Tyee Lake Hydroelectric Project

FERC No. 3015

Exhibit A

Project Description

Tyee Lake Hydroelectric Project
(FERC No. 3015)

Application For License Amendment
For Major Project – Existing Dam

Exhibit A
Project Description

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1.0 INTRODUCTION

The Southeast Alaska Power Agency (SEAPA) operates the Tyee Lake Hydroelectric Project (Project) located on Tyee Creek approximately 40 miles southeast of Wrangell, 70 air miles southeast of Petersburg, and 60 miles northeast of Ketchikan, Alaska (Figure 1-1) under a license issued by the Federal Energy Regulatory Commission (FERC or Commission) (FERC No. 3015).

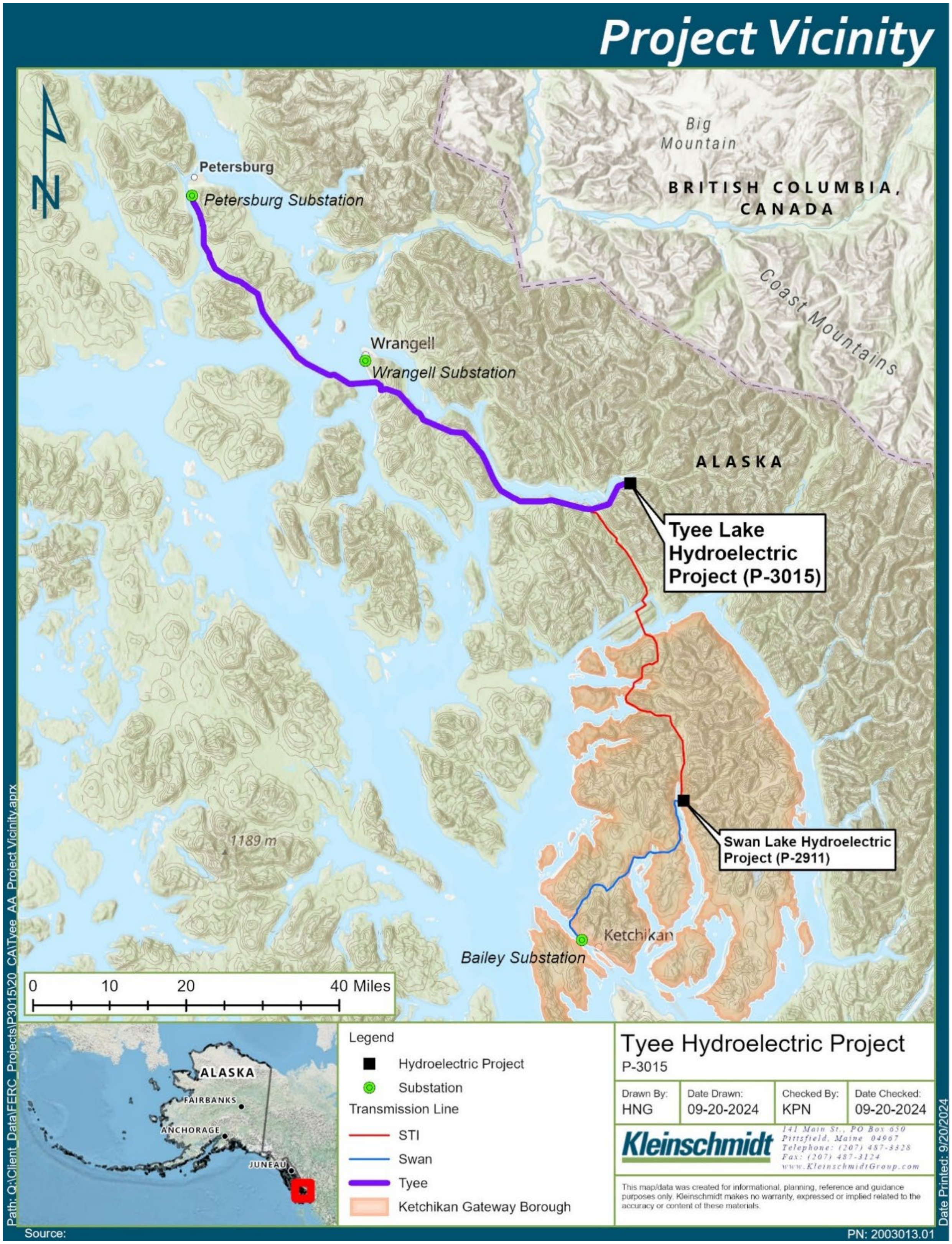

Figure 1-1 Project Location Map.

2.0 PROJECT DESCRIPTION AND PROPOSED FACILITIES

Section 2.1 below describes the current project configuration; Section 2.2 below provides additional detail related to the proposed amendment.

2.1 Project Features

The Tyee Lake Project features consist of a spillway weir, lake tap intake, power tunnel, penstock, powerhouse, switchyard, transmission line, and appurtenant structures (Figure 2-1). The Project does not include a dam, but diverts water to the powerhouse from the naturally impounded Tyee Lake through a lake tap intake.

