-tailed deer. There is winter habitat in the project area; the highest quality is closer to the coast. Project surveys recorded deer sign on the west side of Gilbert Bay, but not in the Sweetheart Lake area.

Common Name (Scientific Name)	Status	Habitat	Potential to Occur in Project Area
Birds			
Aleutian tern (*Onychoprion aleuticus*)	S	Coastal areas west throughout the Aleutians, north to the Chuckchi Sea, east to the Alaska Peninsula and south to Yakutat and Glacier Bay. They nest in coastal colonies.	No known breeding colonies are located in the project area, but this species may occasionally visit the project in the spring and summer, though occurrences are expected to be rare. Project surveys did not record any signs of this species in the project area.
Bald eagle (*Haliaeetus leucocephalus*)	MIS	Eagles nest in large, old trees along the coast and within riparian habitats associated with fisheries.	Known eagle nests are located along shoreline of the project area. Project surveys recorded observations of bald eagle in the project area.
Black oystercatcher (*Haematopus bachmani*)	S	Coastal rocky shoreline habitats with a majority of their distribution in Prince William Sound and the Kodiak Archipelago.	The project area has suitable foraging and nesting habitat for black oystercatcher. Project surveys did not record any signs of this species in the project area.
Brown creeper (*Certhia americana*)	MIS	Brown creepers are found in productive old-growth forest throughout Southeast Alaska and year-round.	The project area has suitable habitat for brown creepers. Project surveys did not record any signs of brown creeper in the project area.
Dusky Canada goose (*Branta Canadensis occidentalis*)	S	Gulf of Alaska including the Copper River Delta and Prince William Sound. They migrate through Southeast Alaska, making beach and estuarine areas important.	The project area has potential habitat for dusky Canada geese. This species may use the project area during spring and fall migration periods. Project surveys did not record any signs of this species in the project area.

Common Name (Scientific Name)	Status	Habitat	Potential to Occur in Project Area
Hairy woodpecker (*Leuconotopicus villosus*)	MIS	Hairy woodpeckers are found in productive old-growth forest with snags and dying trees used for foraging and nesting.	The project area has suitable habitat for hairy woodpeckers. Project surveys did not record any signs of the hairy woodpecker in the project area.
Northern goshawk (*Accipter gentilis laingi*)	S	Northern goshawks use productive old-growth habitats throughout Southeast Alaska and occur year-round. They nest and forage in forested lands, favoring dense stands of conifer and deciduous old-growth forest.	The project area has suitable foraging and nesting habitat for northern goshawk. Protocol surveys in the project area did not record sign of this species.
Red-breasted sapsucker (*Sphyrapicus ruber*)	MIS	Red-breasted sapsuckers use a variety of forest habitats and require snags for nesting. They are indicative of low-volume productive old-growth forest.	There is suitable habitat for red-breasted sapsucker in the project area. Project surveys recorded observations of red-breasted sapsucker in the project area.
Vancouver Canada Goose (*Branta canadensis fulva*)	MIS	Vancouver Canada geese are found in wetlands, estuary, riparian, and upland areas. They nest in old-growth forest.	The project area has suitable habitat for Vancouver Canada geese. Project surveys recorded sign of Canada goose in the project area.

Note: MIS – Tongass National Forest Management Indicator Species, S – Tongass National Forest Sensitive Species

3.3.3.2 Environmental Effects

Effects of Project Construction and Operation on Vegetation

Construction of the project would require vegetation clearing and disturbance associated with the development of the dam, power tunnel, powerhouse, access roads, and transmission line corridor. Operation of the project would affect vegetation within the water elevation fluctuation zone around Sweetheart Lake. Table 3-15 quantifies effects by vegetation type for each project component. These disturbances have potential to alter vegetation community structure through vegetation removal; changes to microsite environmental conditions, including soil compaction or altered sun exposure; or changes in interspecific competition associated with introduction of invasive plants.

Table 3-15. Effects on vegetation in the project area (Source: Juneau Hydro, 2014a).

	Habitat Types (acres)[a]								
Project Features	**HV-POG**	**LV-POG**	**FM**	**UF**	**NF**	**SC2**	**IT**	**ST**	**Total**
Raise Sweetheart Lake elevation from 551 feet to a maximum of 636 feet	128.0	160.0	1.5	62.0	85.0	5.5	0.0	0.0	442.0
Dam	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.4
Tunnel	0.1	0.8	0.1	0.1	0.0	0.0	0.0	0.0	1.1
Powerhouse and facilities	1.3	1.8	0.0	0.0	0.0	0.0	0.0	0.0	3.1
Coastal road	3.0	1.7	0.0	0.0	0.0	0.0	3.3	0.0	8.0
Dock and landing facilities	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.5
Transmission line	26.6	17.0	8.2	0.0	0.0	0.0	1.9	2.9	56.6
Total	159.0	181.3	9.8	62.5	85.0	5.5	6.7	2.9	512.7

Notes: HV-POG – high-volume productive old-growth, LV-POG – low-volume productive old-growth, FM – forest muskeg, UF – unproductive forest, NF – non-forested, SC2 – Size Class 2 (natural young growth from blow-down or natural disturbances), IT – intertidal, ST – subtidal

[a] Habitat types are derived from Forest Service vegetation layers in Geographic Information System.

To minimize adverse effects on vegetation, Juneau Hydro proposes to implement its Vegetation Management Plan. The Vegetation Management Plan describes how the proposed project design would reduce potential effects as compared to earlier project designs that included a 5,900-foot-long forest road alternative with greater effects on forests and wetlands than the proposed 4,400-foot-long coastal access road and a 2.2-mile-long construction access road to the dam site. The Vegetation Management Plan also describes how Juneau Hydro would salvage plants from the areas to be cleared around the powerhouse, lower portal of the power tunnel, and around structure locations in the transmission corridor. Juneau Hydro would transplant the salvaged plants onto the visual barrier constructed in front of the powerhouse, along the coastal access road to narrow the road to one lane after construction, and on temporarily affected areas around the transmission towers and submarine-to-overhead transmission line transition facilities. During construction, Juneau Hydro would inspect and photograph all exposed soil and all replanted areas on a monthly basis during the April–September growing season to monitor the success of the revegetation efforts and to identify any invasive plants that may have become established. Following the start of commercial operation, Juneau Hydro would monitor transplanted areas annually for the first 5 years to determine the success of revegetation and the presence of any invasive species. Monitoring would include photographs, a report of the condition of plantings, any invasive species found, and any maintenance or eradication activities performed.

Forest Service 4(e) condition 22 specifies that Juneau Hydro consult with the Forest Service to finalize the Vegetation Management Plan to ensure the plan includes resource management objectives tied to the Tongass National Forest Land and Resource Management Plan.

Our Analysis

Construction and operation of the project would remove 512.7 acres of vegetation, with the majority (340.3 acres) in productive old-growth communities. The proposed reservoir would inundate about 86 percent (442.0 acres) of the total vegetation lost. Based on the dimensions in the project description and project drawings, project facilities, including the dam, tailrace, powerhouse, switchyard, and the caretaker's facility would permanently remove an additional 1.3 acres of productive old-growth and 0.4 acre of unforested vegetation. The proposed transmission line would result in the conversion of about 43.6 acres of productive old-growth to young-growth forest. Roughly 16 acres of temporary disturbance would occur during site grading and vegetation clearing around proposed facilities, including:

- 8.2 acres in muskeg associated with the transmission line, and
- 7.7 acres of productive old-growth forest associated with the following facilities:
  - 1.4 acres for the powerhouse visual barrier,
  - 1.8 acres for temporary laydown areas and construction camp facilities along the access road,

- 2.0 acres for post-construction narrowing of the access road, and
- 2.5 acres for transmission line structures and buried transmission line.

Juneau Hydro would revegetate these temporarily disturbed areas as described in its Vegetation Management Plan. Revegetating disturbed areas would minimize adverse effects on wildlife and wildlife habitats by reestablishing native vegetation soon after construction.

However, the Vegetation Management Plan does not provide sufficient detail to implement and ensure that the plan achieves its stated goals. For example, the plan does not describe where salvaged plants would be stored during construction or how Juneau Hydro would ensure salvaged plants survive the 2-year construction period until they are transplanted. The Vegetation Management Plan states that any plants brought to the site to supplement the transplants would need to be approved, but it does not indicate who would approve the use of the plants or what species likely would be used and why. Finally, the Vegetation Management Plan indicates monitoring would continue annually for 5 years following completion of construction. While this should be sufficient time for native vegetation to reestablish, the Vegetation Management Plan does not define what criteria Juneau Hydro would use to determine whether revegetation is successful or what measures it would take if revegetation is not successful. Refining the plan in consultation with the Forest Service to include these details would ensure consistency with Forest Service management guidelines, improve implementation, better assure achievement of protection goals, and assist with the Commission's oversight of any license that may be issued.

Effects of Project Construction and Operation on Invasive Species

Construction of the project would require clearing vegetation and transporting heavy machinery and work crews to the site. These activities have the potential to create exposed, loose soil, which is suitable for weedy species to colonize and to introduce seeds or other reproductive propagules. Introduction of invasive plants has the potential to disrupt existing population dynamics and alter vegetation community structure in the project area.

To minimize the potential for introducing invasive plants to the project area, Juneau Hydro proposes to implement its Vegetation Management Plan, which includes measures to reduce the potential for introducing invasive species.[57] As part of the Vegetation Management Plan, Juneau Hydro proposes to: (1) clean all equipment and footwear prior to transporting them onsite; (2) remove all mud, soil, and plant debris from

[57] Juneau Hydro states that its Vegetative Management Plan includes an Invasive Species Management Plan, but Juneau Hydro does not separate the invasive species control measures from other vegetative management measures.

vehicles and equipment; (3) bring only approved plants onsite; (4) inspect all plants arriving onsite; and (5) immediately notify the ECM of suspect species. Juneau Hydro would also monitor for invasive species, while monitoring the success of revegetation. If invasive plants are identified, Juneau Hydro would implement eradication measures.

Forest Service 4(e) condition 15 specifies that Juneau Hydro cannot use pesticides to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, or other pests on NFS lands or in areas affecting NFS lands without the prior written approval of the Forest Service. During the annual consultation meeting described in 4(e) condition 4, Juneau Hydro would submit a request for approval of any planned uses of pesticides for the upcoming year. Juneau Hydro would provide, at a minimum, the following information to the Forest Service for review:

- whether pesticide applications are essential for use on NFS lands;
- specific locations of use;
- specific herbicides proposed for use;
- application rates;
- dose and exposure rates; and
- safety risk and timeframes for application of herbicides.

The Forest Service would only allow exceptions to this schedule when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, Juneau Hydro could make an emergency request for pesticide use. The Forest Service would exclude pesticide use from NFS lands within 500 feet of known locations of rough-skinned newt, western toad, or known locations of Forest Service special status or culturally significant plant populations. Application of pesticides must be consistent with Forest Service riparian conservation objectives.

In 4(e) condition 22, the Forest Service specifies that Juneau Hydro consult with the Forest Service to finalize the Invasive Species Management Plan to ensure that resource management objectives are tied to the Tongass National Forest Land and Resource Management Plan.

Our Analysis

Project construction would temporarily disturb about 20 acres of existing vegetation, creating the potential for invasive species to establish on disturbed soils. Transporting offsite equipment and personnel to the project would provide a potential source of invasive species propagules, including seeds or small pieces of root or stem material capable of generating a new plant. These small propagules can be easily transported in mud, dust, or other debris present on machinery, tools, boots, or other materials transferred to the site. Once invasive species establish in new locations, eradication can be difficult due to high seed production and the ability of many invasive species to regenerate from small sections of roots or stems left behind during removal.

Juneau Hydro's proposal to wash equipment and footwear prior to transport to the project site and to inspect equipment upon arrival would substantially reduce the potential to transport invasive weeds to the project area. However, as noted in Juneau Hydro's Invasive Species Risk Assessment (Bosworth Botanical Consulting, 2013), other project materials, including fill materials or erosion control materials like hay or straw, could contain seeds or plant parts from invasive species. The proposed Vegetation Management Plan does not address these potential vectors and would be improved by including provisions to use weed-free fill and erosion control materials.

Juneau Hydro's proposed monthly inspection of disturbed lands during construction and annual inspection during revegetation efforts would determine whether its preventive measures are effectively stopping the introduction of invasive species and timely identify and take corrective actions if any invasive species are colonizing the area. However, the Vegetation Management Plan does not describe what those eradication measures may entail (mechanical, herbicide, biological, or a combination), how Juneau Hydro would ensure that its construction contractors recognize invasive species, how Juneau Hydro would dispose of invasive plant material to prevent spreading or recolonization by stem or root segments, or who would take appropriate eradication efforts (e.g., certified applicators). The eradication methods would likely need to be determined on a species- and site-specific basis, follow all required application procedures to prevent harm to fish and wildlife, and be selected in consultation with the Forest Service to ensure consistency with forest plan objectives. The information required by the Forest Service (application rates, location, dose, and exposure rates) would be pertinent to such discussions. The plan also does not describe what criteria Juneau Hydro would use to determine if invasive species are adequately controlled. [58] Consequently, the plan would be improved by providing these details, thus ensuring a more effective and protective plan to protect forest resources.

Forest Service 4(e) condition 15 specifies that Juneau Hydro obtain written permission before applying pesticides or chemical treatments on any NFS lands or in areas affecting NFS lands. No actions are contemplated in Juneau Hydro's proposal that would require the use of pesticides. However, they may be needed in the future. We suspect the Forest Service is also concerned about the use of herbicides, which may need to be applied to control invasive species. Inappropriate application of pesticides and herbicides could adversely affect fish and wildlife, including the rough-skinned newt, western toad, or special status or culturally significant plant populations. Consulting with

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[58] We note that in Juneau Hydro's response to comments, filed March 2, 2015, and in Exhibit E of the license application, Juneau Hydro states it would follow guidelines in the Tongass National Forest Land and Resources Management Plan and conduct surveys every 5 years or until vegetation cover is established. This monitoring schedule is inconsistent with what is presented in the plan.

the Forest Service prior to applying herbicides and pesticides, adhering to approved application rates and procedures, and maintaining a sufficient distance from sensitive species would minimize potential adverse effects on fish and wildlife and would ensure proper application consistent with forest management objectives. However, consulting with the Forest Service every time the onsite manager needs to apply pesticides or herbicides may be problematic and administratively burdensome on both the applicant and the Forest Service. Identifying guidelines for their application in the Invasive Species Management Plan or Vegetation Management Plan could improve coordination and timely implementation.

If Juneau Hydro, in consultation with the Forest Service and as specified in 4(e) condition 22, were to revise the Invasive Species Management Plan to include the details noted above, the potential for adverse effects on vegetation and fish and wildlife resources from invasive species would be low.

Effects of Project Construction and Operation on Wetlands

Juneau Hydro incorporated avoidance of wetlands and minimization of sedimentation and other adverse effects on wetlands into the project design to the extent possible. However, project construction activities associated with the access road and increasing the elevation of Sweetheart Lake would unavoidably result in filling or inundating wetlands. Based on current project design and the results of its wetland delineation, Juneau Hydro estimates the project would affect a total of 30.9 acres of wetlands (table 3-16), although some of these effects would not result in a complete loss of wetland function. In the license application, Juneau Hydro stated that it would develop wetland mitigation as part of the section 404 process.

No recommendations to address effects on wetlands have been filed with the Commission.

Our Analysis

The steep topography of the project area likely prevents creating wetlands. Given the undeveloped character of the project area, there are no known options for enhancing or preserving wetlands at the project or nearby. We have not identified and no one has recommended any specific measures to mitigate for effects on wetlands. Because opportunities to mitigate for this loss by creating new wetlands, enhancing degraded wetlands, or protecting existing wetlands are not likely available within the project boundary or nearby, construction of the proposed project would result in the unavoidable loss or alteration of 30.9 acres of wetlands. While wetlands represent important fish and wildlife habitats, they are relatively common and in pristine condition in the project area. Given the abundance of wetlands in the vicinity of the project, the long-term loss of 14.6 acres of wetlands would be localized, regionally insignificant, and thus represents a minor, long-term, adverse effect.

Table 3-16. Project effects on delineated wetlands (Source: Juneau Hydro, 2015b[a]).

Project Feature	Emergent (acres)	Emergent/ Shrub-scrub (acres)	Forested (acres)	Estuarine (acres)	Total
Reservoir at elevation 576 feet	0.0	7.1	4.3	0.0	11.4
Coastal road	0.0	0.0	0.3	0.5	0.8
Facilities pad (includes powerhouse, switchyard, and power tunnel entrance)	0.0	0.0	1.1	0.0	1.1
Landform barrier	0.0	0.0	1.0	0.0	1.0
Transmission line	0.0	0.0	0.3	0.0	0.3
Total	0.0	7.1	7.0	0.5	14.6

[a] Acreages are based on information in Juneau Hydro's section 404 permit application filed with the Commission on December 8, 2014. Juneau Hydro states these values are based on more accurate mapping and calculations of wetland effects at different reservoir elevations than provided in its license application.

[b] An additional 16.3 acres of forested wetlands occur between the proposed minimum reservoir elevation of 576 feet and the proposed maximum reservoir elevation of 636 feet. The project would have varying degrees of effects on these areas based on local elevation and reservoir fluctuations. A total of 11.7 acres of the 16.3 acres of forested wetlands would likely be inundated for at least 60 percent of the growing season.

Effects of Project Construction and Operation on Sensitive and Rare Plants

The proposed project would inundate habitat for the rare plants twocolor sedge, northern golden saxifrage, and boreal bedstraw and potential habitat for inundated clubmoss. Construction of the access road through meadow habitat would disturb potential habitat for sensitive moonwort species, rare twocolor sedge, and sensitive Henderson's checkermallow. Project activities that involve clearing vegetation under the spruce and hemlock forests would disturb potential habitat for the sensitive plant mountain lady's slipper.

Juneau Hydro's proposes to implement its Threatened, Endangered, Proposed for Listing, and Sensitive Plant Species Plan, but the plan does not include any protection measures specific to sensitive or rare plants.

In 4(e) condition 22, the Forest Service specifies that Juneau Hydro consult with the Forest Service to finalize the Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan to ensure that resource management objectives are tied to the Tongass National Forest Land and Resource Management Plan. Neither the Forest Service nor anyone else has recommended any specific measures to protect these plants in response to the Commission' notice of ready for environmental analysis. However, in comments on the draft EIS, the Forest Service recommended salvaging and transplanting a twocolor sedge plant from the reservoir inundation area.

Our Analysis

While suitable habitat for several sensitive plant species occurs within areas of proposed construction, Juneau Hydro's surveys indicate these habitats are unoccupied. Therefore, project construction would not affect sensitive plants.

Raising the level of Sweetheart Lake would inundate and completely remove several small populations of the rare plant species northern golden saxifrage and boreal bedstraw, and one twocolor sedge plant. On the Tongass National Forest, the northern golden saxifrage has been recorded at 7 other locations, boreal bedstraw at 51 other locations, and twocolor sedge at 5 other locations. However, within the project area no other populations of these three species are known to exist except the ones that would be inundated.

It is unknown whether the twocolor sedge plant along Sweetheart Lake can be successfully salvaged and transplanted, as the Forest Service recommends, or because of the tenuous conditions of its current location, whether it is still present. However, if the plant is still viable, any efforts to relocate the plant to similar habitat outside the inundation area would preserve the existing level of viability for this species within the project area. If transplant efforts are unsuccessful, the loss of this plant would not likely result in a loss of population viability in the Forest Service planning area or cause a trend toward federal listing.

Effects of Project Construction and Operation on Wildlife

Effects of Construction

Potential threats to wildlife resulting from proposed construction activities during the 2-year construction period include habitat disturbance and fragmentation, and direct injury or mortality of individual animals. Construction activities, including the use of machinery and blasting, could result in short-term, noise-related disturbances to wildlife, causing them to seek available habitat elsewhere. During construction, some work crews would stay at a camp near the proposed landing dock. The camp would house 20 to 60 workers and be in place for 1 year, starting with the completion of blasting at the caretaker's facility site.

To reduce construction effects on wildlife, Juneau Hydro proposes to implement its Wildlife Mitigation and Monitoring Plan with measures, including: (1) scheduling

tailrace construction work near Sweetheart Creek to minimize any disturbance when bears are fishing; (2) restricting employees, contractors, and subcontractors from hunting, fishing, and trapping within 0.5 mile of project features; (3) conducting pre-construction bald eagle surveys and, if active bald eagle nesting occurs in the vicinity of the project, consulting with FWS to develop measures to avoid or minimize project effects; (4) posting hunting and fishing regulations onsite; and (5) prohibiting personal firearms onsite, except as specifically approved by the ECM with any additional restrictions included in the Environmental Compliance Plan. To minimize potential human-bear conflicts, Juneau Hydro proposes to implement its Bear Safety Plan, which includes measures to minimize human-bear encounters by: (1) training project personnel in bear avoidance measures and procedures to follow during bear encounters; (2) properly disposing of food waste on the project site in bear-proof containers and regularly removing waste from the project area; (3) minimizing the numbers of meals workers consume in the Sweetheart Lake area by serving three meals per day in the camp on Gilbert Bay (only tunnel, dam, and transmission line workers would have lunch at the work site); (4) providing procedures for workers intending to fish in the project area; and (5) providing protocols for dealing with problem bears.

To protect riparian wildlife habitat, Alaska DFG 10(j) condition 11 recommends the siting of construction activities, such as clearings and road/trail corridors for the powerhouse, penstock, and tailrace, and the transmission line corridor and clearing (except for stream crossings), a minimum of 100 feet, measured horizontally, away from the ordinary high water of Sweetheart Creek, its tributaries, and all streams identified in the latest edition of Alaska DFG's Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes.

To protect local wildlife populations from increased hunting pressure associated with the work camp, Alaska DFG 10(j) condition 16 recommends restricting Juneau Hydro employees and subcontractors from hunting, fishing, and trapping within 0.5 mile of project features during construction of the project.

To prevent bear-human interactions, Alaska DFG 10(j) condition 13 recommends Juneau Hydro consult with resource agencies to finalize the final Bear Safety Plan.

Our Analysis

Construction would temporarily remove about 22 acres of wildlife habitat as a result of grading and clearing. Construction would require blasting and the use of heavy machinery, ultimately resulting in the removal of 442 acres of wildlife habitat as the reservoir fills to operational levels. Most highly mobile wildlife would likely avoid the immediate construction area and relocate to quieter nearby habitats. The gradual filling of the reservoir would also allow wildlife time to relocate to other habitats. Consequently, these animals would have little risk of injury or mortality during construction. However, this relocation would increase individuals' stress levels and increase competition between displaced animals and those occupying existing habitats. Adjacent habitats are likely at carrying capacity; therefore, the displaced animals may not

survive. Less mobile species (e.g., amphibians, young birds and mammals) may not be able to flee in time and project construction could increase mortality rates. Harsh winter conditions dictate a construction schedule that overlaps with the nesting and breeding periods for birds, such as migratory songbirds, potentially resulting in the loss of nest, eggs, and chicks and potentially reducing reproductive success for some individuals. All of the above effects represent a short-term, localized effect on wildlife as wildlife communities would stabilize following construction.

Juneau Hydro's proposed project design, including locating the dock and the caretaker's facility away from the mouth of Sweetheart Creek and locating the access road along the coastal area, would limit disturbance to interior forests and coastal marsh areas where wildlife use is high. Juneau Hydro's proposal to limit tailrace construction to May through June would avoid disturbing prime bear fishing habitat during the late summer and fall salmon runs. Juneau Hydro's exhibit drawings show that it has located project facilities at least 100 feet from stream crossings as recommended by Alaska DFG where practicable; those facilities located closer than 100 feet fall within the exceptions noted by Alaska DFG (clearings and road/trail corridors for the powerhouse and appurtenant facilities, penstock, and tailrace, and transmission line stream crossings) and cannot practicably be located further away. Locations of spoil disposal and staging areas still need to be finalized. Maintaining this buffer distance from the ordinary high water of Sweetheart Creek and its tributaries and other anadromous streams would reduce the potential for bank erosion and removal of important riparian habitat supporting salmon and wildlife.

Juneau Hydro's proposals to prohibit workers from hunting, fishing, and trapping within 0.5 mile of the project, post hunting and fishing regulations onsite, and prohibit workers' personal firearms would reduce excessive hunting pressure on local wildlife populations during the construction period by preventing additional access relative to existing conditions. Further, employing an onsite ECM to enforce these measures would also reduce potential for inappropriate harvest levels. Juneau Hydro's proposed 0.5-mile buffer would comply with Alaska DFG's recommendation. However, the Commission cannot enforce state hunting regulations or personnel management through its license; such enforcement would come through state law and personnel management is a private matter between Juneau Hydro and its workers. Therefore, even though these actions would benefit wildlife, the Commission may not be able to require them.

If Juneau Hydro were to construct the project with its proposed measures, project construction would have moderate, adverse effects on wildlife in the short term and a minor effect in the long term.

Avian Collision and Electrocution Hazards

Above-ground transmission lines may result in avian mortality from electrocution from contact or collisions with conductors or grounding wires. These risks are greatest on low voltage lines (less than 60 kV) where the conductors are closer and less visible.

Large birds, including eagles, are at greatest risk because their wings can reach between conductors. Collision hazards are greatest during inclement weather and where they cross migration paths.

Juneau Hydro's proposed design would limit the use of above-ground transmission lines to a 15,400 segment along the Snettisham Peninsula. To minimize adverse of this segment of the transmission line, Juneau Hydro proposes a corridor that is set back from the shoreline and potential eagle nesting trees to reduce the potential for eagles to cross the transmission line when flying from nests to foraging areas. The corridor would also be constructed against the hill slope to reduce the potential of it crossing waterfowl flight paths along the coast. Where the overhead line crosses anadromous fish streams, Juneau Hydro would mark the line with twisted polyvinyl chloride marker coils to improve its visibility to waterfowl and eagles. Juneau Hydro also proposes to construct the line using a horizontal configuration of the conductors and ground wire. Juneau Hydro would install the line on 80-foot-tall steel poles with insulators hanging down from the structure arms to the wires. The insulators would provide at least 60 inches of clearance between the conductors and the poles/arms. Juneau Hydro would inspect the transmission line annually to ensure the markers are in place.

Alaska DFG 10(j) recommendation 12 requests that Juneau Hydro design the transmission line power poles to conform with FWS accepted guidelines as described in *Suggested Practices for Avian Protection on Powerlines—State of the Art in 2006* (APLIC, 2006).

Our Analysis

The proposed transmission line route would avoid major eagle and waterfowl flyways, and effectively uses terrain features and markers to minimize migration paths and increase visibility for birds. The proposed structure configuration would ensure sufficient separation between conductors and grounding materials to prevent birds from electrocution. The proposed overhead transmission line would meet raptor protection guidelines (APLIC, 2006, 2012), as recommended by Alaska DFG. Juneau Hydro's proposed annual surveys would ensure line markers are functional and effective in increasing line visibility. All these factors would minimize potential electrocution and collision hazards.

Wildlife Disturbance and Disruption of Movement Patterns during Operation

Although the number of personnel present during project operation (one full time caretaker and periodic assistance during smolt collection and facility maintenance) would be far less than that during project construction and activities much less obtrusive during project operation, noise and human presence could disturb wildlife. If sufficiently great, such disturbances could displace wildlife, and disrupt foraging and rearing behavior. Project facilities could create physical barriers to wildlife movement, preventing access to important habitats (i.e., bear use of Sweetheart Creek during salmon spawning). These

factors could cause stress, injury, mortality, or reduced reproductive success for wildlife in the project area.

Juneau Hydro proposes a number of design features and mitigation measures to minimize wildlife disturbance and barriers to wildlife movement. These measures include: burying the penstock; constructing 25-foot-high berm on the downhill side of the powerhouse to visually screen the powerhouse and operational activities from wildlife view and muffle sounds associated with operation; constructing a 94-foot-wide wildlife overpass over the tailrace and a connecting trail on the shore side of the berm to the coastal road to accommodate wildlife movements; locating the caretaker's facility away from the mouth of Sweetheart Creek, where wildlife use is concentrated; and constructing a wildlife bypass trail upslope of the caretaker's facility to reduce potential human-wildlife interaction.

Juneau Hydro would construct the berm with rock removed from the access tunnel and excavated topsoil from the powerhouse and switchyard site. Juneau Hydro would plant the berm with moss and native vegetation salvaged from the powerhouse, switchyard, and penstock areas. The berm would block views of the powerhouse from Sweetheart Creek and provide a noise barrier, reducing disturbance to nesting birds and other wildlife.

Our Analysis

Project operation would require a full-time caretaker, creating a consistent human presence in the area over the long-term as opposed to intermittent activities associated with hunting and fishing. Locating permanent lodging and office facilities near the dock and away from the mouth of Sweetheart Creek would minimize the disturbance to wildlife by concentrating activities in an area away from high concentration wildlife areas. While the powerhouse and tailrace would be located near Sweetheart Creek, the height of the visual barrier, particularly after revegetation is complete, would screen project operations and human presence and muffle disturbing noises. However, because of the remote nature of the project area, the caretaker's presence would constitute an unavoidable, minor, adverse effect on local wildlife. This effect would diminish with time as animals grow accustomed to the caretaker's facility and daily human activities.

Burying the penstock would prevent any impedance of wildlife movement between the dam and the powerhouse and would reduce habitat fragmentation. The proposed tailrace would create a peninsula of land between the south side of the tailrace and Sweetheart Creek, ranging in width from roughly 150 feet to 250 feet and potentially impeding wildlife movement. Juneau Hydro's proposed 94-foot-wide tailrace overpass with a trail along the shore side of the powerhouse visual barrier would promote wildlife movement between the mouth of Sweetheart Creek and the falls and would mitigate decreased habitat connectivity in this area.

Juneau Hydro's proposed wildlife bypass trail upslope of the caretaker's facility[59] is intended to allow unobstructed movement for animals along the coastal access road and away from the project area, without human interactions. Upslope of the caretaker's facility is high-volume productive old-growth hemlock spruce forest and a 1.86-acre tract of forested wetland. Juneau Hydro has not provided any details about the wildlife bypass trail, but it is likely that its construction would involve tree removal, resulting in short-term noise disturbance and long-term habitat alteration. There would be no assurance that wildlife would use the proposed trail, but it might be used by hunters, trappers, and recreationists, introducing human disturbance into more of the project area. Therefore, the wildlife access trail might not mitigate wildlife disturbance caused by human interactions to the extent intended.

Therefore, with the proposed and recommended measures, operation of the project would have minimal adverse effects on common wildlife species.

Effects of Construction and Operation on Forest Service Sensitive Species

The Forest Service identified four sensitive species that could occur in the project area—Aleutian tern, black oystercatcher, dusky Canada goose, and northern goshawk. Effects of the proposed project on these sensitive species would be similar to the effects discussed above for wildlife in general. Potential effects include loss of habitat; habitat disturbance related to construction noise and increased human presence; potential injury or mortality associated with vegetation clearing, use of machinery, reservoir filling, or transmission line interactions; and reduced reproduction success associated with nest disturbance.

Juneau Hydro does not propose any measures to address project effects on these sensitive species other than those described previously to generally reduce adverse effects on wildlife (e.g., revegetation).

In 4(e) condition 22, the Forest Service specifies that Juneau Hydro consult with the Forest Service to finalize the Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan to ensure that resource management objectives are tied to the Tongass National Forest Land and Resource Management Plan. However, no specific measures to address project effects on these species have been identified.

Our Analysis

Aleutian Tern

The project area does not support suitable nesting habitat and no nesting colonies are known to occur near the project. Effects of project construction would be limited to

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[59] The caretaker's facility would be located immediately inland of the dock and the north end of the coastal access road.

disturbance of birds migrating through the project. Consequently, effects would be temporary, localized, and minor.

Black Oystercatcher

The black oystercatcher was not found during Juneau Hydro's surveys and there is no evidence of their occurrence at the project site in the past. However, it nests just above the high tide line on bare rock, in shells, gravel, sand, or tufts of grass and among logs from the Aleutian Islands of Alaska to the coast of the Baja California peninsula. Construction of the coastal access road and dock would affect about 4,400 linear feet of coastline that is suitable nesting habitat. If these birds attempt to nest in the project vicinity during construction, noise and human activity could disrupt their nesting behavior. Vegetation removal and coastal access road construction could also destroy active nests. However, given the short duration of construction (2 years), small affected area relative to the species' distribution, and its apparent absence from the area, project effects would be minor and localized.

Northern Goshawk

The northern goshawk was not observed during project surveys, but it likely nests and forages in the 340 acres of old growth forest that would be removed or disturbed by constructing the project. Harsh winter conditions prevent scheduling construction outside the breeding season of the northern goshawk; therefore, vegetation clearing could result in the loss of nests, eggs, and chicks. However, productive old-growth forest provides an abundance of alternative northern goshawk nesting habitat in areas surrounding the project. These effects would be most pronounced during the 2-year construction period.

Dusky Canada Goose

The project does not contain suitable nesting habitat for dusky Canada goose; however, it could forage and rest in the area during migration. Given the short duration of construction (2 years), small affected area relative to the species' distribution, and the apparent absence from the area, project effects would be minor and localized.

In sum, no specific measures to address potential effects on these species have been recommended by others or identified by staff. Thus the proposed project may adversely affect individual Aleutian tern, black oystercatcher, dusky Canada goose, and northern goshawk, but it is not likely to result in a loss of viability in the project area or the Forest Service management area, or to cause a trend toward federal listing for these species. Factors supporting this conclusion include the low potential for these species to occur in the project area, the short duration of these construction effects that are most likely to cause direct injury, and the presence of readily available habitat in the immediate vicinity that is removed from project effects.

Effects of Construction and Operation on Forest Service Management Indicator Species

Forest Service management indicator species that may occur in the project area include: Alexander Archipelago wolf, American marten, black bear, brown bear, mountain goat, red squirrel, river otter, Sitka black-tailed deer, bald eagle, brown creeper, hairy woodpecker, red-breasted sapsucker, and Vancouver Canada goose. Potential effects of the proposed project on management indicator species would be similar to those already discussed above (e.g., habitat loss and noise disturbance).

To minimize potential effects on bears, Juneau Hydro proposes to implement its Bear Safety Plan, which is also discussed above. Therefore, the analysis is not repeated here.

Juneau Hydro proposes specific measures to minimize adverse effects on mountain goats and bald eagles to ensure that project construction and operation does not cause avoidance or abandonment of high-value wintering and kidding habitat near the outlet of Sweetheart Lake. Juneau Hydro proposes to survey for the presence of mountain goats near the outlet of Sweetheart Lake prior to project construction and the annual sockeye salmon smolt collection and transport activities (see section 3.3.2.2, *Aquatic Resources, Environmental Effects*). If these surveys identify mountain goat presence, Juneau Hydro proposes and Alaska DFG 10(j) recommendation 14 requests that flight paths maintain a 1,500-foot vertical and horizontal distance from mountain goats, to the extent possible.

Juneau Hydro proposes to perform preconstruction surveys for bald eagle nests and consult with FWS to develop measures to avoid or minimize potential effects if active nests are identified.

No specific measures were recommended to address bald eagles or other management indicator species.

Our Analysis

Because the effects of project construction and operation (i.e., disturbance, habitat loss, etc.) on Forest Service management indicator species would be the same as those already discussed for other wildlife, the following analysis focuses on the effects on mountain goats and bald eagles and Juneau Hydro's mitigation measures to address those effects.

Mountain Goats

Although Juneau Hydro's mountain goat surveys did not record any goats in the project area, weather conditions made surveys difficult and the results were insufficient to conclude that the species is absent. Alaska DFG noted in its comments that it planned to conduct more detailed analysis of mountain goat use of wintering and kidding habitat in the project area in 2014; however, the results of this analysis were not available at the time this final EIS was prepared.

If mountain goats attempt to use the wintering and kidding habitat on the north shore of Sweetheart Lake in the vicinity of the dam, the noise associated with helicopters, fixed-wing aircraft, machinery, and blasting from project construction and the annual sockeye salmon smolt transport could disturb the animals, causing them to abandon or avoid the habitat. Alaska DFG notes that disturbance can cause mountain goat groups to splinter and individuals to panic, resulting in injuries and/or mortality, and that after being disturbed, goats may stay alert without foraging for several hours, resulting in increased energy expenditures, reduced fat accumulation, and adverse physiological changes. These effects would occur during the mountain goat kidding season, which extends from May 15 to June 15, and may result in a decline in reproductive success.

Juneau Hydro's proposed measures to conduct surveys for goats prior to construction and annual smolt transport,[60] and maintain a 1,500-foot separation distance between goats and aircraft would reduce potential adverse effects on the extent possible. However, as Alaska DFG notes, the proximity between predicted mountain goat habitat and the proposed project facilities, including the dam and the smolt capture area, could make it impossible for Juneau Hydro to maintain the proposed separation distance at all times. Given the short-construction season and the need to transfer salmon smolts timely to the acclimation ponds, such disturbance effects on mountain goats may be unavoidable. In that case, the project would have moderate effects on mountain goats.

Bald Eagles

Although no active bald eagle nests were observed during site surveys, Juneau Hydro observed bald eagles throughout the project area, especially near anadromous fish streams. Bald eagles could build new nests in the project area before the start of any construction. The National Bald Eagle Management Guidelines (FWS, 2007) indicate that nest building in Alaska starts in February and nesting activities can last as late as October before nestlings are fledged.

Proposed construction activities would include blasting, use of heavy machinery, and vegetation clearing, which could disrupt nesting activities or destroy recently built nests. Although bald eagles are sensitive to noise throughout the nesting period, they are most accepting of disturbance during the 4- to 8-week period following hatching. During this period, the potential for nest abandonment decreases, and the nestlings are too young to fly. As nestlings start fledging, 8 weeks after hatching, loud noises could cause them to flush prematurely, potentially resulting in injury.

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[60] Juneau Hydro states that helicopter transport of smolts would likely occur over a 3-week period from the first week in June through the third week in June.

Juneau Hydro's proposal to conduct pre-construction surveys for active bald eagle nests would identify any potential for blasting and other construction noise to affect nesting eagles. To protect nesting eagles from moderate construction noise, the national bald eagle guidelines recommend providing a 660-foot buffer around the nest site. The guidelines recommend a 1,000-foot buffer for helicopter and fixed wing aircraft use. For activities creating loud staccato noises, like blasting, the recommended buffer is 0.5 mile. Adhering to these guidelines would minimize adverse effects on bald eagles.

However, as discussed previously, weather conditions restrict the timing of construction activities. As such, it may be difficult for Juneau Hydro to schedule construction activities to avoid any nesting eagles. If pre-construction surveys identify active bald eagle nests within the 600-foot to 0.5-mile buffer from proposed construction activities, Juneau Hydro would consult with FWS to determine appropriate actions to minimize disturbance. Agency consultation would help identify appropriate methods for monitoring nesting activities and the most opportune scheduling of construction activities to minimize disturbance.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Kittlitz's murrelet (*Brachyramphus brevirostris*) is a candidate species managed by FWS that could occur in the project area (Juneau Hydro, 2015a). For species managed by NMFS, only the humpback whale (*Megaptera novaeangliae*) and the western DPS of the Steller sea lion (*Eumetopias jubatus*) could potentially occur in the project area (NOAA, undated b).

Kittlitz's Murrelet

Kittlitz's murrelets nest on the ground in rocky habitats, typically in recently deglaciated areas, and feed on small fish (e.g., sand lance, herring, and capelin), amphipods, and small crustaceans in marine waters. During the summer breeding season, Kittlitz's murrelets are found in marine waters north of Wrangell, Alaska. During the winter, this species is believed to disperse to the Gulf of Alaska, but specific locations are not known. This species was last evaluated for listing in November 2012.

The proposed project would not affect any habitats designated as high value or essential for the Kittlitz's murrelet. Rocky cliffs that are important for Kittlitz's murrelets would not be affected. Although no nesting habitat is located within the proposed project boundary, Kittlitz's murrelets may nest at high elevations in the upper Sweetheart Creek basin. Due to the distance of this potential nesting habitat from the proposed project, it is unlikely that construction activities would disturb nesting murrelets. Murrelet nests may be active in the region between mid-May and late July and daily movements typically occur during crepuscular hours, when visibility is poor. Because the portion of the project transmission line between potential nesting habitat and marine feeding areas would either be buried or consist of submarine cable, the likelihood

the Kittlitz's murrelet colliding with the transmission line is negligible. The proposed project would have no effect on Kittlitz's murrelet, so no further discussion of this species is warranted.

Humpback Whale

The humpback whale was listed as an endangered species under the ESA in 1970, but critical habitat has not been designated or proposed. For the purposes of the MMPA stock, at least three separate populations occur in the North Pacific: the California/ Oregon/Washington stock that winters in coastal Central America and Mexico and migrates to areas ranging from the coast of California to southern British Columbia in summer/fall; the Central North Pacific stock that winters in the Hawaiian Islands and migrates to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak; and the Western North Pacific stock that winters near Japan and probably migrates to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall. There is some mixing between these populations, though they are still considered distinct stocks (Carretta et al., 2013).

Humpback whales are common in the marine environment throughout Southeast Alaska. In general, humpback whales in Southeast Alaska are from the Central North Pacific stock, although some modification to population structure may be revised when genetic testing results become available (Allen and Angliss, 2014b). Although currently listed as endangered, NMFS has proposed a rule to identify the Central North Pacific population as a DPS and delist the DPS under the ESA (Federal Register Doc. 2015-09010, filed April 21, 2015).

During migration, humpback whales stay near the surface of the ocean. While feeding and calving, humpback whales prefer shallow waters. Calving grounds are commonly near offshore reef systems, islands, or continental shores. Humpback whale feeding grounds are in cold, productive coastal waters. During calving, humpback whales are usually found in the warmest waters available at that latitude (NOAA, 2015i).

The number of humpback whales that forage off the coast of British Columbia and Southeast Alaska is estimated between 2,883 and 6,414 individuals with relatively high densities occurring throughout Southeast Alaska and northern British Columbia in the summer months. While a population trend for the Central North Pacific stock has not yet been estimated, it is clear that the abundance has increased in Southeast Alaska (Allen and Angliss, 2014b). While humpback whales may be found in a variety of marine habitats, their patterns of occurrence likely follow the spatial and temporal changes in types, densities, and distribution of prey (Kreiger and Wing, 1986; Baker et al., 1992). In Southeast Alaska, primary prey species include euphausiids (krill) and small schooling fishes such as capelin, Pacific sand lance, walleye pollock, and Pacific herring (Kreiger and Wing 1986; Straley, 1990).

Humpback whales are common summer residents in Southeast Alaska and have been observed feeding in Gilbert Bay. They are also encountered along shipping routes from Seattle to Juneau. Humpback whales were observed in Gilbert Bay during project wildlife studies. An individual humpback whale was observed on June 29, 2012, near Sentinel Point, and an individual was also observed on July 3, 2012, in the southern end of Gilbert Bay. On July 15, 2012, at least three humpback whales were observed feeding in Gilbert Bay and were active in the bay most of the day. Observations of humpback whales in Gilbert Bay and near the Whiting River by a local cabin owner document their presence as early as April 26 and as late as September 8. While no specific surveys were conducted for marine mammals, personnel conducting field studies for other resources have not observed humpback whales in the bay in late fall or winter.