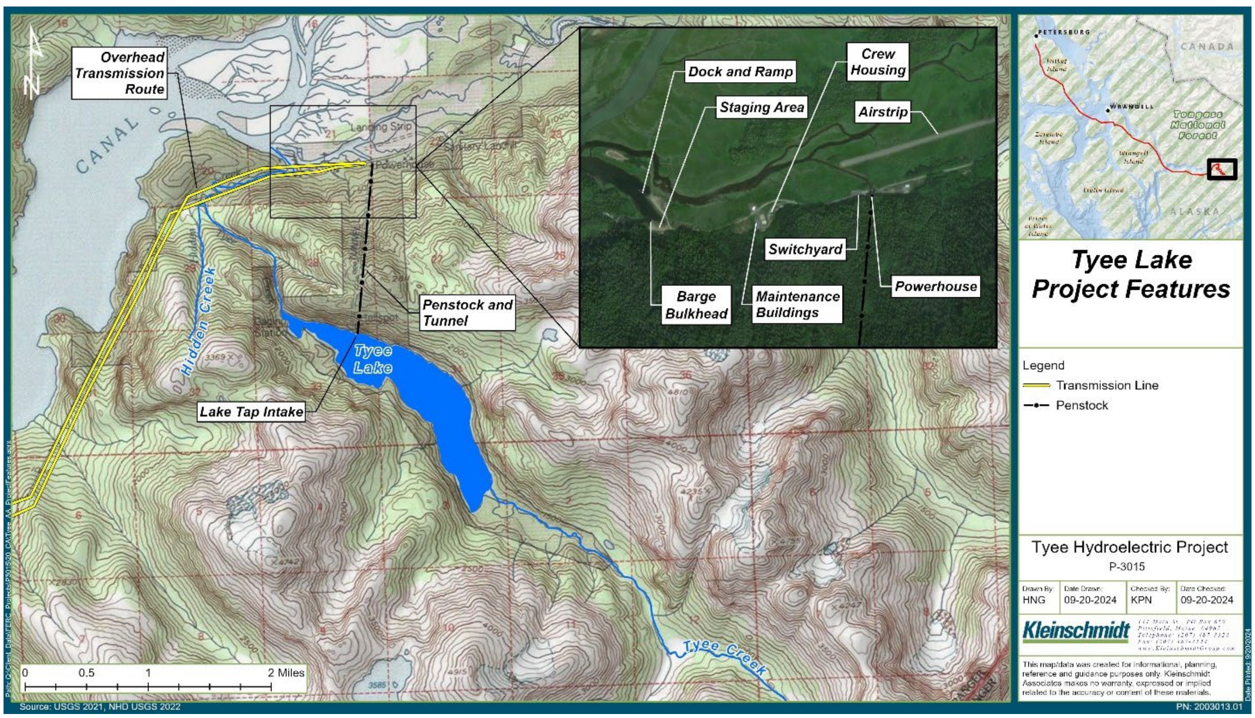

Figure 2-1 Project Features Map.

2.1.1 Tyee Lake

Tyee Lake is naturally impounded, requiring no constructed dam. Tyee's existing FERC license describes operations from elevations 1396 to 1250 feet (ft) with an active storage of 52,400 acre-feet (ac-ft). Based on a USGS survey in 2020 using a calculated NAVD88 datum, the normal full pool elevation is 1398.3 ft. The lake surface area depends on the elevation of the lake. At elevation 1398.3 the water surface area is 481 acres At the time of writing this document, SEAPA is updating its project survey control and benchmarks.

2.1.2 Spillway Weir

A trapezoidal reinforced concrete weir was constructed in 2013 at the natural outlet of Tyee Lake to measure outflow from the lake into Tyee Creek (Photo 2-1). The weir is 18 ft long at an elevation of 1,398.3 ft (USGS 2020), with 1:4 (H:V) side slopes, and a top elevation of 1,400 ft.

Photo 2-1 Tyee Lake Spillway Weir.

2.1.3 Intake Structure/Lake Tap

The hydropower intake structure is located at approximately 1,225 ft elevation on the northern shore of Tyee Lake, approximately 2,000 ft east of the natural outlet of Tyee lake. The intake structure is fitted with a trash rack and directs water into a drop shaft that connects to the power tunnel.

2.1.4 Power Tunnel and Penstock

An 8,300-ft-long, 10-ft-diameter unlined power tunnel extends north-northwest from the intake structure, connecting to a steel 1,350-ft-long penstock bringing flow into the powerhouse, where the penstock trifurcates; the first two portions connect to turbine-generating units 1 and 2. The third leads to a closed valve in the existing empty bay within the powerhouse. Proposed changes to this third portion are described in Section 2.2 below.

2.1.5 Powerhouse

The powerhouse, located near Bradford Canal, is an above ground reinforced concrete substructure and steel superstructure, 122 ft long by 38 ft wide (Photo 2-2). It was constructed with provisions for three turbines. The powerhouse currently contains two horizontal-axis, Pelton-type (impulse) turbines, operating at 720 revolutions per minute (rpm) with a rated capacity of 16,750 horsepower (hp) and 12,500 kVA under a net effective head of 1,306 ft. Gross head ranges from 1,221 to 1,385 ft, and net head ranges from 1,163 to 1,384 ft.

Each existing turbine is coupled to a vertical-shaft synchronous generator rated at 12,500 kVA at 13.8 kV and 0.9 power factor. The generators are capable of delivering 115 % rated kVA continuously and are each provided with a static excitation system. The proposed additional unit is described in Section 2.2 below.

Service power to the station is provided by tapping the main leads of each generator and connecting to a 480-V switchgear through a 13,800/480-V stepdown transformer. Emergency station power is supplied by a pair of 125-kW diesel generators.

All equipment is designed for local-manual, local-automatic, and remote operation based on the concept that the powerhouse is normally unattended and can be controlled from the SCADA control center at Wrangell via power line carrier equipment.

Photo 2-2 Tyee Lake Powerhouse, Switchyard, and Tailrace.

2.1.6 Tailrace

The tailrace is approximately 1,100 ft long and discharges into Airstrip Slough which flows into Hydro Creek before entering the head of Bradfield Canal. The tailrace is tidally influenced. The normal tailwater elevation fluctuates with the tides, and typically ranges from 22 to 24 ft in the upper concrete portion of the tailrace under the powerhouse, and a few feet lower near Airstrip Slough downstream of the powerhouse. The tailrace was constructed to accommodate the operation of three turbines operated at full capacity.

2.1.7 Switchyard

The switchyard is located approximately 200 ft west of the powerhouse. The switchyard includes the generator step-up transformers, circuit switchers, circuit breakers, 138-kV bus, disconnecting switches, line traps, potential transformers, coupling capacitors, and the line take-off structures.