Western DPS Steller Sea Lion

In Southeast Alaska, most Steller sea lions are considered part of the eastern DPS, which was delisted on December 4, 2013, and is discussed in section 3.3.2. However, some endangered western DPS Steller sea lions have been observed in Southeast Alaska (Gelatt et al., 2007; Jemison et al., 2013). Western DPS animals started moving east in the 1990s after steep population declines in the central Gulf of Alaska (Jemison et al., 2013). Of the 2,192 western DPS Steller sea lion pups branded between 2000 and 2010, a total of 89 (4 percent) was subsequently sighted in Southeast Alaska (Jemison et al., 2013). While the majority of western DPS Steller sea lions have been observed in the Glacier Bay National Park region, individuals have been observed throughout Southeast Alaska (Gelatt et al., 2007; Jemison et al., 2013); therefore, some western DPS Steller sea lions could occur in the project area. No critical habitat (major rookery or major haulout) for Steller sea lions is located close to the project area. The nearest critical habitat to Gilbert Bay is located 31.5 miles to the south at Sunset Island and 57 miles to the north at Benjamin Island. As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment*, Mist Island haulout is a non-major haulout for Steller sea lions located on the northern shore of Port Snettisham east of Mist Island, and Steller sea lions have been documented at this location from October through June (Womble et al., 2009). It is not known, however, whether any of the observed Steller sea lions were from the western DPS.

Steller sea lions are considered opportunistic predators that switch prey items and relocate to different areas based upon seasonal prey availability. They forage and feed primarily at night on species such as salmon, eulachon, capelin, cod, herring, pollock, mackerel, squid, and octopus.

3.3.4.2 Environmental Effects

Construction activities including operating vessels and aircraft, blasting, and pile driving would increase noise levels in the project area. Operation of the project would also increase vessel traffic in the area and provide a source of electric and magnetic fields from the submarine cable. These activities would increase the potential of disturbance or

injury to humpback whales and western DPS Steller sea lions if these species were to use waters close to the project.

Juneau Hydro proposes to implement its Wildlife Mitigation and Management Plan (as discussed in section 3.3.2, *Aquatic Resources*), and as a component of this plan, Juneau Hydro also proposes to implement its Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan. The plans include measures to avoid or minimize potential effects on marine mammals, including humpback whales and Steller sea lions. The measures are summarized in table 3-17. Additionally, the Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan includes filing an annual report that summarizes consultation with FWS and NMFS, conservation measures, and implementation of terms and conditions carried out during the preceding calendar year.

Table 3-17. Proposed protection measures for humpback whales and Steller sea lions (Source: Juneau Hydro, 2014a, 2015 letter from Juneau Hydro to NMFS, filed December 29, 2015).

Purpose	Effect	Proposed Protection Measure
Humpback whale and Steller sea lion collision avoidance	Vessel collision with humpback whales and Steller sea lions could result in injury or mortality	Establish a marine mammal safety zone of 100 yards around in-water construction activities for the protection of humpback whales and Steller sea lions from effects caused by in-water construction of placing the submarine cable. Prepare and implement an in-house awareness program to prevent collisions between service boats and marine mammals and to minimize harassment of humpback whales and Steller sea lions. Boat captains on Juneau Hydro business are responsible to spot marine mammals within the safety zone including humpback whales and Steller sea lions and are responsible to notify construction management of humpback whales and Steller sea lions within the safety zone.

Purpose	Effect	Proposed Protection Measure
		If humpback whales or Steller sea lions are in the direct path of a boat and unavoidable, the boat shall either go to slow-safe speed or stop until the whale is clear or can be avoided by a minimum of 100 yards. A slow-safe speed is defined in the International Regulations for Preventing Collisions at Sea 1972 (72 COLREGS Rule 6) and the Inland Navigational Rules (33 CFR, Part 83.06). Both regulations define operation such that "every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions." In the unlikely event of a vessel colliding with a humpback whale or Steller sea lion, NMFS would be notified within 48 hours of the event. Although, vessels laying cable are exempt from the approach distance regulations for humpback whales, Steller sea lions and all marine mammals, trained observers on the cable-laying vessels would notify the vessel captain of marine mammal presence within the 100-yard safety zone and advise initiating a safe-slow speed.

Purpose	Effect	Proposed Protection Measure
Humpback whale and Steller sea lion disturbance avoidance	Noise from pile driving and vessels could alter natural whale and sea lion behavior	In-water pile driving for the marine dock and landing facilities would stop if marine mammals enter a 1,000-meter safety zone, as determined by a dedicated marine mammal monitor; construction would resume only after the animal leaves the zone. All vibratory and impact pile driving activities would include ramp-up procedures. For vibratory driving, the procedure would include initiating the driver for 15 seconds at reduced energy, followed by a 60-second waiting period. This procedure would be repeated two additional times before continuous vibratory driving is initiated. For impact driving, an initial set of three strikes would be made by the hammer at 40 percent energy, followed by a 3-second waiting period. This procedure would be repeated two additional times before continuous impact driving is initiated.
Steller sea lion disturbance avoidance at Mist Island haulout	Noise from vessels and aircraft could prevent use or disturb sea lions using Mist Island haulout.	Marine transportation routes and flight pathways crossing Port Snettisham would be located at least 3,000 feet from the Steller sea lion haulout located east of Mist Island. Weather and sea conditions may dictate the necessity to vary from these routes in the interest of safety of the vessel or aircraft and passengers.

Our Analysis

Vessel Collisions

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the potential for collisions between marine mammals, including humpback whales, and project supply vessels transiting shipping routes between Seattle, Washington and the project site would be unlikely. Based on historical ship strike information, it is estimated that less than 1 ship strike per 10,000 ship transits occurs along the west coast of the United States (CH2M Hill, 2008), and the number of project ship transits from Seattle to Juneau would be small compared to the 10,000 ship transits that result in 1 ship strike.

In Stephens Passage, Port Snettisham, and Gilbert Bay the potential for vessel collisions would increase slightly during the 2-year construction period. The greatest risk during this time would occur during the beginning of the first construction season (likely January through April) and end of the second construction season when most of the project related vessel traffic would occur for the mobilization and demobilization of project construction materials and equipment. Significant vessel traffic, however, already occurs in Port Snettisham from commercial fishing vessels, personal use fishing traffic, and recreation vessel traffic (table 3-18). Juneau Hydro estimates that there would be 104 project-related trips per year during construction. This would represent less than 10 percent of the vessel traffic occurring in Port Snettisham and Gilbert Bay. This estimate is based on 2012 data for commercial fishing vessel landing days in Port Snettisham and extrapolations of 2011 data for personal use fishing permit reports. The potential for humpback whales and Steller sea lions to collide with vessels could also occur during project operation, but to a lesser extent because of fewer annual vessel trips.

Table 3-18. Projected vessel traffic in Port Snettisham during project construction (Source: Juneau Hydro, 2014a).

Traffic Source	Number of Vessel Trips per Year	Percentage
Juneau Hydro	104	9.83
Commercial Fishing	859	81.19
Personal use Fishing	45	4.25
Recreation	50	4.73
Total	**1,058**	**100**

Collisions with vessels are generally rare. For the Central North Pacific humpback whale stock, the annual human-caused mortality and serious injury rate in Alaska due to vessel collisions for the period 2007 to 2011 was 1.8 (Allen and Angliss, 2014b). For Steller sea lions, no mortalities or serious injuries from vessel strikes for the western DPS were reported from 2007 to 2011, while the annual human-caused mortality and serious injury rate reported due to vessel collisions for the eastern DPS was 1.8

(Allen and Angliss, 2014a, 2014c). Implementing Juneau Hydro's proposed avoidance measures (i.e., placing trained observers on vessels, employing trained boat captains, avoiding approaching within 100 yards of a whale, reducing speeds when whales are in the vicinity, and either stopping or going at a slow-safe speed until the whale is clear or can be avoided by a minimum of 100 yards, establishing a 100-yard marine mammal safety zone around construction activities, ceasing those activities when whales enter the zone, and avoiding the Mist haulout for Steller sea lions by 3,000 feet) would minimize the risk for potential vessel collisions with humpback whales and western DPS Steller sea lions during construction and operation to a discountable level.

Noise

Anticipated noise levels generated from construction activities are presented in table 3-11. As described in section 3.3.2.2, construction activities (pile driving and vessel traffic) are expected to produce noise levels that exceed NMFS' defined Level B disturbance criteria, [61] which could alter humpback whale and Steller sea lion behavior and use of Gilbert Bay near the project, if present. Impact pile driving could also produce in-water noise at levels causing Level A disturbances for humpback whale. Such disturbance effects would be temporary, short-term, and localized because whales and Steller sea lions could return to the area once the noise stops. As discussed in section 3.3.2.2, impacts would be mitigated by implementing a 1,000-meter safety zone around pile driving activities, employing ramp-up procedures for pile driving, and a 100-yard safety zone around other in-water construction activities. Additionally, potential effects on the western DPS Steller sea lion are lessened to discountable levels because their presence in the project area is very unlikely.

Behavioral reactions by hauled-out western DPS Steller sea lions could be anticipated at noise levels greater than 100 dB, which is the threshold for Level B disturbance from airborne noise. Only pile driving at the dock (101 dB) is expected to produce airborne noise levels in excess of 100 dB. However, noise levels at the Mist haulout from pile driving activities would be well below 100 dB because the Mist haulout is greater than 5 miles away from the proposed dock location. Overhead noise from increased fixed-wing and helicopter traffic would also occur during the construction seasons. To avoid disturbing Steller sea lions at the Mist haulout, Juneau Hydro proposes

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[61] Under the 1994 Amendments to the MMPA, "harassment" is statutorily defined as, any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment), or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering, but does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment).

to have all marine vessel routes and aircraft fight paths avoid the haulout site by 3,000 feet to the extent this distance can be maintained safely, given weather and sea conditions. At these distances, noise levels are not expected to reach harassment levels; therefore, there should be no effect on the western DPS Steller sea lion.

Entanglements

As discussed in section 3.3.2.2, the submarine cable would not likely result in the entanglement of marine mammals, including the humpback whale and western DPS Steller sea lion, given the cable's size and weight, depth, and burial over much of its length.

Electric and Magnetic Fields

As described in section 3.3.2.2, electric and magnetic fields from project operation are not expected to affect humpback whales and western DPS Steller sea lions. Any electric fields would be blocked by the design and sheathing of the cable. Because humpback whales and sea lions feed in the water column, they are unlikely to come close enough to the bottom-lying submarine cable to experience the magnetic field, particularly where the submarine cable would be or would become buried by sediment or would be covered by rock where the cable comes ashore.

For the above reasons, we conclude that project construction and operation may affect but is not likely to adversely affect the humpback whale and the western DPS Steller sea lion.

3.3.5 Recreation, Land Use, and Aesthetics

The project would be located on land adjacent to Gilbert Bay. The powerhouse, dam, and above-ground portions of the transmission line would be located on undeveloped public lands managed by the Tongass National Forest, and the submerged portions of the transmission line would be located on lands that the state of Alaska owns and Alaska DNR manages. The proposed powerhouse site is about 30 miles from Juneau, the nearest community, and it is only accessible by boat or by air.

The project area would include the 5.4-mile-long by 0.6-mile-wide Sweetheart Lake, which is bordered by steep slopes with rock outcroppings, avalanche chutes, and dense vegetation between two ridgelines. Dense vegetation and rocks occurring on the steep topography screen views of the lower falls on Sweetheart Creek from Gilbert Bay.

Sweetheart Creek is one of numerous tributaries, including the Whiting and Speel Rivers that drain into the bay. Melting snow and rain feed into Sweetheart Creek, which has low flows during the winter months and high flows during the summer and fall. Three waterfalls are located in the lower creek, and the uppermost waterfall is high enough to act as a barrier to upstream fish passage. Sweetheart Creek is an Alaska DFG-designated personal use sockeye fishery.

3.3.5.1 Affected Environment

Recreation

Regional recreation resources in the vicinity of the proposed project are primarily associated with Gilbert Bay, Sweetheart Creek, and surrounding lands. To establish a context for recreational use of the project area, Juneau Hydro conducted interviews and surveys of those who use lands in the vicinity of the project for recreational or commercial purposes. Juneau Hydro conducted visitor surveys to collect information about recreational use from outfitters, guides, and individuals holding 2010 and 2011 fishing permits for Sweetheart Creek. Juneau Hydro also conducted more than 25 visits to Sweetheart Creek, Sweetheart Lake, and Gilbert Bay for the purpose of gathering data for other resource studies and used these opportunities to collect additional recreation information.

Survey results show that overall annual use of the project area is low (an average of about 200 visitors each year) because access to the remotely located project area is only by boat or float plane from Juneau. Most use is associated with the Alaska DFG's permit-only personal use sockeye salmon fishery in Sweetheart Creek and occurs during the sockeye salmon run from late July to mid-August. Fishermen currently moor their boats off shore in Gilbert Bay and use a skiff or inflatable boat to access the shoreline. A number of unimproved and unmarked game and fishing trails lead from Gilbert Bay to preferred fishing locations along Sweetheart Creek. They occur mainly from its mouth at Gilbert Bay upstream to the impassable falls and site of the proposed tailrace (figure 3-11). No public recreational facilities are located at either Sweetheart Creek or along the shoreline at Sweetheart Lake. Steep topography and dense vegetation preclude pedestrian access to Sweetheart Lake from the shoreline of Gilbert Bay and the only way to access the lake is by plane or helicopter. Despite the existing fishery in Sweetheart Lake (rainbow trout, Dolly Varden), interviews with Juneau air charter services suggest that recreational use is low because no recreational visitors have used their services to access the lake. Most fishermen surveyed support the idea of constructing a dock facility and installing mooring buoys in Gilbert Bay to improve access to Sweetheart Creek.

Although fishing is the primary recreational activity in the vicinity of the proposed project powerhouse, commercially guided hunters, resident sport hunters, and trappers also use these lands. Target species for these activities include mountain goats, moose, bears, and furbearers. Brown bears commonly use land in the vicinity of Gilbert Bay and, in particular, are attracted to the upper falls of Sweetheart Creek. Because these falls are a barrier to upstream fish passage, spawning fish concentrate below the falls, attracting both bears and fishermen to this location at the same time. In early August 2012, Juneau Hydro observed at least 10 brown bears near the creek while fishermen were present. The high brown bear concentration occurring in this area provides sightseeing and photography opportunities and discourages camping.

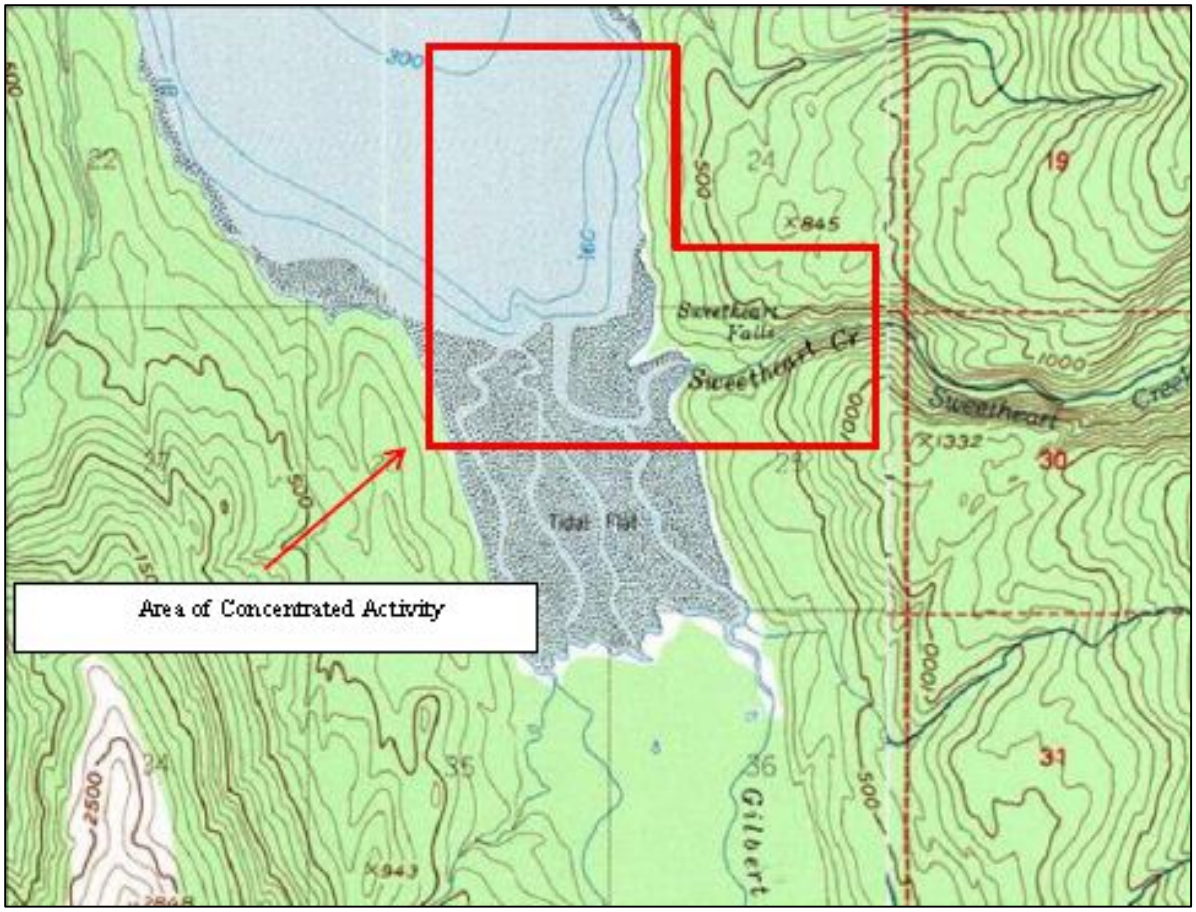

Figure 3-11. Area with concentrated recreation use (Source: Juneau Hydro, 2014a).

Land Use

The proposed project boundary includes 2,058 acres of NFS land and 131.18 acres of tideland and submerged land of the state of Alaska. The proposed project boundary is located at the 700-foot contour of Sweetheart Lake, except near the dam where additional land is included to allow for construction. The project boundary for the power tunnel and access road extends 100 feet from the centerline of each of these linear features. The proposed project boundary enclosing other temporary and permanent project features extends various distances but does not typically exceed 200 feet beyond any area that construction or operation of the project would potentially disturb.

Sweetheart Lake and the proposed locations for the powerhouse, dam, tunnel, tailrace, the caretaker's facility, and recreational facilities are entirely on public land that the Forest Service manages. The proposed transmission line includes both buried and overhead sections that traverse NFS lands. The proposed marine facilities, submarine portions of the transmission line, and coastal access road would be located on submerged and tide lands of the state of Alaska. The entire project area and surrounding land is uninhabited and does not have road access.

The proposed project would be located within the 685,704-acre Taku Snettisham Inventoried Roadless Area and would occupy 2,052.24 acres (0.3 percent) of this entire area. Pursuant to the ruling of the U.S. District Court for the District of Alaska in Organized Village of Kake v. USDA, No. 1:09-cv-00023 (March 4, 2011) (upheld on appeal; 795 F.3d. 956 [9th Cir. 2015]), the Roadless Area Conservation Rule (36 CFR, Part 294) applies to the Tongass National Forest and generally prohibits construction or reconstruction of roads in inventoried roadless areas of the NFS, but with some exceptions. The District Court's final judgment, Organized Village of Kake v. USDA, No. 1:09-cv-00023 (May 24, 2011), makes special provision for certain projects and activities, including:

- road construction and timber cutting for listed projects;
- personal timber use, firewood, and certain roadside microsales; and
- hydroelectric development.

The Forest Service regards these projects and activities identified in the District Court's May 24, 2011, final judgment as exempt from the prohibitions of the 2001 Roadless Rule under the terms of the final judgment. Further, the District Court's judgment also states:

> Nothing in this judgment shall be construed to prohibit any person or entity from seeking, or the USDA from approving, otherwise lawful road construction, road reconstruction, or the cutting or removal of timber for hydroelectric development pursuant to the standards and procedures set forth in the Federal Power Act.

The Chief of the Forest Service continues to review certain activities planned in inventoried roadless areas to ensure the Forest Service is applying a nationally consistent approach to implementation of the Roadless Rule, and that the agency is complying with its mandate to protect roadless area characteristics.

Most of the NFS land (2,054.24 acres) where the proposed project would be located has a Semi-Remote Recreation Land Use Designation (LUD) and some segments of the proposed route of the transmission line would be located on land with Timber Production (70.07 acres) and Old-Growth (3.06 acres) LUDs (figure 3-12). The Forest Service has several management objectives it uses to achieve the following desired conditions in these LUDs:

- Semi-Remote Recreation LUD—Characterized by generally unmodified natural environments. Ecological processes and natural conditions are only minimally affected by past or current human uses or activities. Users have the opportunity to experience a moderate degree of independence, closeness to nature, solitude, and remoteness, with some areas offering motorized opportunities and others non-motorized opportunities (except for the traditional uses of boats, aircraft, and snow machines). Interactions between users are infrequent. Facilities and structures

may be minimal or occasionally may be larger in scale but will be rustic in appearance, or in harmony with the natural setting.

- Timber Production LUD—An extensive road system provides access for timber management activities, recreation uses, hunting and fishing, and other public and administrative uses; some roads may be closed, either seasonally or year-long, to address resource concerns. Management activities will generally dominate most seen areas. Tree stands are healthy and with a mix of age classes from young stands to trees of harvestable age, often in 40- to 100-acre stands. Recreation opportunities, associated with roaded settings from Semi-Primitive to Roaded Modified, are available. A variety of wildlife habitats, predominantly in the early and middle successional stages, is present.
- Old-Growth LUD—All forested areas have attained old-growth forest characteristics. A diversity of old-growth habitat types and associated species and subspecies and ecological processes are represented.

These LUDs, which do not prohibit hydropower development, pertain to land within the Taku Snettisham Inventoried Roadless Area.

The Alaska state lands that would be occupied by the project are designated and managed by the Alaska DNR for habitat harvest, recreation and tourism (dispersed use), and public facilities (reserved sites). Juneau Hydro has submitted a Tidelands Lease and Easement request for all project lands under the jurisdiction of the state of Alaska.

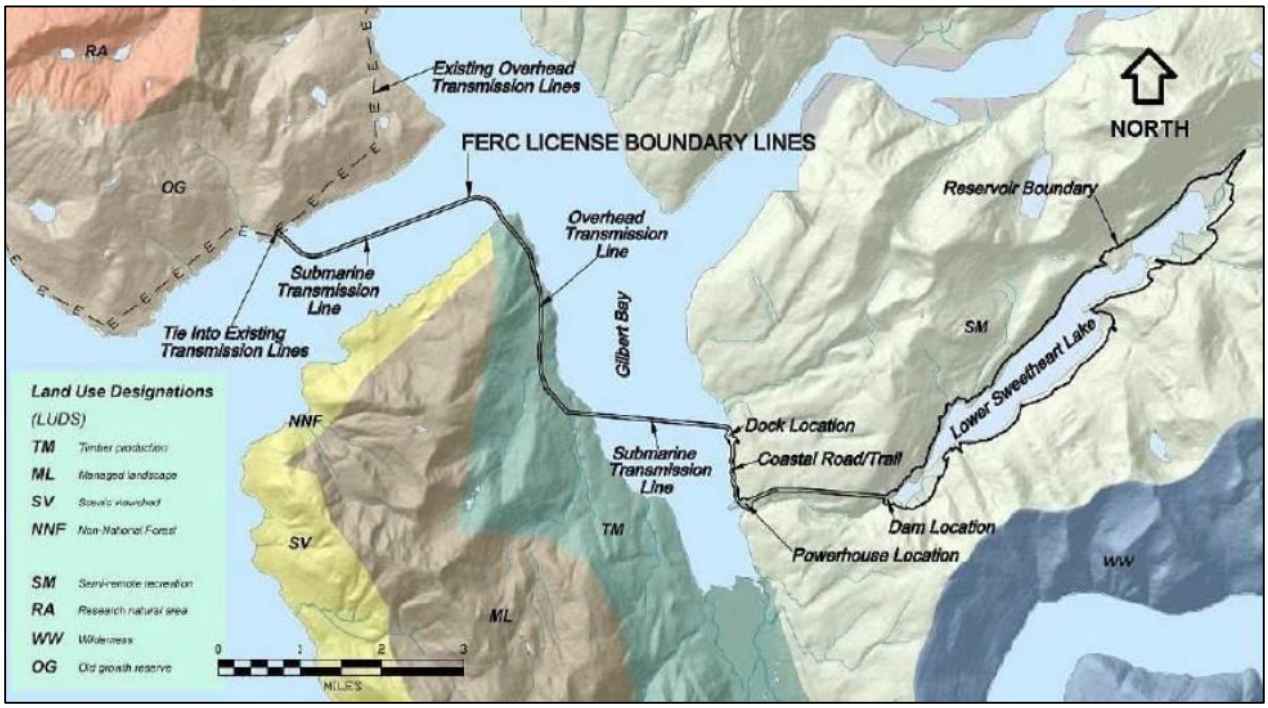

Figure 3-12. Land Use Designations of National Forest System lands in the vicinity of the project (Source: Juneau Hydro, 2014a).

Aesthetic Resources

The project is located in a remote, coastal area of Alaska. Because the area is roadless, it is only viewed by people who visit the area using small private or commercial boats or aircraft. The views at the lower elevations in the vicinity of the project include rounded mountains rising to just higher than 3,000 feet with lowlands extending to the shoreline of Gilbert Bay. Upper elevations in the vicinity of the project consist of rounded exposed rock and alpine vegetation with some brushy landslide and avalanche chutes providing textural contrast. The middle- and lower-elevation slopes are vegetated with western hemlock and Sitka spruce forests and the lowlands have forested as well as emergent wetlands. Shorelines are generally protected from high energy, ocean-like wave action. Streams in the area include Sweetheart and Prospect Creeks, which have steep gradients with clear water. Gilbert Creek and other creeks at the head of Gilbert Bay feed a large, tidewater flat that presents a muddy and gravelly landscape dominated by grasses and sedges.

Other notable visual components of the landscape near the project include an existing transmission line corridor along the northern shore in the vicinity of Port Snettisham and the continuous range of 3,000- to 5,000-foot exposed mountain peaks with ice fields. The existing transmission corridor, extending along the coastline between the Port Snettisham power station and Juneau, has tall metal transmission towers connected by multiple strands of conduit and 200 to 300-foot-wide clearing limits. The ice fields on the surrounding peaks supply the glacial-fed Whiting River that flows into Gilbert Bay north of the project area.

Approximately 88 percent of the Tongass National Forest land base, including land in the vicinity of the project dam and other generation-related infrastructure, has a very high or high existing scenic integrity classification (Forest Service, 2008; table 3.16-1, page 3-353), reflecting a landscape that is visually unaltered. The proposed transmission route includes land with this same classification up to the point where the transmission line emerges from the underwater crossing and joins the existing Port Snettisham transmission line corridor, where the landscape has moderate or low existing scenic integrity and reflects slightly altered landscapes.

Figure 3-13 shows the applicable scenic integrity objectives for the project-affected NFS lands and indicates the allowable degree that a landscape may be modified by human activities.

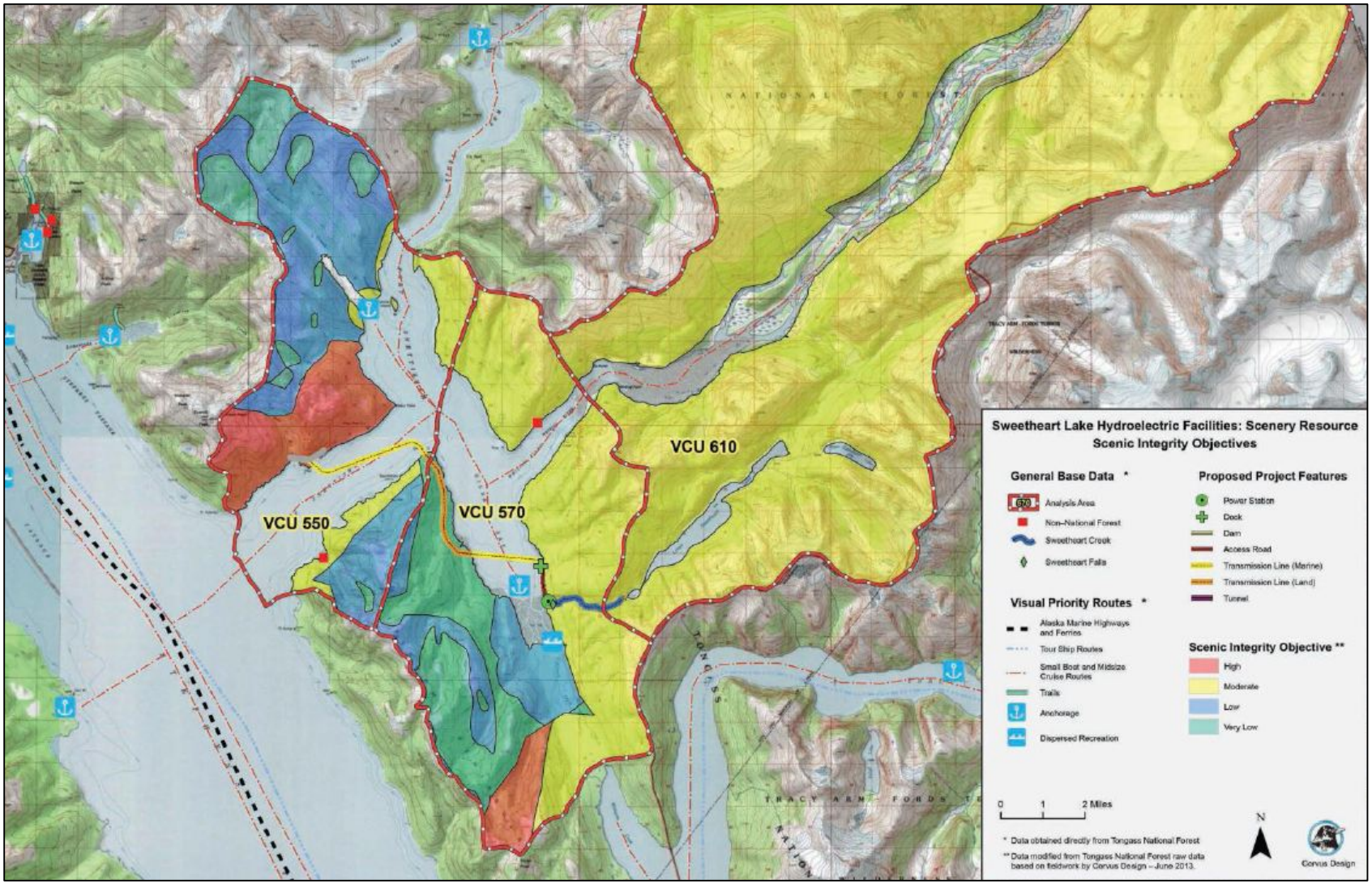

Figure 3-13. Existing scenic integrity objectives of NFS lands associated with the proposed generation and transmission facilities (Source: Juneau Hydro, 2014a).

3.3.5.2 Environmental Effects

Recreation

Construction and operation of the proposed project facilities have the potential to affect recreation resources along Sweetheart Creek and at Sweetheart Lake. Improved recreational access to the project area could lead to increased visitor use of the project area, especially fishing along Sweetheart Creek. Increased use of Sweetheart Lake, however, is expected to be minimal given the steep terrain that limits access to the lake. Proposed enhancements to the salmon fishery could increase both human and bear use in the vicinity of Sweetheart Creek and lead to increased human-bear interactions. Construction activities may require the temporary restriction of recreation use in certain areas of the project site. Juneau Hydro proposes to implement a Recreational Management Plan that includes three program components: (1) Recreation Facility Improvement; (2) Recreation Facility Operation, Maintenance, and Monitoring; and (3) Recreation Resources Monitoring and Evaluation.

Recreational Management Plan

As part of its Recreation Facility Improvement Program, Juneau Hydro proposes the following facilities and measures for the project: (1) installing permanent display panels at the head of the Sweetheart Creek Trail to provide information about the project, bear safety measures, current Alaska DFG personal use fishery regulations, and trail identification maps; (2) constructing sloped, hardened trails to direct foot traffic away from bear-foraging areas along Sweetheart Creek and toward traditionally used fishing areas; (3) constructing a gated, one-lane road that would serve as a trail from the boat mooring site to the powerhouse (no public motorized vehicles would be permitted); (4) installing up to three mooring buoys in Gilbert Bay near the mouth of Sweetheart Creek; (5) allowing public access to the rock tailrace for fishing; and (6) allowing limited (no overnight), public use of the project dock and intertidal ramp on Gilbert Bay north of the mouth of Sweetheart Creek by personal use sockeye fishery permit holders during the fishing season.

As part of the Recreation Facility Operation, Maintenance, and Monitoring Program, Juneau Hydro proposes to operate and maintain the proposed recreation developments and have onsite caretakers to control access and monitor use. Under the Recreation Resources Monitoring and Evaluation Program, Juneau Hydro would collect and analyze recreation data to comply with the Commission's Form 80 requirement to report project recreation use and periodically inspect the recreation facilities. Every 20 years, Juneau Hydro would conduct a comprehensive review with the Forest Service and Alaska DFG to assess recreation use and needs at the project and seek agreement with the agencies regarding recreation-related modifications.

In its comments on the draft license application, Interior supports having a Recreation Management Plan for the project. Interior, however, recommends that Juneau Hydro review the recreation facilities 4 to 8 years after project completion and at 10-year

intervals thereafter to ensure that the new facilities are meeting recreational demand and are adequately designed and managed to meet their intended purpose.

Our Analysis

Juneau Hydro's Recreation Management Plan recognizes: (1) the need to accommodate visitor use to avoid resource impacts, (2) the potential for the project to increase conflicts between bears and humans, and (3) the need to anticipate increased visitor use levels.

Because visitors currently beach their boats and tie them to rocks or vegetation, providing mooring buoys and a dock for temporary use, as Juneau Hydro proposes, would make it more desirable for visitors to access the area. Consistent with Juneau Hydro's study findings, these facilities would enhance recreation opportunities in the area. Because these would be new recreational facilities in an area that currently has no formal recreational facilities, it is uncertain whether: (1) they would provide sufficient or excess capacity, (2) they are properly located, or (3) visitors would follow the rules for using the buoys and dock. Considering these uncertainties, Juneau Hydro's proposal to review the facilities in 20 years may delay needed adjustments to the facilities. Reviewing the adequacy of the facilities within 4 years of construction and every 10 years thereafter, as Interior recommends, would ensure visitor needs are met and visitor use is properly accommodated in a timely manner. Juneau Hydro's proposal to have an onsite caretaker would facilitate monitoring the use of the dock and mooring facilities.

It is difficult to speculate about future recreation needs and visitor use patterns in the context of dynamic federal and state regulations and land use plan guidelines and policies. Reviewing the project recreation use estimates and recreation improvement evaluations with agencies responsible for managing the land and associated resources (i.e., Forest Service, Park Service, and Alaska DFG), as Juneau Hydro proposes as part of its Recreation Management Plan, would allow an opportunity for adjusting the project recreation improvements to align with the existing regulations and policies that evolve during the license term.

The constructed rock tailrace would almost double the area available for fishing. Juneau Hydro's proposal to remove litter, provide trails to direct fishermen away from the areas bears prefer to use, and install interpretive signage to educate visitors about how and where to safely recreate in proximity to bears would reduce potential bear habituation and improve the appearance of the area for visitors.

The steep terrain, muddy conditions, and rapidly growing vegetation in the project area would create a need for frequent trail maintenance. Juneau Hydro's proposal to annually maintain the trails would ensure that these trails adequately accommodate recreational use and minimize the need for users to create alternative trails. Juneau Hydro's proposal to annually inspect the marine facilities would ensure they provide adequate recreational access to the area. The maintenance schedule provided in the

Recreation Management Plan specifies that Juneau Hydro would complete all maintenance by June or July, which should be adequate to ensure that facilities are ready in time for peak recreation use. Inspecting interpretive signs on a weekly basis during the summer and collecting litter in July and August, as Juneau Hydro proposes, would reduce the potential for interactions between bears and humans.

Finalizing the Recreation Management Plan in consultation with the Forest Service, Park Service, and Alaska DFG and filing the plan with the Commission would ensure agency recreational needs are addressed. Filing with the Commission, as-built drawings of all completed recreation measures, reports of all recreational monitoring, and documentation of agency consultation would ensure that all provisions in the Recreation Management Plan to protect and enhance recreation resources in the project area are adequately carried out.

Land Use

Construction Plan

The project may introduce infrastructure or cause activities that may not be consistent with applicable Forest Service LUDs and state of Alaska land use permitting requirements. Juneau Hydro's measures described in the Construction Plan include project design elements that are intended to make the project as compatible as possible with the existing LUDs, including selecting locations for project infrastructure such as the access road and maintenance housing that require the least amount of land disturbance; constructing a visual landform barrier to minimize visibility of project facilities; designing the power tunnel so that it can be used to convey equipment and materials for constructing the dam without the need to build new roads; routing and constructing overhead and buried segments of the transmission line to minimize visual impacts; and using appropriate construction materials to visually blend project facilities with the surrounding environment.

Forest Service 4(e) condition 22 specifies that Juneau Hydro: (1) consult with the Forest Service to finalize the Construction Management Plan; (2) obtain Forest Service approval of the plan; (3) file the plan with the Commission within 1 year of license issuance; and (4) upon Commission approval, implement the plan.

Interior recommends that during construction Juneau Hydro establish and maintain a web site to provide updates on project construction progress and any conditions recreationists may encounter that could affect their visit, identify a point of contact on the web site, and allow for public to submit comments on construction-related issues.

In its reply comments, Juneau Hydro agreed to finalize its construction plan in consultation with the Forest Service and to maintain a web site to provide the services described above.

Our Analysis

The project infrastructure located near the outlet of Sweetheart Creek is within a Semi-Remote Recreation LUD, which consists of landscapes characterized by unmodified, natural environments. Development consistent with this designation may include small-scale rustic recreation facilities and minimal or occasionally large facilities or structures, but they must appear rustic and be in harmony with the natural setting. The proposed infrastructure for this area would generally be within these parameters because the visual land barrier would limit the visibility of the powerhouse and switchyard and the proposed recreation facilities are the minimum necessary to support recreational access and use to the area, while retaining a rural character. Scenic integrity objectives identified in the Tongass National Forest Land and Resource Management Plan (Forest Service, 2008) for this LUD, however, would not be met because project infrastructure in this area would remain visually evident. We discuss this in further detail in our analysis of visual effects.

Constructing the proposed overhead transmission line on the west side of Gilbert Bay would be generally consistent with managing NFS lands within a Timber Production LUD because applicable guidelines allow for this type of use, although scenic integrity objectives would not be met. The project would reduce the acreage available for timber production by 70.07 acres because Juneau Hydro would manage vegetation growth within the corridor to limit its height to comply with transmission line right-of-way maintenance requirements.

The Old-Growth LUD applies to the land where the project transmission line corridor would join the Port Snettisham transmission line corridor. Because the connection would consist of buried infrastructure (a 400-foot-long transmission cable), a switchyard and one power pole located within the clearing limits of the existing Port Snettisham transmission line corridor, the interconnection would only involve land that is already modified and committed to transmission line corridor use. Accordingly, the proposed infrastructure would be similar in appearance and purpose to what is currently present in this area within the Old-Growth LUD, although scenic integrity objectives may not be met. No additional land beyond the existing transmission line corridor would be encumbered for constructing or maintaining the interconnection.

Finalizing the Construction Plan in consultation with the Forest Service before filing with the Commission for approval would ensure the plan contains sufficient detail about infrastructure design, siting, and construction to conform to Forest Service guidelines for the various LUDs affected by the project.

Project facilities, including submarine portions of the transmission line, dock, mooring buoys, and coastal access road, would be located on 131.18 acres of state of Alaska lands. Juneau Hydro consulted with the U.S. Coast Guard, NOAA, U.S. Navy, Federal Communications Commission, and local communications companies to confirm that the proposed location of the submarine transmission cable would not affect any existing or other proposed cable route. Juneau Hydro would obtain a Tidelands Lease

and Easement from Alaska DNR to construct, operate, and maintain these project facilities, which would provide Juneau Hydro with sufficient interest in these lands for licensing the project.

During the 2-year construction period, construction activities may be limited to March through October due to weather and snowfall. To ensure public safety during construction, Juneau Hydro would restrict public access to all active construction sites. Because visitors have to travel about 30 miles to this area by boat, it would be beneficial for visitors to know in advance about access restrictions and conditions that may affect their activities at Sweetheart Creek, so they could adjust their plans, if needed. Providing a public communication tool, such as a web site with site condition information and a point of contact, as suggested by Interior, would meet this need.

Access Management Plan

Juneau Hydro proposes to implement an Access Management Plan whereby the public would have non-motorized, non-commercial access to NFS lands near the project but would be restricted by gates and fences from entering areas near the powerhouse and switchyards. On Gilbert Bay, the dock would only be available for public use by personal use sockeye fishery permit holders during the fishing season. The access road would be gated to only allow pedestrian access. Juneau Hydro would maintain an onsite caretaker to monitor activities near the dock and install electronic surveillance devices at all major facilities. During construction, all active construction sites would be posted and public access would be prohibited.

Forest Service 4(e) condition 22 specifies that Juneau Hydro: (1) consult with the Forest Service to finalize the Access Management Plan; (2) obtain Forest Service approval of the plan; (3) file the plan with the Commission within 1 year of license issuance; and (4) upon Commission approval, implement the plan.

In its reply comments, Juneau Hydro agreed to finalize its access management plan in consultation with the Forest Service.

Our Analysis

Restricting public access and posting signs at locations with construction activity would appropriately provide for public safety. Similarly, because of hazards at and near the powerhouse and switchyard, constructing fences and posting signs at these locations would protect the public during the operation phase of the project. Providing an onsite caretaker would be beneficial in terms of having a point of contact for the project that would have external communication capability to respond and manage unplanned or emergency events involving public use near the project.

Restricting use of the boat dock and ramp to a specific group of recreationists (personal use sockeye fishery permit holders) would not be consistent with the Commission's policy to allow free public access to project lands and waters within safety constraints. Because there does not appear to be any safety issues related to accessing

these facilities, Commission staff sees no reason to exclude other recreationists from using them. Further, because the personal use fishery permit holders comprise the majority of recreational use in the area, allowing use by other recreationists is not likely to overburden these facilities. Finalizing the Access Management Plan in consultation with the Forest Service before filing with the Commission for approval would ensure the plan contains adequate measures to protect the public while accommodating all recreation activities near the project.

Fire Prevention Plan

Juneau Hydro proposes to implement a Fire Prevention Plan that describes fire prevention practices, reporting protocols that would be implemented during construction, and the prevention and suppression equipment that would be provided at the project. Measures include suspending spark-emitting equipment use during high fire danger periods; allowing smoking and campfires only at designated locations; obtaining written approval to burn slash or woody debris; prohibiting the burning of plastic, garbage, petroleum products and discarding matches and cigarettes; initiating fire suppression; and curtailing operation as may be required by the fire precaution class prevailing at the time.

Forest Service 4(e) condition 22 specifies that Juneau Hydro: (1) consult with the Forest Service to finalize the Fire Prevention Plan; (2) obtain Forest Service approval of the plan; (3) file the plan with the Commission within 1 year of license issuance; and (4) upon Commission approval, implement the plan.

Our Analysis

Because Juneau Hydro's Fire Prevention Plan contains typical BMPs to prevent and control wildfires, its implementation would reduce the potential for project-related wildfire. Avoiding wildfire would protect forest lands and resources. Finalizing the Fire Prevention Plan in consultation with the Forest Service before filing it with the Commission for approval would ensure that the plan is consistent with Forest Service management objectives and procedures.