Each generator is connected to a step-up transformer by a 12-kV cable laid in a duct bank. Each step-up transformer is rated at 11,250/15,000 kVA, OA/FA, 13.8/69-138 kV, 3-phase 60 Hz with surge arrestors mounted at the high-voltage bushings. The high-voltage side of these transformers is connected to a 138-kV bus via circuit switchers. A 3-phase, 3-wire overhead transmission line is connected to the bus via an oil circuit breaker. The transmission line operating voltage is set at 69 kV.

The switchyard area was originally designed and constructed with room for installation of equipment associated with the proposed third unit (Photo 2-3).

Photo 2-3 Tyee Lake Switchyard.

2.1.8 Transmission Line

Based on the Exhibit K drawings filed with FERC in 2014, the Project transmission lines extend approximately 40 miles from the Tyee Lake switchyard to the Wrangell Switchyard and then about 40 miles to the Petersburg Switchyard. The transmission system is a 3-

phase, 138-kV (maximum) interconnection that includes 68.1 miles of overhead transmission circuit and 11.4 miles of submarine line. The operating voltage is set to 69 kV.

The overhead transmission circuit consists of approximately 7.8 miles of 556.5 KCM all aluminum (Dahlia) single-pole configuration, approximately 35.0 miles of 556.5 KCM ACSR (Dove) on hinged X-Tower configuration, and approximately 25.3 miles of high-strength 37 No. 8 Alumoweld on high strength structures for long span sections.

The 11.4 miles of submarine cable consists of four sections (3.8, 3.0, 2.8, and 1.8 miles in length) that cross Bradfield Canal, Zimovia Strait, Stikine Strait and Sumner Strait. Each submarine section consists of four cables (three operating with one spare) of 500 KCM copper equivalent, lead-covered wire, armored and laid with separations of 300 to 600 feet in water depths up to about 1,000 ft.

2.1.9 Lands Within Project Boundary

"*All lands of the United States that are enclosed within the project boundary described under paragraph (h) of this section (Exhibit G), identified and tabulated by legal subdivisions of a public land survey of the affected area or, in the absence of a public land survey, by the best ~~this~~ available legal description. The tabulation must show the total acreage of the lands of the United States within the project boundary.*"

The Project is located in a remote area of Southeast Alaska on federal, state, borough and private lands. The following section identifies all lands of the United States that are enclosed within the Project boundary described in Exhibit K of the current license. No changes to the project boundary are proposed. Thus, Exhibit K has not been updated for this Application.

Table 2-1 Land Ownership within Project Boundary.

Ownership	Acreage (Transmission Only)	Acreage (Non-Transmission Only)	Percentage of Total
U.S. Forest Service	1,174.4		38.0
Non-federal, subject to Section 24 of the Federal Power Act	205.8	1,161.7	44.2
Non-federal, not subject to Section 24 of the FPA (includes submarine lines)	551.8		17.8
Total	1,932.0	1,161.7	

Table 2-2 Tyee Lake Project Components and Specifications. Items in Brackets Indicate Final Disposition with Proposed Amendment.

Description	Number or Fact
General Information	
FERC Project Number	P-3015
Owner	Southeast Alaska Power Agency (SEAPA)
Current License Term	50 years
Licensed Capacity	20 MW
Nearest County (Borough)	City and Borough of Wrangell, AK
Nearest Town	City and Borough of Wrangell, AK
River	Tyee Creek
Drainage Area at the Lake Outlet	14.4 sq. miles (USGS 2016)
River Mile (RM)	RM 1.1
Tyee Lake	
Normal Full Pool Elevation	1,396 ft
Minimum Surface Elevation	1,250 ft
Gross Head	1,221 to 1,385 ft
Net Head	1,306 ft (1,163 to 1,384 ft)
Lake Length	2.3 miles
Surface Area at Normal Full Pool	481 acres (based on Terrasond, Ltd. 2009 survey and USGS 2020 weir elevation of 1398.3 ft)
Gross Storage at Normal Full Pool	86,660 ac-ft (based on TerraSond, Ltd. 2009 survey and USGS 2020 weir elevation of 1398.3 ft)
Usable Storage Capacity	52,400 ac-ft)
Lake Tap	

Description	Number or Fact
Construction Type	Lake Tap
Construction Date	May 1984
Lake Tap Invert	1,225 ft (approx.)
Powerhouse	
Construction Type	Reinforced concrete, structural steel and metal panel
Location	Latitude 56°13’01” Longitude -131°29’15”
Dimensions	122 ft long x 38 ft wide
Turbines	
Number of Turbine/Generator Units	2 installed [3]
Minimum Hydraulic Capacity	3 cfs (for station service at 100 kW for the annual 10-day maintenance shutdown; would not change with the addition of a third turbine)
Maximum Hydraulic Capacity	234 cfs (20 MW FERC License and 25 MVA nameplate capacity) [117 cfs each]
Tailrace	
Length	1,140 ft long 30-ft bottom width, 2:1 sides
Normal Tailwater Elevation	22 – 24 ft at powerhouse (tidally influenced)
Switchyard/Transmission Lines	
Transmission Line Length	79.5 miles

Source: Southeast Alaska Power Agency

2.2 Proposed Facilities

SEAPA is proposing to install and operate a third Pelton-style turbine-generating unit (Third Unit) at the Project to better manage peak loads and meet growing energy demands. Adding a third turbine to the Tyee Lake Hydro Project would increase the Project’s installed capacity by 50 %.

The Tyee Lake Project was designed and constructed with provisions for a third turbine. Construction activities for the Third Unit would be limited to the transport and installation of the Pelton-style turbine generating unit within the existing empty bay at the powerhouse and installation of a third transformer and associated equipment within the current footprint of the switchyard.

There would be no new ground-disturbing activities associated with installation of the Third Unit. There would be no changes to the Tyee Lake minimum and maximum normal pool elevations, usable storage capacity, conveyances or tailrace. There would be no changes to the existing 138-kV transmission line. The line was engineered and built for the capacity of the third unit. The proposed third turbine would be designed to operate in a synchronous condenser mode and as a spinning reserve.