Aesthetic Resources

Scenery Management and Monitoring Plan

To address visual effects from project construction, Juneau Hydro proposes to implement a Scenery Management and Monitoring Plan filed with its application. This plan describes measures designed to avoid or minimize visual effects including requirements to:

- vegetate rock fill slopes for the marine access facility, where possible;
- minimize the storage of materials and vehicles in the immediate vicinity of the marine access facility;

- store materials and other items where they would be screened from view from boat travel routes on Gilbert Bay;
- use building colors and materials that blend into the character landscape and avoid the use of metallic colored materials that tend to reflect sunlight and draw attention;
- construct the coastal access road from the dock to the powerhouse in the beach tidal zone to lower the road profile (with minimal tree removal) and bury the transmission line within the road to minimize aesthetic impacts; construct the coastal access road with reverse slopes to obscure the appearance from Gilbert Bay anchorage areas; and reduce the coastal access road to one lane after construction is complete;
- use rounded natural rock and stone along the coastal access road where fill would be exposed to Gilbert Bay on both NFS and state-managed lands;
- incorporate native vegetation along the water's edge on all fill slopes of the road to the greatest extent possible;
- use deep quality organic native soils and native plants for site revegetation;
- minimize exterior lighting and use "cutoff" style lighting that prevents light from appearing beyond the intended areas;
- excavate and, to the extent that it is feasible, construct the powerhouse in or partially bury the powerhouse in the excavated area and use reclaimed rock from the tunnel excavation to construct a visual barrier mound around the powerhouse switchyard area and tunnel to blend the structures with the surroundings;
- design the tailrace to blend with the existing habitat at Sweetheart Creek using as much existing vegetation as possible;
- construct a wildlife crossing arch over the upper portion of the tailrace in a manner that would reduce the visibility of the powerhouse and switchyard; and
- monitor, through photographic documentation, the continued success of scenery management mitigation over a 10-year period.

Forest Service 4(e) condition 22 specifies that Juneau Hydro: (1) consult with the Forest Service to finalize the Scenery Management and Monitoring Plan; (2) obtain Forest Service approval of the plan; (3) file the plan with the Commission within 1 year of license issuance; and (4) upon Commission approval, implement the plan.

Our Analysis

Implementing the Scenery Management and Monitoring Plan, as Juneau Hydro proposes, would minimize project effects on scenic resources. However, anticipating precisely how the modified landscape would appear after project construction is not possible, so it would be appropriate to monitor the visual appearance of project lands

during the term of the license. Although Juneau Hydro would annually provide photographs to the Forest Service to document the appearance of project lands, this monitoring approach would be most effective if permanent photo points and time of year for taking the photos were established in consultation with the Forest Service. Additionally, the Scenery Management and Monitoring Plan does not provide the opportunity for suggesting treatments to address unanticipated circumstances that prevent achieving the desired scenic integrity objectives (e.g., vegetative screening effectiveness). Including this approach in the plan would address issues related to visual resources that may evolve during the license term.

Finalizing the Scenery Management and Monitoring Plan in consultation with the Forest Service before filing it with the Commission for approval would ensure that monitoring locations and time of year are agreed upon with the Forest Service. Consulting with the Forest Service to finalize the plan is consistent with Tongass National Forest Land and Resource Management Plan direction to involve Forest Service staff as project design work evolves to ensure the plan contains adequate measures to protect scenic resources and achieve consistency with applicable scenery integrity objectives.

Visual Effects

Project construction and operation would modify the visual landscape. Juneau Hydro would reduce the flow in Sweetheart Creek, raise the maximum level of Sweetheart Lake, and construct features on an undeveloped landscape, including a transmission line, switchyards, powerhouse, penstock, coastal access road, dock, buoys, trails, signs and fences, spoil piles, and a caretaker's facility. Most of this infrastructure would be located near the mouth of Sweetheart Creek, but the transmission line would extend for about 2 miles along the west shoreline of Gilbert Bay. To minimize visual impacts, Juneau Hydro proposes to construct a landform barrier around the powerhouse and switchyard to hide the facilities from view, route and construct overhead and buried portions of transmission line so these facilities are less visible, and use appropriate construction materials and vegetation removal and re-planting measures to visually blend project facilities with the surrounding environment.

Our Analysis

Increased Sweetheart Lake levels and project-related fluctuations would go unnoticed because steep topography and dense vegetation are barriers to recreational access, and the lake is not visible, except by air. The infrastructure and landscape modification near the mouth of Sweetheart Creek at Gilbert Bay and the overhead transmission line on the west shoreline of Gilbert Bay would introduce most of the visual changes associated with the project. Juneau Hydro used photo simulations of project infrastructure to analyze the proposed project's visual effects. Each simulation was compared with scenic integrity objectives identified for the relevant LUD in the Tongass

National Forest Land and Resource Management Plan (Forest Service, 2008) to ensure compatibility. Applicable descriptions of the scenic integrity objectives include:

- *High*—Modifications must not be evident to the casual observer;
- *Moderate*—Modifications must be subordinate to the characteristic landscape;
- *Low*—Modifications may visually dominate the characteristic landscape but must have visual characteristics similar to those of natural occurrences within the surrounding area or characteristic landscape; and
- *Very low*—Modifications may dominate the landscape.

To be consistent with these objectives, the project must meet the applicable objective within 1 year at the foreground distance zone (visible area within a half-mile of a visual primary route) and within 5 years in the middleground zone (visible area between foreground and background of a visual primary route) or background zone (visible area greater than 5 miles and less than 15 miles from a visual primary route). The objectives provide for considering exceptions on a case-by-case basis for small areas of nonconforming developments within Old-Growth and Semi-Remote Recreation LUDs.

East Side of Gilbert Bay—The proposed penstock, powerhouse, switchyard, coastal road, utility corridor, marine access facility, storage yard, maintenance facility, and caretaker's facility, would be constructed within a Semi-Remote Recreation LUD. Even with Juneau Hydro's measures to screen and blend the facilities' appearance, the development would exceed the visual modification associated with its designated moderate objective. Accordingly, constructing these features, as proposed, would not meet the Tongass National Forest Land and Resource Management Plan objectives.

West Side of Gilbert Bay and South Side of Port Snettisham—The proposed submarine and overhead transmission line and transition facility would be constructed within a Timber Production LUD. The landscape would appear modified and the transmission towers, conduit and cleared right-of-way corridor would dominate the landscape. Although maintaining a low cover of vegetation in the transmission line corridor would borrow a visual element of vegetation from the surrounding landscape and lessen the degree of modification, the corridor would still have a linear appearance that would not repeat an existing pattern or texture in the landscape when viewed from the middle ground. Consequently, constructing the overhead transmission line and transition facility, as proposed, would not meet the Tongass National Forest Land and Resource Management Plan objectives.

North Side of Port Snettisham—The submarine transmission line would emerge on the north side of Port Snettisham and interconnect to the existing Port Snettisham transmission line, which has an Old-Growth LUD. Although Juneau Hydro would minimize the appearance of these facilities by burying the line as it emerges from the water, above-ground modifications would be evident and would not meet the applicable high scenic integrity objective in the Tongass National Forest Land and Resource

Management Plan. Staff agrees with Juneau Hydro's assertion that it is unlikely that any scenery protection measures would sufficiently reduce the visual impacts on the east side of Gilbert Bay to meet the moderate scenic integrity objective within the 1-year period or be subordinate to the characteristic landscape. Similarly, the project transmission line would not meet the high scenic integrity objective within the Old-Growth Habitat LUD within a 6-month period.

Even if project lands receive a Transmission and Utility System LUD, the project would still not meet all scenic integrity objectives for the east and west sides of Gilbert Bay or the south side of Port Snettisham for this designation. Although staff agrees that all visual effects cannot be avoided and the management objectives may not be achieved, implementing the measures described in the Scenery Management and Monitoring Plan would minimize project affects to the landscape to the greatest extent practicable.

Spoil Disposal Plan

The Spoil Disposal Plan (see section 3.3.1, *Geologic and Soil Resources*) identifies temporary and permanent disposal sites for the project. Spoil consisting of soil that remains after construction would be placed at the caretaker's facility or visual landform barrier; small amounts may be placed adjacent to the coastal access road. This material would be contoured to the existing terrain and revegetated. Rock-based spoil would be placed in the dam construction staging areas or the visual landform barrier adjacent to the powerhouse. This material would be contoured to the existing terrain.

Forest Service 4(e) condition 22 specifies that Juneau Hydro: (1) consult with the Forest Service to finalize the Spoil Disposal Plan; (2) obtain Forest Service approval of the Spoil Disposal Plan; (3) file the Spoil Disposal Plan with the Commission within 1 year of license issuance; and (4) upon Commission approval, implement the Spoil Disposal Plan.

Our Analysis

Several components of Juneau Hydro's project would make use of spoil generated from the tunnel, powerhouse, and dam excavation. Juneau Hydro does not anticipate the project would create conspicuous, unused piles of spoil material because constructing the visual landform barrier, coastal access road, and dock would consume much of that material. Some of the spoil material would also be used for the wildlife overpass and to armor the tailrace channel. Proposed treatments such as contouring and revegetation would reproduce colors, textures, and landforms similar to what currently exists. Although the spoil material used for construction may be visible from Gilbert Bay immediately after project construction, its appearance would diminish over time as the surfaces revegetate and rocks weather.

The Spoil Disposal Plan includes testing spoil and provides a contingency for treating certain acid-generating spoil material. Because the material may require separate disposal treatment, it would not be used as intended (e.g., coastal access road construction) and additional location(s) may be necessary for its disposal. If this occurs,

and because the amount of material and its disposal location is not known at this time, it is uncertain if or how these areas would appear on the landscape.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the NHPA requires the Commission to evaluate potential effects on properties listed or eligible for listing in the National Register prior to an undertaking. An undertaking means a project, activity, or program funded in whole, or in part, under the direct or indirect jurisdiction of a federal agency, including, among other things, processes requiring a federal permit, license, or approval. In this case, the undertaking is the issuance of an original license for the project. Potential effects associated with these undertakings include project-related effects associated with the day-to-day operation and maintenance of the project.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. Traditional cultural properties are a type of historic property eligible for the National Register because of their association with cultural practices or beliefs of a living community that: (1) are rooted in that community's history or (2) are important in maintaining the continuing cultural identity of the community. In this EIS, we also use the term cultural resources to include properties that have not been evaluated for eligibility for listing in the National Register. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register.

Section 106 also requires that the Commission seek concurrence with the SHPO on any finding involving effects or no effects on historic properties, and allow the Advisory Council on Historic Preservation an opportunity to comment on any finding of effects on historic properties. If Native American properties have been identified, section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

On August 13, 2010, Juneau Hydro requested that the Commission grant it the authority to initiate section 106 consultation with interested parties. On August 24, 2010, the Commission designated Juneau Hydro as the Commission's nonfederal representative for carrying out day-to-day consultation in regards to the above licensing efforts pursuant to section 106 of the NHPA; however, the Commission remains ultimately responsible for all findings and determinations regarding the effects of the project on any historic property, pursuant to section 106.

Area of Potential Effect

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by the issuance of a proposed license within a project's Area of Potential Effect (APE). According to the Advisory Council on Historic

Preservation's regulations, the APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist" (36 CFR, Part 800.16[3]).

The APE encompasses the proposed project boundary and the likely extent of project operation and project-related environmental measures that could be undertaken during the term of any license that may be issued for the proposed project. For this undertaking, Juneau Hydro defined the APE as including Sweetheart Lake and that portion of its shoreline that would be inundated, the dam site near the outlet of the lake, the tunnel portion on its shoreline that would be inundated, the dam site near the outlet of the lake, the tunnel portal near the lake, the staging area near the lake tunnel entrance, the tunnel portal near the mouth of Sweetheart Creek, the proposed site for the powerhouse near the mouth of Sweetheart Creek, the two alternative routes for the access road on the east side of Gilbert Bay, the proposed dock location, the intertidal areas on both sides of Gilbert Bay where the submarine transmission line would enter the water, the route of the overhead transmission line on the west side of Gilbert Bay, and the intertidal areas in Port Snettisham near Sentinel Point and Mist Island where the submarine transmission line would enter the water (Pipkin, 2013). By letter dated May 17, 2013, the Alaska SHPO concurred with this definition of the APE (letter from J.E. Bittner, State Historic Preservation Officer, Alaska DNR, Anchorage, AK, to M. Pipkin, Walking Dog Archaeology, Anchorage, AK, filed May 24, 2013).

Cultural History Overview

The background information provided below is adapted from Juneau Hydro's 2012 cultural resources report (Pipkin, 2012).

Until approximately 12,000 years ago much of Southeast Alaska was glaciated and not inhabitable. The earliest documented archaeological site in the region dates to approximately 10,000 years ago. While little is known of the cultural traditions of this time, small microblades are commonly found in early artifact assemblages. This microblade culture was followed by a 4,000-year transitional phase documented by changes in technology and an increasing emphasis on ground stone tools and a greater reliance on maritime and river resources. This phase ultimately led to the more traditional Northwest coast cultural patterns. Winter villages included large structures associated with ethnographic Tlingit and Haida populations. Today, the project area lies within the traditional territory of the Taku Tribe, Tlingit who are represented primarily by the DIA. Current tribes and tribal organizations with interests in the project area include the DIA, Central Council Tlingit and Haida Indian Tribes of Alaska, Goldbelt Incorporated, Sealaska Corporation, and the Alaska Native Brotherhood Camp #70 Glacier Valley.

While Spanish exploration of Southeast Alaska began in 1584 and 1587, the first known European contact with native populations occurred in 1741 when Russian sailors reached the area. Spanish explorers reached Prince of Wales Island in 1774. Subsequent

visits by the French, English, Russians, and Americans led to the establishment of a trade economy with the Tlingit and Haida, with fur being an important commodity. In the 1930s, the Hudson Bay Company and the Russian-American Company established several large trading posts in the region. These economic pursuits resulted in tenuous relations and disputes with native populations. European contact also resulted in the introduction of European disease, including smallpox, which had devastating effects.

In the middle 1880s, the discovery of gold in the northwest led to an increase in prospectors entering the region and to the establishment of numerous mining claims. Placer mining was the initial focus, but was followed by the mining of gold found in quartz veins. By the end of the nineteenth century, numerous stamp mills had been constructed to process the ore.

It is believed that Frank Cook, who had staked gold claims in the vicinity of Sweetheart Falls, was the first to recognize the potential of the Sweetheart Creek area for power generation. In 1915, USGS established a gaging station at Sweetheart Falls and began compiling flow data. In 1921, plans were developed to construct a dam but those plans were subsequently dropped. In 1950, the Federal Power Commission issued a report that suggested a need for hydroelectric power in the region. The Flood Control Act of 1962 authorized the Snettisham Hydroelectric Facility to use water obtained from Long and Crater Lakes. The first phase of the project was completed in 1973 and the second phase in 1990.

Prehistoric and Historic Archaeological Resources

Juneau Hydro completed a cultural resources study to identify historic properties within the APE that could be adversely affected by project operation and activities. The results of the study are presented in *2012 Cultural Resource Investigations for the Sweetheart Lake Hydroelectric Project* (Pipkin, 2012).

Background archival research conducted prior to fieldwork indicated that the only archeological surveys in the vicinity of the project were cursory inspections undertaken at Gilbert Bay. Only a few known sites had been previously documented near the project. Additionally, ethnographic literature examined during this research also revealed very little information about indigenous use of the area. However, research indicated that the APE contains the potential for mining related sites, including test holes, spoil piles, tailing piles, adits, shafts, water collection features, and other features.

Archaeological field surveys consisted of surveying the portion of Sweetheart Lake's shoreline that would be flooded when the proposed project is constructed, including the dam, dam site, locations of the power generation facility and associated features, corridor for the overhead transmission line route, and submarine transmission cable route. Most of the project tunnel and the submarine transmission cable were excluded from the study because other than the tunnel's outlet adjacent to the power generation facility, no surface ground-disturbing activity would occur as the result of the construction of these components of the project. Additional information regarding the

methodology and intensity of cultural resources surveys conducted at the proposed project is provided in a report filed March 13, 2014 (Pipkin, 2014). This report states that lands in the vicinity of the Marine Transition Station located on the north shore of Port Snettisham were visited and that the cleared easement for the existing transmission line extends almost to the shoreline in this area (Pipkin, 2014). The area was described as being rugged and steep just beyond the beach, heavily overgrown with brush, and covered with slash debris; the shoreline was reported to be rocky and not easily accessible.

Archival research and field investigation identified six sites in the vicinity of the project. Three of these sites are the remains of the Friday and Crystal Mines and the community of Snettisham. However, these three sites are located well outside the project APE. Within the APE, one site is a prehistoric fish trap and two sites date to the historic period. Table 3-19 provides a summary of all prehistoric and historic resources identified within the project APE.

Table 3-19. Archaeological and historic resources within or adjacent to the Sweetheart Project Area of Potential Effect (Source: Juneau Hydro, 2014a).

Resource Number	Description	National Register Eligibility
SUM-098	Sweetheart Creek Cabin	Not eligible
SUM-118	Sweetheart Creek Stone Fish Trap	Eligible
SUM-121	Frank Cook Cabin	Not eligible

In its March 28 letter, the Alaska SHPO refers to January 22, 2013, correspondence in which it determined that the two historic period sites were not eligible for listing on the National Register. However, the prehistoric fish trap was determined to be eligible for listing under Criterion D for its potential to contribute to the understanding of the prehistory of Southeast Alaska.

Traditional Cultural Properties

In 2010, Commission staff consulted with the tribes and tribal corporations, including the DIA, Central Council Tlingit and Haida Indian Tribes of Alaska, Goldbelt Incorporated and Sealaska Corporation, to determine whether the tribes wanted to participate in the licensing process for the proposed project. Juneau Hydro also consulted with the DIA regarding cultural resources. No tribes have reported any known traditional cultural properties within the proposed project's APE.

On December 3, 2012, the Alaska Native Brotherhood Camp #70 Glacier Valley filed a resolution in support of the proposed project.

3.3.6.2 Environmental Effects

The construction, operation, and maintenance of the proposed project has the potential to affect cultural resources. The only identified property within the project APE that is eligible for listing on the National Register is the prehistoric stone fish trap (SUM-118). However, this feature is not located in an area that would be affected by project construction. In its cultural resources report (Pipkin, 2012), Juneau Hydro concluded the project would not affect this site. By letter dated November 9, 2012, the Forest Service concurred with this conclusion, agreed that the site could be avoided, and concluded that the proposed project would not affect historic properties. However, the Forest Service also recommended that Juneau Hydro conduct an intensive archaeological survey of the lower access route (coastal road alternative) if that alternative was ultimately selected for construction.

Forest Service 4(e) condition 22 would require Juneau Hydro, within 1 year of license issuance, to file a heritage resource protection plan prepared in consultation with the Forest Service and applicable federal and state agencies.

On March 28, 2014, the Alaska SHPO determined that the proposed project would not affect historic properties but supported the Forest Service's stipulation that Juneau Hydro develop a heritage resource protection plan. The Alaska SHPO also recommended that Juneau Hydro consider archaeological monitoring for certain ground-disturbing activities.

Juneau Hydro prepared a draft Heritage Resource Protection Plan and filed it with its license application on May 29, 2014 (Juneau Hydro, 2014c). The plan includes provisions to ensure the protection of archeological resources should they be discovered during the license term.

Our Analysis

Because only one property eligible for listing on the National Register has been identified in the area and this site can be avoided during project construction, project construction, operation, and maintenance would not affect historic properties. Therefore, a Historic Properties Management Plan for the proposed Sweetheart Lake Project and the drafting of a programmatic agreement to resolve adverse effects on historic properties would not be necessary.

However, unknown sites may be uncovered during project construction and maintenance activities. Developing procedures to address any newly discovered structures would protect their cultural value and ensure compliance with section 106. Juneau Hydro's Heritage Resource Protection Plan includes the necessary procedures to comply with section 106 requirements, including ceasing all land-clearing, land-disturbing, and spoil-producing activities in the vicinity of any discovery; immediately notifying the Forest Service archeologist, SHPO, and the DIA; following appropriate procedures to safeguard the discovery; developing a Memorandum of Understanding with the interested parties to mitigate any adverse effects; and if appropriate, developing a

Cultural Resource Management Plan in conjunction with the Forest Service and DIA and submitting it for SHPO concurrence. The Memorandum of Understanding, and if required, the Cultural Resource Management Plan, would include (1) procedures to document and evaluate each site for National Register eligibility, (2) a description of potential impacts on each site and proposed mitigation measures, (3) a schedule for mitigating effects and conducting additional studies as needed, and (4) documentation of consultation with the interested parties. The Heritage Resource Protection Plan also includes provisions to follow protocols required by the Native American Graves Protection and Repatriation Act of 1990 and the State of Alaska should human remains be discovered.

In its comments on the draft EIS, the Forest Service stated that it is important for project personnel and the ECM to be able to recognize cultural materials and know the proper procedures to follow if such materials or human remains are identified during construction activities. Section 4.4 of the Heritage Resources Protection Plan states that a worker education-orientation program would be implemented to train workers about their responsibilities regarding cultural resources and in the identification of cultural materials. Ensuring that an ECM is also trained would provide another level of protection. The plan also states that all workers would receive a briefing on Heritage Resources, detailing the consequences of non-compliance with these requirements. The Heritage Resources Protection Plan does not contain specific details about these training programs. Providing these details would improve plan implementation.

The Forest Service and the Alaska SHPO also commented that an archaeological monitor should be present during initial ground-disturbing activities in areas that are highly sensitive for the presence of archaeological materials. The Heritage Resources Protection Plan does not currently contain a requirement for archaeological monitoring, but Juneau Hydro proposes to define those areas in consultation with the SHPO and Forest Service. Employing an onsite archeological monitor during initial ground-disturbing activities in areas likely to have undiscovered archeological resources would ensure that cultural resources are adequately protected.

The provisions in Juneau Hydro's proposed Heritage Resource Protection Plan, filed in May 2014, would ensure the protection of any cultural resources discovered over the term of the license.

3.3.7 Socioeconomics

3.3.7.1 Affected Environment

The proposed project is located on Gilbert Bay and Sweetheart Lake, located at the head of Port Snettisham, a narrow fjord about 30 miles southeast of Juneau, Alaska. Gilbert Bay is undeveloped and has mountains rising steeply from the water's edge. Port Snettisham is a protected deep-water bay that has some development, including infrastructure to transport mineral deposits found in the area, the Snettisham Hydroelectric Facility, and a state-run fish hatchery.

While the proposed project would be located on undeveloped federal and state land in a rural area about 30 miles from the nearest city, the area is within the political boundary of the City and Borough of Juneau, Alaska. We use Juneau for our socioeconomic analysis because it is the area most likely to be influenced by project-induced social and economic effects.

Population and Households

Table 3-20 provides an overview of current population, household size, and household numbers, as well as population trends for Juneau derived from the U.S. Census Bureau (2000, 2010, and 2013). Juneau's population increased by about 6 percent between 2000 and 2013. It is the second largest city in Alaska after Anchorage, which is located about 800 miles north by ferry and car.

Table 3-20. Selected social and economic indicators for the City and Borough of Juneau Alaska (Source: U.S. Census Bureau, 2000, 2010, and 2013).

Geography	Population (2000)	Population (2010)[a]	Population (2013)[a]	Average Household Size (2013)[a]	Number of Households (2013)[a]
Study area	30,711	31,275	32,600	2.6	11,543
State of Alaska	626,932	710,239	736,732	2.74	221,600

[a] Statistics for the years 2010 and 2013 are 5-year annual average statistics. Annual dates are reported in the columns above for the last year in the 5-year series (e.g., 2010 is the 2006–2010 American Community Survey 5-year average, and 2013 is the 2009–2013 American Community Survey 5-year average).

Employment and Income

Employment in the area encompassing Juneau consists primarily of government services (table 3-21). Juneau is the capital of Alaska, and the primary employer in Juneau, by a large margin, is government, including federal, state, and municipal government (which includes the local airport, hospital, harbors, and school district), as well as the University of Alaska. State government alone makes up approximately one-quarter of Juneau's employment. Other important employers include trade and transportation; tourism, particularly cruise ships; and fishing. A total of 15,765 persons were employed in Juneau in 2013.

Table 3-21. Employment by industry, 2013, Juneau City and Borough (Source: Bureau of Economic Analysis, 2013).

Employment	Number of Workers	Percent of Total Employed
State government	4,009	25.4
Trade, transportation and utilities	2,961	18.8
Local government	2,270	14.4
Educational and health services	1,570	10.0
Leisure and hospitality	1,282	8.1
Professional and business services	850	5.4
Construction	803	5.1
Financial activities	559	3.5
Other	538	3.4
Natural resources and mining	401	2.5
Manufacturing	260	1.6
Information	255	1.6
Unknown	7	0.0
Total	15,765	100

The unemployment rate in Juneau has generally been low and steady as compared to Alaska and the United States, ranging from a low of 4.3 percent in 2007 to a high of 5.9 percent in 2011 as a result of the recent national economic downturn. These rates are in contrast to state and national unemployment rates that exceeded 8 percent over the same period (figure 3-14).

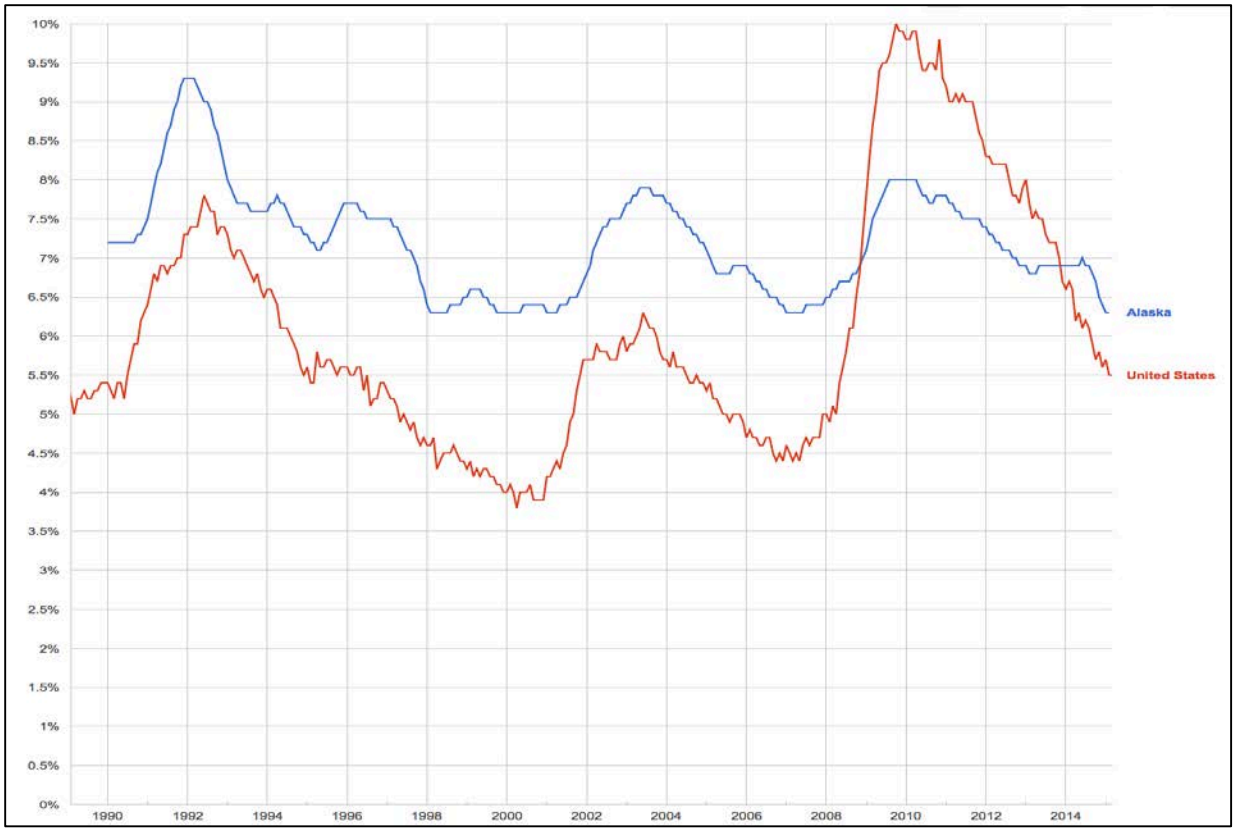

Figure 3-14. Seasonally adjusted unemployment rate in Alaska and the United States (Source: Bureau of Economic Analysis, 2013).

Median household income increased by about 13 percent in Juneau between 2000 and 2013. In addition, the median household income was consistently higher than the median household income reported for Alaska (table 3-22).

Table 3-22. Median household income for the study area in 2000, 2010, and 2013, with percent change (Source: U.S. Census Bureau, 2000, 2010, and 2013).

Geography	2000[a]	2010[a]	2013[a]	Percent Change (2000–2013)
Juneau	$62,034	$75,517	$81,490	31%
State of Alaska	$51,571	$66,521	$70,760	37%

[a] All dollars are inflation adjusted, 2013 dollars.

Fishing

Most of the population, economic activity, and development in the City and Borough of Juneau is located in the City of Juneau. Very little development occurs in the Borough of Juneau, a large area that surrounds the city, although there are mines,

hydropower developments, timber operations and other natural resource extraction businesses, as well as a few small towns. The project area is very rural, located about 30 miles from the city on the southern boundary of the borough. Fishing is the primary economic activity that occurs in the immediate project area. Alaska State law recognizes four categories of fishing: commercial, sport, personal use, and subsistence.

Commercial Fishing

Commercial fishing is the taking of fish "with the intent of disposing of them for profit, or by sale, barter, trade, or in commercial channels" (Alaska Statute Title 16, *Fish and Game*). Juneau Hydro reports that Port Snettisham and Gilbert Bay have productive commercial fisheries that include halibut, shrimp, and Dungeness, snow, and king crab. Much of the commercial fishing data from the Port Snettisham area are protected from publication under state law. Juneau Hydro was able to report the average commercial catch for a few species in the immediate area of the project (table 3-23).

The average annual commercial halibut catch ranges from 10,000 net pounds[62] to 140,000 net pounds in an area that includes but is much larger than Port Snettisham and Gilbert Bay. Consequently, the halibut catch near the proposed project would be a smaller portion of the total catch for the area. Additionally, according to interviews with local fishermen, Juneau Hydro learned that few commercial fishermen target halibut in Port Snettisham or Gilbert Bay because the Speel Arm, immediately north of Gilbert Bay, is more productive and economical to fish. From these interviews, Juneau Hydro also learned that Port Snettisham may be a poor location to fish for halibut because of sand fleas, a parasitic crustacean, that live in the reach and are known parasites on halibut and other fish.

Table 3-23. Commercial fishery average annual catch for 2000–2013 (Source: Juneau Hydro, 2014b).

	Port Snettisham	**Gilbert Bay**
Species	**(pounds)**	
Dungeness crab	2,300	6,000
Tanner crab	8,400	21,200
King crab	NA	2,100
Shrimp (trawler)	6,000	24,300

[62] Net weight is measured with the fish head off and a deduction for ice and slime.

Sport Fishing

Sport fishing is defined as the taking "for personal use, and not for sale or barter, any fresh water, marine, or anadromous fish by hook and line held in the hand, or by hook and line with the line attached to a pole or rod, which is held in the hand or closely attended, or by other means defined by the Board of Fisheries" (Alaska Statute Title 16, *Fish and Game*). Alaska DFG surveys registered sport fishermen and estimates the total catch and effort by species based on the number of sport fishing permits issued for the region. Table 3-24 summarizes Alaska DFG estimates in the Angoon and Fredrick Sound areas, both of which are south of the project area. These two sub-districts account for about 29 percent of the total salt-water sport fishing catch within the Juneau management area for 2013.

Table 3-24. Estimated sport fishing catch and effort (Source: Alaska DFG, 2015c).

Survey Item	**Angoon Area**	**Frederick Sound**
Number of anglers	1,266	1,259
Number of days	4,656	4,532
Sea-run Chinook salmon	340	108
Sea-run coho salmon	7,052	2,314
Sockeye salmon	85	--
Pink salmon	2,157	1,879
Chum salmon	1,019	254
Dolly Varden	--	--
Halibut	3,578	3,372
Lingcod	163	160
Black cod	667	--
Rock fish	2,479	4,695
Other	501	18

Personal Use and Subsistence Fishing

Alaska has a long history of subsistence and personal use fishing that is an important element of Alaska's social and cultural heritage and a component of the subsistence sector of the state's economy (Alaska DFG, 2013). Alaska State law defines subsistence fishing as the taking of fish, shellfish, or other fishery resources by Alaska residents for "noncommercial, customary and traditional uses" for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the

making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; and for the customary trade, barter, or sharing for personal or family consumption (Alaska DFG, 2015d). Subsistence fishing is permitted by the state and allowed in designated areas.

Personal use fishing is defined as the taking of fish "by Alaska residents for personal use and not for sale or barter, with gill or dip net, seine, fish wheel, long line, or other means defined by the Board of Fisheries" (Alaska Statute Title 16, *Fish and Game*). Personal use fishing differs from subsistence fishing in that it does not meet the criteria for "customary and traditional" uses. It also provides opportunities to use efficient fishing methods, such as nets and traps, in areas closed to subsistence fishing.

Personal use fisheries in the Juneau Management Area include Sweetheart Creek between Gilbert Bay and the lower falls. In 2011, Alaska DFG issued 456 permits in the Juneau Management Area with an estimated harvest of 8,267 fish. Sockeye salmon harvests constituted 75 percent of the total harvest (Alaska DFG, 2013). Juneau Hydro estimates that greater than 90 percent of visitors to the project are personal use fishermen, primarily for salmon fishing in Sweetheart Creek. Personal use fishing permits at Sweetheart Creek are highly variable, ranging from a low of 48 to a high of 339 between 1993 and 2013 with no obvious annual trends. Although there are no specific estimates of catch rates for personal use fishing at Sweetheart Creek, the number of permits issued represents a medium to larger percentage of the total permits issued for the Juneau Management Area.

Some guiding and outfitting does occur in the project area, but Juneau Hydro found through its survey that a very small group of outfitters and guides bring the clients to Gilbert Bay and Sweetheart Lake.

Subsistence Hunting and Gathering

Subsistence hunting is a year-round activity that occurs throughout Alaska. It is considered to be central to the economies, customs, and traditions of many families and cultural groups in Alaska, providing nutrition, food security, and economic stability (Alaska DFG, 2015d). Depending on the community and area, Alaska's subsistence hunters target moose, caribou, deer, bear, sheep, mountain goat, beaver, seals, sea lion, walrus, and whale. Alaska DFG manages subsistence hunting under the same regulations as general season hunting, which requires a permit drawing, a hunting license, and harvest tag.

Alaska Native Tribes, including Tlingit from the Angoon area, have traditionally used most of the west coast of Admiralty Island, from Hawk Inlet to the southern tip of Admiralty Island, and land and waters near the project area for fishing, hunting and gathering (Alaska DFG, 2013). Following federal and state guidance for evaluating subsistence hunting opportunities in the project area, Juneau Hydro identified Sitka black tail deer as an indicator of potential subsistence resources. Juneau Hydro identified the presence of Sitka black-tailed deer in field studies near Gilbert Bay and noted that habitat

suitable for deer is present throughout the project area. Hunting pressure for deer in the project area is very low. Based on state records, Juneau Hydro identified only one Sitka black-tailed deer harvested from the project area between the 1999 and 2008.

Energy Usage and Demand in Juneau

Despite being connected to the mainland, Juneau operates like an island economy. The only access for goods arriving and leaving the city is by boat or air, and many goods arriving into Juneau and the surrounding community originate from Vancouver, British Columbia, and Seattle, Washington. Goods arriving at Juneau include fossil fuels, such as gas, diesel, fuel oil for heating and other commercial uses. Juneau Hydro estimates that 80 percent of energy consumed in Juneau is imported fuel oil for heating and shipping.

Most residential electricity used in Juneau is from hydropower, such as the Port Snettisham Hydroelectric Facility near Sweetheart Lake. In contrast, most residential heating is from fuel oil. For new construction, electricity and fuel oil are substitutes for one another and Juneau Hydro reports that most new home construction uses electricity for heating rather than fuel oil.

Juneau is growing and the demand for electricity over fuel oil and other fossil fuels appears to be growing as well. During hearings for a recent proposed expansion of the commercial docks in Juneau, representatives from AEL&P testified that it could not supply electricity for even one of the two docks. As a result of the constraints on the electrical system, businesses with large electricity demands tend to develop micro grids with fuel oil generators to meet base loads.

3.3.7.2 Environmental Effects

Project Construction and Operation

Juneau Hydro estimates that construction of the hydro project and transmission line would take about 2 years. During the summer months, the construction crew would average 50 to 60 people and Juneau Hydro estimates that monthly payroll would be approximately $972,000. Weather and difficult access would limit the size of the construction crew to about 25 to 30 people from November through March, and the monthly payroll during this period would be approximately $486,000. Juneau Hydro estimates that an additional 10 to 20 part-time jobs would be created for local residents who would provide transportation and support services during construction.

Based on Juneau Hydro's experience with other hydroelectric projects, it determined that local contractors and organized labor from Juneau would supply the majority of the skilled labor required for the project. A small number of specialized workers (2 to 3 per day) would be brought in for short duration and specialized tasks.

Because of the remote location and weather conditions, Juneau Hydro expects that most of the construction personnel would live onsite for extended periods of 3 to 4 weeks

and then return to their homes in Juneau for breaks. It is expected that a few (4 to 6 persons) of key managerial or engineering/technical personnel from contractors may relocate temporarily to Juneau for the duration of the project. Once operating, the project would employ two full-time people.

Juneau Hydro estimates that the capital costs for the project would be about $170 million expended over about 2 years. Annual operating costs would be about $2.1 million, including operation and maintenance costs that would include labor, management, and travel to and from site, Commission and Forest Service fees, expected line losses, estimated wheeling fees, insurance, administration, plant betterment, and miscellaneous expenses.

The net average annual energy generation for the 19.8-MW project would be about 116,000 MWh (or 116,000,000 kilowatt-hours). Juneau Hydro estimates that the first year cost of energy would be about 10 cents per kilowatt-hours.

Our Analysis

Juneau Hydro estimates that wages paid during construction could reach as high as $60 million. Most of the project-induced employment during construction would benefit individuals residing within the City and Borough of Juneau, resulting in short-term benefits to the local economy.

The population of Juneau is growing, and the economy is continuing to diversify. Juneau has a housing shortage partly because of the lack of land. Because workforce requirements for the project would be relatively modest and because most of the workers would be temporarily housed at the construction site and return to their primary residence in Juneau, the project would not generate major population growth associated with the in-migration of construction-phase workers. As a result, the project would not generate substantive increases in demand for local housing, strains on public services, or social disruption effects commonly observed in other settings where larger scale resource development projects have occurred.

The remote location of the project area precludes the potential that residents would be disturbed by construction-phase noise, dust, or vehicle traffic. However, construction may interfere with other activities in Gilbert Bay, such as personal use and commercial fishing, discussed below.

Current boat and plane travel infrastructure based in Juneau is adequate to accommodate project-related transportation without substantial expansion of these businesses. Likewise, existing Juneau businesses that provide supplies, such as food and personal equipment, can also support the increased demand during construction. Project-related spending on supplies and transportation by Juneau Hydro or construction workers in the project area would result in a short-term, beneficial effect on local tax revenues, income, and employment.

Buying supplies and paying staff salaries would result in minor, long-term, beneficial effects on local income, sales, employment, and tax revenues in the project area.

Because the long-term increase in total employment would be relatively small, no long-term effects would occur to population, housing, infrastructure, or government services as a result of operating the proposed project.

The primary purpose of the project is to generate affordable, clean, reliable electricity for Juneau. Juneau's reliance on fossil fuels for energy and heating creates a public risk that costs for energy could increase over time. The proposed project would generate electricity at levelized costs that are projected to be below electricity and heat produced by fossil fuel, and would appear to support population growth and demand for electricity in Juneau. While the project would not solve all of the future needs for electricity, it would be an important element in providing affordable and stable base load energy for the community.

The project would connect to the Port Snettisham transmission line west of the known avalanche chute that has disrupted Juneau's power supply from the Snettisham Hydropower Facility twice in the last decade. The addition of Sweetheart Lake to the portfolio of energy resources for Juneau would add to energy security and provide additional electrical reliability for Juneau ratepayers and capital city governmental operation.

Fishing and Subsistence Uses

Under existing conditions, Douglas Island Pink and Chum, Inc., stocks Sweetheart Lake with up to 500,000 sockeye salmon fry annually. Presently, between 20,000 to 60,000 sockeye smolt reach Gilbert Bay with about 1,000 to 5,000 returning adults being harvested each year in Sweetheart Creek. Construction of the proposed project would block outmigration of sockeye salmon and eliminate the sockeye fishery in Sweetheart Creek. To maintain the existing sockeye salmon fishery in Sweetheart Creek, Juneau Hydro proposes to construct a smolt collection and transport system that would be seasonally operated in Sweetheart Lake to collect out-migrating sockeye salmon smolts. Smolts would be collected and prepared for helicopter transport from Sweetheart Lake and delivered to a smolt re-entry pool located at the powerhouse. Following a monitoring period, the sockeye salmon smolts would be released to the anadromous reach of Sweetheart Creek to continue their migration to Gilbert Bay.

The proposed project would include an 8.77-mile-long transmission line with two submarine cable segments that would cross Gilbert Bay and Port Snettisham. The project's submarine transmission cables have the potential to interfere with commercial fishing, either by placing a physical hazard in areas commercially fished or by disrupting the ecology of the fishery. Also, if a commercial fisherman hooked the cable, it could result in destabilizing the boat and, possibly, electrocution, if the cable was to be severed.

Juneau Hydro also proposes a number of recreational improvements that may affect fishing opportunities, including a public dock and moorings, and a road along the shoreline that would be open to the public.

Our Analysis

Submarine Transmission Cable—A small risk exists that trawlers and line fishermen could catch or snag the submarine cables because they are not aware of the location of the submerged cables. The cables would be marked on both shorelines in relatively narrow bays. In most weather conditions, fishermen should be able to see the shore and warning signs, allowing commercial fishermen to set their nets, traps, and lines safely around the submerged cables.

Another possible consequence of a submarine cable is the potential to disrupt the fishery by disrupting fishing beds or modifying substrates that are important for marine life. The primary commercial fishery in the project area is halibut, shrimp, and crab. Figure 3-15 shows that the proposed alignment for the submarine cable generally would avoid the primary commercial fishing areas. In Gilbert Bay, crabbing tends to follow shoreline and shallower areas. The cable would be trenched in these areas and would not interfere with crabbing; it would cross under a known halibut fishery in Port Snettisham, but this area is only lightly fished due low fish productivity. Shrimp trawling does occur in Gilbert Bay, but the proposed cable route would be in the shallower waters in the inner bay, and most of it would be trenched. It is unlikely that shrimp trawlers would catch the cable in Gilbert Bay.