2.2.1 Proposed Third Unit Turbine and Generator

The turbine generator for this Project would be a vertical shaft, six-jet Pelton turbine rated at approximately 12,500 kW (not considering a power factor) with a 720 rpm synchronous generator rated at 12,500 kVA, 13.8 kV, 3-phase 60 Hz with an allowable 115 percent continuous overload. It would include brushless excitation and internal bearing oil coolers and a closed-loop cooling water system. It would match the existing units hydraulically with a maximum flow of 117 cfs. The turbine would be designed to the characteristics presented in Table 2-3 The turbine manifold configuration of the selected unit is presented in Figure 2-2.

Table 2-3 Characteristics of the Proposed Third Turbine at Tyee Lake Hydroelectric Project.

Characteristic	Description
Type	Impulse
Orientation	Vertical
No. Units	1
Rated Discharge (cfs)	117
Rated Head (ft)	1,306
Design Turbine Output (kW)	11,800
Unit Speed (rpm)	720
Max Runaway Speed (rpm)	1,278
Runner Pitch Diameter (in)	43.31
Outer Runner Diameter (in)	53.71
Number of Buckets	22
Number of Nozzles	6

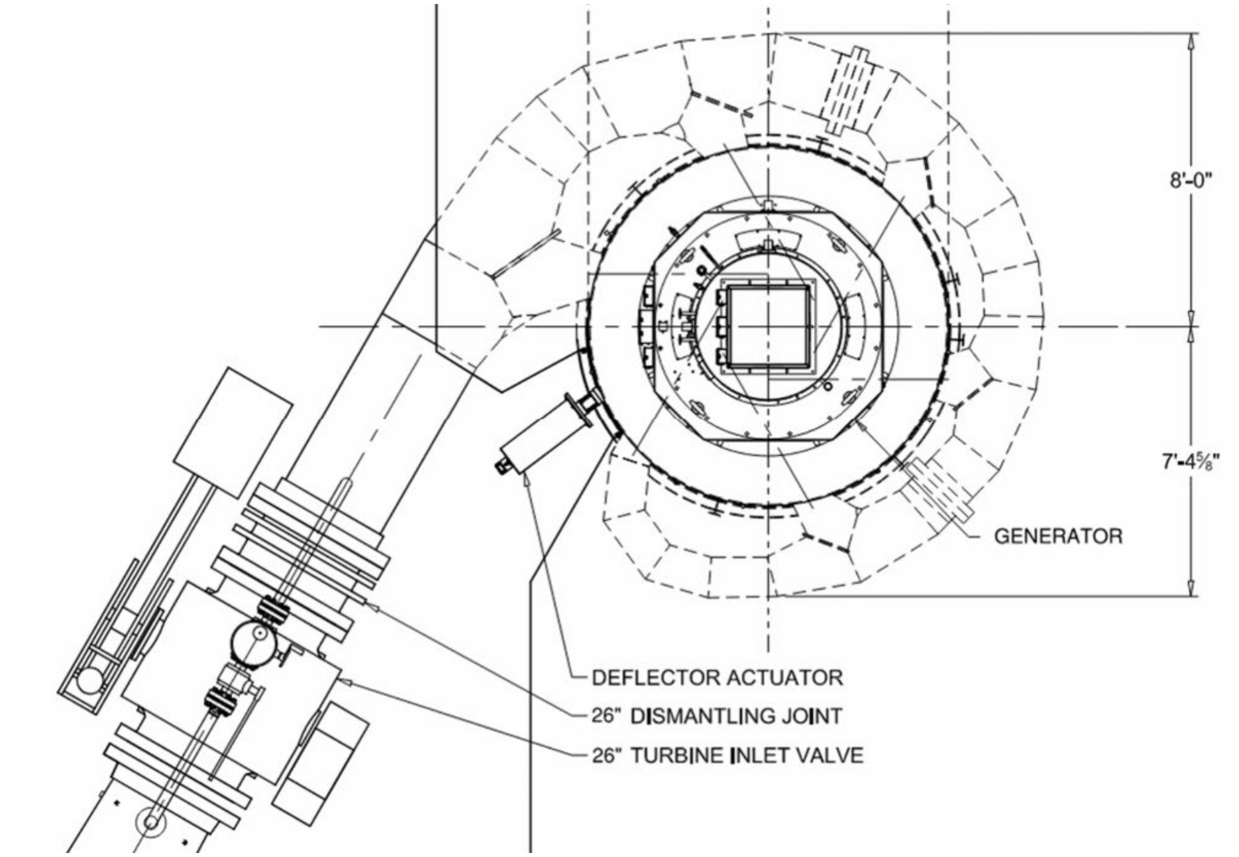

Figure 2-2 Turbine Manifold of the Proposed Third Turbine at Tyee Lake Hydroelectric Project.

2.2.2 Proposed Appurtenant Project Equipment

Power and control design for the Third Unit would follow as closely as practical to that which is used in Units 1 and 2. Where the hardware used in the existing generator controls are readily available, these would be specified in the design of the third unit. However, where improvements in technology or in cost suggest the use of other devices, these would be considered and implemented where appropriate.

Station service changes for the Third Unit installation would be minor overall. As explained below, there is an ongoing comprehensive AC station service upgrade project which would be complete prior to completing the Third Unit installation design. Station service upgrades would consist of adding additional local panel boards as necessary. The current 125 VDC battery set consists of SBS, part number STT2V300 batteries, with a total of 58 cells. There are two 75 ADC charges, with one used at any one time. It was noticed under normal conditions that the DC current draw was approximately 18 ADC. The SBS batteries are rated, when new, at 40 ADC for 8 hours. It is believed the battery set size is adequate for the third unit, given the standby generator set and that local operators reside on site. The battery set should be sufficient to allow for a timely restoration of station service in the event of a loss, providing power for emergency shutdown and relay operations.

The control design philosophy for operation of the Third Unit would be nearly identical to that of Units 1 and 2. The local control interface at the main switchboard would look and operate the same, with the same indicator light and switch arrangement. The Third Unit would also be interfaced with the local RTAC to provide the same type of remote control and monitoring. However, some of the hardware would likely be different based on the age of the existing components and availability of newer technology. Controls for the Third Unit would consist of a standalone digital governor and a voltage regulator (Basler 250N or equivalent feeding the brushless excitation system) for managing voltage and VAR output. The governor would control the rotation of the unit (through the HPU control), as well as operate the cooling and auxiliary systems. Both the governor and voltage regulator would be digitally connected to a new RTAC dedicated to the operation of the Third Unit which would allow it to be programmed and tested without interfering with the existing plant operation. RTAC for the Third Unit would be connected to the existing SCADA network and operated remotely similarly to Units 1 and 2.

The existing Units 1 and 2 use external Basler static exciters. These use brushes to apply the 335 ADC at 100 VDC to the rotor. Brush systems are relatively high maintenance items, requiring periodic cleaning, brush replacement, and a vacuum system to maintain a minimum cleanliness (collecting particles from the brush wear). It is proposed that the Third Unit use a brushless system in lieu of a static exciter and the associated power transformer and electronics.

The design criteria for the switchyard modification are to accommodate the addition of a third generating unit rated 12.5 MVA inside the powerhouse. This requires the addition of a third Generator Step Up (GSU) and circuit switcher and connecting them to the existing main high voltage bus. A new GSU would be added to the switchyard with ONAN/ONAF rating of 11.25/15 MVA.

The basic insulation level of the transformer would be 650 kV at the 13.8 kV secondary side and 95 kV at the 13.8 kV primary side. The primary winding would be delta connected while the secondary winding would employ solidly grounded wye connection with 5x2.5%

no-load taps. For consistency with the existing GSUs, the secondary winding would be equipment with a special tap for selection of 138 kV or 69 kV.

3.0 REFERENCES

TerraSond, Ltd. 2009. Tyee Lake Bathymetric Survey Hydrographic and Topographic Survey Report. Prepared for Southeast Alaska Power Agency. September 25, 2009.

US Geological Survey (USGS). 2016. USGS Alaska 5 Meter Lower_Southeast_Alaska_Mid_Accuracy_DEM 1896: U.S. Geological Survey.

U.S. Geological Survey. 2020. Tyee Lake Gage and Power House Survey, 1992-2019. Prepared by R. H. Host and E. H. Moran.

TYEE LAKE HYDROELECTRIC PROJECT

FERC NO. 3015

EXHIBIT B

PROJECT OPERATION AND RESOURCE UTILIZATION

https://www.ecfr.gov/current/title-18/part-4/subpart-F#p-4.51(c)

Tyee Lake Hydroelectric Project
(FERC No. 3015)

Application For License Amendment
For Major Project – Existing Dam

Exhibit B
Project Operation and Resource Utilization

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1.0 PROJECT OPERATION

"A statement whether operation of the powerplant will be manual or automatic, an estimate of the annual plant factor, and a statement of how the project will be operated during adverse, mean, and high-water years;"

1.1 Powerplant Operation

The Tyee Lake Hydroelectric Project (Project) is a conventional hydroelectric plant and is operated in conjunction with the Swan-Tyee Intertie (Intertie) and SEAPA's Swan Lake Hydroelectric Project. The Intertie provides a transmission path that allows for the coordination of generation assets between Petersburg and Wrangell (on the northern end of the distribution system) and Ketchikan (at the southern end).

Operation of the Project is automatic; however, all equipment is designed for local-manual, local-automatic, and remote operation. The system is manned 7 days per week 1 shift per day and constantly monitored with staffing on site to tend to any callouts.

Tyee Lake generators are a Pelton impulse-type designed specifically to operate in a range from 1,163 feet (ft) to 1,384 ft net head. Due to the design of the turbines, the turbines at Tyee can operate at lower MW and remain within their efficiency zone. SEAPA uses the automated real-time automation controller – Swan-Tyee Control System (STCS) – to control generation for maximizing efficiency, delivering power, and balancing lake levels (SEAPA 2023).

1.1 Project Operation During Adverse, Mean, and High-Water Years

Each year SEAPA develops an annual operations plan to forecast reservoir levels and coordinate operation of the Tyee Lake and Swan Lake hydroelectric projects to maximize output from SEAPA facilities, optimize water resources and efficiency of the generating units, and to minimize the need for diesel generation. Pursuant to the Power Sales Agreement, the operations plan gives first priority to the dedicated Firm Power Requirements of each utility and optimizes Additional Dedicated Output as a second priority for additional power requirements. Petersburg and Wrangell's Firm Power Requirements are typically provided by SEAPA by utilizing Tyee Lake's Dedicated Output. Ketchikan's Firm Power Requirements are typically provided by SEAPA by utilizing Swan Lake's Dedicated Output and Tyee Lake's Additional Dedicated Output. Swan Lake does not have the capacity to meet the Firm Power Requirements of Ketchikan without Additional Dedicated Output from the Tyee Lake Project.

Tyee Lake can operate between elevation 1,250 ft and 1,396 ft, but typically maintains a Draft Limit at 1,260 ft. The reservoir is operated to store runoff during the summer months and to release flows for power generation throughout the year. Under normal water years, the reservoir is filled in the summer from snowmelt and precipitation runoff, and is generally at its lowest in late spring prior to snowmelt. Because of the generational flexibility required in this closed-loop system, water levels in Tyee Lake vary based on loads and inflow to the system.

As part of the annual operations plan, SEAPA develops a Tyee Lake reservoir model with two case scenarios, a Guide/Curtailment Curve (based on 2018 drought year minus 10 ft and normal loads) and a Sales Curve (SEAPA 2023). If Tyee Lake elevations fall below the Guide/Curtailment Curve, Additional Dedicated Output is considered unavailable and net sales from Tyee Lake to Ketchikan are curtailed until Tyee Lake levels reach the Sales Curve. The area between the Guide/Curtailment Curve and the Sales Curve is considered the Tyee Operations Band. Once the elevation of Tyee Lake has reached the Sales Curve, Additional Dedicated Output is made available to Ketchikan for as long as Tyee Lake levels remain within the Tyee Operations Band.