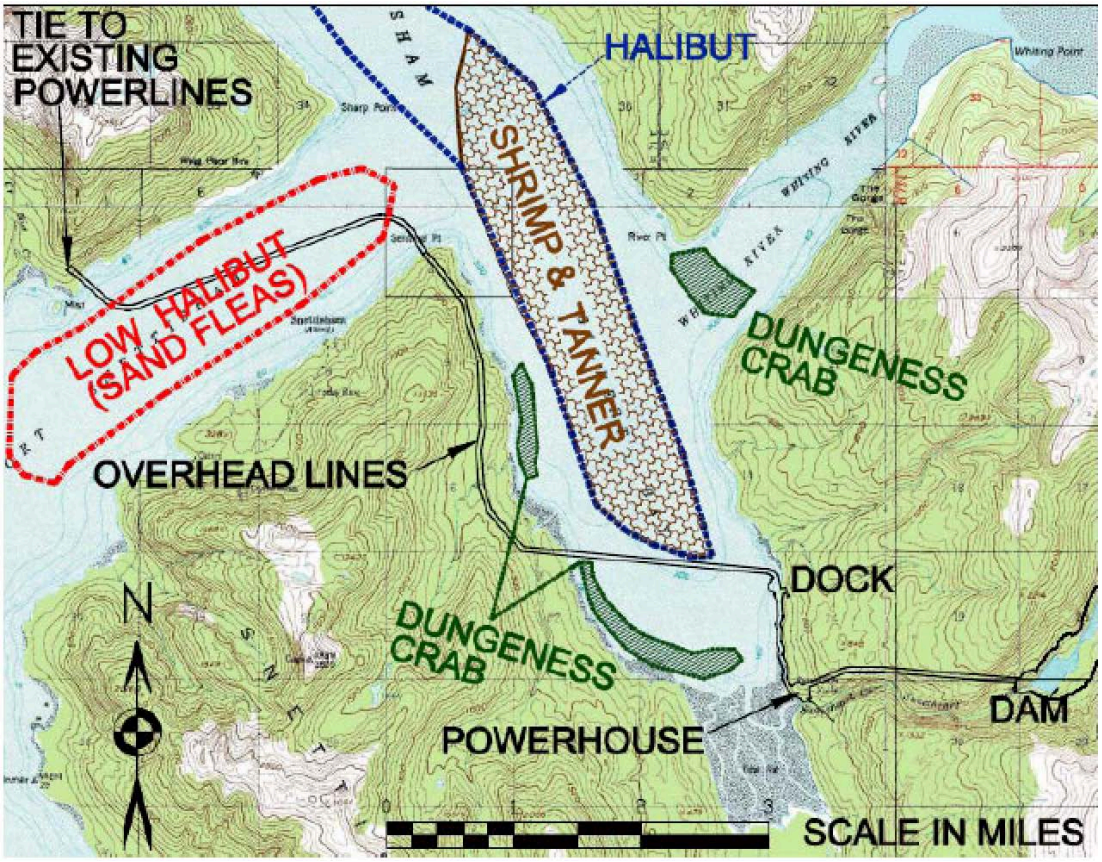

Figure 3-15. Submarine cable routing and commercial fishery (Source: Juneau Hydro, 2014b).

To help identify and protect sensitive fisheries from project equipment, Juneau Hydro interviewed commercial fishermen who currently fish in the area and Alaska DFG biologists in charge of the fisheries in Port Snettisham. Juneau Hydro discussed information about the cable locations, including habitat, fishing areas, areas with high catch rates, bottom geology and bathymetry. Juneau Hydro also observed crab and shrimp pot locations in the project area.

Based on review of the proposed cable and available information, the submarine cable would result in no measurable, adverse effects on fishing in the project area. Commercial fishermen should know the location of the cables from the cable vaults and signs and be able to set lines, traps, and nets in a manner that avoids hooking the cable. Once in place, the cable would not interfere with primary fishing areas or disrupt fish habitat. As a result, the installation and operation of the submarine cable would have no measurable adverse socioeconomic effects on the commercial fishery.

*Fish Return*s—Juneau Hydro estimates that greater than 90 percent of visitors to the project are personal use fishermen, primarily for salmon fishing in Sweetheart Creek. The construction phase would introduce, to an otherwise tranquil area, noise and light from heavy machinery; traffic from transportation of workers and equipment by boat, plane and helicopter; and up to 60 construction workers that would not typically be in the area. This activity may discourage some of the personal use and guided fishing that would have otherwise occurred during the construction years.

After construction is complete, activity at the project area would return to nearly pre-project conditions and disturbed areas would start to regrow. In this environment, personal use fishing would likely return to Sweetheart Creek. The proposed project includes recreational enhancements that would make access to Sweetheart Creek and the project tailrace relatively easy for boaters, including a boat launch and dock, public mooring, and a shoreline road. These improvements may attract additional fishermen to the area or may create opportunities for longer visits to the project area.

Juneau Hydro's proposed smolt collection and transport system, if successful, would maintain the sockeye salmon fishery in Sweetheart Creek and therefore should not have an adverse impact on the existing economic benefits derived from the sockeye salmon fishery.

Overall, the proposed project would provide a net benefit over existing conditions for personal use fishing by improving public access. Nonetheless use is likely to remain low because of the long distance from Juneau and the relative abundance of good fishing areas in the region closer to Juneau.

Subsistence Fishing, Hunting, and Gathering—Subsistence uses in the project area include hunting and personal use fishing at Sweetheart Creek and around Gilbert Bay. Alaska National Interest Lands Conservation Act, section 810, requires an evaluation of effects on subsistence hunting, fishing, and gathering (Legal Information Institute, 2015). The act requires that this evaluation include findings on three specific

issues: (1) the effect of use, occupancy, or disposition on subsistence uses and needs; (2) availability of other lands for the purpose sought to be achieved; and (3) other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence uses.

Alaska DFG manages subsistence fishing using a permit system for designated areas. No designated subsistence fishing areas are located near the proposed project. As discussed above, Sweetheart Creek supports an important personal use fishery that would be enhanced over time by improved public access.

Juneau Hydro, in consultation with stakeholders, found that the Sitka black-tailed deer was the only subsistence species in the project area and that, if adversely affected, subsistence hunting could also be adversely affected. The project would remove habitat for Sitka black-tailed deer. However, as discussed in section 3.3.3, *Terrestrial Resources*, the amount of habitat lost as a result of the proposed project dam, penstock, powerhouse, shoreline road, and overhead transmission line would be minimal when compared to the amount of habitat available in the project area. Therefore, habitat loss from the proposed project would not affect the distribution or the abundance of Sitka black-tailed deer and would not adversely affect subsistence hunting opportunities.

Juneau Hydro consulted with Tribes and agencies to understand whether the project area was used for subsistence gathering of natural resources. Juneau Hydro did not identify subsistence-gathering opportunities in the project area.

Juneau Hydro considered other alternative sites for hydropower development in the region. The altitude of Sweetheart Lake, with a steep drop to the shoreline of Gilbert Bay, and the proximity to the Port Snettisham transmission line indicate that project site is one of the best opportunities for hydropower development near Juneau.

Overall, the proposed project would have no measurable adverse effects on subsistence hunting and gathering opportunities and would enhance personal fishing opportunities. The proposed project would disturb a small land area in an expansive, wild landscape and may improve fish returns to Sweetheart Creek.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Sweetheart Lake Project would not be constructed. The physical, biological, or cultural resources of the area would not change, and electrical generation from the project would not occur. The power that would have been developed from a renewable resource would have to be replaced from nonrenewable fuels. The noise and air quality effects of the existing diesel fuel-fired generation system would continue unabated or at increased levels as the local electrical demand increased. The risk of spills of diesel fuels would likewise continue at current or increasing levels. The financial benefits to the residents of the City and Borough of Juneau in the form of lower electrical rates and to Juneau Hydro in terms of project operating revenues would not be realized.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Sweetheart Lake Project's use of Sweetheart Lake and Sweetheart Creek 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.*,[63] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using the 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 in the EIS 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 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 4-1 summarizes the assumptions and economic information we use in our analysis. This information was provided by Juneau Hydro in its license application. We find that the values provided by Juneau Hydro are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs, estimated future capital investment required to maintain and extend the life of plant equipment and facilities, licensing costs, normal operation and maintenance cost, and Commission fees.

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[63] 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 the fuel cost is the largest component of the cost of electricity production.

Table 4-1. Parameters for the economic analysis of the Sweetheart Lake Project (Source: Juneau Hydro, 2014a, as modified by staff).

Parameter	**Value**
Period of analysis (years)	30
Period of financing (years)	20
Federal income tax rate	35
Insurance	$202,110
Initial Construction Cost, $[a]	$148,922,150
Licensing cost, $[b]	$2,779,020
Operation and maintenance, $/year[c]	$847,860
Commission fees, $/year[d]	$2,960,410
Energy value ($/MWh)[e]	133.79
Interest rate	5.0
Discount rate	5.0

[a] Construction costs include design measures that were originally included by Juneau Hydro as environmental measures, including: partial burial of the powerhouse and switchyard to minimize the effects of project operation on wildlife; burial of the transmission line and telecommunication cables along the coastal road, and installation of submarine cables crossing the Gilbert Bay flats to protect migratory birds.

[b] Licensing costs include the administrative, legal/study, and other expenses to date.

[c] Operation and maintenance includes routine operation and maintenance costs associated with the proposed project and does not include incremental costs associated with proposed environmental measures. The cost includes air fare for maintenance access to the lake area.

[d] Commission fees are estimated based on projected fees for use of federal lands and administrative charges based on authorized capacity.

[e] The energy rate reflects $140/MWh for firm power (100,000 MWh) and $95/MWh for non-firm power (16,000 MWh). This produces a composite rate of $133.79/MWh.

As currently proposed, the Sweetheart Lake Project would have an installed capacity of 19.8 MW and generate an average of 116,000 MWh annually.

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 compares 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 Juneau Hydro's proposal and the staff alternative.[64]

Table 4-2. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Sweetheart Lake Project (Source: staff).

	Juneau Hydro's Proposal	Staff Alternative
Installed capacity (MW)	19.8	19.8
Annual generation (MWh)	116,000	116,000
Annual cost of alternative power ($/MWh)	$15,519,640 (133.79)	$15,519,640 (133.79)
Annual project cost ($/MWh)	$18,290,330 (157.68)	$18,291,480 (157.69)
Difference between the cost of alternative power and project cost ($/MWh)[a]	($2,770,690) (23.89)	($2,771,840) (23.90)

[a] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is greater than the cost of alternative power.

4.2.1 No-action Alternative

Under the no-action alternative, the project would not be constructed and would not produce any electricity. None of the environmental enhancements would be implemented.

4.2.2 Applicant's Proposal

Based on a total installed capacity of 19.8 MW, and an average annual generation of 116,000 MWh, the cost of alternative power would be $15,519,640, or about $133.79/MWh. The average annual project cost would be $18,290,330, or about $157.68/MWh. Overall, the project would produce power at a cost that is $2,770,690, or $23.89/MWh, more than the cost of alternative generation.

[64] The staff alternative includes all mandatory conditions.

4.2.3 Staff Alternative

The staff alternative includes the same developmental upgrades as Juneau Hydro's proposal and, therefore, would have the same capacity and energy attributes. Table 4-3 shows the staff recommended additions, deletions, and modifications to Juneau Hydro's proposed environmental protection and enhancement measures and the estimated cost of each.

Based on a total installed capacity of 19.8 MW, and an average annual generation of 116,000 MWh, the cost of alternative power would be $15,519,640, or about $133.79/MWh. The average annual project cost would be $18,291,480, or about $157.69/MWh. Overall, the project would produce power at a cost that is $2,771,840, or $23.90/MWh, more than the cost of alternative generation.

4.3 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.

Table 4-3. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the Sweetheart Lake Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
General				
1. Provide representatives of Alaska DFG access to the project, and reserve the Forest Service right to use of NFS lands.	Juneau Hydro, Forest Service, Alaska DFG, staff	$0	$0	$0
2. Implement the Environmental Compliance Plan, including retaining an ECM.	Juneau Hydro, Forest Service, Alaska DFG, staff	$262,740	$2,530	$18,500
3. Correct, document, and report out-of-compliance events as part of the Environmental Compliance Plan.	Juneau Hydro, Alaska DFG, staff	$0	$0	$0[c]
Geology and Soils				
4. Revise, if necessary, the Erosion Control Plan and Storm Water Plan.	Juneau Hydro, Forest Service, Alaska DFG, staff	$116,160	$2,530	$9,090[d]
5. Implement a 100-foot stream buffer and monitor turbidity as part of the Erosion Control Plan.	Juneau Hydro, Alaska DFG, staff	$0	$0	$0[e]
6. Additional measures to be included in the Erosion Control Plan (submittal of the plan 60 days prior to construction).	Staff	$0	$0	$0[f]

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
7. Revise, if necessary, the Spoil Disposal Plan and Acid Rock Plan.	Juneau Hydro, Forest Service, staff	$20,160	$3,790	$3,760[d]
8. Additional measures to be included in the Acid Rock Plan (detailed designs for acid-producing spoil storage, disposal, treatment, and monitoring measures).	Staff	$0	$0	$0[f]
Aquatic Resources				
9. Revise, if necessary, the Water Management Plan (includes a Reservoir Management Plan, a Stream Flow Management Plan, and a Stream Flow Measurement Plan).	Juneau Hydro, Forest Service, Alaska DFG, staff	$30,160	$3,790	$4,400[d,g]
10. Additional measures to include in the Water Management Plan (instream flow compliance description, flow monitoring equipment maps, calibration procedures, reporting procedures, and implementation schedule).	Staff	$21,220	$1,260	$2,180[f]
11. Implement the proposed minimum flows.	Juneau Hydro, Alaska DFG, staff	$0	$0	$0[h]

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
12. Provide means of fail-safe flow continuation (synchronous bypass valves and the diversion tunnel).	Juneau Hydro, Alaska DFG, staff	$0	$0	$0[i]
13. Develop a plan to evaluate the effectiveness of releasing pulse flows in stimulating upstream migration of sockeye salmon.	Juneau Hydro, Alaska DFG, staff	$84,880	$0	$5,440[f]
14. Install and maintain a weather station and stream gages for minimum flows.	Juneau Hydro, Forest Service, Alaska DFG, staff	$151,580	$0	$9,720
15. Develop and implement a sockeye smolt transport plan.	Juneau Hydro, Alaska DFG, staff	$20,000	$80,000	$53,280[f]
16. Additional measures to include in the sockeye smolt transport plan (smolt transport success reporting).	Staff	$0	$0	$0[l]
17. Construct and operate a sockeye salmon smolt collection and transport system.	Juneau Hydro, Alaska DFG, staff	$1,283,400	$65,690	$125,010
18. Install and maintain intake fish screens.	Juneau Hydro, Alaska DFG, staff	$1,212,670	$15,160	$87,630
19. Develop and implement a fish screen operating plan.	Staff	$10,000	$0	$640[f]
20. Install and maintain a tailrace fish exclusion structure.	Juneau Hydro, Alaska DFG, staff	$150,000	$10,000	$16,120[f]

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
21. Develop and implement a fish exclusion structure operating plan.	Staff	$10,000	$0	$640[f]
22. Finalize and implement the Hazardous Substances Plan.	Juneau Hydro, Forest Service, Alaska DFG, staff	$5,000	$0	$320[d]
23. Revise, if necessary, the Solid Waste Plan.	Juneau Hydro, Forest Service, staff	$5,000	$0	$320[d]
24. Revise, if necessary, the Aquatic Habitat Plan.	Juneau Hydro, Forest Service, staff	$14,100	$10,110	$7,470
25. Monitor salmon spawning in Sweetheart Creek, as part of the Aquatic Habitat Plan.	Juneau Hydro, Alaska DFG	$0	$20,000 for first 5 years	$3,660
26. Additional measures to include in the Aquatic Habitat Plan (agency consultations and provide monitoring report).	Staff	$0	$3,000 in year 3	$110[f]
27. Revise, if necessary, the Fish Mitigation Plan.	Juneau Hydro, Forest Service, Alaska DFG, staff	$10,050	$0	$650[j]
28. Additional measures to include in the Fish Mitigation Plan (provide monitoring report).	Alaska DFG, staff	$0	$3,000 in year 3	$110[f]
29. File a report on the timing window for in-stream construction.	Juneau Hydro, Alaska DFG, staff	$0	$0	$0[k]

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
Terrestrial Resources				
30. Construct and maintain the overhead transmission line using the APLIC guidelines.	Juneau Hydro, Alaska DFG, staff	$202,110	$20,210	$26,100
31. Construct a tailrace overpass and coastal road connecting trail.	Juneau Hydro, staff	$252,640	$0	$16,200
32. Develop a wildlife trail upland of the caretaker's facility.	Juneau Hydro	$5,050	$0	$320
33. Bury the penstock.	Juneau Hydro, Alaska DFG, staff	$0	$0	$0[i]
34. Bury the coastal road transmission line and install the submarine transmission line.	Juneau Hydro, staff	$0	$0	$0[i]
35. Revise, if necessary, the Vegetation Management Plan (includes an Invasive Species Management Plan; and a Threatened, Endangered, Proposed for Listing, and Sensitive Plant Species Plan).	Juneau Hydro, Forest Service, staff	$30,210	$5,050	$5,220
36. Additional measures to include in the Vegetation Management Plan (salvaged plant storage and treatment description, revegetation proposed species list, revegetation success criteria, data collection and analysis monitoring methodology, and provision for monitoring and supplemental plantings).	Staff	$10,000	$0	$640[f]

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
37. Prior to reservoir filling, salvage the rare twocolor sedge plant that would be inundated by the reservoir and replant in adjacent suitable habitat outside the inundation zone.	Forest Service, Staff	$250	$0	$20[f]
38. Additional measures to include in the Invasive Species Management Plan (weed-free fill materials and erosion control methods, monitoring schedule, proposed eradication measures, and avoidance of pesticide use.	Staff	$5,000	$0	$320[f]
39. Revise, if necessary, the Wildlife Mitigation and Monitoring Plan; and Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan to include measures for protection of marine mammals during construction.	Juneau Hydro, Forest Service, staff	$30,210	$7,580	$6,860[f]
40. Modify the Wildlife Mitigation and Monitoring Plan to remove restrictions on hunting, fishing, and trapping on onsite possession of personal firearms by project personnel, and hunting and fishing regulation posting requirement.	Staff	$0	$0	$0[f]
41. Implement the Bear Safety Plan.	Juneau Hydro, Alaska DFG, staff	$27,740	$0	$1,780

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
42. Conduct annual mountain goat surveys.	Juneau Hydro, Alaska DFG, staff	$0	$2,020	$1,310
43. Conduct pre-construction surveys for bald eagles, and potentially consult with FWS.	Juneau Hydro, staff	$17,830	$0	$1,140[f]
Recreation Resources				
44. Revise the Recreational Management Plan.	Juneau Hydro, Interior, staff	$85,900	$52,550	$39,670[d]
45. Additional measures to include in the Recreation Management Plan (final as-built plans, periodically review new recreational facility's adequacy, file recreation monitoring reports, and file future recreation proposals).	Staff	$0	$10,000 in years 4 and 14	$480[l]
Land Use and Aesthetics				
46. Revise, if necessary, the Scenery Management and Monitoring Plan.	Juneau Hydro, Forest Service, staff	$15,110	$2,530	$2,610
47. Additional measures to include in the Scenery Management Plan (detailed monitoring protocols, and means for addressing visual issues).	Staff	$0	$0	$0[f]
48. Revise, if necessary, the Construction Plan.	Juneau Hydro, Forest Service, staff	$5,000	$0	$320[d]

Enhancement/Mitigation Measures	Entities	Capital Cost (2015$)[a]	Annual Cost (2015$)[a]	Levelized Annual Cost (2015$)[b]
49. Establish and maintain a construction progress and recreational information web site.	Juneau Hydro, Interior, staff	$0	$5,000 for first 3 years	$580[f]
50. Revise, if necessary, the Access Management Plan.	Juneau Hydro, Forest Service, staff	$5,000	$0	$320[d]
51. Revise, if necessary, the Fire Prevention Plan.	Juneau Hydro, Forest Service, staff	$5,000	$0	$320[d]
Cultural Resources				
52. Revise, if necessary, the Heritage Resource Protection Plan to include cultural resources training and monitoring protocols	Juneau Hydro, Forest Service, Alaska SHPO, staff	$15,110	$2,530	$2,610[d]

[a] Unless otherwise noted, all cost estimates are from Juneau Hydro, escalated to 2015 dollars.

[b] All capital and annual costs were converted to equal annual costs over a 30-year period to give a uniform basis for comparing all costs.

[c] The cost for this measure is included in the Environmental Compliance Plan costs.

[d] Cost provided by Juneau Hydro in its additional information response, filed on October 20, 2014, and modified by staff.

[e] The cost for this measure is included in the Erosion Control Plan costs.

[f] Cost estimated by staff.

[g] This cost does not include installation of a weather station and stream gaging, a provision of the Stream Flow Measurement Plan, as it is accounted for as a separate measure.

[h] Any potential lost energy associated with the proposed bypassed reach minimum flow is already included in the annual generation estimate for the project. The recommended minimum flow requirements for the anadromous reach would typically be provided through turbine discharge, so no lost energy associated with those releases is expected.

[i] Cost included in Juneau Hydro's construction cost.

[j] Only the cost of installation for a water temperature sensor in Sweetheart Lake was included in our economic analysis, as it is the only definitive measure proposed. The cost for this measure does not include population monitoring for rainbow trout and Dolly Varden, which is accounted for in the cost for sockeye smolt collection. Potential measures that were not incorporated into our analysis because their implementation is contingent on monitoring results include: stocking of Sweetheart Lake, stream rehabilitation for one or more tributaries to Sweetheart Lake, and offsite mitigation.

[k] Staff estimates that consultation with Alaska DFG and development of the report would have a negligible cost.

[l] Staff recommends a recreation survey be conducted within 4 years of beginning project operation, with additional surveys conducted every 10 years thereafter for the term of the license. Staff estimates $10,000 in years 4 and 14 for recreation surveys, with the proposed third survey to be conducted in year 24 accounted for in the cost of the single survey included in Juneau Hydro's proposed Recreation Management Plan.

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5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPARISON OF ALTERNATIVES

In this section, we compare the development and non-developmental effects of Juneau Hydro's proposal, Juneau Hydro's proposal as modified by staff, and the no-action alternative.

We estimate the annual generation of the project under the two action alternatives identified would be 116,000 MWh.

5.2 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, 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 licensing the Sweetheart Lake 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 in regard to 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 Juneau Hydro to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 19.8 MW of electric capacity would come from a renewable resource that would not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife resources and would provide improved recreation opportunities at the project.

In the following section, we make recommendations as to which environmental measures proposed by Juneau Hydro or recommended by agencies and other entities should be included in any license issued for the project. In addition to Juneau Hydro's proposed environmental measures, we recommend additional staff-recommended environmental measures to be included in any license issued for the project. We also discuss which measures we do not recommend including in the license.

5.2.1 Measures Proposed by Juneau Hydro

Based on our environmental analysis of Juneau Hydro's proposal discussed in section 3.0 and the costs discussed in section 4.0, we recommend including the following design and environmental measures proposed by Juneau Hydro[65] in any license issued for the project.

Construction

- Provide representatives of Alaska DFG access to, through and across project lands and waters, and project works, in the performance of their official duties upon appropriate advance notification and reserve the Forest Service right to use or permit others to use NFS lands for any purpose, as long as it does not interfere with project purposes specified in a license.
- Implement the Environmental Compliance Plan filed with the license application to retain an ECM during construction to ensure environmental protection measures are being properly implemented.
- Revise, if necessary, the Erosion Control Plan, Storm Water Plan, and Solid Waste Plan filed with the license application to include site-specific BMPs for controlling erosion and protecting water quality from stormwater runoff, sewage, and fuel spills; site storage and disposal areas at least 100 feet from streams and intertidal areas to protect fish and wildlife; functional design drawings and specific topographic locations of erosion control measures; daily monitoring of turbidity to assess the effectiveness of erosion control measures by an ECM; and procedures for taking corrective actions.
- Revise, if necessary, the Spoil Disposal Plan filed with the license application to include: site-specific measures for handling and disposing of excavated materials, testing for acid rock drainage forming materials, disposing of the excavated spoils containing such acid-forming materials in a designated area with a liner and cap to prevent leaching, and determining whether the spoils would need to be treated onsite with a buffering agent, such as limestone. Final plans for disposing and treating spoils with the potential to create acid leachate would be developed within 90 days of discovery.
- Develop and implement timing windows for instream construction activities and stream crossings in consultation with Alaska DFG.

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[65] Juneau Hydro's proposal reflects those Alaska DFG and Forest Service recommended measures that Juneau Hydro agreed to implement in its February 28, 2015, and January 19, 2016, reply comments.

- Revise, if necessary, the Vegetation Management Plan filed with the license application that includes salvaging native plants from construction areas and transplanting them to revegetate disturbed sites; monitoring the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; implementing measures to avoid the potential spread of invasive plants associated with project construction; and avoiding the use of pesticides and herbicides within 500 feet of sensitive species and habitats.
- Revise, if necessary, the Wildlife Mitigation and Monitoring and Threatened and Endangered Species Protection Plan filed with the license application and updated on January 27, 2016, that includes: reducing vessel speed or stopping if marine mammals (including the endangered humpback whale and Steller sea lion) are within 100 yards of in-water construction activities to prevent collisions between service boats and marine mammals; ceasing pile driving if a marine mammal is observed within 1,000 meters (1,094 yards) of pile driving activity to minimize noise effects on marine mammals; implementing pile driving ramp-up procedures to minimize sudden exposure of marine mammals to loud noises; using hammer cushions to minimize noise effects on marine mammals during impact pile driving; defining flight paths and marine transportation routes to avoid disturbance of Steller sea lions and mountain goats; and surveying for nesting bald eagles and taking necessary steps to minimize disturbance if needed during project construction.
- Implement the Bear Safety Plan filed with the license application that includes protocols to minimize the risk of human-bear interactions.
- Revise, if necessary, the Construction Plan filed with the license application that outlines the location, methodology, and scheduling that would be followed to construct the project facilities to ensure compliance with National Forest objectives.
- Establish and maintain, with frequent summer season updates, a web site describing construction progress and any visitor access limitations. Identify a point of contact on the web site and include a provision for receiving public questions or comments regarding project construction-related issues.
- Implement the Heritage Resource Protection Plan filed with the license application to protect cultural, archeological, or historical resources (or human remains associated with the Native American Graves Protection and Repatriation Act of 1990) in the event that they are inadvertently discovered during construction and operation.

Project Design Features and Operation

- Install and maintain a fish exclusion structure in the project tailrace to prevent fish from entering the turbine draft tubes.

- Install and maintain fish screens on power tunnel intake structure according to NMFS criteria to prevent entrainment of fish.
- Bury the penstock and construct a 94-foot-wide tailrace overpass and connecting trail to mitigate barriers to wildlife movements.
- Bury the transmission and telecommunication cables along a new coastal access road and install submarine cables across the Gilbert Bay flats to minimize visual impacts and to protect migratory birds from collision and electrocution hazards.
- Release a minimum flow of 3 cfs into the Sweetheart Creek bypassed reach.
- Maintain a minimum flow of 40 cfs in the anadromous reach of Sweetheart Creek from January through February, 45 cfs in March, 119 cfs in April, 300 cfs from May through October, and 117 cfs from November through December, as measured at a stream gage installed immediately downstream of the tailrace.
- Develop a pulse flow release and monitoring plan, in consultation with Alaska DFG, that includes conducting a 3- to 5-year evaluation of the effectiveness of releasing at least four pulse flows of up to 486 cfs between July 1 and August 31 of each year, in stimulating returning sockeye salmon to enter Sweetheart Creek from the estuary.
- Revise, if necessary, the Water Management Plan filed October 20, 2014, that includes: (1) a Reservoir Management Plan containing procedures for monitoring reservoir levels, monitoring reservoir water quality, and managing reservoir vegetation and floating debris; (2) a Stream Flow Management Plan that describes methods for controlling the minimum flows and ensuring continuous flow when the project is not operating (i.e., install conduit and gated diversion tunnel to provide bypassed reach flow and synchronous bypass valves on each turbine to provide anadromous reach flow); and (3) a Stream Flow Measurement Plan that includes procedures and equipment for measuring minimum flow releases.
- Construct and operate a sockeye smolt collection and transport system and develop an operating plan (sockeye smolt transport plan) that includes: (1) a description of the procedures that would be used to capture, hold, transport, and release sockeye salmon smolts from Sweetheart Lake into Sweetheart Creek; (2) a description of the protocols for monitoring survival of sockeye salmon; and (3) contingency provisions to ensure sockeye salmon smolts are successfully imprinted and released in Sweetheart Creek if the sockeye smolt collection and transport system fails.
- Revise, if necessary, the Aquatic Habitat Plan filed October 20, 2014, that includes assessing spawning habitat in the anadromous reach of Sweetheart Creek and potentially conducting gravel augmentation based on the results of the spawning habitat assessment.

- Revise, if necessary, the Fish Mitigation Plan filed October 20, 2014, that includes monitoring rainbow trout and Dolly Varden populations and measuring water temperatures in Sweetheart Lake following project construction. If monitoring results indicate poor recruitment of rainbow trout and Dolly Varden, Juneau Hydro would stock triploid rainbow trout and Dolly Varden in Sweetheart Lake, improve access to potential spawning habitat in tributaries to Sweetheart Lake, or implement offsite mitigation determined in consultation with Alaska DFG and Forest Service.
- Revise, if necessary, the Hazardous Substances Plan filed with the license application that includes procedures for reporting and responding to releases of hazardous substances.
- Construct and annually inspect the overhead 138-kV transmission line using the APLIC guidelines for protecting birds from electrocution and collision hazards.
- Revise, if necessary, the Fire Prevention Plan filed with the license application that defines protocols that would be followed to prevent and control wildfires.
- Revise, if necessary, the Access Management Plan filed with the license application that includes provisions to control public access to the project to ensure public safety, project security, and project consistency with Forest Service roadless area management goals; and monitor the effectiveness of access control measures.
- Revise, if necessary, the Recreation Management Plan filed with the license application that includes installing and maintaining interpretive displays at the head of Sweetheart Creek Trail; a new trail system that leads fishermen to the traditional fishing areas at Sweetheart Creek and away from prime bear fishing locations; landform berms to provide scenic, sound, and light barriers between the powerhouse/switchyard area and Sweetheart Creek recreational areas; a rock tailrace to increase available fishing area along Sweetheart Creek; a dock and intertidal ramp on the eastern shore of Gilbert Bay and a trail from the boat dock to the powerhouse location that would be available for public use; and at least three mooring buoys in Gilbert Bay.
- Revise, if necessary, the Scenery Management and Monitoring Plan filed with the license application that provides for using exterior colors for the transmission and marine access facilities and fencing that minimize contrast with the surrounding environment; minimizing vegetation removal; using native vegetation to reduce visibility of the project; avoiding use of exterior lighting to minimize light pollution; and monitoring, through photographic documentation, the continued success of scenery management mitigation over a 10-year period.

5.2.2 Additional Measures and Modifications Recommended by Staff

In addition to the measures above, we recommend the following modifications to Juneau Hydro's proposed measures be included in any license issued for the Sweetheart Lake Hydroelectric Project:[66]

(1) modify the Acid Rock Plan to include a provision to provide detailed plans for acid-producing spoil storage, disposal, treatment, and monitoring measures based on geotechnical study results and prior to beginning construction;

(2) file a schedule for in-water construction activities for Commission approval;

(3) modify the proposed Water Management Plan to: (a) remove the provision that requires Juneau Hydro to file annual stream gauge data with the Commission by April 1 of each year; (b) define the criteria for determining water quality deviations for turbidity, pH, and temperature during project operation; (c) add continuous monitoring of water temperature, pH, and turbidity for the first 5 years of project operation and file a report with the Commission for approval at the end of the 5-year monitoring period documenting the results of the water quality monitoring and any recommendations for continuing monitoring; (d) include a provision to notify the Commission in the event that water quality deviations are detected and file a report within 10 days that describes the deviation, corrective actions taken, and proposals to modify procedures; (e) include a description of how Juneau Hydro would document compliance with minimum instream flows, including a detailed description of the gages to be installed, their location, maintenance and calibration procedures, and an implementation schedule; and (f) include a provision to file a report of any deviation from minimum flow or flow continuation requirement with the Commission within 10 days of the deviation and describe the deviation, any observed environmental effect, and corrective actions taken;

(4) prepare an operation and maintenance plan for the proposed draft tube fish exclusion structure;

(5) prepare an operation and maintenance plan for the intake fish screen;

(6) modify the proposed sockeye smolt transport plan to include a provision to file an annual report with Alaska DFG and the Commission on the effectiveness of collection and transport system in meeting the defined performance criteria and after the third year of operation file a final report summarizing the cause(s) of any system failures and any recommended corrective measures;

(7) modify the proposed Aquatic Habitat Plan in consultation with Alaska DFG, NMFS, and the Forest Service to include additional details on spawning habitat

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[66] Consistent with the Forest Service's 4(e) conditions, we also recommend additional consultation with the Forest Service during finalization and implementation of the plans proposed by Juneau Hydro.

monitoring and mitigation methods, and file a report with the Commission by December 31 of year 3 following implementation of the spawning habitat assessment summarizing the spawning gravel assessment results and recommendations for continuing the assessment, or plans to augment spawning gravel, and remove the requirement to monitor salmon spawning in the anadromous reach;

(8) modify the proposed Fish Mitigation Plan to include a requirement to file a report with the Commission by December 31 of year 3 following implementation of the monitoring program summarizing the monitoring results and recommendations for continuing the monitoring or to implement measures to improve fish recruitment;

(9) modify the proposed Vegetation Management Plan to include: (a) a description of storage and treatment of salvaged plants; (b) a list of plant species that would be imported to revegetate disturbed areas; (c) criteria, based on existing conditions, to determine whether revegetation efforts are successful; (d) a description of data collection and analysis methods for monitoring that corresponds with success criteria; (e) provisions for monitoring and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons; and (f) salvage and transplant the rare twocolor sedge plant that would be inundated by the reservoir;

(10) modify the proposed Invasive Species Management Plan to: (a) include measures to use weed-free fill materials and weed-free erosion control methods; (b) include a monitoring schedule that addresses short-term (first 5 years) and long-term monitoring needs; (c) include a description of proposed eradication measures; and (d) avoid the use of pesticides and herbicides on NFS lands or in areas affecting NFS lands and within 500 feet of rough-skinned newt, western toad, or any other special status or culturally significant plant population without the prior written approval of the Forest Service;

(11) revise the proposed Wildlife Mitigation and Monitoring Plan to remove the proposed wildlife bypass trail around the caretaker's facility and the restrictions on hunting, fishing, and trapping and onsite possession of personal firearms by project personnel, and the posting of hunting and fishing regulations during construction;

(12) modify the proposed Recreation Plan to: (a) consult with the Forest Service, Park Service, and Alaska DFG to finalize the Recreation Management Plan; (b) file as-built drawings of all completed recreation facilities; (c) review the adequacy of new recreational facilities in consultation with the Forest Service, Park Service, and Alaska DFG within 4 years of completion of project construction, and every 10 years thereafter; and (d) file recreation monitoring reports with the Commission;

(13) revise the Access Management Plan to allow full public access to the proposed boat ramp and dock, with these revisions also reflected in the revised Recreation Management Plan;

(14) finalize the proposed Scenery Management Plan to include protocols to document compliance with the plan (e.g., establishing photo points, the time of year to

take the photos), and procedures and a schedule to review and update the plan to address visual issues that may arise during the license term; and

(15) revise the Heritage Resources Protection Plan to include cultural resources training and monitoring protocols.

The bases for our recommended modifications to the proposed plans are discussed below.

Schedule for Consultation and Review of Plans and Designs

In its reply comments, Juneau Hydro agreed to implement all of Alaska DFG's recommended measures; however, in many cases Juneau Hydro noted that the recommended schedules for agency consultation and review of plans and designs could delay initiation of project construction. For instance, for the Erosion Control Plan (Article 17), Stream gaging and Instream Flow Compliance (Article 4), Biotic Monitoring Plan (Article 9), and Bear Safety Plan (Article 13), Alaska DFG stipulated that consultation with resource agencies regarding these plans should occur at least six months prior to the start of any land disturbing or land clearing activities and that resource agencies should be allowed 60 days after the license issuance to review the plans and provide comments and recommendations. For the Fish Exclusion and Tailrace Design (Article 6) and Sockeye Smolt Collection and Transportation Plan (Article 8), Alaska DFG recommended that resource agencies be allowed 60 days after license issuance to review the design or plan and provide comments and recommendations. Juneau Hydro also noted that it has already consulted with Alaska DFG on the development of environmental measures and plans and provided the plans and designs to expedite agency review and maintain construction schedules.

In comments included with its final 10(j) recommendations, Alaska DFG acknowledged that Juneau Hydro included in its final license application most of the plans it identified; nonetheless, further consultation and revisions would be likely.

We support finalizing the plans and designs in consultation with Alaska DFG and the Forest Service. Because Juneau Hydro has already prepared drafts of many of the recommended plans and designs in consultation with Alaska DFG, the lead time recommended by Alaska DFG may be unnecessary. We recommend that Juneau Hydro allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plans with the Commission for approval. The Commission would need at least 30 days to approve the plans; therefore, Juneau Hydro should plan accordingly.

In regard to the Erosion Control Plan, for the reasons stated by Juneau Hydro, we agree that submittal of the final plan at least six months prior to beginning ground-disturbing activities is unnecessary. Therefore, we recommend that Juneau Hydro file the final Erosion Control Plan for Commission approval at least 60 days prior to beginning any land disturbing activities. This recommendation is consistent with Forest Service 4(e) condition 22 regarding the filing of an Erosion Control Plan within 1 year of

issuance of the license and is typical of Commission license requirements for new construction.

We find this revised schedule would be of sufficient duration for agency's to review and to provide comments on the recommended plans and designs and would have no effect on the levelized annual cost for these measures.

Acid Rock Plan

There is the potential to encounter acid-producing rock during project construction, including drilling and excavation activities. Such rock, when exposed to water and air, may undergo a chemical reaction resulting in the production of acidic leachate. This leachate has the potential to affect soil and aquatic resources by increasing the pH to deleterious levels, or by mobilizing metals or other toxic compounds found in the rock or soil. While Juneau Hydro does not anticipate encountering such rock, it proposes to implement an Acid Rock Plan, part of its Spoil Disposal Plan, contingent on the results of its final geotechnical investigation. The Acid Rock Plan includes prescriptions to test rock borings for acid production potential, and general measures for handling and disposing of acid-producing materials.

To ensure proper storage, treatment, and disposal of spoil with acid-production potential, we recommend that Juneau Hydro revise its Acid Rock Plan to provide additional details that would be followed if acid-producing rock is encountered. These additional provisions include: (1) the specific location of spoil storage and disposal sites; (2) detailed spoil storage and disposal site design plans, including cap and liner type and composition; (3) leachate monitoring protocols, including sample collection methodology and a sample result reporting schedule; (4) detailed leachate collection and treatment system design plans; (5) disposal methods for treated leachate and/or sludge, as appropriate, and (6) unanticipated leachate release cleanup procedures. These elements of the Acid Rock Plan should cover both the construction and operation periods of the proposed project, until the spoil is stabilized.

The inclusion of these provisions in Juneau Hydro's Acid Rock Plan ensures that all additional information would be available as needed, and adequately provides for Commission and agency oversight. If acid-producing rock is encountered, the implementation of the final Acid Rock Plan with these additional provisions would avoid potential effects on soil and aquatic resources from such rock. Because Juneau Hydro proposes to consult with the agencies on the final plan, staff estimates no additional cost for the proposed modifications. Therefore, we conclude that the modifications recommended by staff for the Acid Rock Plan would be worth the additional effort.

Timing Windows for Instream Construction

In-water construction can result in the disturbance of salmon redds and creation of silt during sensitive spawning periods. Alaska DFG recommended that timing windows be established for instream construction activities and stream crossings at the project so

these activities do not adversely affect aquatic resources. As discussed in section 3.3.2, *Aquatic Resources,* establishing timing windows for instream activities in consultation with Alaska DFG and filing the recommended timing windows with the Commission for approval would ensure the timing windows are adequate to protect aquatic resources while accommodating project construction requirements. The cost of developing these windows in consultation would be minimal.

Water Management Plan

Juneau Hydro proposes to implement its Water Management Plan, which includes the following sub-plans and associated provisions: (1) a Reservoir Management Plan with provisions to monitor reservoir levels, monitor reservoir water quality, and manage reservoir vegetation and floating debris; (2) a Stream Flow Management Plan with a provision to maintain minimum flows in the anadromous reach of Sweetheart Creek and in the bypassed reach; and (3) a Stream Flow Measurement Plan with a provision to measure stream flows in Sweetheart Creek at the barrier falls and at the dam into upper Sweetheart Creek. Specifically, Juneau Hydro would install permanent gaging instrumentation on the inner face of the dam to measure reservoir water levels, maintain a permanent gage in Sweetheart Creek below the exit of the proposed tailrace to monitor flow entering the anadromous reach, install a gage or metering device at the base of the toe of the proposed dam to monitor instream flow releases into the bypassed reach, operate and maintain the gages according to USGS standards, and record the data.

To monitor water quality in Sweetheart Lake during project operation, Juneau Hydro proposes to install automated monitoring and recording devices near the proposed power intake structure to measure temperature, pH, and turbidity. In the event that an abnormal deviation in any of these parameters occurs, Juneau proposes to investigate the deviation and determine if action is warranted. Although we find monitoring water quality during project operation would aid in the detection of abnormal water quality conditions so that appropriate corrective actions could be implemented to protect aquatic resources from potential adverse effects, Juneau Hydro did not provide information on the duration or frequency of monitoring, exceedance thresholds that would require corrective actions to be implemented, or a description of the potential corrective actions that would be implemented in the event an abnormal deviation in water quality occurs. Juneau Hydro's proposal also does not include any requirements for reporting the results or deviations of the water quality monitoring provision to the Commission. Monitoring for the first 5 years of project operation would likely be sufficient to determine if project lake level fluctuations are adversely affecting water temperature, pH, and turbidity in Sweetheart Lake and in the anadromous reach of Sweetheart Creek.

Therefore, we recommend Juneau Hydro revise its provision for water quality monitoring during project operation included in its Reservoir Management Plan to: (1) define the thresholds for turbidity, pH, and water temperature that would constitute an abnormal deviation in water quality for the project; (2) include a provision to conduct continuous monitoring of water temperature, pH, and turbidity at hourly intervals for the

first 5 years of project operation; (3) include a provision to file a report with the Commission for approval at the end of the 5-year monitoring period documenting the results of the monitoring and any proposals and recommendations about the need for continued monitoring; and (4) include a provision to notify the Commission in the event that water quality deviations are detected during implementation of the proposed water quality monitoring program, any immediate reasonable actions taken to remediate the deviation, and file a report within 10 days that describes the deviation, the corrective actions taken, and proposals to modify procedures to avoid future deviations.

Juneau Hydro's proposal also does not describe how it would maintain minimum flows or include any requirements for reporting any deviations to these instream flows. Including these details would facilitate the Commission's oversight of the license requirements and ensure that corrective actions are timely taken to protect aquatic resources. Therefore, we recommend that Juneau Hydro revise the Stream Flow Management Plan, in consultation with Alaska DFG and Forest Service, to include: (1) a clear description of how the project will be operated to maintain compliance with minimum instream flows for the bypassed reach and anadromous reach of Sweetheart Creek; and (2) a provision to file a report of any deviation from minimum flow or flow continuation requirement with the Commission within 10 days of the deviation. This report should include a description of: (a) the cause, severity, and duration of the incident; (b) any observed or reported adverse environmental impacts resulting from the incident; (c) operational data necessary to determine compliance; (d) a description of any corrective measures implemented at the time of the incident and the measures implemented or proposed to ensure that similar incidents do not recur; and (e) comments or correspondence, if any, received from interested parties regarding the incident.

We also recommend that Juneau Hydro revise the Stream Flow Measurement Plan, in consultation with Alaska DFG and Forest Service, to include: (1) a clear description of the mechanisms or structures to be used for monitoring compliance with minimum instream flows; (2) the exact location of all flow monitoring equipment and gages, including the coordinates and a map showing each monitoring location; (3) justification for the placement of each monitoring location, including how each monitoring location relates to project operation; (4) procedures for maintaining and calibrating monitoring equipment; and (5) an implementation schedule.

We find our recommendation to modify the Stream Flow Management Plan to include a provision to notify the Commission in the event of deviation from minimum flow or flow continuation requirements within 10 days of the deviation and implement corrective measures would be sufficient to ensure the adequate protection of aquatic resources during project operation.

For the reasons described above, we conclude that the modifications recommended by staff would be worth the estimated levelized annual cost of $2,180.

Fish Exclusion Structure

The discharge from the proposed powerhouse could attract upstream migrating salmonids into the draft tubes where they could be struck, injured or killed by the turbines. To address these potential effects, Juneau Hydro proposes to install a fish exclusion structure in the project's tailrace just downstream of the powerhouse. Alaska DFG also recommended the tailrace be designed and constructed to exclude fish from entering the powerhouse and that Juneau Hydro consult with resource agencies regarding the final designs of the fish exclusion structure. Although Juneau Hydro provided some specifications on the design of the fish exclusion structure and indicated its design would meet NMFS criteria, these specifications lacked sufficient detail to ensure its effectiveness.

Therefore, to facilitate the design, construction, operation, and maintenance of its fish exclusion structure we recommend that Juneau Hydro develop a fish exclusion structure plan. We envision that the plan would include a conceptual design of the fish exclusion structure that would be developed after consultation with Alaska DFG and NMFS, and would comply with NMFS' *Anadromous Salmonid Passage Facility Design Guidelines*, dated July 2011. We also recommend that the fish exclusion structure plan include written operations and maintenance procedures to ensure that the fish exclusion structure is properly operated and maintained within its hydraulic design criteria. We estimate that the levelized annual cost of the plan would be $640, and conclude that the additional benefits of developing a fish exclusion structure plan that ensures that the fish exclusion structure functions as designed would be justified by the cost.

Fish Screen

Juneau Hydro proposes, and Alaska DFG recommends, installation of a fish screen in front of the power tunnel intake structure in Sweetheart Lake to exclude salmonid fry. The intake screen would be designed based on NMFS fish screening criteria, including having an approach velocity of no more than 0.4 foot per second and screen mesh no larger than 3/32 inch. This measure would minimize entrainment of sockeye salmon fry, as well as resident rainbow trout and Dolly Varden, through the project intake which could adversely affect the sockeye salmon fishery and Sweetheart Lake fish communities. Although Juneau Hydro provided a preliminary design and specification for the intake screen, they did not include details on how the intake screen would be tested or maintained. As discussed in section 3.3.2, *Aquatic Resources*, conducting a post-construction evaluation of the intake screen and developing operation and maintenance procedures for screen operation would verify performance of all components of the system and ensure that the facilities are operated and maintained in a manner that minimizes entrainment of fish. Therefore we recommend Juneau Hydro prepare a final fish screen design plan in consultation with Alaska DFG and NMFS that includes final fish screen design plans and a description of any proposed testing and maintenance procedures that would be implemented to ensure the screen operates within its hydraulic design criteria. We estimate that the levelized annual cost of the plan would

be $640, and conclude that the additional benefits of developing and implementing a fish screen design plan that ensures that the fish screen on the power tunnel intake functions as designed would be justified by the cost.

Sockeye Smolt Transport Plan

Sweetheart Lake is used to rear sockeye salmon to support a fishery in the anadromous reach of Sweetheart Creek. Construction of the proposed dam at the outlet of Sweetheart Lake would block the downstream migration of stocked sockeye salmon smolts into the Sweetheart Creek bypassed reach. To maintain the sockeye salmon fishery, Juneau Hydro proposes to construct and operate a sockeye salmon smolt collection and transport system to provide downstream passage to sockeye salmon using attraction, collection, transportation, and holding facilities located on Sweetheart Lake and near the tailrace in Sweetheart Creek. Juneau Hydro also agreed with Alaska DFG's recommendation to consult with the resource agencies to prepare a sockeye salmon smolt collection and transport plan that would include: (1) a description of the methods and facilities that would be used to capture, hold, transport, and release sockeye salmon smolts; (2) a description of how the survival rate of smolts would be monitored at each step in the collection and transportation process; and (3) contingency provisions to ensure that sockeye smolts are successfully released and imprinted to Sweetheart Creek if the smolt collection and transport system is unsuccessful.

If the collection and transport system is unsuccessful, Juneau Hydro proposes, for the first 3 years of operation of the system, to have hatchery-reared sockeye salmon smolts available as replacement stock for imprinting directly in the project's acclimation pool before release into the anadromous reach of Sweetheart Creek. Juneau Hydro's performance criterion requires a release of at least 21,000 live sockeye salmon smolts into the anadromous reach of Sweetheart Creek each year, meaning at least that many smolts would be made available for stocking and imprinting for the first 3 years of the license should such stocking be needed. While 3 years is likely to be a sufficient period to evaluate the collection system, it is unclear what Juneau Hydro would do after the initial 3 years to maintain this important and well-used fishery if the collection system does not function as needed. Therefore, we recommend that Juneau Hydro provide an annual report to the Commission on the effectiveness of the collection system and at the end of the 3-year evaluation, file a final report summarizing the cause(s) of system failure and any recommended corrective actions. These notification and filing procedures would provide a means for the Commission to evaluate any proposals for modifying project operations, facilities, or environmental measures to prevent future occurrences of failure to meet performance criteria. We estimate that this additional notification and reporting requirement would not increase the overall cost of developing and implementing the sockeye smolt transport plan.

Aquatic Habitat Plan

Reduced flows in the bypassed reach during project operation could result in a reduction of sediment transport and affect spawning habitat in the anadromous reach of Sweetheart Creek. As part of its Aquatic Habitat Plan, Juneau Hydro proposes to assess spawning gravel availability in the anadromous reach of Sweetheart Creek. At the end of the third year of project operation, Juneau Hydro would review the monitoring results in consultation with Alaska DFG and Forest Service to determine whether there has been a reduction in the area of suitable spawning habitat. If so, Juneau Hydro would prepare a plan in consultation with Alaska DFG and Forest Service that would include provisions to identify areas with hydrology suitable for spawning and add gravel to restore the area of spawning habitat to baseline conditions. Upon the sixth and every successive fifth-year anniversary after the start of project operation, Juneau Hydro, Alaska DFG, and Forest Service would meet to review the spawning habitat assessment and prescriptive gravel augmentation program and determine the necessity of continuing these actions for the next 5 years. In its comments on the draft EIS, NMFS requests that Juneau Hydro develop the Aquatic Habitat Plan in consultation with NMFS to ensure the timely identification of any reduction in spawning gravels and timely and effective replacement of this important habitat to avoid adverse effects on EFH.

Alternatively, Alaska DFG recommends that Juneau Hydro monitor spawning of pink and chum salmon in the anadromous reach and intertidal areas of Sweetheart Creek for 5 years to ensure regulated instream flows are sufficient to support post-project salmon use of habitat. Juneau Hydro agreed to monitor spawning in addition to conducting its spawning habitat assessment.

Based on our analysis of the Juneau Hydro's instream flow study and recommended minimum flows discussed in section 3.3.2, *Aquatic Resources*, the proposed project flow regime would provide adequate velocities and depths to maintain spawning habitat for salmon in the anadromous reach. However, it is unclear whether project operation would alter sediment transport to the anadromous reach and affect spawning habitat for salmon. Juneau Hydro's proposal to assess the availability of spawning habitat in the anadromous reach and to potentially conduct gravel augmentation would ensure suitable substrate is available to support spawning habitat requirements. In contrast, Alaska DFG's recommendation to monitor salmon spawning in the anadromous reach would provide information on the number of salmon spawning in the project area, but would not provide a means to determine if a change in the number of spawning salmon is a result of project operation, including instream flows, or the result of some other factor unrelated to the project (e.g., ocean conditions, harvest, predation, disease). Therefore, we find that the benefits of such monitoring do not justify the levelized annual cost of $3,660 and do not recommend monitoring spawning of salmon. In its December 29, 2015, comments on the draft EIS, Alaska DFG stated because it conducts annual escapement counts on Sweetheart Creek as part of its pink salmon index stream monitoring, not adopting the recommendation to monitor pink and chum salmon spawning would be acceptable.

Juneau Hydro's proposed spawning habitat assessment could benefit spawning habitat for salmon if the assessment indicates a reduction in suitable spawning substrates; however, the Aquatic Habitat Plan does not include methods or evaluation metrics for the spawning habitat assessment. Further, the plan lacks reporting requirements that would allow the Commission to enforce compliance with the proposed measures and approve proposed mitigation measures. We therefore recommend modifying the plan in consultation with Alaska DFG, NMFS, and the Forest Service to include the additional monitoring and mitigation details and to file a report with the Commission by December 31 of year 3 following implementation of the spawning habitat assessment, describing the assessment results and any recommendation for continuing the monitoring program or implementing measures to augment spawning habitat. Revising the Aquatic Habitat Plan to include these requirements would have a levelized annual cost of $110 and we find the benefits are worth the cost.

Fish Mitigation Plan

Project operation would cause fluctuating lake levels that could adversely affect access to suitable spawning areas and rearing success of resident rainbow trout and Dolly Varden in Sweetheart Lake. As part of its Fish Mitigation Plan, Juneau Hydro proposes to monitor Dolly Varden and rainbow trout recruitment in Sweetheart Lake and its inlet streams for 5 years, or less if Alaska DFG and other resource agencies determine that project operation has not been shown to adversely affect aquatic resources. If results of the monitoring indicate poor recruitment in the first 3 years of project operation, Juneau Hydro would implement mitigation measures that could include: (1) stocking triploid rainbow trout and Dolly Varden in Sweetheart Lake; (2) improving access to potential spawning habitat in tributaries to Sweetheart Lake; or (3) conducting offsite mitigation determined in consultation with Alaska DFG and Forest Service.

Juneau Hydro provided a description of its proposed monitoring program methods and evaluation metrics but did not specify in detail the sampling schedules and level of effort required to ensure effective sampling. Alaska DFG recommended that the plan include defined sampling protocols, methods, schedules, and effort, as well as evaluation metrics. Alaska DFG also recommended that monitoring continue for a minimum of 5 years post construction, with annual reporting and review, and evaluation of potential study plan modifications, as necessary. Juneau Hydro agreed to finalize the plan in consultation with Alaska DFG and Forest Service to include these elements. This detail is needed to design an effective monitoring plan.

While Juneau Hydro's proposed mitigation measures could provide some benefits to resident fish if monitoring indicates a decline in recruitment, it is premature to recommend specific mitigation measures because there is insufficient information to assess the need, benefits, and costs of the measures or their relationship to project effects or purposes. We therefore recommend that the plan be modified to include the additional monitoring details recommended by Alaska DFG, and to file a report with the Commission by December 31 of year 3 following implementation of the monitoring

program, describing the monitoring results and any recommendation for continuing the monitoring program or implementing measures to improve recruitment. Revising the Fish Mitigation Plan to include these requirements would have a levelized annual cost of $110 and we find the benefits are worth the cost.

Vegetation Management Plan

Project construction would result in the removal of about 509 acres of vegetation and the temporary disturbance of about 20 acres of vegetation. Project operations would also inundate the twocolor sedge plant identified within the tributary floodplain around Sweetheart Lake. To minimize adverse effects on vegetation and wildlife, Juneau Hydro proposes to revegetate disturbed sites with native plants and moss salvaged from disturbed areas, supplement the plantings as needed to recover the sites, control invasive species, and monitor revegetation efforts annually for 5 years through photo documentation. To prevent the establishment of invasive species, Juneau would wash equipment prior to its transport to the project site and inspect equipment upon its arrival, monitor disturbed areas monthly during the growing season while construction occurs and annually for 5 years after construction is complete, and implement eradication measures for any invasive species identified during monitoring.

Forest Service 4(e) condition 22 specifies and Juneau Hydro has agreed to consult with the Forest Service to finalize the Vegetation Management Plan to ensure the plan includes resource management objectives tied to the Tongass National Forest Land and Resource Management Plan. Similarly, Forest Service 4(e) condition 15 specifies and Juneau Hydro has agreed to obtain written permission before applying pesticides or herbicides on any National Forest lands, in areas affecting National Forest lands, or within 500 feet of rough-skinned newt, western toad, or any special status or culturally significant plant population. This measure would ensure any use of pesticides would be appropriate to the task and reduce the potential for inadvertent overuse. Salvaging and transplanting the twocolor sedge plant prior to clearing and inundating the project reservoir site as recommended by the Forest Service would minimize effects of inundation on this species. We find this measure would preserve existing levels of species viability within the project area and would have a levelized annual cost of $20, and we find the benefits would be worth the cost.

Revegetation Measures

Juneau Hydro's proposed Vegetation Management Plan lacks certain details that would improve its implementation, the effectiveness of the proposed revegetation measures, and Commission administration of the license.

Therefore, we recommend Juneau Hydro consult with the Forest Service to refine the Vegetation Management Plan to include: (1) a detailed description of the storage and treatment of salvaged plants; (2) a proposed species list for supplemental plantings; (3) criteria, based on existing conditions, to determine whether revegetation is successful; (4) a description of data collection and analysis methods for monitoring that correspond

to success criteria; and (5) provisions for monitoring and supplemental plantings, as needed, until success criteria are met for 2 consecutive growing seasons.

With these additional measures, the Vegetation Management Plan would provide for increased survivorship of salvaged plants and reduce the need for plants from an offsite location. The plan would identify those species Juneau Hydro would import to the site to supplement salvaged plants, expediting acquisition of the appropriate plants. Our recommended modifications would reduce potential for insufficient revegetation, maximize the reduction of project effects on vegetation resources, and ensure monitoring is not discontinued prematurely. Revising the Vegetation Management Plan to include these requirements would have a levelized annual cost of $640, and we find the benefits would be worth the cost.

Invasive Species Management Measures

Juneau Hydro's plan does not address use of herbicides. While there is no indication that the Juneau Hydro might need to apply herbicides or pesticides, such use may be required in the future. Pesticides and herbicides could adversely affect rough-skinned newt, western toad, or any other special-status species or culturally significant plant populations. Defining appropriate pesticide and herbicide application methods and obtaining Forest Service approval for their use would prevent adverse effects on fish and wildlife, particularly sensitive species.

While Juneau Hydro's plan would substantially reduce the potential for transporting invasive weeds to the project area, the plan lacks certain details that would improve its implementation and the effectiveness of the control measures. For example, project construction materials, including fill materials or erosion control materials like hay or straw, could contain seeds or other regenerative materials from invasive species. The proposed plan does not explicitly address these potential vectors. The plan mentions eradication measures that could prevent the spread of invasive plants; however, the plan does not indicate what eradication measures are proposed or how Juneau Hydro would dispose of plant material to prevent additional colonization from stem and root segments. Additionally, the plan does not provide for any additional measures should eradication attempts prove unsuccessful following 5 years of treatment and monitoring. Therefore, we recommend Juneau Hydro, in consultation with the Forest Service, and as specified in Forest Service 4(e) condition 22, revise the invasive species plan to include: (1) use of weed-free fill materials and weed-free erosion control methods; (2) a monitoring schedule that addresses short-term (first 3 to 5 years) and long-term monitoring needs; (3) a description of proposed eradication measures; and (4) avoid the use of pesticides and herbicides on National Forest lands or in areas affecting National Forest lands and within 500 feet of rough-skinned newt, western toad, or any other special-status species or culturally significant plant populations. Implementing our recommended measures would reduce the likelihood for introduction of invasive plant propagules via construction materials. Our measures would ensure proposed eradication measures are consistent with Forest Service regulations and identify conditions where use of pesticides would be

appropriate, to expedite eradication and reduce the need for future approvals. For the reasons described above, we conclude that the modifications recommended by staff for the Vegetation Management Plan, including the Invasive Species Management Plan, would be worth the estimated levelized annual cost of $960.

Wildlife Mitigation and Monitoring Plan

To reduce construction effects on wildlife, Juneau Hydro would implement the following measures included in its Wildlife Mitigation and Monitoring Plan: (1) locate the coastal road and trail to minimize disturbance to forested areas; (2) construct a 94-foot-wide overpass over the tailrace and a connecting trail on the shore side of the visual landform barrier to the coastal trail to prevent barriers to wildlife movements; (3) develop a wildlife trail upland to bypass the caretaker's facility to minimize human-animal interaction; (4) bury the penstock to avoid impeding animals traversing the project area; (5) construct the powerhouse and switchyard in an excavated area to minimize the effects of project operation on wildlife; (6) surround the powerhouse and switchyard with a naturalized berm to reduce visibility and noise that may disturb wildlife; (7) schedule construction work on the tailrace near lower Sweetheart Creek for May through June to minimize disturbance at the time that bears are fishing; (8) locate the caretaker's facility on Gilbert Bay as far away from Sweetheart Creek and the heavy animal use areas as possible within the project boundary; (9) restrict employees, contractors, and subcontractors from hunting, fishing, and trapping within 0.5 mile of project features during construction of the project; (10) post hunting and fishing regulations onsite; and (11) prohibit personal firearms onsite, except as specifically approved by the ECM with any additional restrictions included in the Environmental Compliance Plan.

We do not recommend constructing the proposed wildlife bypass trail around the caretaker's facility. Wildlife may not use the trail, but hunters, trappers, and recreationists would, increasing interactions of wildlife with humans. Tree felling would likely be required for the trail's construction, resulting in short-term noise disturbance and long-term habitat alteration. Because there is no assurance that the trail would benefit wildlife and the trail's construction would have adverse impacts, implementing this measure is not warranted and any benefits to wildlife are not worth the estimated capital cost of $5,050 to construct the trail.

Juneau Hydro proposes and Alaska DFG recommends restricting project personnel from hunting, fishing, and trapping within 0.5 mile of the project during construction. Juneau Hydro also proposes restricting the onsite possession of personal firearms by project personnel and posting hunting and fishing regulations during construction. Alaska DFG states that overharvest of animals, particularly brown bears, by project personnel might occur due to increased access. Juneau Hydro's proposed measures would likely benefit fish and wildlife, provided the restrictions and regulations are adhered to. However, enforcing state hunting, fishing, and trapping regulations is the state's responsibility, and if the state wishes to impose site-specific limitations for the project, it would be able to do so outside any license issued. Therefore, we recommend

that Juneau Hydro, revise the Wildlife Mitigation and Monitoring Plan to remove the proposed restrictions on hunting, fishing, and trapping and onsite possession of personal firearms by project personnel, and the posting of fishing and hunting regulations.

Recreation Management Plan

Juneau Hydro proposes to implement a Recreation Management Plan that includes constructing permanent interpretive displays at the head of Sweetheart Creek Trail; constructing a trail system to the traditional fishing areas at Sweetheart Creek that would separate human activity from bear activity; constructing a trail from the boat dock to the powerhouse location; installing at least three mooring buoys in Gilbert Bay; constructing landform berms to provide scenic, sound and light barrier between the powerhouse/switchyard area and Sweetheart Creek recreational use areas; constructing a rock tailrace that increases the areas available for fishing; and constructing a dock and intertidal ramp on the eastern shore of Gilbert Bay that would be available for public use. We therefore recommend that Juneau Hydro consult with the Forest Service, Park Service, and Alaska DFG to finalize the Recreation Management Plan, file the plan with the Commission for approval, and file as-built drawings with the Commission to ensure that the recreation facilities are completed and adequate to meet recreational needs.

The Recreation Management Plan also includes a provision to review the adequacy of the proposed recreational facilities 20 years after the license is issued. It appears, however, that a shorter time period until the first review would be necessary to ensure that the proposed recreational facilities are adequately accommodating recreational needs in the project area. Given that these are new recreational facilities in an area previously without any such facilities, it is uncertain whether they would have sufficient or excess capacity, are properly located, and visitors would follow the rules for using the buoys and dock. Further, it is unclear how changing federal and state regulations and land use plan guidelines and policies might affect the management of future recreational use in the project area. Therefore, we recommend that Juneau Hydro review the adequacy of its new recreational facilities within 4 years of completion of project construction in consultation with Forest Service, Park Service, and Alaska DFG, and every 10 years thereafter. To ensure that recreational needs at the project are being adequately addressed, Juneau Hydro should file all recreational facility and use monitoring reports with the Commission along with any proposals to revise the Recreation Management Plan to accommodate future recreation needs. The associated levelized annual cost of $480 to increase the number of recreational facility reviews over the term of the license would be justified by the increased benefits to be derived from meeting future recreation needs in the project area.

Access Management Plan

Juneau Hydro proposes to implement an Access Management Plan to ensure that project facilities are protected, public access is controlled, and worker and public safety is maintained. As part of this plan, Juneau Hydro proposes to restrict public access to the

proposed boat dock and ramp to only personal use sockeye fishery permit holders. Restricting public use of project recreation facilities to a specific group, however, is not consistent with the Commission's policy on public access, which encourages free and safe public access to project lands and waters. Because there does not appear to be any safety concerns related to accessing these facilities, and allowing access for the small number of non-fishery-related recreational users is not likely to put a strain on these facilities, we recommend that Juneau Hydro allow public access to these facilities for all recreationists. If recreational monitoring, as provided for in the Recreation Management Plan, shows that use should be limited, then use limitations should be determined by capacity constraints rather than by recreational user type. We, therefore, recommend that Juneau Hydro revise its Access Management Plan to allow full public access to the proposed boat ramp and dock. We recommend that these revisions also be reflected in the revised Recreation Management Plan. Filing the Access Management Plan for Commission approval after consultation with the Forest Service would ensure that public access is adequately maintained and managed to meet recreational needs. Allowing additional public access for the limited number of non-fishery-related recreationists in the project area would have a negligible effect on the project. We estimated that revisions to the Access Management Plan as proposed by Juneau Hydro, and revisions to the Recreation Management Plan as recommended by staff, would have levelized annual costs of $320 and $480, respectively. Additional revisions to these plans to reflect full public access would have negligible additional costs.

Scenery Management and Monitoring Plan

Juneau Hydro proposes to implement a Scenery Management and Monitoring Plan designed to avoid or minimize visual effects during project construction and operation. Measures in the plan include using exterior colors for the proposed transmission structures, marine access facilities and fencing that minimize contrast with the surrounding environment; minimizing vegetation removal; using native vegetation to reduce visibility of the project; allowing reestablishment of native vegetation in disturbed areas; and minimizing use of exterior lighting. Implementing the Scenery Management and Monitoring Plan, as Juneau Hydro proposes, would ensure the project is constructed to minimize its effects on scenic resources. Although Juneau Hydro would annually provide photographs to the Forest Service to document the appearance of project lands for the first 10 years of the license, this monitoring approach would be more effective if permanent photo points and the time of year for taking the photos were established in consultation with the Forest Service. Additionally, the Scenery Management and Monitoring Plan does not provide an opportunity for periodically reviewing the project over the life of the license to determine if it is still meeting the desired scenic integrity objectives (e.g., vegetative screening effectiveness). Including this approach in the plan would address issues related to visual resources that may evolve during the license term.

Therefore, Juneau Hydro should finalize the plan in consultation with the Forest Service and include provisions to establish specific photo points and the time of year to

take the photos to monitor the project's visual effects during the first 10 years of the license, as well as procedures to report and address visual issues during the entire license term. Consulting with the Forest Service to finalize the plan is consistent with Tongass National Forest Land and Resource Management Plan direction to involve Forest Service staff as project design work evolves, to ensure the plan contains adequate measures to protect scenic resources and achieve consistency with applicable scenery integrity objectives. Because Juneau Hydro already proposes to take monitoring photographs and to consult with the Forest Service on the final Scenery Management and Monitoring Plan, staff does not anticipate any additional costs related to establishing specific photo points or reporting procedures. Therefore, we conclude that the modifications recommended by staff for the Scenery Management and Monitoring Plan would be worth the additional effort.

Cultural Resources Training and Monitoring

Juneau Hydro proposes to implement a Heritage Resources Protection Plan to ensure that cultural resources are adequately protected during construction activities and over the term of the license. While the plan indicates that cultural resource training programs would be provided for project workers, it does not provide specific details about the training program or indicate whether the ECM would be trained in the proper cultural resource protocols, as recommended by the Forest Service. Further, the plan has no provision to have an onsite archeological monitor during ground-disturbing activities in archeologically sensitive areas, as recommended by the Forest Service and Alaska SHPO. Revising the Heritage Resources Protection Plan to include cultural resource training program details for all workers, including the ECM, would ensure that any previously undiscovered cultural resources are correctly identified and proper protocols are followed. Including a provision in the Heritage Resources Protection Plan for an onsite archeologist to monitor initial ground-disturbing activities in areas likely to yield previously undiscovered archeological resources would ensure that cultural resources are adequately protected in archeologically sensitive areas. We find these benefits would be worth the minor additional cost ($2,610 levelized annual cost).

5.2.3 Measures Not Recommended by Staff

Some of the measures proposed by Juneau Hydro and recommended by other interested parties would not contribute to the best comprehensive use of the Sweetheart Lake and Sweetheart Creek water resources, do not exhibit sufficient nexus to the project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discusses the basis for staff's conclusion not to recommend such measures.

Monitoring Salmon Spawning as Part of Aquatic Habitat Plan

As described above, we are not adopting Alaska DFG's recommendation to monitor salmon spawning in the anadromous reach, as part of the Aquatic Habitat Plan.[67] Such monitoring would not provide a means to determine if a change in the number of spawning salmon is a result of project operation, or the result of some other factor unrelated to the project (e.g., ocean conditions, harvest, predation, disease). Therefore, we find that the benefits of such monitoring do not justify the levelized annual cost of $3,660.

Wildlife Bypass Trail as Part of Wildlife Mitigation and Monitoring Plan

We are not recommending the proposed wildlife bypass trail around the caretaker's facility. As we discuss above, there is no assurance that the trail would benefit wildlife and the trail's construction would have adverse impacts, and any benefits to wildlife are not worth the estimated capital cost of $5,050 to construct the trail.

Restrictions on Hunting, Fishing, and Firearms Use as Part of Wildlife Mitigation and Monitoring Plan

We are not recommending Juneau Hydro's proposal and Alaska DFG's recommendation to restrict project personnel from hunting, fishing, and trapping within 0.5 mile of the project during construction. As we describe above, enforcing state hunting, fishing, and trapping regulations and posting fishing and hunting regulations are the state's responsibility, and if the state wishes to impose site-specific limitations for the project, it would be able to do so outside any license issued.

5.3 UNAVOIDABLE ADVERSE IMPACTS AND IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

5.3.1 Unavoidable Adverse Impacts

Project construction would disturb soils in the project area, resulting in temporary adverse effects on soil resources. Juneau Hydro's proposed Erosion Control Plan, Storm Water Plan, Spoil Disposal Plan, and Acid Rock Plan provide a comprehensive set of measures to avoid or minimize construction effects on soil erosion, sedimentation, and water pollution during construction. Even with implementation of these plans, there would still be temporary increases in sediment and turbidity levels which would cause short-term effects on aquatic biota in Sweetheart Creek and Gilbert Bay.

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[67] In its comments on the draft EIS, Alaska DFG agreed that monitoring pink and chum salmon spawning in Sweetheart Creek would not provide a means to determine effects of the proposed project operation; however, Alaska DFG did not withdraw this provision of its 10(j) recommendation.

During initial project operation, there is the potential for newly inundated soils to cause a temporary increase in turbidity in Sweetheart Lake. Juneau Hydro's proposed Reservoir Management Plan defines measures Juneau Hydro would take to minimize these impacts, such as maintaining vegetation in place to provide soil stability. Regardless, temporary increases in the turbidity of Sweetheart Lake are anticipated to cause short-term effects on aquatic biota in Sweetheart Lake.

Reducing flows in the bypassed reach could reduce transport of gravel and fine sediment to the Sweetheart Creek anadromous reach. Juneau Hydro's proposal to monitor aquatic habitat and potentially augment gravel in Sweetheart Creek would ensure suitable spawning and rearing habitat is available to salmonids and minimize any adverse effects.

Construction of the dam would eliminate downstream passage for resident rainbow trout, Dolly Varden, and sockeye salmon into the bypassed reach. Rainbow trout and Dolly Varden collected from the bypassed reach are not thought to be self-sustaining and the existing reach has limited habitat for these species; therefore, minimal adverse effects on rainbow trout and Dolly Varden would occur. Operation of Juneau Hydro's proposed sockeye salmon smolt collection and transport system would provide downstream passage and could minimize any adverse effects on the personal use fishery in the anadromous reach of Sweetheart Creek.

Project operations would cause substantial lake level fluctuations in Sweetheart Creek and could adversely affect spawning success of rainbow trout and Dolly Varden. Juneau Hydro's proposal to monitor fish recruitment in Sweetheart Lake and potentially conduct stocking or improve access to suitable habitat in inlet streams would minimize any adverse effects.

Project construction would result in the permanent loss or alteration of about 70 acres of vegetated wildlife habitat, including high-volume productive old-growth forest; low-volume productive old-growth forest; forest muskeg; unproductive forest; non-forested, natural young growth; and intertidal and subtidal vegetation, including about 2 acres of delineated wetlands, for the dam, tunnel portal, powerhouse, tailrace, coastal access road, dock and landing facility, caretaker's facility, and overhead transmission line. Inundation around Sweetheart Lake would result in the loss of an additional 442 acres of vegetation, including about 11.4 acres of wetlands, with additional effects on 16.3 acres, depending on reservoir levels. Roughly 20 acres of temporary vegetation disturbance would occur during project construction. The reservoir would inundate individuals or populations of three rare plant species. There would be an increased risk for the introduction of invasive plant species. However, revegetating the disturbed areas and ensuring the successful establishment of native vegetation and controlling the introduction and spread of invasive species would minimize the effects on the extent practicable.

Wildlife would be disturbed by noise and human presence during the 2-year construction period and, to a lesser extent, project operation and maintenance. The

overhead transmission line could result in bird collisions which could cause direct injury or mortality of individual animals. Designing the overhead line consistent with practices outlined by APLIC, including marking anadromous stream crossings to increase visibility would minimize this potential to the greatest extent practicable. A greater presence of humans during construction and to a lesser degree during operation, would increase the chances of bear-human interactions and the potential need to kill or relocate bears. Juneau Hydro's bear protection plan would minimize such interactions to the extent practicable.

Existing recreational access to the project area would be periodically interrupted during the 2-year construction period. Noise generated by project construction activities would temporarily reduce the wilderness-type experience presently offered to recreationists in the project vicinity. Decreased flow over the upper falls in the project bypassed reach during project operation would reduce the aesthetic appeal of the falls to fishermen in the area. Construction of project facilities would introduce man-made modifications to an existing unmodified natural landscape that could not be mitigated to meet all Tongass National Forest Land and Resource Management Plan scenery management objectives.

5.3.2 Irreversible and Irretrievable Resource Commitments

An irreversible commitment of resources refers to the loss of production or use of a resource from a land use decision, that once executed, cannot be changed. An irretrievable commitment of resources applies to losses of production or use of renewable resources for a period of time.

The construction and operation of the proposed project under the action alternatives would commit lands and waters from their current use to use for energy production. Therefore, any land or water occupied by the proposed project, including vegetated areas, wetlands, and wildlife habitat occupied by project facilities, would be irretrievably lost for at least the duration of any licenses issued.

During project construction, the loss of productive soils resulting from erosion would be irreversible. Road construction, excavating the power tunnel, and construction of the visual landform barrier in front of the powerhouse under the staff alternative would cause the greatest concentration of soil displacement and sediment movement.

5.4 SUMMARY OF SECTION 10(j) RECOMMENDATIONS AND 4(e) CONDITIONS

5.4.1 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, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

Alaska DFG was the only agency to file 10(j) recommendation in response to our notice of intent to prepare an EIS and request for comments, final recommendations, terms and conditions, and prescriptions. On January 16, 2015, Alaska DFG filed 22 section 10(j) recommendations. In the draft EIS, we determined that 18 of the 22 recommendations fell within the scope of section 10(j). Of those recommendations, we determined that the recommendation to evaluate pulse flows may be inconsistent with the substantial evidence standard of section 313(b) of the FPA. We also determined that the pink and chum salmon monitoring component of the agency's recommended Biotic (Aquatic) Habitat Monitoring Plan may be inconsistent with the FPA.

On October 29, 2015, we informed Alaska DFG of the inconsistencies. On December 29, 2015, Alaska DFG filed additional information to support the need for evaluating pulse flows and modified its recommendation to include details of its recommended pulse flow release and monitoring plan. After analyzing this information in section 3.3.2.2 and weighing the benefits in section 5.2.2, we now recommend developing a plan to evaluate the effectiveness of releasing pulse flows in any license issued; therefore, this issue is resolved.

In a December 29, 2015 letter, Alaska DFG also stated that because Alaska DFG conducts annual escapement counts on Sweetheart Creek as part of its pink salmon Index Stream monitoring, FERC's recommendation to not require pink and chum monitoring is acceptable to Alaska DFG; therefore, we consider this issue resolved.

After considering the comments and information filed on the draft EIS, we revised our findings as discussed above. Table 5-1 lists the recommendations subject to section 10(j), and whether the recommendations are adopted 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 and our recommendations provided in section 5.2.2. Of the 18 recommendations that we consider to be within the scope of section 10(j), we wholly include 17, and include 1 in part.

Table 5-1. Alaska Department of Fish and Game recommendations for the Sweetheart Lake Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
1. Continuously release 3 cfs from the dam site into the Sweetheart Creek bypassed reach. This flow may be temporarily modified, if required, by operating emergencies beyond the control of Juneau Hydro, or for short periods upon agreement between Juneau Hydro, Alaska DFG, and other requesting agencies.	Alaska DFG	Yes	No cost; any potential lost energy is already included in the annual generation estimate	Yes
2. Operate the project to maintain instantaneous instream flows in the anadromous reach, pursuant to the schedule below: • January–February (40 cfs) • March (45 cfs) • April (119 cfs) • May–October (300 cfs) • October–December (117 cfs)	Alaska DFG	Yes	No cost; flows would be released through the powerhouse turbines	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
3. Release a minimum of four pulse flows of up to 486 cfs between July 1 and August 31 of each year and develop a pulse flow release and monitoring plan, in consultation with the resource agencies.	Alaska DFG	Yes	$5,440	Yes
4. Operate and maintain a stream gage in the project tailrace (according to USGS standards). Data would be recorded at a frequency of not greater than 15-minute intervals. Consult with resource agencies regarding how to monitor and ensure compliance with the instream flow provisions.	Alaska DFG	Yes	$9,720	Yes
5. Provide fail-safe provisions to ensure that flow releases are provided continuously to the bypassed and anadromous reaches of Sweetheart Creek during routine maintenance periods, emergency project shutdowns, and interruptions to the power grid.	Alaska DFG	Yes	Included in the cost of construction	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
6. Design and construct the powerhouse tailrace to exclude fish from entering the turbine draft tubes to avoid or minimize the potential for fish injury or mortality.	Alaska DFG	Yes	$16,120	Yes
7. Install a fish screen at the power tunnel intake structure in Sweetheart Lake to prevent the entrainment and impingement of salmonid fry. The screen shall be designed based on NMFS fish screening criteria.	Alaska DFG	Yes	$87,630	Yes
8. Prepare a sockeye smolt transport plan.	Alaska DFG	Yes	$53,280	Yes
9. Consult with resource agencies and prepare a Biotic (Aquatic Habitat) Monitoring Plan. The plan would include the following components: (1) monitoring of pink and chum salmon spawning in the anadromous reach and intertidal areas of Sweetheart Creek; and (2) monitoring of resident Dolly Varden char and rainbow trout spawning and young of year recruitment in Sweetheart Lake and the inlet streams.	Alaska DFG	Yes, with regard to preparation and implementation of the plan. No, with regard to consultation, because consultation is not a specific fish and wildlife measure.	$4,310	Yes, except for requirement to monitor pink and chum salmon spawning.

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
10. Establish timing windows for instream construction activities and stream crossings (in consultation with the Alaska DFG habitat biologist assigned to the project).	Alaska DFG	Yes, except for agency consultation, which is not a specific fish and wildlife measure.	Negligible	Yes
11. Locate all clearings and road/trail corridors a minimum of 100 feet, measured horizontally, away from ordinary high water of Sweetheart Creek and its tributaries. Clearings and road/trail corridors for the powerhouse and appurtenant facilities, penstock, and tailrace are excluded from this requirement. Except for stream crossings, locate the transmission line corridor a minimum of 100 feet, measured horizontally, away from ordinary high water of all streams identified in the latest (2011) edition of Alaska DFG's Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes.	Alaska DFG	Yes	Included in the cost of the Erosion Control Plan.	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
12. Construct transmission line power poles to conform to guidelines accepted by FWS and described in *Suggested Practices for Avian Protection on Power Lines—State of the Art in 2006.*	Alaska DFG	Yes	$26,100	Yes
13. Implement a Bear Safety Plan that includes: (1) operating practices when in bear country that minimize possible conflict; (2) minimizing encounters and avoid areas often used by bears, if possible; (3) keeping construction sites and refuse areas clean of substances that attract bears; (4) installing bear-proof garbage receptacles and other measures during construction to prevent bears from obtaining food or garbage; (5) dealing with problem bears; and (6) notifying Alaska DFG of any bear-human conflicts.	Alaska DFG	Yes, except that the provision for notifying a resource agency of any bear-human conflicts is not a specific fish and wildlife measure.	$1,780	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
14. Aircraft shall maximize their distance away from mountain goat habitat and observed mountain goats. To the extent possible, a 1,500-foot vertical or horizontal clearance should be maintained from mountain goat habitat and observed mountain goats. Of particular concern is use of kidding habitat between May 15 and June 15.	Alaska DFG	Yes	$1,310	Yes
15. Construct the project penstock underground, to protect wildlife movement.	Alaska DFG	Yes	Included in the cost of construction	Yes
16. Restrict employees, contractors and subcontractors from hunting, sport fishing, or trapping within 0.5 mile of project features.	Alaska DFG	No, because hunting, fishing, and trapping are state-regulated activities over which the Commission has no jurisdiction.	Negligible	No, enforcement of hunting, fishing, and trapping regulations are the responsibility of the state.

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
17. Develop and implement an Erosion Control Plan that includes (1) a description of site characteristics to include: soils, landscape, vegetation, topography, nearby waters including springs and seeps; (2) preventative measures based on site-specific conditions; (3) location of areas for storage or deposition of removed overburden including erosion control to be utilized in those areas; (4) detailed descriptions, functional design drawings, and specific topographic locations of all control measures, including riprap placement and stream setback and proposed stabilization measures for spoil material; and (5) prescriptions for revegetation of all disturbed areas including treatment of overburden deposition sites, plant species, and methods to be used. Also, file the final plan with the Commission at least six months before the start of any land disturbance or land clearing activities.	Alaska DFG	Yes, except that the timing of the filing of the plan is an administrative matter, and therefore, is not a specific fish and wildlife measure.	$9,090	Yes, except for the timing of filing the plan with the Commission

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
18. Provide for an ECM who: (1) is employed through the duration of project construction; (2) has the authority to issue cease work orders in the field as deemed necessary; (3) documents compliance with license conditions; and (4) is responsible for preparation of weekly construction reports to be filed with the Commission and Alaska DFG.	Alaska DFG	No; not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$18,500	Yes
19. Monitor turbidity in Sweetheart Creek upstream and downstream of construction activities on a daily basis.	Alaska DFG	Yes	Included in the cost of the Erosion Control Plan.	Yes
20. Implement the Hazardous Substances Plan filed with the license application that includes procedures for reporting and responding to releases of hazardous substances.	Alaska DFG	Yes	$320	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
21. Within 10 days of detecting events that are out-of-compliance with license requirements, notify the Commission, Alaska DFG, and other requesting agencies that the event occurred. Take immediate steps to correct the out-of-compliance event including causes of such events so that they do not recur, and document those steps in a detailed description of the event to be filed with FERC and requesting agencies, no later than 30 days following detection of the event.	Alaska DFG	No; these are administrative measures related to compliance, and therefore, they are not specific measures to protect, mitigate, or enhance fish and wildlife resources	Negligible	Yes
22. Provide representatives of Alaska DFG free and unrestricted access to, through, and across project lands and waters and project works, in the performance of their official duties upon appropriate advance notification.	Alaska DFG	No; not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$0	Yes

5.4.2 Land Management Agencies' Section 4(e) Conditions

In section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the 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.

Of the Forest Service's 22 conditions, we consider 18 of the conditions (conditions 1 through 14 and 16 through 20) to be administrative or legal in nature and not specific environmental measures. We therefore do not analyze these conditions in this final EIS. Table 5-2 summarizes our conclusions with respect to the three 4(e) conditions that we consider to be environmental measures. We include in the staff alternative all three conditions as specified by the agency.

Table 5-2. Forest Service 4(e) conditions for the Sweetheart Lake Project (Source: staff).

Condition	Annualized Cost	Adopted?
No. 15, pesticide use restrictions on NFS lands	$0	Yes
No. 21, qualified ECM to oversee construction	$1,640	Yes
No. 22a, construction plan	$320[a]	Yes
No. 22b, spoil disposal plan	$3,760[a]	Yes
No. 22c, access and road management and maintenance plan	$320[a]	Yes
No. 22d, reservoir management and inundation plan	$1,470	Yes
No. 22e, erosion control plan	$7,790[a]	Yes
No. 22f, solid waste and wastewater plan	$320[a]	Yes
No. 22g, hazardous substances plan	$320[a]	Yes
No. 22h, fire prevention plan	$320[a]	Yes
No. 22i, heritage resource protection plan	$2,610[a]	Yes
No. 22j, scenery management plan	$2,610[a]	Yes
No. 22k, vegetation management plan	$4,250[a]	Yes

Condition	Annualized Cost	Adopted?
No. 22l, invasive species management plan	$1,470 [a]	Yes
No. 22m, wildlife mitigation and monitoring plan	$4,250[a]	Yes
No. 22n, fish mitigation and monitoring plan	$650[a]	Yes
No. 22o, threatened, endangered, proposed for listing, and sensitive species plan	$2,610[a]	Yes
No. 22p, stream flow management plan	$1,470[a]	Yes
No. 22q, stream flow measurement plan	$11,190[a]	Yes
No. 22r, aquatic habitat restoration and monitoring plan	$7,470[a]	Yes
No. 22s, environmental compliance monitoring plan	$16,860	Yes
No. 22t, storm water plan	$1,300	Yes

[a] Cost provided by Juneau Hydro in its additional information response, filed on October 20, 2014, and modified by staff.

5.5 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 federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 18 comprehensive plans that are

applicable to the Sweetheart Lake Project, located in Alaska.[68] We have determined that the project would be consistent with their provisions with the exception of the *Tongass National Forest Land and Resource Management Plan*, as discussed below.

The Tongass National Forest Land and Resource Management Plan identifies the following Scenic Integrity Objectives for various LUD areas:

High—Modifications must not be evident to the casual observer;

Moderate—Modifications must be subordinate to the characteristic landscape;

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[68] (1) Alaska Administrative Code. 2012. 5 AAC § 39.222. Policy for the Management of Sustainable Salmon Fisheries. Juneau, Alaska; (2) Alaska Administrative Code. 2003. 5 AAC § 75.222. Policy for the Management of Sustainable Wild Trout Fisheries. Juneau, Alaska; (3) Alaska Department of Fish and Game. 2011. Alaska Anadromous Waters Catalog – Southeastern Region. Anchorage, Alaska. June 1, 2011; (4) Alaska Department of Fish and Game. U.S. Fish and Wildlife Service. 2007. Black Oystercatcher (*Haematopus bachmani*) Conservation Action Plan. Anchorage, Alaska. April 2007; (5) Alaska Department of Natural Resources. 1993. Juneau State Land Plan. Juneau, Alaska. December 1993; (6) Alaska Department of Natural Resources. Alaska's Outdoor Legacy: Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2009–2014. Anchorage, Alaska; (7) Forest Service. 2008. Tongass National Forest Land and Resource Management Plan. Department of Agriculture, Ketchikan, Alaska. January 2008; (8) National Marine Fisheries Service. 2007. Conservation Plan for the Eastern Pacific Stock of Northern Fur Seal (*Callorhinus ursinus*). National Marine Fisheries Service, Juneau, Alaska. December 2007; (9) National Marine Fisheries Service. 2008. Recovery Plan for the Steller Sea Lion: Eastern and Western Distinct Population Segments (*Eumetopias jubatus*). National Marine Fisheries Service, Juneau, Alaska. March 2008; (10) National Park Service. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993; (11) U.S. Fish and Wildlife Service et al. 2008. Alaska Shorebird Conservation Plan. Version II. Anchorage, Alaska. November 2008; (12) U.S. Fish and Wildlife Service. 2009. Alaska Seabird Conservation Plan. Anchorage, Alaska. 2009; (13) U.S. Fish and Wildlife Service. 2005. Regional Seabird Conservation Plan. Pacific Region, Portland, Oregon. January 2005; (14) U.S. Fish and Wildlife Service. 2002. Steller's Eider (*Polysticta stelleri*) Recovery Plan. Fairbanks, Alaska. September 2002; (15) U.S. Fish and Wildlife Service. 1996. Spectacled Eider (*Somateria fischeri*) Recovery Plan. Anchorage, Alaska. August 1996; (16) U.S. Fish and Wildlife Service. 1994. Conservation plan for the Pacific Walrus in Alaska. Anchorage, Alaska. June 1994; (17) U.S. Fish and Wildlife Service. 1994. Conservation Plan for the Sea Otter in Alaska. Anchorage, Alaska. June 1994; (18) U.S. Fish and Wildlife Service. n.d. Fisheries USA: The Recreational Fisheries Policy of the U.S. Fish and Wildlife Service. Washington, D.C.