During normal water years, SEAPA operates to maximize potential generation and to minimize spill when the reservoirs are refilling. In a typical year, Tyee Lake has the capacity to meet Petersburg and Wrangell's Firm Power Requirements and provide Additional Dedicated Output to Ketchikan. When inflow causes Tyee Lake elevations to exceed 1,396 ft, excess water is spilled over the weir at the natural outlet of Tyee Lake into Tyee Creek. Spill typically occurs in response to precipitation events, the frequency and intensity of which are influenced by the El Nino Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO), as is the air temperature and demand for power. In an average water year, spill to Tyee Creek may or may not occur. No spill occurred in 2017. In 2023, spill occurred on two days for a total spill of about 1 cfs.

In drought conditions, load demands beyond what can be produced by Tyee Lake and Swan Lake are provided via other sources of generation (i.e., Petersburg and Wrangell Supplemental Diesel Generation or KPU Supplemental Diesel Generation). As Tyee Lake levels approach the lower elevation limit (typically early spring), SEAPA may curtail or shut off generation at the Draft Limit to preserve limited available capacity (approximately 10 ft of water or 4,150 megawatt hours [MWh] of available capacity). Petersburg and Wrangell may utilize supplemental diesel generation to slow the draft rate until the Draft Limit is reached. Once the Draft Limit has been reached, Tyee Lake generators may remain off and Petersburg and Wrangell may utilize full diesel generation to meet Petersburg and Wrangell's Full Power Requirements until Tyee Lake recovers and reaches sufficient capacity (typically around WSE 1,265 ft) to meet the Firm Power Requirements of Petersburg and Wrangell (SEAPA 2023). Tyee Lake does not supply Additional Dedicated Output to Ketchikan until the lake elevation reaches the Sales Curve In low water years, Tyee Lake may not have the capacity to provide Additional Dedicated Output to meet Ketchikan's demand, as occurred in the 2018-2019 drought (SEAPA 2023).

During high water years, SEAPA operates to maximize potential generation and to minimize spill. More spill occurs during high water years, particularly during the summer and fall months (July through October) during precipitation events when Tyee Lake is generally full. For example, during above-average-water years 2020, 2021, and 2022, spill occurred on 62, 130, and 81 days each year, respectively. The amount of annual energy that could potentially be generated from the amount of spill ranged from 27,755 MWh in 2022 to 67,112 MWh in 2021. The proposed development to increase the capacity at Tyee Lake would allow SEAPA to capture water that would have otherwise been spilled to provide Additional Dedicated Output to meet Ketchikan's demand and could offset the need to generate power from stored water at Swan Lake and reduce reliance on diesel generation later in the year.

1.2 Project Operation and Operation During Maintenance Activities

Tyee Lake is a naturally formed lake that is dependent on inflows from snowmelt and seasonal precipitation. The single lake tap intake can only discharge within the limits of the turbines. If a maintenance activity requires a Tyee Lake drawdown, SEAPA may control reservoir levels by limiting summer refill from runoff and otherwise coordinating with Swan Lake operations to lower Tyee Lake levels. The Project is typically shut down for 10 days each year during summer to perform routine maintenance activities. During this time, 3 cfs is diverted to supply station service at 100 kW.

1.3 Proposed Operational Changes

With the addition of a third generating unit, SEAPA would continue to operate the Tyee Project in coordination with the Swan Lake project to maximize output from SEAPA facilities and optimize water resources and unit efficiency. The third turbine would allow SEAPA to better meet load demand when water for generation is available and reduce reliance on diesel generation.

1.4 Annual Plant Factor

The average annual plant factor is determined using the following equation:

$$\frac{\text{Average Annual Output}}{\text{Licensed Capacity x 8760 hours/year}} = \text{Average Annual Plant Factor}$$

The Project's average annual power generation 2017 through 2023 was approximately 105,805 MWh. The average annual plant factor is approximately 60% based on the current licensed capacity of 20 MW. Actual generation would vary based on several variables outside of SEAPA's control. However, all things being equal, generation would increase with the addition of the third unit and the Average Annual Plant Factor is expected to exceed 50%.

2.0 DEPENDABLE CAPACITY AND AVERAGE ANNUAL ENERGY PRODUCTION

"An estimate of the dependable capacity and average annual energy production in kilowatt-hours (or a mechanical equivalent), supported by the following data:

"The minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, with a specification of any adjustments made for evaporation, leakage, minimum flow releases (including duration of releases), or other reductions in available flow; monthly flow duration curves indicating the period of record and the gauging stations used in deriving the curves; and a specification of the period of critical streamflow used to determine the dependable capacity;"

2.1 Dependable Capacity

The dependable capacity of Tyee Lake is 4,150 MWh. This represents the available capacity when Tyee Lake has 10 ft of usable storage. At this elevation, SEAPA typically ceases generation in favor of other generation sources in the system (e.g., diesel generators). There are no proposed changes to the dependable capacity.

2.2 Average Annual Generation

The Project's average annual power generation from 2017 through 2023 was approximately 105,805 MWh. The Project's average monthly energy generation for 2017 through 2022 is provided in Table 2-1.

Table 2-1 Tyee Lake Project Average Generation by Month (MWh) 2017-2022.