Low—Modifications may visually dominate the characteristic landscape but must have visual characteristics similar to those of natural occurrences within the surrounding area or characteristic landscape; and

Very low—Modifications may dominate the landscape.

To be consistent with these objectives, the project must meet the applicable LUD objective within 1 year at the foreground distance zone and within 5 years in the middleground or background zones.

Project facilities located on the east side of Gilbert Bay (penstock, powerhouse, switchyard, coastal road, utility corridor, marine access facility, storage yard, maintenance facility and caretakers' facility) would be located within a Semi-Remote Recreation LUD. Even with Juneau Hydro's proposed measures to screen and blend the facilities with the surrounding environment, the project would not be able to accomplish the *moderate* scenic integrity objective associated with this LUD within 1 year. If project lands were to receive a Transmission Utility System designation in the future, the project would still not meet visual objectives for this area because visual effects on the landscape would be evident beyond 5 years.

Project facilities located on the west side of Gilbert Bay and the south side of Port Snettisham (submarine and overhead transmission line and transition facilities) would be located within a Timber Production LUD. Even with Juneau Hydro's proposed measures to maintain a low cover of vegetation in the transmission line corridor, the corridor would still have a linear appearance that would not repeat an existing pattern or texture in the landscape when viewed from the middle ground as required for this LUD. Even if project lands later receive a Transmission Utility System designation, the project would still not meet scenic integrity objectives for this land designation because it would visually impact the landscape beyond 5 years.

The submarine transmission line and interconnection facility on the north side of Port Snettisham would be located within an Old Growth LUD. Although Juneau Hydro would bury the transmission line as it emerges from the water, the above-ground modifications would be visible and would not meet the *High* scenic integrity objective for this area. If this area is later designated as a Transmission Utility System, however, scenic integrity objectives would be met.

Notwithstanding our finding, we note, as stated in our analysis in section 3.3.5.2, that the project could still be in the public interest despite these inconsistencies. The Tongass National Forest Land and Resource Management Plan also provides for exceptions on a case-by-case basis for small areas of non-conforming development within Old Growth and Semi-Remote LUDs. We find that Juneau Hydro's proposed measures would effectively bring the project as close as possible into compliance with the plan by substantially reducing potential project impacts on visual resources and would therefore meet the substance of the aforementioned comprehensive goals and objectives.

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APPENDIX A

Staff Responses to Comments on the Draft Environmental Impact Statement
Sweetheart Lake Hydroelectric Project

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COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE SWEETHEART LAKE PROJECT

Sweetheart Lake Project—FERC Project No. 13563-003–Alaska

The Federal Energy Regulatory Commission (Commission or FERC) issued its draft environmental impact statement (EIS) for the licensing of the Sweetheart Lake Project (project) on October 29, 2015. Comments were due by December 29, 2015. In addition, Commission staff conducted two public meetings in Juneau, Alaska, on December 2, 2015, to take oral comments on the draft EIS. In this appendix, we summarize the written comments received on the draft EIS and pertain to the project; provide responses to those comments; and indicate, where appropriate, how we have modified the text in the final EIS. We grouped the comment summaries and responses by topic for convenience. Comments that point out minor revisions to the draft EIS are not summarized; however, we have made those revisions in the final EIS. We do not summarize comments that only express opinions either for or against the proposed project or the staff alternative. The following entities filed comments on the draft EIS.

Commenting Entity	Filing Date
U.S. Environmental Protection Agency, Region 10	December 22, 2015
U.S. Department of the Interior	December 23, 2015
Representative Cathy Munoz	December 23, 2015
U.S. Department of Agriculture, Forest Service	December 24, 2015
Carole Bookless	December 28, 2015
Alaska Department of Fish and Game	December 29, 2015
Alaska Department of Natural Resources, Division of Mining, Land & Water	December 29, 2015
Alaska Electric Light and Power Company	December 29, 2015
National Marine Fisheries Service	December 29, 2015
Scott Spickler	December 29, 2015
International Union of Operating Engineers	January 6, 2016

Juneau Hydropower, Inc. (Juneau Hydro) filed reply comments on January 20, 2016.

GENERAL

Comment: Alaska Electric Light and Power Company (AEL&P) states that it is unsure why the supporting studies (e.g., botanical, cultural, historical, and wetlands) used to

prepare the EIS do not include field surveys in the project area on the north side of Snettisham Inlet, where a switchyard and transmission line interconnection would be located per the plans submitted with the U.S. Army Corps of Engineers' section 404 permit application.

Response: In a cultural resources report filed on March 13, 2014, Juneau Hydro described the methodology and intensity of cultural resources surveys conducted at the proposed project. According to the report, lands in the vicinity of the Marine Transition Station located on the north shore of Port Snettisham were visited. The report states that the cleared easement for the existing transmission line extends almost to the shoreline in this area. Further, the report describes the site as being rugged and steep just beyond the beach, heavily overgrown with brush, and covered with slash debris. The shoreline was reported to be rocky and not easily accessible. Juneau Hydro also reports in its response to comments filed on January 20, 2016, that its field investigators visited the site and found no wetlands, waters of the US, or likely rare or sensitive plant habitat. Because of the limited size of the interconnection site and the previous disturbance associated with the existing transmission line, detailed botanical and wetland surveys, if conducted, would only describe the previously-disturbed nature of the site.

Comment: The U.S. Department of Agriculture, Forest Service (Forest Service), states that the Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan should be included in the list of resource management plans required under Forest Service 4(e) conditions No. 22 under the *Staff Alternative* in the Executive Summary.

Response: We added this plan to the list of resource management plans in the Executive Summary of the final EIS.

Comment: The Forest Service states that the following regulations should be listed and described in section 1.3, *Statutory and Regulatory Requirements*, of the final EIS: (1) Migratory Bird Treaty Act and Executive Order 13186; (2) Alaska Nation Interest Land Conservation Act, section 810; and (3) Bald and Golden Eagle Protection Act.

The U.S. Environmental Protection Agency (EPA) recommends that section 1.3 of the final EIS include information about Clean Water Act, section 404, because understanding section 404 is important for considering 404-related mitigation and compensation. EPA recommends discussing section 404 mitigation requirements in a separate section or an appendix to the final EIS.

Response: The statutes discussed in section 1.3 are limited to those statutes that must be satisfied before the Commission can act on a license application.

Comment: The Forest Service points out that the draft EIS incorrectly dates the enactment of the Native American Graves Protection and Repatriation Act as 1992 when it should be November 1990.

Response: We corrected this date throughout the final EIS.

Comment: The Forest Service requests that during project development and review, the landscape architect for the Forest Service be included on reviews of all ground-disturbing site modification and site development drawings, such as excavation plans, spoil disposal plans, and site plans that show locations for proposed facilities and their relationship to vehicular and pedestrian circulation.

Response: Section 4(e) condition no. 2 requires written Forest Service approval of all final design plans for project components affecting or potentially affecting National Forest System (NFS) land. The Forest Service could include its landscape architect in this approval process to achieve its desired review.

Comment: The Forest Service provided the names and addresses of multiple people that should be either removed or added to the List of Recipients in section 8.0.

Response: We updated section 8.0, *List of Recipients*, of the final EIS.

Comment: Carole Bookless has concerns about the timeline of the project and asks: (1) is it guaranteed that the project would be completed, (2) does a timeline exist for completion after which the rights to develop would be taken back, and (3) is there a provision that states that the rights to use this land are for the purpose of the proposal and no other use?

Response: Any license issued by the Commission will require that a licensee file a financing plan that shows that the licensee has sufficient financial resources to complete the project, and has specific timelines for initiating and completing construction. If a license is issued, it gives the licensee exclusive rights to develop and operate a project on project lands, until the license expires or is surrendered. Once issued, any license would require Juneau Hydro to commence construction of project works within 2 years of license issuance, and complete construction within 5 years of license issuance.

NEED FOR POWER

Comment: EPA states that the draft EIS is not clear on whether Greens Creek Mine is included in the stated peak demand of 89.3 megawatts (MW) for the Juneau electric system grid in 2024.

Response: The need for power analysis is based on the best information publicly available—the Southeast Alaska Integrated Resource Plan (Alaska Energy Authority, 2011), which states that the annual demand from the [Greens Creek] mine would be 67,000 megawatt-hours (MWh) in 2011 and that the demand from this mine would remain constant throughout this forecast period. Thus, the referenced analysis does include the Hecla Greens Creek Mine.

Comment: EPA questions the assumption used in the Southeast Alaska Integrated Resource Plan analysis of moderate population growth and the high cost of diesel and other petroleum fuels, given the state's current fiscal situation and the recent decrease in fuel prices. EPA also recommends that the most recent population and fuel cost

projections be incorporated into the need for power assumptions, and that any future retirement of hydropower projects be discussed.

Response: As stated in the EIS, the assumptions of moderate population growth and a high cost of petroleum fuel are corroborated by published data from the State of Alaska and the Energy Information Authority. The analysis in the Southeast Alaska Integrated Resource Plan assumed a population growth rate of 0.8 percent over the period from 2014 to 2024 (Alaska Energy Authority, 2011), while the Alaska Department of Labor and Workforce Development (ADL, 2014) estimates a population growth of approximately 1.5 percent over the same period. Thus, the Southeast Alaska Integrated Resource Plan's assumptions appear valid.

While it is true that current oil prices are lower than they have been in decades, Energy Information Authority (2016) indicates that crude oil prices, while volatile, have increased on average 4.6 percent per year in inflation-adjusted 2015 dollars for the period 1986 to 2014. Thus, the return to such a trend, while speculative, is a reasonable assumption. Therefore, the assumptions made in the Southeast Alaska Integrated Resource Plan analysis are reasonable and remain applicable to the current project.

With respect to the retirement of future hydropower projects, no plans are before the Commission to retire existing facilities that supply power to the Juneau grid.

Comment: EPA notes that the current Juneau system has 102.8 MW of hydropower generation and 84.8 MW of diesel generation, and it is unclear how the proposed project's power would displace diesel generation because the current hydropower capacity is already greater than the projected power needs in 2024. EPA recommends that the final EIS include additional information or clarification on the total existing and projected future power supply and how the proposed project would fit within future power needs via additional power supply or displacement of other power supplies.

AEL&P also questions the need for power that would be generated at the project. While AEL&P supports hydro development, it states that the project is not needed at this time, especially given the fact that all the existing hydro projects connected to AEL&P's grid had surplus capacity and spilled water in 2015. In support, AEL&P comments that the draft EIS references an incorrect annual energy consumption projection potential of an additional 4.59 percent from 441,237 to 461,494 MWh between 2015 and 2024. AEL&P states that energy consumption has never reached the levels outlined in Alaska Energy Authority's (2011) Southeast Integrated Resource Plan used in the draft EIS; instead energy consumption in 2015 was significantly lower at 397,850 MWh. AEL&P notes that while there was an energy consumption increase of 5.66 percent from 2010 to 2011, that growth rate was unusually high as a result of the recovery of temporary load loss from the avalanches experienced in 2008 and 2009.

Response: In its response to comments on the draft EIS, Juneau Hydro stated that it has two power sales agreements that would cover all of the annual generation from the project. The first agreement is with the Kensington Mine to displace its current diesel-

fueled generation, and the second is with a large customer for the balance of generation in 2018 that is not already sold to the Kensington Mine to displace its diesel-fueled heating. Additionally, this second power sales agreement allows for additional excess electricity to potentially be sold seasonally to other consumers.

Comment: Carole Bookless states that AEL&P customers are at risk of increased electricity rates based on statements made by AEL&P regarding a lack of need for the proposed project's power. Accordingly, Ms. Bookless recommends an extension of time for comments to allow for more public outreach via a direct mailing to all AEL&P customers and to let concerned parties know about the possible effects of the project on electric rates.

Response: An extension of time to comment is not warranted because the public has had multiple opportunities for input since the filing of Juneau Hydro's pre-application document in 2010.

ADAPTIVE MANAGEMENT

Comment: EPA agrees with the extensive monitoring and sampling included in both the applicant-proposed and staff-recommended alternatives but believes that additional adaptive management components should be included for certain plans and operational procedures for the life of the project. For example, the Acid Rock Drainage Contingency Plan should also include a post-construction component to address unanticipated drainage should it occur. EPA also encourages adaptive management components be included in the requirement to report deviations in instream flows to FERC within 10 days. EPA supports plans that already include adaptive management components.

Response: We revised sections 3.3.1.2 and 5.2.2 of the final EIS to more clearly indicate that monitoring, if needed, should occur during and following construction until the site is fully stabilized. In regard to deviations in minimum flow, hydropower licenses with minimum flow requirements typically also include a standard requirement for the licensee to report any deviations in minimum flow to the Commission and the resource agencies within a specific period after an occurrence and to take corrective actions to prevent future deviations.

GREENHOUSE GAS EMISSIONS

Comment: EPA recommends that the EIS analyze greenhouse gas (GHG) emissions attributable to the project in accordance with Council on Environmental Quality's February 18, 2014, draft guidelines. EPA notes that during the first years of reservoir filling, decaying organic matter within the inundation zone can release large amounts of GHG (carbon dioxide and methane), and that large earth-moving construction projects regularly result in the emission of substantial quantities of GHG. EPA states, however, that electricity generated by the proposed project, a renewable energy source, may displace power generated by diesel-powered generators, and that after construction and initial operation the project would have minimal GHG emissions. EPA believes that this

would be a long-term environmental benefit because of improved air quality locally, reduced generation of GHG, and reduced risk of diesel spills.

Response: We believe that our analysis conforms to the Council on Environmental Quality's draft guidance. We estimated potential GHG emissions based on best available information. Raadal et al. (2011) reviewed more than three dozen life-cycle assessments of hydroelectric projects to determine mean GHG emissions from both construction activities and reservoir inundation. The review categorized the life-cycle assessments as reservoir hydroelectric projects including gross GHG emissions from flooded land, reservoir hydroelectric projects excluding GHG emissions from flooded land, or run-of-river projects. To compare these categories, GHG emissions were normalized by generation capacity. Based on this analysis, the authors determined that the average combined emissions from construction and reservoir inundation for hydroelectric projects are approximately 31 metric tons (tonnes) carbon dioxide equivalent per gigawatt-hour (CO_2e/GWh)[69] with a range of 4.2 to 152 tonnes CO_2e/GWh. Assuming a worst case scenario of 152 tonnes CO_2e/GWh, the proposed project's estimated annual generation of 116 GWh would result in emissions totaling approximately 17,630 tonnes CO_2e, which is below the Council on Environmental Quality's draft guidance benchmark of 25,000 tonnes CO_2e.

Additionally, generation of GHGs at specific projects is a function of climate and topography. Typically, projects in colder climates produce fewer emissions from reduced biological activity that releases CO_2 and methane from organic material. Projects situated in locales with higher topographical relief, such as the proposed project, also produce fewer GHGs because of less vegetated land surface being inundated per volume unit of active storage (Weisser, 2007). Therefore, the worst case scenario assumption of 152 tonnes CO_2e/GWh for the proposed project is conservative.

Lastly, this estimate of GHG emissions does not account for the reduction in GHGs from the displacement of oil power generation. Per Juneau Hydro's final license application, filed April 29, 2014, the power produced by the project would replace that currently produced from approximately 8.3 million gallons of diesel fuel per year used to supply electricity to the Kensington Mine, residential and commercial buildings for heat, and potentially cruise ships docked at Juneau Harbor. This represents approximately 116,000 tonnes of CO_2 that would not be released to the atmosphere.

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[69] In a simplistic sense, different gases are better or worse at trapping heat in the atmosphere (i.e., they have different radiative forcing potential). Therefore, gases such as methane are typically converted to an equivalent mass of carbon dioxide to normalize for their different ability to trap heat and effect global climate change. For example, 1 kilogram of methane is equal to approximately 25 kilograms of CO_2 because methane has a greater ability to trap heat.

GEOLOGY AND SOILS

Comment: The Forest Service comments that the Erosion Control Plan should be revised to address impacts and mitigation for the "primitive pioneer road."

Response: The Soil Erosion subsection (in *Geologic and Soil Resources*, section 3.3.1.2, *Environmental Effects*) discusses soil erosion as a result of the development of the project, which includes the primitive pioneer road. We expect best management practices to be applied to all areas of ground disturbance to control erosion. Nonetheless, Forest Service's 4(e) condition 22 and Commission practice provides for Forest Service and Commission review of erosion control plans prior to beginning construction. Therefore, no revision of the EIS is necessary.

Comment: The Forest Service comments that the paragraph on page 3-2 of the draft EIS is an incomplete description of the site geology because it does not describe the various rock types found in the area, including meta-sedimentary, meta-volcanic, and plutonic rocks, or metamorphic grade.

Response: We added text about the rock types to section 3.3.1.1 of the final EIS.

Comment: The Forest Service states that the paragraph on page 3-4 of the draft EIS describing the subduction of the Pacific plate beneath the North American plate is incorrect. The Forest Service notes that the margin of Southeast Alaska is not a subduction zone; the southeastern Alaska coastline is seismically active because of the Queen Charlotte-Fairweather Fault systems, which are strike-slip faults with right lateral movements. Therefore, the Forest Service requested this be corrected and the effects of seismic activities from this fault on proposed structures be reassessed.

Response: We revised and expanded section 3.3.1.1 of the final EIS accordingly. In addition, we have reviewed the final EIS text regarding seismic activities; no changes were needed.

Comment: The Forest Service comments that the section describing soil erosion on page 3-9 is incomplete and does not provide a discussion or a description of the overall loss of productive soil in the project area. The analysis should be incorporated in the Environmental Effects section in chapter 3 and in the Unavoidable Adverse Effects section in section 5.3.

Response: We discuss the loss of productive soils via erosion in section 3.3.5.2, and therefore no revision to the environmental analysis is necessary. We revised section 5.3 to discuss the project's irreversible and irretrievable resource commitment of productive soils.

WATER RESOURCES

Effects of Construction on Water Quality

Comment: The Forest Service states that to better describe project impacts on water quality on Class I/II stream crossings disturbed from construction of the coastal road and

transmission line, the final EIS should note the number of streams crossed, planned passage status and construction timing windows, or clarify that no Class I/II streams were identified in the proposed development areas.

Response: We identified one potential Class I/II stream that is crossed by the overhead transmission line on the Snettisham Peninsula and identified it in section 3.3.2.2 of the final EIS. This potential Class I/II stream was identified using the Alaska Department of Fish and Game (Alaska DFG) Anadromous Waters Catalog. It is unclear whether construction of the transmission line would require in-water work to span the stream. However, in the EIS, staff recommends that Juneau Hydro establish timing windows for all instream constructions activities in consultation with Alaska DFG which should be adequate to minimize any effects to aquatic resources at stream crossing locations.

Instream Flows

Comment: Alaska DFG agrees with the staff alternative recommendations for all adopted recommended 10(j) terms and conditions in table 5-1 on page 5-24 of the draft EIS, with the exception of 10(j) recommendation no. 2 for pulsing flows in the anadromous reach.[70] Without a pulse flow during the sockeye spawning period, Alaska DFG is concerned that sockeye salmon may mill around in saltwater (where personal use fishers are not allowed to fish) and never move upstream into the pools where the personal use fishery occurs. Alaska DFG believes that pulsing flows may be necessary to maintain this personal use fishery because (a) unlike pink and chum salmon that spawn in the intertidal reach, sockeye salmon may need pulse flows to stimulate migration farther upstream to the location of the personal use fishery; (b) pulse flows have been documented as an environmental cue that stimulate sockeye movement at Auke Creek weir in Southeast Alaska; and (c) the proposed pulse flows would continue to provide hydrological conditions to stimulate upstream movement of sockeye salmon similar to pre-project conditions.

To support its conclusions, Alaska DFG provided a discussion of relevant literature (Hasler et al., 2014; Huntsman, 1948; Gilhousen, 1960; Burgner, 1991; and Bell, 1973), as well as summary of data collected from the Auke Creek weir that documents a local example of the upstream migration response of sockeye salmon to pulse flows. Alaska DFG states that based, on the pulse flow range data from Auke Creek weir, increasing flows from 300 cfs up to 486 cfs should be an adequate pulse flow to provide a cue for sockeye salmon migration at the project. Further, Alaska DFG modified its recommendation to include details of its recommended pulse flow release and monitoring plan.

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[70] Alaska DFG refers to its pulse flow recommendation as no. 2, but in table 5-1 of the draft and final EISs, we identify it as recommendation no. 3.

Response: After reviewing the additional information provided by Alaska DFG, we now recommend in section 3.3.2.2 that Juneau Hydro provide the recommended pulse flows and develop, in consultation with Alaska DFG, a plan to evaluate the effectiveness of releasing pulse flows in stimulating sockeye salmon to enter Sweetheart Creek from the estuary.

Comment: In response to staff's concerns in section 3.2.2.2 of the draft EIS that: "neither Juneau Hydro nor Alaska DFG explains how such an evaluation might be done, when, or what criteria would determine whether a pulse flow would be needed," Alaska DFG states that these details would be worked out as a component of a post-construction biologic monitoring program to be developed in consultation with Juneau Hydro prior to dam construction. Alaska DFG states that it is difficult to develop such details until all aspects of a project are finalized. Nonetheless, it modified its 10(j) recommendation No. 2 to explain that pulsing flows would likely be short term, probably a few hours in duration a minimum of four times from July 1 to August 31 and would involve increasing flows from the proposed static operational flow up to 486 cfs. This pulse flow evaluation would occur for up to the first 5 years of project operation with an annual report on the pulse flow observations.

Response: We clarified Alaska DFG's recommendation in the final EIS.

Comment: The Forest Service comments that the text on *ecological processes* mentioned at the end of the bypassed reach instream flow environmental effects analysis on page 3-48 is vague and should be revised in the final EIS to clarify specifically which ecological processes are being considered.

Response: The ecological processes mentioned in the draft EIS, included those complex natural processes required to maintain the viability of instream populations (i.e., fish, amphibians, aquatic macroinvertebrates, and other organisms). We clarified our meaning by removing the reference to ecological processes.

Comment: The Forest Service agrees with Juneau Hydro's proposal and Alaska DFG's recommendation for "Instream Flow Compliance and Flow Continuation" as part of the Water Management Plan and suggests that the final EIS include a map depicting stream gage locations and reference information for U.S. Geological Survey methods used for instream gaging stations.

Response: The EIS describes in section 5.2.2 Juneau Hydro's proposal to install permanent gaging instrumentation on the inner face of the dam to measure reservoir water levels, maintain a permanent gage in Sweetheart Creek below the exit of the proposed tailrace to monitor flow entering the anadromous reach, and install a gage or metering device at the base of the toe of the proposed dam to monitor instream flow releases into the bypassed reach. We recommend revising the Stream Flow Measurement Plan, in consultation with Alaska DFG and Forest Service, to specify the exact location of all flow monitoring equipment and gages, including the coordinates and a map showing each monitoring location. We expect that specific locations for gaging equipment would

be determined during the final design of the project in consultation with Alaska DFG and Forest Service.

Comment: The Forest Service would like clarification about whether the use of *subsistence* in the analysis section on page 3-59 of the draft EIS is intended to mean *personal use fishery*.

Response: We changed the term *subsistence* to *personal use* in the final EIS.

AQUATIC HABITAT

Comment: The Forest Service states that the discussion on page 3-17 describing the proposed reservation of water is confusing because within this section there is reference to 1.35 miles of anadromous habitat, yet footnote 33 lists 1,400 feet as the length of the anadromous reach. Forest Service requests the length of the anadromous fish reach be clarified in the final EIS.

Response: We corrected the Water Quantity subsection in section 3.3.2.1, *Aquatic Resources*, of the final EIS. The length of the anadromous reach is approximately 1,400 feet.

Comment: The Forest Service comments that the draft EIS and Aquatic Habitat Plan do not specify how substrate that would otherwise naturally recruit in the bypassed reach would be moved down to the anadromous reach with only occasional maintenance flushing flows. The Forest Service requests that FERC staff identify the potential loss of spawning gravels as an adverse effect, conduct a more thorough appraisal of material lost prior to project implementation, establish baseline conditions, and specify that monitoring should include consultation with the Forest Service, with alternatives other than gravel augmentation potentially required.

Response: We revised the analysis in section 3.3.2.2 in the final EIS to include a more detailed description of project effects on gravel recruitment into the bypassed and anadromous reaches of Sweetheart Creek. The EIS acknowledges that the potential loss of gravel could adversely affect the quality of spawning habitat for pink and chum salmon. As a result, we recommend implementing the Aquatic Habitat Restoration and Monitoring Plan filed on October 20, 2014, that includes assessing pre and post-project spawning habitat in the anadromous reach of Sweetheart Creek, and potentially conducting gravel augmentation based on the results of the spawning habitat assessment. Implementation of this plan would occur in consultation with the Forest Service, as requested.

Comment: The Forest Service recommends that the final EIS state in the analysis whether or not baseline data for substrate monitoring has been collected.

Response: No data on the substrate has been collected at this point. However, Juneau Hydro would monitor changes to baseline spawning gravel 3 years after commencement of project commercial operation.

Comment: The Forest Service recommends that the final EIS contain a determination of effects on all essential fish habitat (EFH) species and state whether the National Marine Fisheries Service (NMFS) has concurred with the EFH determinations.

Response: In section 1.3.6 of the draft EIS, we conclude that issuing a license for the proposed project would not adversely affect pink and chum salmon EFH in lower Sweetheart Creek, or sockeye, pink, and chum salmon EFH in Gilbert Bay. NMFS did not agree that the project would not affect EFH for spawning and incubating pink and chum salmon. To avoid adverse effects on EFH, NMFS recommends that Juneau Hydro consult with NMFS on the Aquatic Habitat Plan, to provide timely identification of reduced spawning gravels and effective replacement of spawning habitat. We are now recommending that the Aquatic Habitat Plan be revised in consultation with NMFS, Alaska DFG, and Forest Service to include additional details on the monitoring and mitigation methods.

Comment: The Forest Service comments that clarification is needed on the long-term effect to the resident fish population in Sweetheart Lake, the potential for fish to become stranded in inlet streams with lake level fluctuations, and whether any of the inlet streams provide overwintering habitat that would be accessible at the new elevations. Additionally the final EIS should clearly elaborate anticipated consequences to rearing success for resident fish if the project is implemented.

Response: We added a more detailed description of the potential long-term effects of project operations on the resident fish populations in Sweetheart Lake in section 3.3.2.2 of the final EIS.

Comment: NMFS notes that the draft EIS correctly identifies Lower Sweetheart Lake and Gilbert Bay as EFH and agrees that the 1,400-foot anadromous reach of Sweetheart Creek could be affected by project operations through a reduction of both sediment transport and loss of spawning gravels. Therefore, NMFS does not agree that the project would not affect EFH for spawning and incubating pink and chum salmon. As its EFH conservation recommendation, NMFS recommends that Juneau Hydro consult with NMFS on the development of the Aquatic Habitat Plan to provide for timely identification of reduced spawning gravels and provide for timely and effective replacement of this important habitat to avoid adverse effects to EFH.

Response: As described above, we now recommend that Juneau Hydro modify the Aquatic Habitat Plan in consultation with NMFS, Alaska DFG, and the Forest Service to ensure these agencies' concerns are addressed.

Trout Abundance

Comment: The Forest Service notes that the paragraph on page 3-31 describes the presence of trout and Dolly Varden only in Inlet 1; however, table 3-8 on page 3-32 of the draft EIS indicates that Dolly Varden were captured in 11 of the inlets.

Response: Juneau Hydro observed rainbow trout and Dolly Varden in the lower 1,000 feet of Inlet 1 (in the stream environment) during its aquatic habitat survey effort. According to the final license application, three adult rainbows were observed attempting to spawn in the stream 361 feet from the mouth of Inlet 1 in late June. The information included in table 3-8 refers to fish captured in the Sweetheart Lake portion of all the inlets (in the lake environment) during Juneau Hydro's fish trapping efforts. We clarified section 3.3.2.1 of the final EIS to eliminate any confusion regarding species distribution.

Comment: The Forest Service notes that the Sockeye Salmon Smolt Collection and Transport Plan does not address the possibility of blocked downstream movement of fish and the consequences of transferring smolts for only 1 month per year. The Forest Service recommends the final EIS include an assessment of the impact on the resident fish population of sockeye not captured and remaining in the lake, any capture duration alternatives, and the potential development of a kokanee population from a reduction in naturally occurring outmigration due to the project. Additionally, the Forest Service would like clarification on how the applicant would avoid capturing and transporting resident fish with their smolt transport plan.

Response: We expanded our analysis in the final EIS to include a discussion of the potential long-term effects of blocking the downstream movement of lake resident fish and transferring sockeye smolts for only 1 month per year. This expanded analysis also includes an assessment of the potential impacts of residualized sockeye on resident fish populations.

TERRESTRIAL PLANTS AND WETLANDS

Comment: The Forest Service states that any chemical treatment on NFS lands would require prior written approval of the Forest Service (4[e] condition no. 15).

Response: We modified the text in section 3.2.2.2 of the final EIS to specify that Juneau Hydro would obtain written permission before applying pesticides or chemical treatments on any NFS lands or in areas affecting NFS lands.

Comment: The Forest Service requests removing the statement: "However, neither the Forest Service nor anyone else has recommended any specific measures to protect these [rare] plants," from the final EIS because the Forest Service has asked Juneau Hydro to consider salvaging and reintroducing affected rare plants into nearby suitable habitat (see the January 16, 2015, review of Volume 2, Preliminary Draft Environmental Assessment and Appendices of the Final License Application). The Forest Service further requests the final EIS state whether the remaining populations are sufficient to ensure viability in the project area.

Response: We modified the EIS to clarify that no one recommended any mitigation measures for rare plants in response to the ready for environmental analysis notice. We also clarified that all the identified rare plant populations in the project area would be inundated. However, if the recommended relocation of twocolor sedge to similar habitat

outside the inundation area is successful, the existing level of population viability for this species in the project area would be preserved.

Comment: The Forest Service recommends that the discussion of the Reservoir Management Plan be modified to clarify what Juneau Hydro intends to do with the timber within the inundation zone. The Forest Service states that the Vegetation Management Plan will need to be revised to specify the need for a Timber Settlement Sale as outlined in 36 CFR 223.12 and that this information be incorporated in the final EIS where appropriate.

Response: Although Juneau Hydro has not specified what it intends to do with the timber within the reservoir, Forest Service's 4(e) condition no. 1 requires that the Licensee obtain a special use authorization for the occupancy and use of NFS lands. In a filing dated, January 16, 2015, the Forest Service stated that the special use authorization must include language requiring the owner of the hydroelectric project to sign a Timber Settlement Contract with the Forest Service to deal with the inundation/cutting/removal of any merchantable timber in the project area. Furthermore, the Forest Service commented that it should be involved when the Vegetative Management Plan is developed. We agree that the Forest Service should be involved in the development of the Vegetation Management Plan and that any Timber Settlement Contract is appropriately included in the special use authorization, but not within the Vegetation Management Plan.

Comment: The Forest Service recommends that the description of Juneau Hydro's proposed transplanting of salvaged plants be revised to specifically include the submarine-to-overhead transmission line transition facilities as well as the other locations listed in the description. The Forest Service further states that the Vegetation Management Plan would need to be revised to address this concern.

Response: The Vegetation Management Plan states that the disturbed areas around the power poles and over the buried segment of transmission line would be replanted, but does not explicitly address the submarine-to-overhead transmission line transition facilities. We assume that the plan's omission of these transmission-related facilities was an oversight and have revised section 3.3.3.2 accordingly.

Comment: The Forest Service comments that the final EIS should define and quantify any irreversible or irretrievable commitment of soil and wetland resources (40 Code of Federal Regulation 1502.16) because such losses are considered unavoidable adverse effects and an irreversible commitment of resources. It recommends disclosing the acres of productive soils and wetlands lost (i.e., converted to infrastructure) in the final EIS.

Response: We added section 5.3.2 to address irreversible or irretrievable commitment of soil and wetland resources. We quantify the loss of wetlands as result of project construction and operation in section 5.3.1, *Unavoidable Adverse Impacts*. Although we acknowledge that some irreversible loss of productive soil would occur as a result of the project, we are unable to quantify this loss.

TERRESTRIAL WILDLIFE

Comment: Because the analysis pertains to all wildlife, not just birds, the Forest Service requests that staff revise the concluding statement on page 3-98 of the draft EIS that states: "Therefore, with the proposed and recommended measures, operation, of the project would have minimal adverse effects on birds."

Response: We revised this sentence in section 3.3.3.2 of the final EIS.

Comment: The Forest Service has reviewed and commented on a draft biological evaluation for wildlife species but requests that Juneau Hydro submit a final evaluation to the Forest Service and that the analysis of effects on sensitive wildlife species be incorporated in the final EIS.

Response: We did not identify the need for any revisions prior to acting on the proposed license. If the applicant files revisions to its biological evaluation that affect our analysis prior to any licensing action, we will consider such information as appropriate.

Comment: The Forest Service recommends resolution between conflicting statements on page 3-100 of the draft EIS that states: "No specific measures were recommended to address bald eagles or other management indicator species," and other sections of the draft EIS, specifically the final paragraph on page 3-99 that states: "Juneau Hydro proposes specific measures to minimize adverse effects on mountain goats and bald eagles…"

Response: These two statements are not in conflict. Juneau Hydro did propose mitigation measures for bald eagle, but no agency made recommendations related to this species. We treat applicant-proposed measures and agency recommendations separately in the EIS to differentiate between applicant proposals and agency recommendations.

THREATENED AND ENDANGERED SPECIES

Comment: The Forest Service states that the information on page 3-102 of the draft EIS on the listing status of the yellow-billed loon points out that the following statement on the species on page 3-102 of the draft EIS is outdated; the most recent U.S. Department of the Interior, Fish and Wildlife Service (FWS), evaluation of the species is not October 2011, as the draft EIS states, but October 1, 2014, when FWS published a 12-month finding that listing the yellow-billed loon as threatened or endangered under the Endangered Species Act was not warranted. The Forest Service recommends this section be updated or omitted in the final EIS.

Response: We revised section 3.3.4.1 of the final EIS to omit the yellow-billed loon, which is no longer a candidate species because of the FWS finding.

Comment: The Forest Service recommends the analysis of effects on listed species (page 3-109 of the draft EIS) disclose whether a biological assessment was done and include the Commission's October 29, 2015, request for NMFS concurrence on the

determination that the proposed action "may affect but is not likely to adversely affect the humpback whale and the western DPS Steller sea lion."

Response: We added text to section 1.3.3, *Endangered Species Act*, indicating that the EIS serves as the biological assessment in compliance with section 7 consultation requirements and that a letter requesting concurrence on the determination was sent to NMFS on October 29, 2015.

Comment: NMFS states that the underwater noise thresholds for both cetaceans and pinnipeds provided in FERC staff's November 16, 2015, letter, did not use measurements from comparable pile driving activities. Therefore, NMFS would like the opportunity to work more closely with FERC to develop appropriate mitigation measures that would avoid take of Steller sea lions and humpback whales.

Response: When the draft EIS was prepared, Juneau Hydro had not specified the piling size for the docks. Subsequently, Juneau Hydro filed additional information that indicates that the proposed dock would now use 24-inch steel pilings. Juneau Hydro also revised its proposed protection measures to closely follow the marine mammal protection measures used for the construction of Ketchikan Ferry Dock Project. Because the pilings used at the Ketchikan Ferry Dock are larger (30-inch pilings) than would be required for the Sweetheart Lake Project (24-inch pilings), the effects would be greater and the same protection measures more conservative for the Sweetheart Lake Project. We revised sections 3.3.2.2 and 3.3.4.2 of the EIS to reflect this new information and recommend that the proposed protection measures be included as part of the proposed Wildlife Mitigation and Monitoring Plan, and Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan.

Comment: NMFS recommends FERC staff review the Letter of Concurrence that it sent to Juneau Hydro for the Ketchikan Ferry Dock Project because the Letter of Concurrence contains relevant study reports and useful information about the mitigation measures proposed by the Department of Transportation, Federal Highway Administration, involving the use of Micarta-like pile cushions to reduce the sound source levels from pile driving, and the use of marine mammal observers to shut down activities if marine mammals were observed approaching a zone of 1,000 meters from the pile driving.

Response: As noted in the previous response, we updated sections 3.3.2.2 and 3.3.4.2 of the final EIS to reflect the updated information.

RECREATION

Comment: The Forest Service requests to be involved in the development and implementation of the Recreation Management Plan.

Response: Although the staff alternative specifies agency involvement during plan implementation, we have added text throughout the EIS to specify that Juneau Hydro finalize the proposed Recreation Management Plan in consultation with the Forest Service and file the plan with the Commission for approval.

Comment: The Forest Service would like the final EIS to clarify when recreational facilities such as the dock, intertidal ramp and coastal road would be available for public use because there appears to be confusion between the statements on page 3-117 that proposes the public use of these facilities and the statement on page 3-121 that states the dock would only be available for public use by personal use sockeye fishery permit holders during the fishing season.

Response: We clarified the text in the Recreation subsection of section 3.3.5.1 of the final EIS to state that Juneau Hydro proposes to limit use of the boat ramp and dock to personal use sockeye fishery permit holders during the fishing season but that coastal road access would remain available to all pedestrian use. To be consistent with Commission policy on public access, however, we have revised sections 3.3.5.2, 5.2.1 and 5.2.2 of the final EIS to recommend that Juneau Hydro, as part of its Access Management Plan, allow access to the boat dock and ramp for all recreational users. We believe this would be appropriate because public safety does not appear to be an issue at the boat dock and ramp and allowing use by additional recreationists would not likely put a strain on these facilities because personal use sockeye fishermen comprise most of the recreational use at the project site.

LAND USE

Comment: The Alaska Department of Natural Resources (Alaska DNR) comments that in the event that a state land use authorization is required, each subunit's combination of designations represents the uses and resources the area would be managed for. In this case, the applicable designations are habitat, harvest, recreation and tourism (dispersed use), and public facilities (reserved sites).

Response: We added this information to the Land Use subsection of section 3.3.5.1 of the final EIS.

Comment: Alaska DNR comments that if authorized, the project's access road is proposed to be constructed in state tidelands designated as habitat and would require fill in these tidelands. Alaska DNR and Alaska DFG would determine stipulations or measures needed to protect fish, wildlife, or their habitats, which would be enforced through a series of steps outlined in a December 29, 2015, comment letter. In the event that measures do not avoid substantial and irreversible loss of habitat, Alaska DNR and Alaska DFG would consider requiring replacement with or enhancement of fish and wildlife habitat though structural or non-structural solutions, or legislative or administrative allocation of lands to a long-term level of habitat protection that is sufficiently greater than that which they would otherwise receive.

Response: If the project is licensed, the licensee would have to comply with any federal, state, or local laws that are not preempted by the Federal Power Act.

Comment: Alaska DNR comments that the access road, powerhouse site, and submarine crossing are in or adjacent to areas designated for harvest. When feasible and prudent, authorized activities adjacent to designated commercial or community fish and wildlife

harvest areas should not foreclose public access during the harvest or use season unless alternative access is available.

Response: Juneau Hydro's proposed recreation facilities (dock access and mooring buoys) would not foreclose, but rather would increase public access during the harvest and use season.

Comment: Alaska DNR comments the access road, powerhouse site, and submarine crossing are also in or adjacent to areas designated for recreation and tourism. If authorized, mooring buoys would not be allowed in: (1) existing natural anchorages unless they would increase the capacity or reliability of the anchorage, (2) where they may interfere with commercial fishing, and (3) in or adjacent to sensitive habitats unless they would help preserve the habitat by minimizing the use of anchors.

Response: Although Alaska DNR has not identified this area as a natural anchorage, Gilbert Bay has a sandy bottom and windy weather can cause boats to slip their anchor (see page 242 of the final license application) in this area. As indicated in section 3.3.5.2 of the EIS, visitors to the project area currently beach their boats and tie them to rocks or vegetation; therefore, mooring buoys would increase reliability for anchoring in this area whether or not it is considered an existing natural anchorage. The location for placing the submarine transmission line and mooring buoys was selected to avoid areas used for commercial fishing, as discussed in section 3.3.7.2 of the EIS, so interference with this activity is unlikely. Although Alaska DNR has not identified this area as in or adjacent to sensitive habitat, section 3.3.5.1 of the EIS states that most personal use fishery permit holders said they would use mooring buoys, if provided, indicating this measure would likely minimize anchor use.

Comment: Alaska DNR comments that public access along the shoreline of a waterbody should be reserved. Alaska DNR notes that while public rights reserved normally would include only the right of ingress and egress, on an individual basis, the state may reserve specific rights (for example, the right to fish or to picnic) as necessary to protect the public interest. Alaska DNR also notes that while individual reserved access widths, building setbacks, and fish habitat zones may vary, minimum widths of 50 feet for reserved public access and 100 feet for building setbacks along anadromous fish waterbodies apply in this area.

Response: As indicated in section 3.3.5.2 of the EIS, although the coastal road/trail would be gated after construction, pedestrian public access would still be permitted and the recreation trails proposed in the Recreation Management Plan would improve public access along Sweetheart Creek. The Access Management Plan provides for unrestricted public access to areas that do not pose a risk to the public or project facilities and specifies that all active construction sites would have restricted access for safety reasons. The staff alternative, which adopts Alaska DFG 10(j) recommendation of a minimum of 100-foot setback from the ordinary high water of Sweetheart Creek and its tributaries, would be consistent with Alaska DNR's minimum 100-foot setback.

Comment: The Forest Service recommends the final EIS disclose the number of acres of federal land in each Land Use Designation.

Response: We added acreages within the project boundary for each land use designation to the Land Use subsection in section 3.3.5.1 of the final EIS.

Comment: The Forest Service notes that figure 3-12 on page 3-113 of the draft EIS should be updated as it shows some Inventoried Roadless Areas that allow road construction and reconstruction; however, such activities are not allowed in Inventoried Roadless Areas.

Response: Although the source of the figure is the map set referenced in the Roadless Rule, figure 3-12 has been deleted from the final EIS because it does not depict the latest information.

Comment: The Forest Service points out the Roadless Area Conservation Rule discussion on page 3-112 of the draft EIS needs to be updated pursuant to the July 29, 2015 ruling by the US District Court for the District of Alaska. This ruling affirmed the district court's summary judgment in favor of the Organized Village of Kake, finding that the USDA's promulgation of the Tongass National Forest Exemption to the Department's "Roadless Rule" (limiting road construction and timber harvesting in national forests) violated the Administrative Procedure Act; vacated the Tongass Exemption; and reinstated application of the Roadless Rule to the Tongass National Forest in Alaska.