Month	Average Monthly Energy Generation (MWh)
January	11,098
February	10,175
March	9,770
April	9,073
May	6,775
June	5,257
July	8,448
August	8,127
September	5,792
October	6,814
November	9,377
December	12,383
Average	**8,591**

2.3 Project Hydrology

The Project basin lies within a temperate rainforest. The Tyee Lake watershed varies in elevation from 1,250 to 5,005 ft mean sea level (msl) and is composed primarily of dense coniferous forest below the alpine. There are no glaciers present in the watershed and runoff from rainfall is the primary source of water, followed by snowmelt. Mean annual precipitation is 81.5 inches, but can vary widely from year to year as rainfall and snowpack are influenced by the ENSO and the PDO (SEAPA 2023). The watershed has an estimated area of 14.4 square miles (USGS 2016) and the lake receives between 250 and 350 ft of water from precipitation and runoff. Water is diverted to the powerhouse through a lake tap. The Tyee Lake Project normal operating pool ranges in elevation from 1,250 ft to full pool. At 1,398.3 ft elevation (USGS 2020), water spills over a weir at the natural lake outlet to Tyee Creek which joins Hidden Creek before flowing into Bradfield Canal about one half mile from the tailrace.

There are currently no gages that record the inflow into Tyee Lake or the amount of water available for generation. There was a USGS gage (USGS Gage No. 15020100) that operated August 1, 1963, to September 29, 1969, at the mouth of Hidden Creek near Bradfield Canal, downstream from Tyee Lake and Tyee Creek's confluence with Hidden Creek representing a drainage area of 16.1 square miles. Through correlation with concurrent records available for the Harding River USGS Gage (located about 5 mi west of the mouth of Tyee Creek), records for flow at the mouth of Hidden Creek were expanded to cover water years 1952 through 1978 and inflow from Tyee Lake was then synthesized from drainage area proportioning and adjusted for elevation and runoff differences between the upper and lower portions of the basin (IECO 1982). The synthesized estimates of mean monthly and daily discharge from Tyee Lake across the period of record is presented in Table 2-2 and Figure 2-1.

Runoff from spring snowmelt and seasonal precipitation is the primary water source for Tyee Lake, as no glaciers are present within the watershed. Approximately 70 percent of the runoff in the Tyee Lake basin occurs from June through October (IECO 1982). Historical mean monthly flows peaked in June, July, September, and October, and were lowest in February and March, highlighting the seasonal variability in water availability. The runoff pattern shows a high volume of flow occurring during June and July, the magnitude and duration of which depend on the depth of the snow in the basin, the temperatures during the melting season, and the occurrence of rain. Extremely high flows also occur in September and October, and to a lesser extent August, resulting from heavy rain events.

Table 2-2 Synthesized Average Monthly and Daily Discharge at Tyee Lake Outlet (1952-1978).

Month	Average Monthly Discharge (cfs)	Average Daily Discharge (cfs)
January	47	5.8
February	36	1.0
March	28	0.1
April	53	2.2
May	193	66.9
June	350	199.1
July	293	159.4
August	238	98.7
September	218	154.0
October	275	143.1
November	113	40.9
December	76	12.8
Annual	161	**73.8**

Source: IECO 1982.

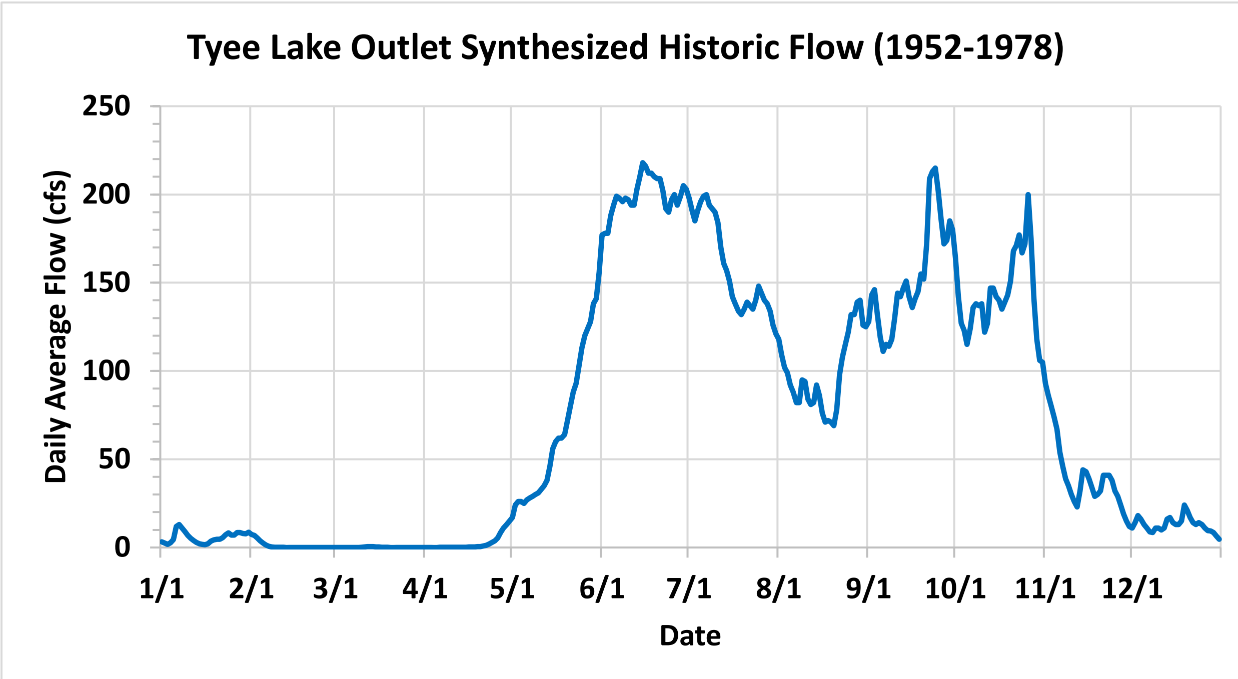

Figure 2-1 Hydrograph at Tyee Lake Outlet Based on Synthesized Average Daily Discharge (1952-1978).