Response: We revised the text in the Land Use subsection of section 3.3.5.1 of the final EIS to be consistent with the Forest Service briefing paper, Frequently Asked Questions Regarding Inventoried Roadless Areas (Forest Service Alaska Region, October 2015).

Comment: The Forest Service notes that the draft EIS does not reflect the potential impact to the shoreline of Gilbert Bay near the coastal road and believes this shoreline would be permanently changed from the rock fill.

Response: We discuss effects associated with the coastal road in section 3.3.3.2 of the final EIS. The coastal road would remove 0.3 acre of forested and 0.5 acre of estuarine wetlands; these effects are unavoidable adverse effects of the project. We agree that the addition of rock fill for construction of the coastal road would permanently change the shoreline in this area.

AESTHETICS

Comment: The Forest Service generally agrees with the draft EIS findings that proposed activities are unlikely to fully meet Forest Plan Scenic Integrity Objectives. However, the Forest Service indicates that it is not possible, at this time, to determine all of the effects the construction and operation of the project would have on Scenic Integrity Objectives, as many scenic details, key project designs, management strategies, and monitoring issues are not disclosed.

Response: The staff alternative includes final 4(e) condition no. 2 that requires written Forest Service approval of all final design plans for project components affecting or potentially affecting NFS land, so Forest Service personnel would be able to review the details of project design that would affect scenic resources.

Comment: In regard to the existing scenic integrity classification of land within the Tongass National Forest as mentioned on page 3-115 of the draft EIS, the Forest Service states that the 2008 Forest Plan Final EIS, Volume I, page 3-405, Table 3.16-1, *The Existing Scenic Integrity of the Tongass National Forest (percent)*, estimates that 88 percent of the Tongass National Forest is in an existing scenic integrity (ESI) condition of either Very High or High, combined. The final EIS does not provide a separate total for land in a Very High ESI. This EIS should reflect this information.

Response: We revised the text to reflect information from the Tongass National Forest Plan. However, we did not separate out the percentage of land with a Very High scenic integrity classification because the Forest Plan does not provide this information and because this information would not have a bearing on the effects analysis.

Comment: The Forest Service is unsure how the applicant would avoid the removal of trees when constructing the coastal access road from the dock to the powerhouse, as stated on page 3-122 of the draft EIS, and request the applicant disclose this information.

Response: Juneau Hydro chose the coast route to minimize tree removal but some trees would still need to be removed as indicated in Table 3-15 of page 3-86 of the draft EIS which shows that 3.0 acres of high-volume old growth forest and 1.7 acres of low volume old growth forest would be removed during road construction. Therefore, we revised the EIS to indicate that the coastal road would be constructed in a beach tidal zone with minimal tree removal required.

Comment: The Forest Service requests that the final EIS clarify how and where the applicant would get its source material (rounded natural rock and stone) for the coastal access road where fill would be exposed to Gilbert Bay on both NFS and state-managed land.

Response: Determining the source for material to construct the project is a construction detail that would be determined during final design.

Comment: The Forest Service requests rewording the following statement on page 3-125 of the draft EIS: "…background zone (beyond 5 miles away from the observer)" to include "… (beyond 5 miles and less than 15 miles away…)."

Response: We revised the text as requested because it would be consistent with the 2008 Tongass National Forest Plan affected environment description for Scenery Resources (pages 3-351 to 3-352), which defines distance zones relative to a distance from an identified Visual Primary Route.

Comment: Because some of the most sensitive receptors for changes in visual resources would be visitors arriving in Gilbert Bay by boat and utilizing tidelands owned by the

State of Alaska, Interior recommends that Alaska DNR also be involved, if possible, in the selection of photo points and seasons within the Scenery Management Plan. Additionally, Interior recommends that the Scenery Management Plan be filed with the Commission, just as the Recreation Management Plan would be.

Response: The staff alternative includes Forest Service 4(e) condition no. 22 which specifies preparing the Scenery Management Plan in consultation with the Forest Service and applicable federal and state agencies, and filing the plan with the Commission for approval. Additionally, we have added text to the final EIS to specify the plan would be filed with the Commission for its approval.

Comment: Carole Bookless is concerned about Juneau Hydro having sufficient resources to complete the project, and fears if the project is licensed and Juneau Hydro is unable to complete the project, a pristine environment could be destroyed by a half-constructed project. Carole Bookless recommends a provision in the approval documents that requires all structures be removed and the land remediated to its prior condition if the project is abandoned at any time.

Response: Commission-issued licenses typically require that a licensee, prior to commencing construction, file a financing plan that shows that the licensee has sufficient financial resources to complete the project, and has specific timelines for initiating and completing construction.

CULTURAL

Comment: The Forest Service notes in regard to the Heritage Resource Protection Plan that it would be essential during construction that project personnel are able to recognize cultural material and know the notification procedure to follow. Also, the environmental compliance monitoring plan would include a requirement that the environmental compliance monitor (ECM) be qualified to identify historical and cultural resources.

Response: Section 4.4 of Juneau Hydro's Heritage Resources Protection Plan filed on May 29, 2014 in compliance with Forest Service 4(e) condition 22, states that a worker education-orientation program would be implemented that would provide workers with training in cultural resources responsibilities and in the identification of cultural materials. Ensuring that an ECM is also trained in the identification of cultural materials and human remains, would provide another level of protection. Additionally, the plan also states that all workers would receive a Heritage Resources Briefing that would detail the consequences of non-compliance with these requirements. Although the May 2014 Heritage Resources Protection Plan does not contain specific details regarding cultural resources training, we recommend providing these details in a revised plan to be filed with the Commission and Forest Service within 1 year of license issuance in accordance with the 4(e) condition. We added this recommendation to sections 3.3.6.2 and 5.2.2 of the final EIS.

Comment: The Forest Service and the State Historic Preservation Office recommend that an archaeological monitor be present during initial ground disturbing activities in areas that are highly sensitive for the presence of archaeological material.

Response: The May 2014 Heritage Resources Protection Plan does not contain a requirement for cultural resources monitoring; however, because the likelihood of encountering undiscovered cultural resources in the project area is high (see our revisions to *Prehistoric and Historic Archeological Resources* in section 3.3.6.1 regarding "high probability" areas identified in the plan), an archeological monitor would help to ensure the protection of any cultural resources that might be discovered during construction in highly sensitive areas. Therefore, we recommend that an archaeological monitor be present during initial ground disturbing activities.

SOCIOECONOMICS

Comment: The Forest Service points out that the law referenced on page 3-143 is the Alaska National Interest Lands Conservation Act, section 810.

Response: We updated the final EIS to include a reference to the Alaska National Interest Lands Conservation Act.

ECONOMICS

Comment: Interior questions why the parameters used in the project's economic analysis (i.e., table 4.1 on page 4-2) included a 30-year period of analysis if the Commission typically issues 50-year license terms for unconstructed projects. Interior recommends that the final EIS clearly state the license term, explain any discrepancies between the license term and EIS analyses, and, where appropriate, modify the analysis to ensure it evaluates the project for its entire term.

Response: We do not evaluate the economics of a project over its entire term. Since 1995, the Commission's approach to evaluating the economics of hydropower projects has used current costs (i.e., first-year costs) to compare the costs of the project and likely alternative power with no forecasts concerning potential future inflation, escalation, or deflation beyond the license issuance date. The basic purpose of the Commission's economic analysis is to provide a general estimate of the potential power benefits and the costs of a project, and of reasonable alternatives to project power. The estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. The Commission's approach includes using a 30-year period of analysis, the typical minimum term of a license, for annualizing the capital costs so that they can be used in the determination of the first-year cost of the proposed action and each alternative. The 30-year period is applied equally among the alternatives so that there is no discrepancy among the alternatives. For more information on the Commission's approach to evaluating the economics of a proposed project, see Mead Corporation, Publishing Paper Division, Project No. 2506-002, Federal Energy Regulatory Commission (72 FERC ¶61,027, July 13, 1995).

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APPENDIX B

Sweetheart Lake Hydroelectric Project Alternative Analysis for the U.S. Army Corps of Engineers

(The following appendix was prepared by Juneau Hydropower, Inc., for the U.S. Army Corps of Engineers (Corps) and was submitted to the Commission by the Corps for inclusion as part of the final EIS for the Sweetheart Lake Hydroelectric Project. The information in this appendix is to be used for the Corps' 404 permitting process.)

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Sweetheart Lake Hydroelectric Project Alternative Analysis for U.S. Army Corps of Engineers

Introduction

The U.S. Army Corps of Engineers, Alaska District (USACE) has received an application for a Department of the Army Permit under Section 404 of the Clean Water Act (CWA) from Juneau Hydropower, Inc. (Juneau Hydro) to construct the Sweetheart Lake Hydroelectric Project (Project). Juneau Hydro is a privately held corporation primarily consisting of Juneau Alaska based investors seeking to establish short and long-term energy security, maintaining low and reasonably priced energy for Juneau, and providing sustainable and renewable energy options for Juneau that will reduce Green House Gas (GHG) emissions helping Juneau meet its GHG reduction goal of 25% by 2035. Juneau Hydro believes that the construction and operation of the Sweetheart Lake Hydroelectric Project combined with continued and expanded deployment of locally proven heat pump technology with efficiencies exceeding 300% presents an exponential effect on combined energy cost savings and GHG savings from the No Action Alternative. Juneau has also experienced a sustained growth in electrical vehicle transportation, and further, boasts one of the highest per capita electrical vehicle chargers in the US[1]. Combined with a market ready to transform to renewable energy, the Proposed Alternative, provides a renewable energy solution for current and future Juneau market requirements.

In accordance with the National Environmental Policy Act (NEPA), the Federal Energy Regulatory Commission (FERC) has determined that issuance of such a FERC hydropower license may have a significant impact on the quality of the human environment and, therefore, requires the preparation of an Environmental Impact Statement (EIS). The USACE is a cooperating agency with FERC for the Project EIS. The Alternative Analysis required by the USACE is different from what is required in the FERC EIS. Juneau Hydro is submitting this Alternative Analysis to meet the standards and conditions required for the USACE to make decisions regarding Juneau Hydro's Application for Permit under Section 404 of the Clean Water Act.

USACE must evaluate alternatives that are practicable and reasonable.

The following Alternative Analysis is prepared with these steps:

Step 1.	Definition of Purpose and Need
Step 2	Identify Alternatives
Step 3	Describe and Analyze Alternatives for Practicability
Step 4	Identify the Least Environmentally Damaging Practicable Alternative

[1] Juneau Economic Development Council. 2015

Step 1. Definition of Purpose and Need.

The Project purpose and need was modified with agreement between the USACE, Mr. Jamie Hyslop and Juneau Hydro, Mr. Duff Mitchell on March 1, 2016.

The purpose and need is to construct and operate a new hydropower facility to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.

Additional information regarding the project purpose. The market conditions and market demand exist for hydropower development and operation to produce renewable energy to displace fossil fuel use for electrical generation as well as to displace fossil fuel heating with the Juneau market existing within the City and Borough of Juneau, Alaska.

The following unmet diesel generated electrical loads that currently exist in Juneau that would convert to lower cost renewable electrical energy demand if available and that would be satisfied by the preferred and proposed alternative of Sweetheart Lake Hydroelectric Facility:

1. Coeur, Alaska Kensington Mine- Estimated annual demand 65,000 MWh
2. Hecla Greens Creek Mine – Estimated annual demand 14,000 MWh

The Hecla Greens Creek Mine purchases firm hydropower from Avista/Alaska Electric Light & Power on an interruptible basis and must regularly self-generate on more expensive and less reliable diesel power generation. The annual average of shortage of power is 14,000 MWh. This power is not equal in every year; in fact, there are many years that there is no demand because all of the power can be fulfilled by AELP hydropower. The Hecla Greens Creek Mine demand represents a potential demand that could be served by the Sweetheart Lake Hydroelectric Facility under certain circumstances.

The two CBJ docks currently under reconstruction that are not currently electrified but have plans to do so, represent 12,000 MWh to 13,000 MWh of “unmet” renewable energy demand that currently exists in the local Juneau market. Further, these summer loads are ideal for hydropower since this is when hydropower water levels of reservoirs are highest.

The following unmet renewable electrical energy demand that would be built simultaneous with the proposed project that would require renewable electrical energy:

1. Juneau District Heating – Estimated annual demand 50,000 MWh

Beginning in 2018, Juneau District Heating would use renewable electrical energy to operate a seawater heat pump district heating system for downtown Juneau. The 300% efficiency would displace higher cost diesel home and space heating needs and would therefore produce 150,000 MWh of heat per year with a 50,000 MWh renewable electrical energy input. The seawater based heat pump district heating system essentially, “value adds” the renewable electrical energy with efficiency, displacement of three times the fossil fuel use and a corresponding reduction of greenhouse gas emissions.

Juneau Hydro has agreements with the Coeur Alaska, Kensington Mine, and the Juneau District Heating to supply immediate need for renewable electrical energy. These facilities require firm power which means that there is consistent power available on a 24/7 basis 365 days a year. The immediate annual need for renewable electrical energy is 115,000 MWh. The higher end of potential immediate annual need for renewable electrical energy is 142,000 MWh with no reserve for industrial, business, or residential growth that is already occurring with electrification of transportation. In addition to these customers, there has been a steady growth in Juneau for air source heat pump sales for businesses and residences converting from diesel based heating. There has also been a large growth in electrical vehicle adoption in Juneau.

The proposed project, Sweetheart Lake Hydroelectric Facility, has the storage capability to provide firm power for 116,000 MWh annually.

Project Goals

Juneau Hydro has further identified specific goals of the project as following:

1. Immediately displace Juneau fossil fuel heating with renewable electric energy to operate Juneau District Heating's seawater heat pump district heating system that will provide lower cost, zero emission heat. Juneau District Heating has an operation date of 2018 and is in immediate need of renewable electrical energy that is currently non-existent and not available.
2. Provide immediate renewable electrical energy security to Juneau that is susceptible to avalanche power outages along the Speel Arm in Port Snettisham as evidence by the 2008 and 2009 avalanches.
3. Provide immediate renewable electrical energy to the Coeur Alaska, Kensington Mine to provide long-term energy security and lower emissions from their current diesel self-generation demand.
4. Minimize and, where possible, displace the social and environmental impacts caused by fossil fuel energy production and heating.

Step 2. Identify Alternatives

The list and brief description of Alternatives that could meet the overall project purpose which is *to construct and operate a new hydropower facility.*

Alternative 1. Juneau Hydro's Preferred Alternative: Sweetheart Lake Hydroelectric Project.

Alternative 2. No Action alternative. No site is developed and no hydropower facility is developed. B. A potential Lake Dorothy II hydropower site (not available to the Project proponent) requiring a major FERC amendment is investigated, developed, designed and constructed at some point in the future.

Alternative 3.	Taku River, a previously identified potential run of river hydropower source.
Alternative 4.	Whiting River, a previously identified potential run of river hydropower source.
Alternative 5.	Sheep Creek, a previously constructed and abandoned hydropower site that is a potential hydropower site.
Alternative 6.	Tease Lake, a previously identified potential hydropower site.
Alternative 7.	Lake 3160, Alaska Power & Telephone Lake 3160 Project, a currently FERC permitted hydropower site.

All alternatives are located in the geographical scope of the City and Borough of Juneau and are either previous or currently identified hydropower sites.

Projects that are determined unreasonable by virtue of being too small of firm energy output to produce the required 115,000 MWh of firm power to accommodate the project are considered "unreasonable" and impracticable due to smallness of size to accommodate the Project and are eliminated from further evaluation. A brief description of the eliminated Alternatives and reason are listed below.

Projects determined to be unreasonable and impracticable due to smallness of size to accommodate the Project's need and purpose and therefore eliminated from further evaluation:

Sheep Creek Alternative #5

Based on the USGS Geological Survey Water-Supply Paper 1529 Waterpower Resources near Petersburg and Juneau Southeastern Alaska-Sheep Creek was identified as an early Alaska hydropower project. Sheep Creek was developed as a hydropower facility to provide power to the Douglas Island, Treadwell Mine and consisted of a diversion dam from a flume leading to what was called the "Treadwell" powerhouse. Historical records reveal that a small amount of power was developed on Sheep Creek as early as 1908. In 1910, the Oxford Mining Company constructed a power plant with the natural head of 270 feet. In 1914 this plant was replaced by a larger development of the Alaska Treadwell Mining Co. and was later purchased by the Alaska Juneau Gold Mining Co., which was the owner until the land was subsequently purchased along with the previous FERC permit to Alaska Electric Light & Power (AELP- now a wholly owned subsidiary of Avista Utilities which serves electric and natural gas customers in Washington, Oregon, Idaho and Alaska). The Sheep Creek power plant deteriorated into a state of disrepair and was later abandoned.

Previous studies demonstrate that the drainage area of the Sheep Creek Alternative watershed consists of 4.57 square miles and is relatively small watershed compared to the Proposed Alternative with a drainage area of 35 square miles.

Sheep Creek is located within the City and Borough of Juneau.

It is unknown if there are any federally listed threatened or endangered species or their critical habitat, and or the presence of any historical properties or resources based on information and studies that would have been reported on the FERC website. Because Sheep Creek was a former hydropower site with an intact powerhouse, it is likely that historical properties exist on the site.

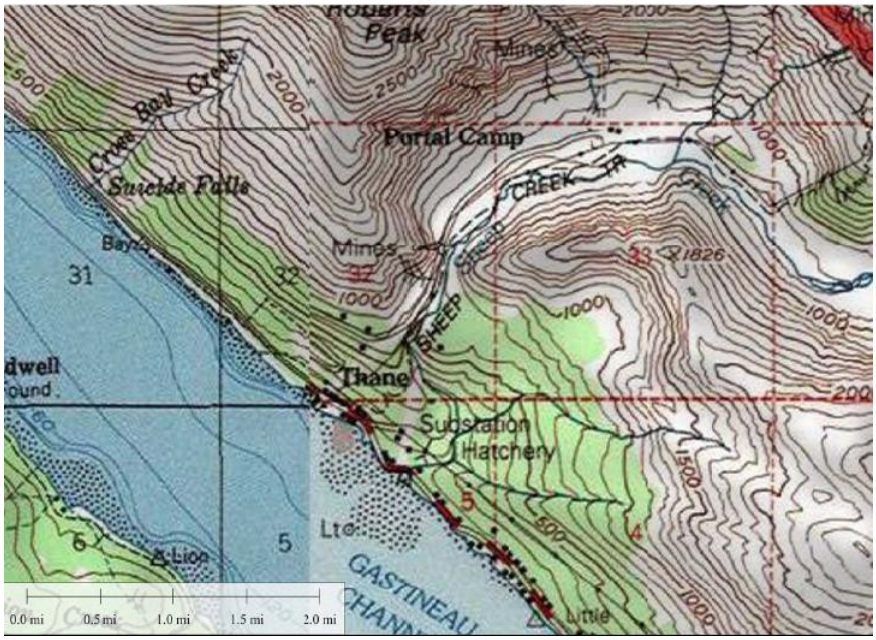
On April 30, 2013, AELP received a new FERC preliminary permit for Sheep Creek with a proposed 3.3 MW project that would annually generate 16, 317 MWh with a proposed dam of 10 feet high by 75 feet wide. AELP subsequently filed for an application to exempt the site from FERC jurisdiction and withdrew their FERC preliminary permit on the project.

On June 12, 2013, AELP filed a Declaration of Intention to determine if a FERC license would be required for the Sheep Creek Hydroelectric Project. On July 1, 2014, FERC Issued an Order Ruling on the Declaration of Intention and found that a FERC License was not required for the project. The Order was filed under Docket No. DI13-8-000.

On October 13, 2015, AELP informed the Thane Road Neighborhood Association (a neighborhood group near Sheep Creek) that AELP would not be proceeding with the development of Sheep Creek stating that it is not economical to develop in the next few years.

According to previously published documents, the reservoir site of Sheep Creek is broad and U-shaped. Depending on the size of dam and the impoundment would have corresponding impacts on side streams with an area of 50 to 387 acres. The most recently proposed plans have been abandoned with a determination that the facility is not economical.

Sheep Creek



Conclusion to not further evaluate Sheep Creek hydropower site.

The Sheep Creek hydropower site is not large enough to meet *to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.* The Sheep Creek hydropower site cannot provide the requisite renewable electrical energy output necessary to provide renewable electrical energy to the Coeur Alaska, Kensington Mine or the Juneau District Heating, let alone meet one of these immediate renewable electrical energy demands. Additionally, the most recent determination of a proposed plan on this site is that a hydropower facility is not economical to develop.

The Sheep Creek hydropower site alternative is removed from further analysis as it is too small in generation size and year round availability of power to meet the immediate demand for renewable electrical energy that would be immediately served by the Sweetheart Lake Hydroelectric Facility.

Tease Lake Alternative #6

Tease Lake was at one time a developed hydropower facility that operated briefly to provide power for a collocated pulp mill owned by the Alaska Pulp and Paper Co. The power plant was operated intermittently from January 25, 1921 to December 15, 1923 when its use was abandoned. In 1925, the wood crib dam washed out. During operation, 2 Pelton turbines of 1,000 and 350 horsepower (total 1 MW capacity) were used to drive grinders, saws and other machinery. The power plant facility was abandoned in 1931 (in part, due to dam failure) and the FERC license revoked in 1935.

Based on information from the USGS Geological Survey Water-Supply Paper 1529 Waterpower Resources near Petersburg and Juneau Southeastern Alaska, Tease Lake has a watershed area of 10.9 square miles, which is less than 1/3 of the watershed of Sweetheart Lake. The Tease Lake head elevation is approximately 990 feet and estimated average discharge estimated between 105 and 125 cubic feet per second (cfs). Although a larger head, the discharge compares to about 1/3 of the average discharge of Sweetheart Lake. Tease Lake is estimated to provide a storage capacity of 22,000-acre feet that is considerably less than ¼ of the storage capacity of the Proposed Alternative. Although the Tease Lake Alternative is a smaller lake and smaller storage area for the reservoir, the estimated size of the dam is approximately 540 feet. Low-level observations from a 1958 USGS flight showed that the valley floor is flat and that a considerable part of the valley floor is marshy. A subsequent flight observation and site reconnaissance conducted by Juneau Hydro confirms that there are large tracts of wetlands at the Tease Lake Alternative if a wetland delineation were to occur.

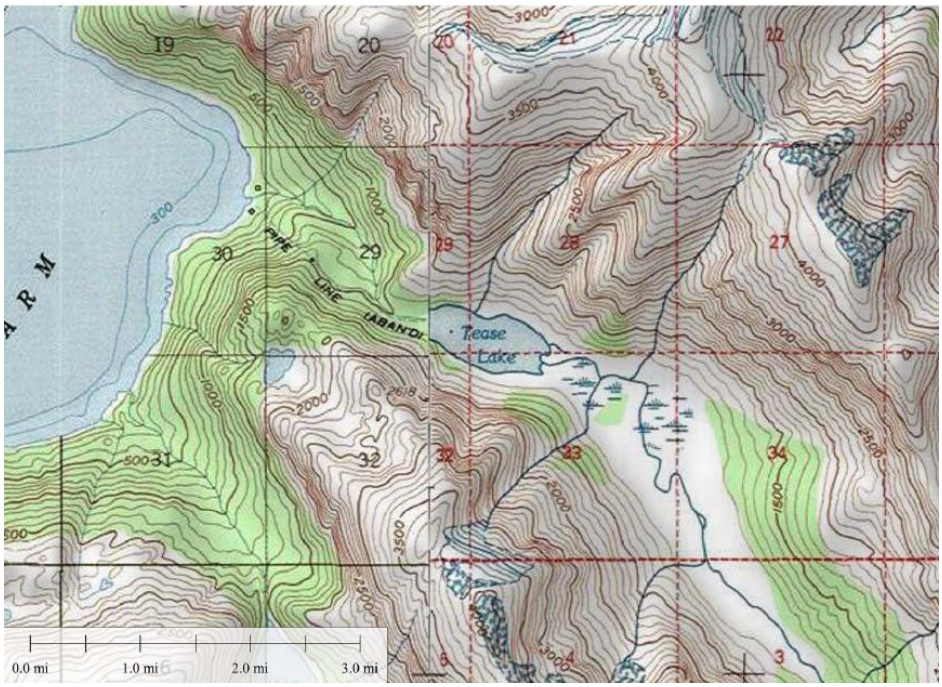
Upon a previous Tease Lake Alternative site visitation and inspection conducted by Juneau Hydro of the previous power house site and penstock and a subsequent flight reconnaissance over the

Tease Lake Alternative dam site it was found that virtually all infrastructure has been removed (presumably salvaged) from the original dam, penstock, dock, and powerhouse facility.

Based on information from the USGS Geological Survey Water-Supply Paper 1529 Waterpower Resources near Petersburg and Juneau Southeastern Alaska, Tease Lake on page 69, the Tease Lake hydropower site has the potential of a 7MW capacity and would have a storage capacity of roughly 25% of the Sweetheart Lake Hydroelectric Facility.

Tease Lake is located within the City and Borough of Juneau. It is unknown from published studies from past government publications if there are any federally listed threatened or endangered species or their critical habitat, and or presence of any historical properties or resources. Due to the fact, that there was a previous hydropower powerhouse at the site, there is likely historical property resources on the site.

Tease Lake



Conclusion to not further evaluate the Tease Lake hydropower site.

The Tease Lake hydropower site is not large enough *to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.* The Tease Lake hydropower site cannot provide the requisite renewable electrical energy output necessary to provide renewable electrical energy to the Coeur Alaska, Kensington Mine or the Juneau District Heating, let alone meet one of these immediate renewable electrical energy demands. Additionally, it would appear

that the development of the facility would incur, from observation and written documents, a large amount of wetland disturbance that would likely exceed that of the Preferred Alternative.

The Tease Lake hydropower site alternative is removed from further analysis as it is too small in generation size and year round availability of power to meet the immediate demand for renewable electrical energy that would be immediately served by the Sweetheart Lake Hydroelectric Facility.

Lake 3160 Water Power hydropower project Alternative #7.

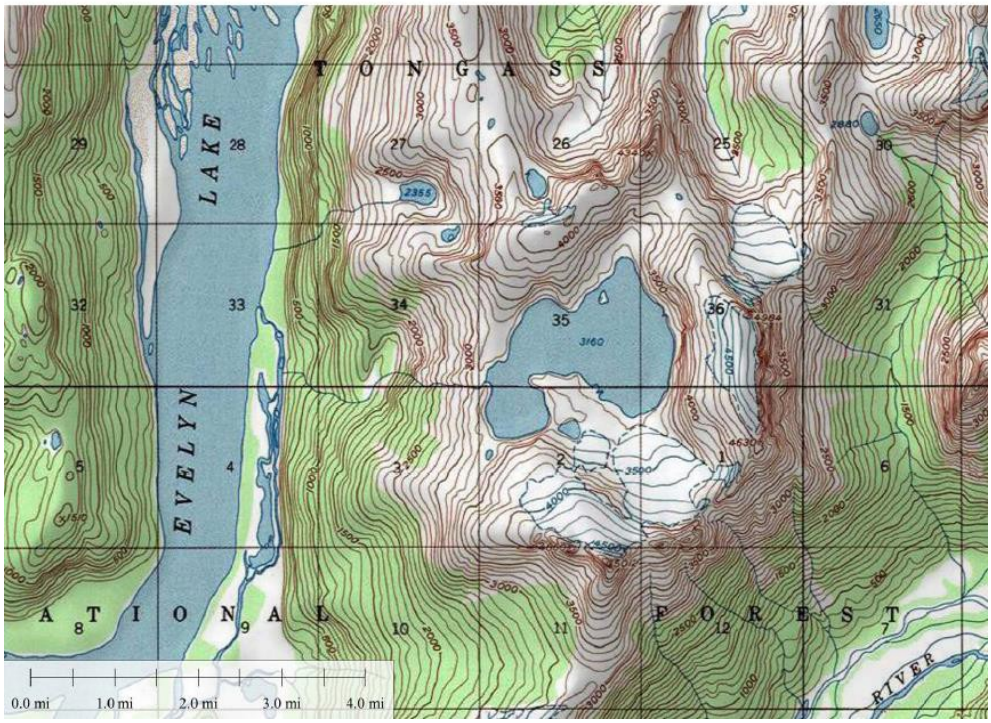
The Lake 3160 Water Power project is a Federal Energy Regulatory Commission (FERC) permitted project with a Project number of P-14588 and is located at an unnamed lake in Juneau, Alaska.

Alaska Power & Telephone (AP&T) submitted and attained a preliminary permit on July 17, 2014. The project is proposed to have 28,700-acre feet of storage and has an annual estimated annual generation of 40,000 MWh. Based on project correspondence; AP&T is conducting stream gage analysis to determine the power output of the project along with environmental and engineering analysis. Under the project permit application, the Lake 3160 proposed project would use the existing 451-acre Lake 3160 with 19,700 acre-feet of storage and would consist of: (1) either a siphon intake directional bore or a 20-foot-high concrete dam with a spillway which would increase Lake 3160's surface area to 471 acres with 28,700 acre-feet of storage; (2) either a directional bore to the lake bottom or an above-ground 20- to 24-inch-diameter, 8,800-foot-long penstock; (3) a powerhouse containing either one or two generating units with a total installed capacity of 4,995 kilowatts; (4) an open channel tailrace conveying powerhouse discharges to Evelyn Lake; (5) a 7.6-mile-long, 14.4/24.9 kilovolt (kV) (or higher) transmission line which would be built either as: (i) an overhead line; (ii) buried line in a conduit; (iii) submarine cable; or (iv) a combination of all three to intertie with the existing line at a nearby mine on Johnson Creek; and (6) appurtenant facilities. The estimated annual generation of the project would be 40 gigawatt-hours. The project would be located within the Tongass National Forest.

Based on the published data of this facility under FERC e-library website, the project proponent has not conducted an agency meeting to evaluate the impacts of wetlands or affects on the Waters of the US. Therefore, it is unknown as to wetland areas that will be impacted by the penstock, tailrace, 20-foot concrete dam or other infrastructure at this time. It is unknown if there will be modifications in the proposed project upon further agency meetings and from the results of any investigation from environmental plans. However, the project would appear to be a high alpine lake that would invariably freeze during the winter months and thereby reduce power output in the winter months. The proposed project would also only create 40 gigawatt hours (40,000 Megawatt hours) which would not meet the immediate demand for electrical renewable energy as required from the proposed project. Further, the project is in its preliminary permitting and at this time, it appears that just stream gage information is being obtained. Therefore, it is extremely unlikely and not realistic that the project can be brought forward in a timely manner to meet the need and purpose for the proposed project.

Lake 3160 is located within the City and Borough of Juneau. It is unknown from studies from the current development if there are any federally listed threatened or endangered species or their critical habitat, and or the presence of any historical properties or resources.

Lake 3160



Conclusion to not further evaluate the Lake 3160 Water Power Project.

The Lake 3160 Water Power Project hydropower site is not large enough *to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.* The Lake 3160 Water Power Project hydropower site cannot provide the requisite renewable electrical energy output necessary to provide renewable electrical energy to the Coeur Alaska, Kensington Mine or the Juneau District Heating, let alone meet one of these immediate renewable electrical energy demands.

The Lake 3160 FERC permitted project is not large enough and cannot provide the requisite renewable electrical energy output to fuel the Coeur Alaska, Kensington Mine or the Juneau District Heating, let alone one of these immediate demands.

The Lake 3160 hydropower site alternative is removed from further analysis as it is too small in generation size and year round availability of power to meet the immediate demand for renewable

electrical energy that would be immediately served by the Sweetheart Lake Hydroelectric Facility. For this and other reasons previously mentioned Lake 3160 has been removed as an Alternative from further analysis.

In summary, Sheep Creek, Tease Lake, and Lake 3160 have not been developed and have conducted limited to no environmental studies, wetland delineations or engineering design. It is therefore likely that in the advent of additional studies that environmental issues and impacts, to include impacts on wetlands and aquatic resources, will become known. Based on previous information conducted by USGS and other governmental entities, these projects will require roads, transmission and or other infrastructures that will impact the environment. Due to the nature of development in Alaska remote wilderness, the specific impacts of each of these sites cannot be determined with specificity and information can only be obtained from the documents published.

The cost of the studies associated with the foregoing projects, the time involved to execute the studies combined with the limited power that these hydrologic resources can achieve by way of capacity and generation, make further analysis as a viable alternative to meet the Project's need and purpose imprudent.

These Alternative sites do not meet the project-sizing/ renewable electrical energy screen to meet the purpose and need of the proposed project.

Consideration of a combination of multiple small projects is eliminated from Analysis.

A possibility exists that one or more, smaller projects with the appropriate power generation and size could meet the purpose and need for the proposed activity. However, this scenario is unlikely in combining study intensive hydropower projects that have many unique characteristics in overcoming environmental and engineering challenges, especially in Alaska. Even if multiple projects were combined to achieve the requisite level of renewable electrical energy to meet local demand it is extremely unlikely that the parallel development timing of multiple projects can result in the level of timely and simultaneously immediate need for renewable electrical energy as required in the Project purpose and need for the proposed activity. The average hydropower development in America takes up to 10 years of regulatory process at the cost of millions of dollars in which many FERC permitted projects never make it to achieving an accepted FERC license for a multitude of many well founded reasons. The regulatory uncertainty that includes the US Forest Service "roadless rule", endangered and threatened species, poor hydrology records, cost uncertainty, and environmental impact uncertainty makes the combined development of multiple projects risky and unlikely that multiple projects could be considered practicable to meet the intended purpose and need. Therefore, for the reasons presented, a combination of smaller projects to meet the purpose and need of the Project is unreasonable and not practicable.

Step 3 Describe and Analyze Alternatives for Practicability-Analysis of remaining Alternatives

Unlike the previously eliminated alternatives, the remaining alternatives have the capacity and electrical generation potential size to meet the immediate demand for renewable electrical energy that would be immediately served by the Sweetheart Lake Hydroelectric Project and therefore meet the market sizing screen for the Project.

Each of these remaining alternatives are analyzed and evaluated according to Practicability and Availability of being developed and operated by Juneau Hydro.

Alternative 1. Juneau Hydro's Preferred Alternative: Sweetheart Lake Hydroelectric Project.
Alternative 2. No Action alternative. Avista/AELP Lake Dorothy II a potential hydropower site requiring a major FERC amendment and construction at some point in the future.
Alternative 3. Taku River, a previously mentioned potential dam or run of river hydropower s source.
Alternative 4. Whiting River, a previously mentioned potential dam or run of river hydropower source.

Each of these Alternatives will be presented with General Site information and then each Alternative will be evaluated for Practicability. Alternatives that are practicable are those that are available and capable of being developed by Juneau Hydro after considering the following factors in relation to the purpose and need for the proposed activity.

Practicability considers the following factors:
Cost. Costs are analyzed in the context of the overall scope/cost of the project and whether it is unreasonably expensive. Cost is an objective, industry-neutral inquiry.
Existing Technology. Are there limitations or incorporation of the most efficient, least impacting construction methods currently available.
Logistics. An examination of various logistics associated with the project. Location of the Alternative and any land restrictions, placement of infrastructure, and accessibility to develop, construct or operate the proposed activity.

Upon an analysis and discussion of Practicability of each Alternative, each Alternative is evaluated for Availability. If an otherwise practicable alternative is not presently owned by the application that could be reasonably obtained, utilized, expanded, or managed in order to fulfill the overall purpose of the proposed activity then the Alternative can still be considered a practicable Alternative. Availability will consider and anticipate alternatives available during the timeframe the Corps conducts its Alternate Analysis. Alternatives will be analyzed for their availability in relation to the purpose and need for the proposed activity.

Other information. Any other information that conveys the practicability of the alternatives reviewed in consideration of the overall purpose and need for the proposed activity.

1. **General Site Information**

Alternative 1. Juneau Hydro's Preferred Alternative: Sweetheart Lake Hydroelectric Project.

Juneau Hydro Proposal- Constructing the Sweetheart Lake Hydroelectric Project as Proposed and accepted in the FERC License Application

The proposed project would consist of the following new facilities: (1) A 280-foot-wide, 111-foot-high roller-compacted concrete dam to be constructed at the existing natural outlet of Lower Sweetheart Lake with a 125-foot-wide ungated overflow spillway at a crest elevation of 636 feet; (2) a 525-foot-long, 10-foot-high, 10-foot-wide arched reservoir outlet tunnel at the right dam abutment; (3) a 45-foot-long, 25-foot-wide, 16-foot-high rectangular concrete intake structure with six 7-foot-diameter, 10-foot-high cylindrical fish screens adjacent to the right dam abutment; (4) a 9,612-foot-long, 15-foot-wide, 15-foot-high horseshoe-shaped, unlined underground power tunnel; (5) an 896-foot-long, 9-foot-diameter saddle-supported steel penstock installed within the lower portion of the power tunnel; (6) three 160-foot-long (mean length), 7- to 9-foot-diameter buried steel penstocks connecting the lower portion of the power tunnel to the powerhouse; (7) a 160-foot-long, 60-foot-wide, 30-foot-high concrete and steel powerhouse; (8) three 7.1-MW Francis turbines with 6.6-MW generators with a total installed capacity of 19.8 MW; (9) a 541-foot-long, 30- to 90-foot-wide rock tailrace with a fish exclusion structure, discharging to Sweetheart Creek; (10) a 4,400-foot-long coastal road from the powerhouse to a dock/landing site for aerial and marine vehicle access, located on the east shore of Gilbert Bay; (11) an 8.69-mile-long, 138-kilovolt (kV) transmission line traversing Gilbert Bay, the Snettisham Peninsula, and Port Snettisham, consisting of: (a) two buried segments, totaling 4,800 feet in length; (b) two submarine cable segments, totaling 25,700 feet in length; and (c) one 15,400-foot-long, overhead segment; (12) a 22,000-square-foot fenced switchyard adjacent to the powerhouse; (13) a 25-foot-long, 5-foot-wide, 4-foot-deep salmon smolt re-entry pool[2] located adjacent to the powerhouse and tailrace; (14) a 4,225-square-foot caretaker's facility near the dock; (15) a 4,800-foot-long, 12.47-kV service transmission line and communication cable extending from the powerhouse to the dock and the caretaker's facility, providing operational electricity and communications; (16) a 10,000-foot-long, 12.47-kV service transmission line and communication cable extending from the powerhouse to the dam site, providing operational electricity and communications; (17) a 400-square-foot shelter at the dam site for employee use during smolt transport facility operations; and (18) appurtenant facilities.

Construction of the project would raise Lower Sweetheart Lake from a water surface elevation of 551 feet mean lower low water[3] and a surface area of 1,414 acres to a new maximum water

[2] The re-entry pool would provide temporary holding of sockeye salmon smolts collected and transported from Sweetheart Lake, for imprinting and release to the tailrace.

[3] The mean lower low water level is the 19-year average of the lower of the two daily low tides and serves as the reference elevation chosen by Juneau Hydro for project facilities.

surface elevation of 636 feet and surface area of 1,702 acres, and a new minimum water surface elevation of 576 feet and surface area of 1,449 acres.

The facility would generate 19.8 MW of nameplate capacity and generate 116,000 MWh of renewable electrical generation sufficient to meet immediate demand for renewable based electricity. The preferred alternative is expected to take two construction seasons to complete upon receipt of the project FERC Notice to Proceed.

The tailrace, which returns water from the operations, would enter Sweetheart Creek approximately 1,300 feet upstream from the creek mouth on Gilbert Bay bypassing an approximately 2-mile-long reach of Sweetheart Creek from the lake outlet to the impassable fish barrier at the falls near the tailrace outlet.

The project would occupy 2,058.24 acres of federal lands located within the Tongass National Forest. The proposed project boundary would also include 131.18 acres of tideland and submerged lands of the state of Alaska.

The project would affect 3.33 acres of direct fill on the Waters of the US (WOTUS) and another 11.38 acres of inundation because of the raise in reservoir from hydropower operations.

The Project is located within the City and Borough of Juneau.

The Sweetheart Lake Hydroelectric Project is listed in the Draft Southeast Integrated Resource Plan (SEIRP 2012) as an Initial Screened Potential Hydro Project List. The Draft SEIRP has not been approved or adopted and is considered a reference document.

The Sweetheart Lake Hydroelectric Project is a listed Power Site Classification site for the US government. As part of the Public Interest determination, the Sweetheart Lake Hydroelectric Project is a Power Site Classification number 221. Public Land Order (PLO) 382b dated March 6, 1929 with a Secretarial Order established the Sweetheart Lake and Sweetheart Falls Creek as a public land withdrawal for the purposes of developing hydropower on the site for the benefit of the citizens of the United States.

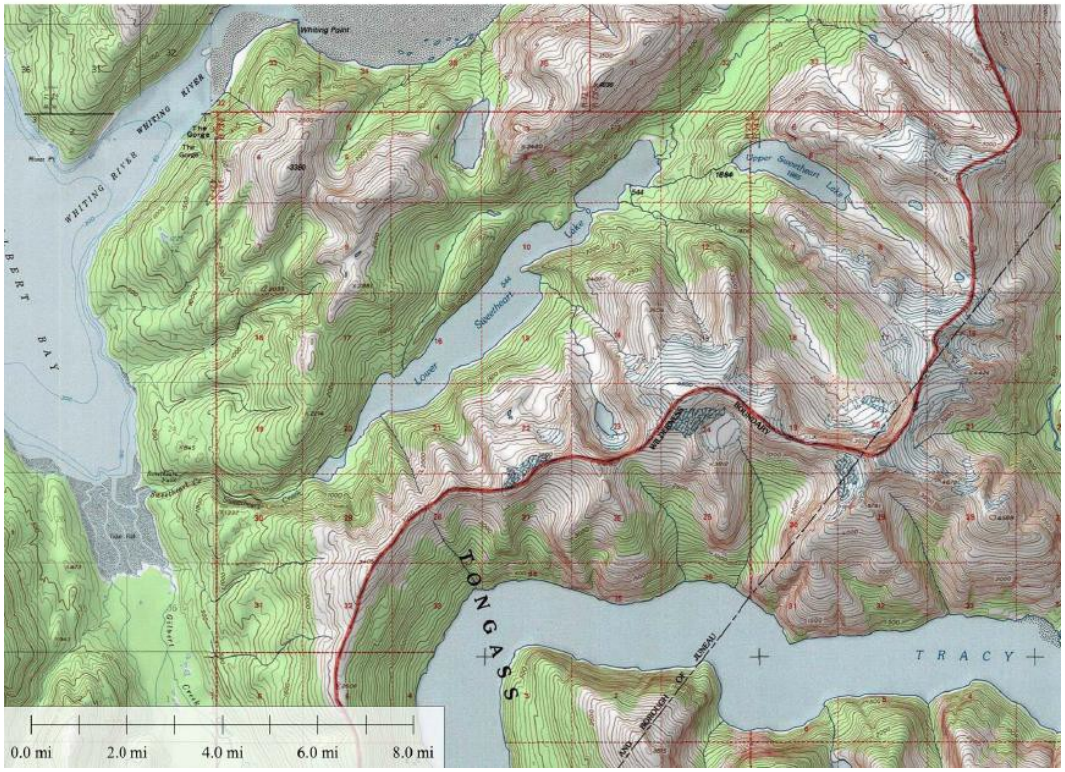
There are no known presence of federally listed threatened or endangered species or their critical habitat, and/or presence of historical or cultural resources that would preclude or pre-empt the development plans as submitted to FERC under the FERC license application accepted by FERC.

The project has identified and included the proposed site infrastructure with the Preferred Alternative description.

Under the FERC license application alternative, Juneau Hydro has secured customers to purchase all of its electrical capacity and average annual generation from the Sweetheart Lake

Hydroelectric Project that will displace fossil fuels currently used to produce industrial electrical generation and displace a magnitude of three that displacement of fossil fuel use for space heating. The resulting decrease in fossil fuel use, reduction of GHG emissions would allow the CBJ to meet its GHG emission goals set forward in the CBJ Climate Action and Implementation Plan.

Sweetheart Lake



2. **Practicability and Availability Analysis of Alternative 1, the Juneau Hydro Preferred Alternative.**

Cost.

The cost of the preferred Alternative of developing, constructing, and operating the Sweetheart Lake Hydroelectric Facility was presented in the Juneau Hydro License Application. The total costs presented in the FERC license application consider and incorporate various contingencies that may prove reasonable or overstated depending on construction timing and other variables that include interest rates, management, and material costs among other factors.

In Exhibit D of the Juneau Hydro license application, Juneau Hydro estimated the cost of the proposed alternative would cost $114,465,000 before contingencies, interest during construction, escalation, and reserves. This dollar amount would represent the best-case scenario. With all

potential contingencies, interest during construction, escalation and reserves, these costs could rise to $187,827,687.

Juneau Hydro is uniquely eligible for Alternative 1 and Juneau District Heating (a user of the Preferred Alternative's renewable electrical energy) for a US Department of Energy Title VII loan that provides loans at prime rate. This factor would reduce the interest costs of Alternative 1 as reported in the FERC license application for the preferred Alternative.

Existing Technology. Juneau Hydro has employed to the maximum extent, existing technology for the most efficient, least-impacting construction methods currently available. For example, Juneau Hydro has reduced and eliminated the need for damsite access roads by incorporating the water tunnel to accommodate equipment and material during construction. Another salient example is that the tunnel spoils are fully utilized and incorporated into the roller compact concrete dam, aesthetic barriers, and trail improvements. The incorporation of project tunnel spoils as an input ingredient into the project infrastructure is innovative technology, is efficient, and eliminates potential fill on waters of the US and or transport from the existing site.

Logistics.
Through the development process, Juneau Hydro has eliminated all logistics constraints that would otherwise pose a barrier to development. The Alternative is located on deep water and therefore material and equipment can be landed at the site. The Alternative has developed an innovative use of the water conveyance tunnel to move material and equipment to the dam site without the construction and the environmental effects of a road. The land and location is available for hydropower development under the US Forest Service land use designations (LUD's) under the Tongass Land and Resource Management Plan (TLMP). The hydrological resources are sufficient to meet the need and purpose of the proposed activity.

b. Availability

Juneau Hydro holds the permit to develop the Sweetheart Lake Hydroelectric Facility and has an accepted license application by the Federal Energy Regulatory Commission (FERC). The availability of this alternative with FERC license approval expected in the summer of 2016 would enable the notice to proceed and construction activities to commence to meet the purpose and need of the proposed activity.

Alternative 2. No Action alternatives.

The No Action alternative Option A is that the preferred alternative is not built, no renewable electrical energy project is built and there is no renewable electrical energy developed to meet the purpose and need of the project. There is no conversion or displacement of diesel generation and diesel home heating in the Juneau area, and there is no environmental benefits accrued by reducing greenhouse gas emissions that would otherwise be derived from the Preferred Alternative by

displacement of fossil fuel electrical generation or fossil fuel home heating that would meet the Purpose and need of the Project. Further, it is more than likely that under the No Action Alternatives Option A, that fossil fuel use will grow within the City and Borough of Juneau as renewable electrical energy options becomes a non-existent alternative to meet immediate need. Gaps in energy demand not met from the proposed activity will be met with fossil fuel energy sources.

The practicability and availability of what is essentially a do nothing alternative is self-evident.

1. General Site Information of the No Action Alternative

Under the No Alternative Option B, there is a scenario where the Lake Dorothy II Project could become developed, licensed, and constructed at some point in the future. Such an action would require a major FERC license amendment and would require a new set of studies, design and permitting to investigate and determine feasibility and practicability of this potential alternative. Major FERC licensing amendments can lead to several years of permitting and investigation activities in order to receive a determination on a major license amendment.

Lake Dorothy II is a separate and distinct project from the existing Lake Dorothy I in that Lake Dorothy II would require an entirely new power tunnel and powerhouse. Operationally water from Lake Dorothy can only be used once to produce electricity. Currently under Lake Dorothy I operations, water diverted from Lake Dorothy flows into Lieuy Lake and then to Bart Lake where it is then conveyed to the Lake Dorothy I powerhouse.

The Lake Dorothy Project II No Action Alternative B is located in the City and Borough of Juneau.

The Alternative is listed in the Draft Southeast Integrated Resource Plan (SEIRP 2012) as an Initial Screened Potential Hydro Project List. The Draft SEIRP has not been approved or adopted and is considered a reference document and not an Integrated Resource Plan.

No wetland delineation study or report was conducted on the Lake Dorothy projects[4]. It was determined and thought there was to be little wetlands in 2000. However, areas of muskeg were mentioned within the project area and it is unknown if these muskeg areas would be considered affected wetlands or avoided. It is also unknown to what extent any impact would occur with the surrounding streams and creeks that currently carry water from Lake Dorothy to tidewater from any future changes in lake elevations affected by the final design of any future project amendment and approved expansion.

At the time of license approval of Lake Dorothy 1 project (2003), there was not any listed presence of federally listed threatened or endangered species or critical habitat and/or any presence of

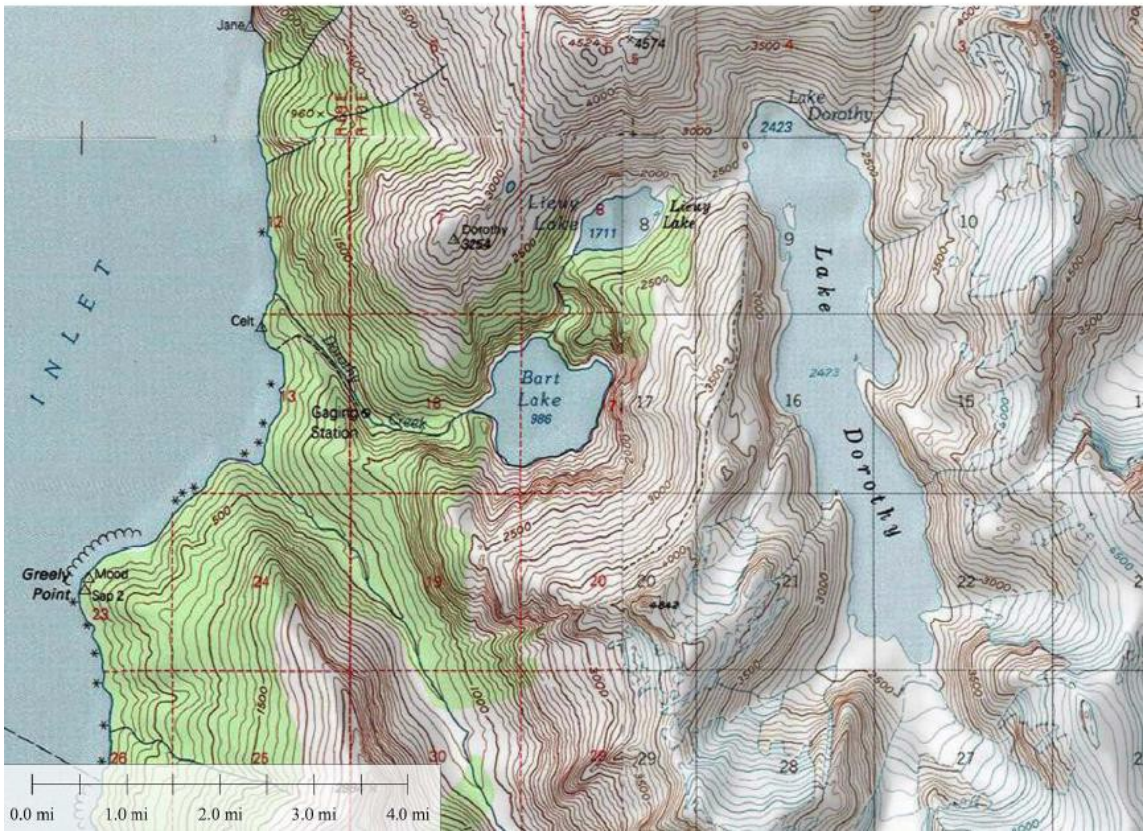
[4] FERC Lake Dorothy I EIS.

historical and cultural resources that were not resolved with the Lake Dorothy I Project License issuance. However, new studies would be required to determine the presence of any newly listed species or population migration of species have been introduced in the project area.

Although, until a final design is approved, it is unknown if any new roads or access will be required or where fill from 17,000 feet of 8 foot to 12 foot tunnel will be placed.

The Lake Dorothy II Alternative would displace Lake Dorothy I and would directly tap to Lake Dorothy bypassing Lieuy Lake and Bart Lake with the construction of a 17,000-foot tunnel (over 3.22 miles)[5]. The diversion of Lake Dorothy water resources from Lake Dorothy I would substantially impair the power capacity and generation output of Lake Dorothy I as published in the Lake Dorothy I license application. Lake Dorothy water resources can only be used once for power purposes. Lake Dorothy I's current firm annual generation would drop from 62,800 MWh to only 4,600 MWh firm annual generation[6]. This represents a significant power loss as well as a financial dilemma to devalue and cannibalize an existing indebted project that is functioning for a larger project at some point in the future.

Lake Dorothy



[5] AELP-Regulatory Commission of Alaska TA 334-1. Exhibit A October 3, 2005
[6] AELP-Regulatory Commission of Alaska TA 334-1. Exhibit A October 3, 2005

2. Practicability of No Action Alternative B.

Cost

The financial ramifications is that the debt laden Lake Dorothy I would become economically impaired to sustain its debt load upon the operation of Lake Dorothy II and remaining debt load of Lake Dorothy I would need to be paid by energy proceeds from Lake Dorothy II rendering a very high relative and impractical cost of power. This diminished energy value Lake Dorothy I would be would create certain financing, bonding and regulatory rate challenges that may prove insurmountable, but are beyond the control of Juneau Hydro.

The estimated cost for Lake Dorothy I was $30,000,000 dollars [7~8], but history has shown that the project cost was either underestimated or not executed properly as the actual construction cost was more than double at just under $70,000,000[9]. Under previously submitted FERC documents, there is not an estimate of the cost of this alternative to develop, license and construct Lake Dorothy II expansion. Based on the difference between projected costs and actual costs of Lake Dorothy I, any cost figures related to the possible expansion of the No Action, Alternative B would be dated and therefore inaccurate to correlate the data used for cost analysis to be current with respect to the time of the alternative analysis.

Under the No-Action Alternative B, the unlikely, but possible Lake Dorothy II hydropower could, with proper license amendments and financing, develop and construct Lake Dorothy II. An application to amend Lake Dorothy would require a license amendment that involves a change of generating capacity of more than five MW, is a major investment, and constitutes a major regulatory undertaking. Under 18 CFR 4.201- (b) *Required exhibits for capacity related amendments.* Any application to amend a license for a hydropower project that involves additional capacity not previously authorized, and that would increase the actual or proposed total installed capacity of the project, would result in an increase in the maximum hydraulic capacity of the project of 15 percent or more, and would result in an increase in the installed name-plate capacity of 2 megawatts or more, must contain the following exhibits, or revisions or additions to any exhibits on file, commensurate with the scope of the licensed project:
(5) For amendment of a license for a water power project that, at the time the application filed, has been constructed and is proposed to have a total installed generating capacity of more than 5 MW—Exhibits A, B, C, D, E, F, and G under § 4.51of the same chapter.

These extensive and costly exhibits, A through G are the same FERC exhibits and have a similar time consuming regulatory study investigation, review and approval that is required for a new FERC license application.

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[7] AELP Lake Dorothy Draft EA 2002
[8] Juneau Empire, Looking to Lake Dorothy for More Power. January 13, 2002.
[9] AELP press release, AELP announces completion of Lake Dorothy, September 3, 2009.

However, even if license amendments and other environmental provisions are investigated, reviewed and approved, a large debt load is still owed on Lake Dorothy I, which cost $68,343,820 to build and of which bonds have been issued to 2035[10] that would presumably (under normal financing arrangements) need to be paid in full or refinanced. Regardless of refinancing options and differing potential financing arrangements, the additional costs associated with the underlying debt and then building this Alternative upon existing debt would likely make this Alternative the most expensive option available. Further, such an expensive endeavor would unlikely receive approval from the Regulatory Commission of Alaska if it increased the rates of Juneau. It is unknown what the new construction costs of Lake Dorothy II would require in funding sources or what financing would be required.

The added cost of debt remaining on Lake Dorothy I that would need to be salvaged and recapitalized into this Alternative would make this Alternative prohibitively costly and this assumes that the combined projects are financially bondable. The added cost of refinancing the underlying debt on an asset base materially impaired (the Alternative cannibalizes on the existing hydropower project) would make this Alternative being determined impracticable due to the additional costs.

Existing Technology

There is no existing technology advantages or disadvantages of this alternative over the Preferred Alternative. There does not appear to be any technology constraints that would make this alternative not practicable. State of the art construction techniques are assumed available for this Alternative.

Logistics

This alternative require extensive tunnel boring at 17,000 feet, but the No Action Alternative does not address the fill or removal of tunnel waste rock which is roughly double the amount of fill and spoils required to be removed from the site or dumped in the waters of the US. The Alternative does have marine access in which to barge and dispose of waste rock in US water bodies, if permits were granted.

b. Availability.

The No Action Alternative is located on the same or similar project area of an existing FERC project and is therefore unavailable to Juneau Hydro. The FERC project territory for this Alternative could not be reasonably obtained, utilized, expanded, or managed in order to fulfill the overall purpose of the proposed activity.

Even if this No Action Alternative could in some way be made directly or indirectly “available” for licensing, development and construction, it is not available to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau. Therefore, the

[10] Alaska Electric Light & Power (AELP) FERC 1 Report 2013

Availability criterion on both accounts, physical availability and time availability would render this Alternative as unreasonable and not practicable to meet the purpose and need for the proposed activity.

c. Other Information affecting Practicability.

Even with the requisite license amendments, additional environmental provisions and regulatory requirements necessary to build No Action Alternative B secured and financing arrangements were immediately obtainable; it is unreasonable to assume that the alternative could complete these requirements to fulfill the overall purpose of the proposed activity. Construction logistics, operations and timelines, which are additional to the regulatory and financial requirements necessary, make the No Action Alternative impossible to meet and fulfill the need and purpose of the proposed activity.

Additionally other information renders this Alternative B as unlikely. Avista Utilities, the owning entity of AELP and the Lake Dorothy site would not fiduciary consider building Lake Dorothy II to financially compete against and diminish the energy market opportunity for Avista's promoted Juneau LNG business strategy[11]. Avista Utilities, which is a Natural Gas Utility and Electrical Utility, has publicly committed to explore shipping LNG Liquefied Natural Gas (LNG) to Juneau and providing natural gas distribution to provide a fossil fuel derived alternative to meet Juneau's current and future energy needs[12]. Therefore, the Lake Dorothy Alternative must be placed in context with an owner of the site predisposed and with a publicly stated effort to pursue LNG and fossil fuel options over renewable electrical energy alternatives which are competitive and contrary to the purpose and need of the proposed activity. This additional information further renders the Lake Dorothy II as an unreasonable and impracticable Alternative to meet the purpose and need of the proposed activity.

Summary of No Action Alternative Analysis.

Thus, the No Action Alternative in this Alternative Analysis consists of two No Action alternatives. The first No Action Alternative B is discussed above. The second No Action Alternative A consists of not building and operating the Sweetheart Lake Hydroelectric Project. This No Action Alternative permeates the Status quo continuance and eliminates the renewable electrical energy option for Juneau to displace fossil fuel use now and potentially for the next 10 years, which is the average time for a new hydropower development. The No Action Alternative A leaves no renewable energy alternative to compete and displace fossil fuel consumption for Juneau mining industrial users, peaking electrical generation or winter demand space heating needs. The No-Action Alternatives effectively delays and likely preempts the City and Borough

[11] Bringing LNG to Juneau http://juneauempire.com/local/2015-11-01/%E2%80%A2-avista-aelp-push-natural-gas-juneau-%E2%80%A2-does-converting-gas-make-financial-sense-%E2%80%A2

[12] Avista's (AVA) CEO Scott Morris on Q3 2015 Results - Earnings Call Transcript http://www.nasdaq.com/aspx/call-transcript.aspx?StoryId=3644816&Title=avista-s-ava-ceo-scott-morris-on-q3-2015-results-earnings-call-transcript

of Juneau in meeting the Green House Gas Emission goals as set forth in the CBJ Climate Action and Implementation Plan-CBJ Resolution 2593. Further, it is more than likely that under the No Action Alternatives that fossil fuel use will grow in the Juneau market and make the community more dependent on fossil fuel use. However and most importantly, the renewable electrical energy under the No Action Alternatives is either delayed for up to 10 years (permitting, licensing, development, construction) is non-existent, non-available, and a non-achievable alternative to meet the purpose and need of the proposed activity to meet the immediate need for renewable electrical energy within the City and Borough of Juneau.

Alternative 3. Taku River as a potential hydropower resource.

1. **General Site Information of the Taku River as a hydroelectric resource**

The damming of the Taku River is mentioned in several previous hydrological studies conducted by the US government. Additionally, the Alaska Territorial government established the Yukon-Taiya Commission that after WWII looked at diverting water from the Yukon River to the Taku River for the purposes of generating hydropower for aluminum smelting. The 18,800 square kilometer (4.5 million acre) Taku watershed is vast: it covers an area roughly twice the size of Yellowstone National Park and larger than many countries.[13]

1947 Waterpowers of Southeast Alaska, a publication co-written by the US Forest Service and the Federal Power Commission stated on Page 45-, "It should also be mentioned that there is considerable power to be found in the Taku and Stikine Rivers in British Columbia. These rivers are practically at sea level when they cross the international boundary into southeast Alaska. From these crossing points they rise rapidly into the interior. This means that they have considerable fall as well as large gathering areas with many of their tributaries fed by the glaciers and 'ice-fields which exist along the eastern slopes of the principal ridges which mark the boundary. It is estimated that there are 1,500,000 kilowatts of firm capacity in the Taku River basin and 4,000,000 kilowatts in the Stikine River. These are sizable blocks of power which may eventually be linked with some of the developments which may be undertaken on the mainland and the island areas of southeast Alaska. With this potential capacity of power both in and near southeast Alaska, its proper and useful economic development is assured at reasonable costs."

The Taku River is 54 miles in length of which 16 miles is located on the US side of the US and Canadian border. The river is navigable to the Canadian border with only shallow draft boats and jet drives due to the sand bars that exist throughout the river basin.

The elevation of the Taku River is relatively at sea level. Most of the hydrologic resource of the river would be found with an impoundment on the Canadian side of the border. Further, while no site location was selected in previous hydrological studies, any impoundment or dam would need to occur near the international border or on the Canadian side of the border due to narrower width

[13] A Taku Salmon Stronghold. *Initial Assessment of an Exceptional International Watershed. 2010*

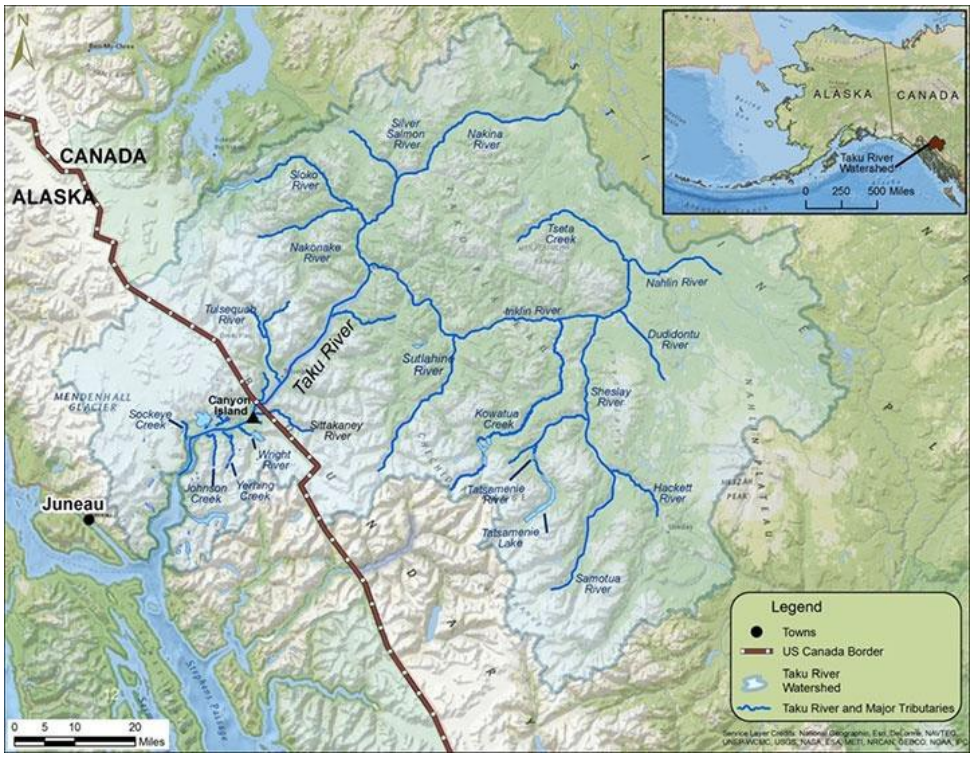
of the river in these locations. For similar reason and to attempt to maximize head, any run of the river hydroelectric project would also require a very long distance flume facility near the border as well in order to generate any head. Either type of facility would be challenging due to low elevations, long transmission line distances and the obstacle of the Taku Glacier. Further due to the shallow depth of the Taku River, it would prove challenging to deliver material and machinery to a hydropower site location from the American side of the border and there are no roads or access routes on the Canadian side of the border.

Additional and better producing hydropower resources are likely found upstream on the Canadian border that also are limited by no roads. Only one study exists and that was published in 1955 Yukon Taiya Commission Report, Chapter VIII as the Taku River as a hydroelectric alternative. This enormous alternative suggested diverting the Yukon River basin to the Taku River basis. "The diversion would be through a transmountain tunnel from the southern end of Atlin Lake to Sloko Lake of over 1 mile in length. Water would then be conveyed from Sloko Lake to Tahi Creek valley through a tunnel about 11 miles long. About 1000 foot of head could be used by a power plant below the tunnel outlet. A dam could be constructed at one of two sites below Tahi Creek". Potential site 1 is at the Nakina River in British Columbia, BC at the beginning of the Taku River about 5 miles above the mouth of the Inklin River. Another, more restrictive dam site could be located east of Sinwa Mountain, about 3.5 miles downstream of the mouth of the Inklin River.

Preliminary studies indicate that the power generated at the Taku River would be more expensive than produced at the Taiya River citing an expensive tunnel and dam system. Furthermore, sites of the project features are remote, and access problems would be major.

The proposed tunnels and proposed dam sites would be located in British Columbia whereby transmission to Juneau would cross the international border.

The Taku River on the United States side of the border is located within the City and Borough of Juneau and in the Tongass National Forest.



Source: Alaska Department of Fish and Game

Although it is clear that damming the Taku River would be a major international undertaking it could provide significant hydropower capacity and generation. The Project would also likely yield significantly more electricity than the Juneau market could reasonably use for the near future. The Taku River, like other transboundary rivers in Southeast Alaska is susceptible to seasonal flooding that would need to be considered in environmental and engineering designs.

Periodically, the Taku River reaches flood stage (43 ft.) or above. Records of the NOAA Advanced Hydrologic Prediction Service (AHPS)[14], a branch of the National Weather Service that in the last two decades the river crested above 43 feet (13 m) six times. The highest level reached in that period was 45.07 feet (13.74 m) on June 25, 2004.

The Taku River is a transboundary River in the International Boundary Waters Treaty Act signed between Canada and the United States of 1909. This act provides mechanisms for resolving any development and dispute over any waters bordering the two countries. The act provides for an International Joint Commission (IJC). The IJC has jurisdiction for regulating water quality including flows and levels, the Treaty enumerates the following order of precedence of use (Article

[14]AHPS Taku River
http://water.weather.gov/ahps2/hydrograph.php?wfo=pajk&gage=tkua2&view=1,1,1,1,1,1,1,1&toggles=10,7,8,2,9,15,6&type=2

VIII): Domestic and Sanitary use, Navigation, Power and Irrigation. The Treaty applies the riparian doctrine one use cannot materially impair another protected use. Therefore, many issues of transboundary habitat for salmon and water quality are also within the IJC's purview. There has and continues to be local concern regarding mining activities and acid run off from the abandoned Tulsequah Mine that is thought to impact or could impact major transboundary salmon runs.

Of significant local, national, and international importance however, is the adverse environmental impacts and damages that would result from blocked salmon migration and destruction of aquatic habitat. These serious environmental flaws deemed this alternative unreasonable and not practical for development. The Taku River is an important transboundary river that is and should be protected for the continuation of salmon runs that use the Taku River.
In January 2009, the Alaska Department of Natural Resources approved a request from the Alaska Department of Fish and Game to designate the entire U.S. portion of the Taku River as "important habitat," a designation that put the stretch of river within the purview of protective provisions in Alaska law that require those applying for certain river use permits "avoid, minimize, or mitigate significant adverse impacts to the special productivity of the habitat." The important habitat designation remains in place for a 16-mile section beginning at the river's mouth near Juneau, Alaska.[15]

Fishing and fishing related activities are the key economic activity of the Taku River. Below are the aquatic resources and salmon related harvesting activities of the Taku River compiled from The Taku River Economy: An Economic Profile of The Taku River Area by the McDowell Group, Juneau 2004:
• The ex-vessel value of the commercial harvest of Taku River salmon has been between $603,000 and $2.9 million since 1994. The ten-year average is approximately $1.3 million. Sockeye accounted for about 86 percent of the total US commercial harvest value in 2003.
• The first wholesale value of the US commercial harvest of Taku River salmon has ranged from $2 million to $7.4 million since 1994. The ten-year average value is approximately $3.4 million. About 80 percent of the first wholesale value of Taku River salmon was from the sockeye harvest in 2003.
• The total economic impact of the US commercial harvest and processing of Taku River salmon includes 80 jobs, $1.4 million in labor income, and $5.4 million in total regional economic output.
• Approximately 400 people earn income from the commercial harvest of Taku salmon, including permit holders and their crew, processing employees and others.

Additionally, both the Canadian Taku River Tlingit First Nation and the Douglas Indian Association US federally recognized Tribe of which both recognized tribal entities having historical and cultural standing in the Taku Region have taken active stands against development in the Taku River area.

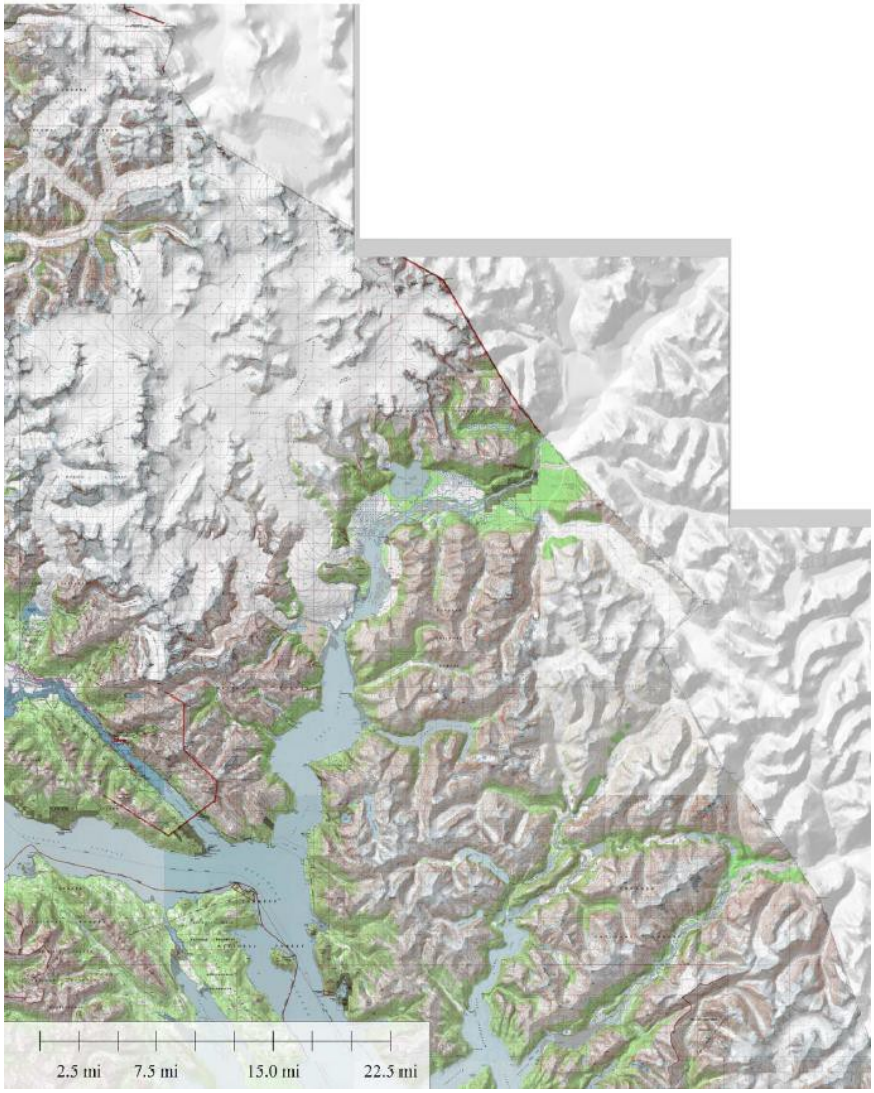
[15] Alaska Department of Natural Resources, 2009.

On July 19, 2011, the Taku River Tlingit First Nation signed historic agreements with the British Columbian government establishing land protection measures and shared management responsibility for their ancestral lands. The Wooshtin Wudidaa Land use plan protects over 7 million acres from commercial logging and designates over two and half million acres as First Nation Conservancy Parks on the Canadian side of the Taku border.

The Taku River Alternative Site is not listed as an Initial Screened Potential Hydro Project in the Draft SEIRP, 2012.

The Taku River does not have a federal power site withdrawal for the purposes of developing hydropower.

Taku River



2. **Practicability of Taku River Alternative as an Alternative hydroelectric resource.**

Cost

The 1955 Yukon Taiya Commission report suggested that rerouting the Yukon River headwaters to the Taku River would require two tunnels. One tunnel would be 1 mile in length, where the second tunnel would be 11 miles in length culminating in 12 miles of tunnel. This distance of tunnel would represent a 4 to 6 fold increase from any other Alternative. Tunneling represents the major cost of many hydropower developments. The added issue of remoteness where trucks would need to be transported by air to haul waste rock from tunnels and flying in all fuel, service and support would clearly make this Alternative exorbitant more costly than the preferred or any other Alternative. The resulting cost of power would be so expensive that it would not be saleable. Therefore, the Taku River Alternative is so expensive that it would render this Alternative as unreasonable and not practicable.

Existing Technology

Designing and constructing an 11 mile long tunnel is a large engineering undertaking. Existing technology exists with Tunnel Boring Machines, but these machines can be problematic even in urban locations. Other components of a dam or a flume required for a run of river project are within the scope of existing technology.

Logistics

Developing and building a hydroelectric resource on the Taku is logistically challenging. In the past attempting to use hover barges or shallow draft boats for the Tulsequah Chief Mine, on the Canadian side of the border, proved unsuccessful. The shallow depth and changing sand bars of the Taku River would prove problematic for delivery of machine and material from the US side of the border. On the Canadian side of the border, no roads exist. Therefore, this Alternative is logistically challenged and would render this Alternative not practicable.

b. Availability.

For the reasons presented earlier and primarily revolving that, any project on the Taku River would likely require oversite and approval of the International Joint Commission. Further, the jurisdiction for US law and regulations stop at the border. It is therefore very unlikely that this Alternative is available for development and if it were to be developed, it would take a much longer time horizon for planning, development, design, and construction that would require two national governments, Alaska and the BC provincial governments as well as tribal entities and non-governmental organizations from both sides of the border. For these reasons, the project is not determined to be available for the project purpose and need.

c. Other information

Any industrial development of the Taku River is controversial for a multitude of reasons: international fisheries; transboundary waters; federally recognized tribal and first nations (Canada) concerns. The recent attempt to develop the Tulsequah Chief Mine on the Canadian side of the Taku River is well documented and has been and still is fraught with controversy. These factors combined with multi-jurisdictional agencies would lead to a complex development that may or may not ever be permitted.

Alternative 4. Whiting River potential hydropower resource.

1. **General Site Information of the Whiting River as a hydroelectric resource**

Although fewer studies and reference sources exist for the potential damming of the Whiting River, this alternative is similar in many ways to the Taku River. Both rivers, the Taku and the Whiting, are important transboundary salmon streams and have shallow depths susceptible to floods and ever-changing sand bars. Previous hydrological studies and investigations did not estimate the energy potential of the Whiting River.

The Whiting is the wildest and most remote watershed in the BC-Alaska transboundary region. It is the only watershed without any roads of any description. In transboundary terms, it is a small watershed, nestled in glacial terrain between the giant Iskut-Stikine and Taku watersheds. The entire Whiting is only 80km/50 miles long, flowing from BC southwest into Stephen's Passage 48km/30 miles southeast of Juneau. Numbers for the US side are difficult to identify, but the Canadian drainage area of the Whiting is 2,375 km² /915 square miles. Both the Tahltan and Tlingit people consider the entire Canadian portion of the Whiting to be within their traditional territory[16].

The Whiting River is a transboundary River in the International Boundary Waters Treaty Act signed between Canada and the United States of 1909. This act provides mechanisms for resolving any development and dispute over any waters bordering the two countries. The act provides for an International Joint Commission (IJC). The IJC has jurisdiction for regulating water quality including flows and levels, the Treaty enumerates the following order of precedence of use (Article VIII): Domestic and Sanitary use, Navigation, Power and Irrigation. The Treaty applies the riparian doctrine one use cannot materially impair another protected use. Therefore, many issues of transboundary habitat for salmon and water quality are also within the IJC's purview.

Of significant local, national, and international importance importantly, however, is the adverse environmental impacts and damages that would result from blocked salmon migration and

[16] Rivers without Borders website. http://riverswithoutborders.org/about-the-region/whiting

destruction of aquatic habitat. These serious environmental flaws deemed this alternative unreasonable and not practical for development.

From the 1947 Federal Power Commission, “The largest rivers originate in the interior plateaus of Canada and have cut their way through the coastal range. The four principal rivers are the Stikine, Whiting, Taku and Klehini.”

The Whiting River (the US portion of the river) is located within the City and Borough of Juneau and is located within the Tongass National Forest.

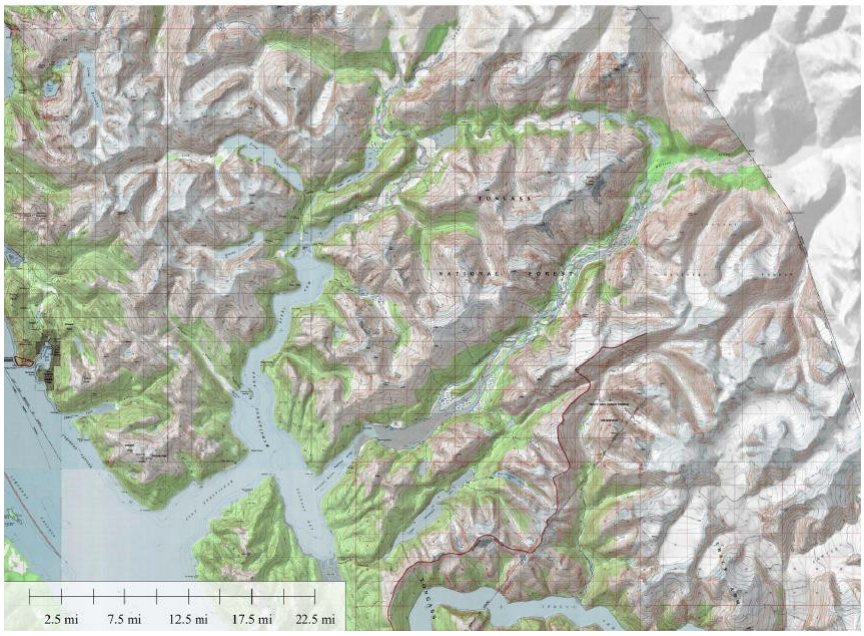
The Whiting River Alternative Site is not listed as an Initial Screened Potential Hydro Project in the Draft SEIRP, 2012.

The Whiting River does not have a federal power site withdrawal for the purposes of developing hydropower. Despite its potential hydropower and its potential energy value, the remoteness and high construction costs apparently did not warrant federal power site withdrawal that occurred on many Alaska sites in the 1920’s and 1930’s.

The entire Canadian portion of the river was recommended for protection in a park in the 1990s, and the U.S. portion was recommended for a National Wild and Scenic River designation. However, no part of the watershed has actually been protected or designated.

Specific economic analysis and costs of developing, constructing, and operating a hydropower facility on the Whiting River, although likely considerable, were not evaluated in previous studies.

Whiting River



2. **Practicability of the Whiting River Alternative as a hydroelectric alternative resource.**

Cost

The Whiting River is a very remote North American river despite its transboundary nature. It is likely due to its remoteness that the Whiting River has not been studied as a potential hydropower resource despite its hydropower potential. In part due to its remoteness and in part due to the lack of previous studies, this Alternative would require a large investment in obtaining baseline information before development and hydropower studies could commence. Based on its sea level topography and wide river nature, any dam type hydropower would require a large length of dam. Any run of the river project would require a large flume distance in order to capture usable head. It is more likely that any viable hydroelectric potential that could meet the purpose and need would require siting on the Canadian side of the border (like the Taku Alternative). A Whiting River hydroelectric development does not have historical or governmental waterpower or hydrological investigations. Therefore, these pre-development costs would need to be incurred before it could be determined that the Whiting River Alternative could be a viable hydropower resources. For these reasons, it is not likely that the Whiting River Alternative would be time or cost practicable.

Existing Technology

Constructing a dam or a constructing a flume required for a run of river project are within the scope of existing technology.

Logistics

Developing and building a hydroelectric resource on the Whiting River is even more logistically challenging than developing a hydropower on the Taku River. The Whiting River is not navigable due to the ever present and shifting sand bars and would require the use of hover barges to move material and equipment from the US side of the border. On the Canadian side of the border, no roads exist. Therefore, this Alternative is logistically challenged and would render this Alternative not practicable.

b. Availability.

For the reasons presented earlier and primarily revolving that, any project on the Whiting River would likely require oversite and approval International Joint Commission. Further, the jurisdiction for US law and regulations stop at the Canadian border. It is therefore very unlikely that this Alternative is available to for development. Even if it were developed, it would take a much longer time horizon for planning, development, design and construction that would require two national governments, Alaska governmental agencies, British Columbia provincial government agencies as well as tribal entities and non-governmental organizations from both sides of the border. For these reasons, the project is not determined to be available for the project purpose and need.

c. Other information

Any industrial development of the Whiting River is controversial for a multitude of reasons: international fisheries; transboundary waters; and federally recognized tribal and first nations (Canada) concerns. These factors combined with multi-jurisdictional agencies would lead to a complex development that may or may not ever be permitted.

Presentation of Alternatives

Based upon the presentation of Practicability factors and Availability of each alternative, the following Alternative Comparison Matrix for Practicability is presented rating each Alternative with Practicability Factors.

Alternative Comparison Matrix for Practicability					
Practicability Category	**Factor**	**Alternative 1 Preferred Alternative**	**Alternative 2 No Action Alternative**	**Alternative 3 Taku**	**Alternative 4 Whiting**
Cost	Acquisition, development, licensing and construction cost	Yes, all development and licensing completed. Construction costs known and reasonable	No, Alternative 2 is not likely available at any cost. Refinancing of existing debt and bonds prohibit development and make project too costly. Construction cost unknown	No, Exorbitant development, licensing and construction costs	No, Exorbitant development, licensing and construction costs
Existing Technology	Technologically attainable for hydropower development	Yes	Yes	Yes	Yes
Logistics	Sufficient Energy Size Potential to meet need and purpose	Yes	Yes	Yes	Yes
	Existing permitting available	Yes	Yes	No, requires international permits which may not be available.	No, requires international permits which may not be available.
	Availability for Access	Yes	Yes	No	No
Other Information	Meets immediate need for renewable electrical energy	Yes	No, owner is pursuing LNG and not hydropower options, making competitive renewable energy development of this Alternative impracticable. Could take up to a decade to license and construct	No, would require international cooperation + development and construction resulting in more than an estimated decade	No, would require international cooperation + development and construction resulting in more than an estimated decade
Availability	Available for Acquisition and Use	Yes	No, applicant cannot claim or develop on an existing FERC site	No, would require international cooperation	No, would require international cooperation

Summary of the Comparison of Alternatives

Alternative 2, the No Action Alternative is not Practicable for multiple reasons. The No Action Alternative would be more costly and is not likely financeable. The existing hydropower facility on the project site was built in 2009 and much of the debt remains on the facility. The hydrologic resource currently producing power would need to be cannibalized and redirected to a new larger facility. A new hydropower facility on the project site would require complete refinancing of the existing debt and the current assets would be impaired both financially and in their ability to reduce power rendering the facility impracticable in cost. Further, such an endeavor to license a new larger facility would require a major FERC license amendment with requisite environmental studies. This could take years and up to a decade for approval. The time and effort required to develop; design, license and construct the Alternative would not meet the purpose and need of the proposed activity.

Secondly, the owner of the current FERC facility has opted to introduce LNG into the Juneau market and the development of the preferred alternative or the expansion of their current hydropower facility is competitive making the No Action alternative moot and blocked from development for the near future.

Lastly, the No Action Alternative is not available to the applicant as the Alternative is located on a FERC project site and is therefore unavailable to development by the applicant.

Therefore, Alternative 2- the No Action Alternative, for the factor determinations provided render the Alternative unreasonable and not practicable to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.

Alternative 3, the development of the Taku River as a hydropower resource in not Practicable for a number of reasons. Alternative 3 would be foremost an exorbitant costly project. The Alternative would be costly to develop, license, and construct. Logistically the Alternative is not reasonable or practicable because the Alternative would require international cooperation with multi federal, state, provincial, and tribal entities which would render this Alternative impracticable and unable to ever be built. Additionally, the remote location and no access only further renders this Alternative unavailable for logistical purposes. For the same reasons, the Alternative would not be “available” for development and if it were to become available, the permitting required on an international project could take more than a decade.

Therefore, Alternative 3-the Taku River Alternative for the Practicability determination factors provided, render the Alternative unreasonable and not practicable to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.

Alternative 4, the development of the Whiting River as a hydropower resource is not Practicable for many reasons. The Alternative would be costly to develop, license, and construct. Logistically the Alternative is not reasonable or practicable because the Alternative would require international cooperation with multi federal, state, provincial, and tribal entities, which would render this

Alternative unable to ever be built. Additionally, the remote location only further renders this Alternative unavailable for logistical access. For the same reasons, the Alternative would not be "available" for development and if it were to become available, the permitting required on an international project could take more than a decade.

Therefore, Alternative 4-the Whiting River Alternative for the Practicability determination factors provided, render the Alternative unreasonable and not practicable to meet the immediate need for renewable electrical energy demand within the City and Borough of Juneau.

Step 4: Identify and Determination of the Least Environmentally Damaging Alternative

Based on the conclusion of factors evaluated in the Alternative Comparison Matrix for Practicability there is only one Alternative, the Preferred Alternative that is found to be Practicable and Available to meet the purpose and need for the proposed activity.

Therefore, the Preferred Alternative, the Sweetheart Lake Hydroelectric Project, is the Least Environmentally Damaging Potential Alternative to serve the Purpose and Need of the Proposed Activity.

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