United States Geological Survey (USGS) Gauge No. 15019990 Tyee Lake Outlet is the only active gage, and it measures water flow at the Tyee Lake outlet. The gage does not account for significant seepage from the natural lake outlet into Tyee Creek that is believed to begin at some point when the lake levels exceed 1,360 ft. A concrete weir structure was constructed at the Tyee Lake outlet in 2013 to better measure the outflow from Tyee Lake and was further modified in 2015 in an attempt to reduce leakage around and under the giant stones deposited millennia ago at the lake outlet.. The USGS gage measures water that spills over the weir, but some unquantified seepage continues to flow from the lake into Tyee Creek during high lake levels.

Monthly minimum, mean, and maximum discharge and spill data are provided in Table 2-3. The annual average discharge from the powerhouse was approximately 122 cfs or 88,354 acre-feet (ac-ft) of water. The monthly average discharge ranged from 76 cfs (4,523 ac-ft) in June to 171 cfs (10,482 ac-ft) in December. No spill occurred from December through May. Spill over the weir primarily occurred from June through October (Table 2-3). The monthly mean spill ranged from 7 cfs in November to 80 cfs in August. Monthly maximum spill flows ranged from 350 cfs in November to 637 cfs in August.

Table 2-3 Monthly Discharge through Tyee Lake Powerhouse and Spill (2017-2022)

Month	Tyee Plant Use				Spill			
	Min (cfs)	Mean (cfs)	Max (cfs)	Mean (ac-ft)	Min (cfs)	Mean (cfs)	Max (cfs)	Average # Days of Spill
January	47	154	226	9,480	0	0	0	0
February	47	157	212	8,758	0	0	0	0
March	20	139	212	8,522	0	0	0	0
April	41	136	216	8,080	0	0	0	0
May	35	97	170	5,981	0	0	0	0
June	0	76	158	4,523	0	23	514	2
July	56	116	188	7,158	0	42	357	8
August	48	112	177	6,885	0	80	637	12
September	1	82	184	4,899	0	75	571	11
October	0	93	138	5,724	0	59	600	11
November	78	132	195	7,860	0	7	350	2
December	97	171	222	10,482	0	0	0	0
Annual		122		88,354				

Annual and monthly flow duration curves developed from the 7-year record of daily flows at USGS Gage 15020100 Tyee Creek at Mouth (1963-1969), which is located downstream of the lake and confluence with Hidden Creek near Bradfield Canal, are provided in Appendix B-1.

2.4 Area-Capacity Curve

"An area-capacity curve showing the gross storage capacity and usable storage capacity of the impoundment, with a rule curve showing the proposed operation of the impoundment and how the usable storage capacity is to be utilized;"

An area-capacity curve for the Project is shown in Figure 2-2, and a storage-elevation curve is shown in Figure 2-3. Figure 2-4 shows the daily reservoir elevation for years 2017 through 2022, the minimum and maximum reservoir elevation, and the daily average historic flow data from USGS Gage 15019990 (1952 to 1978). Spill occurred in 2020, 2021, and 2022.

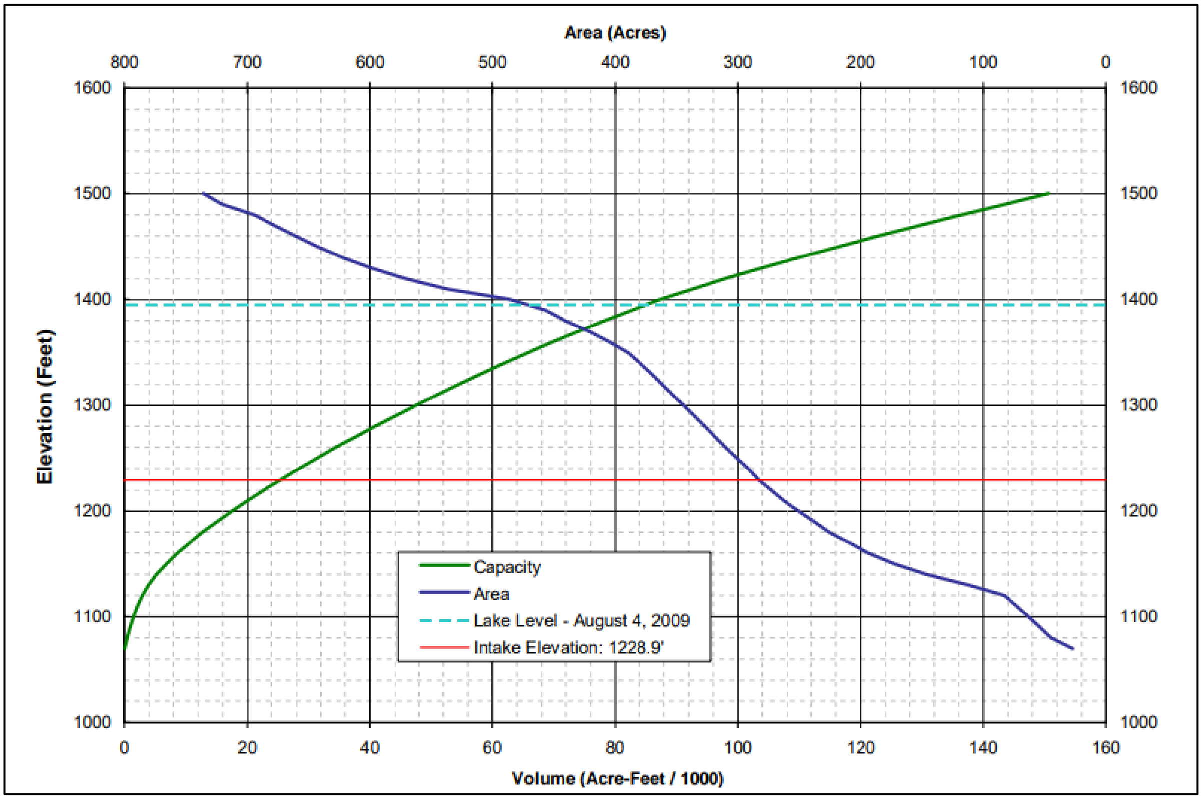

Figure 2-2 Area-Capacity Curve. Source: TerraSond 2009.

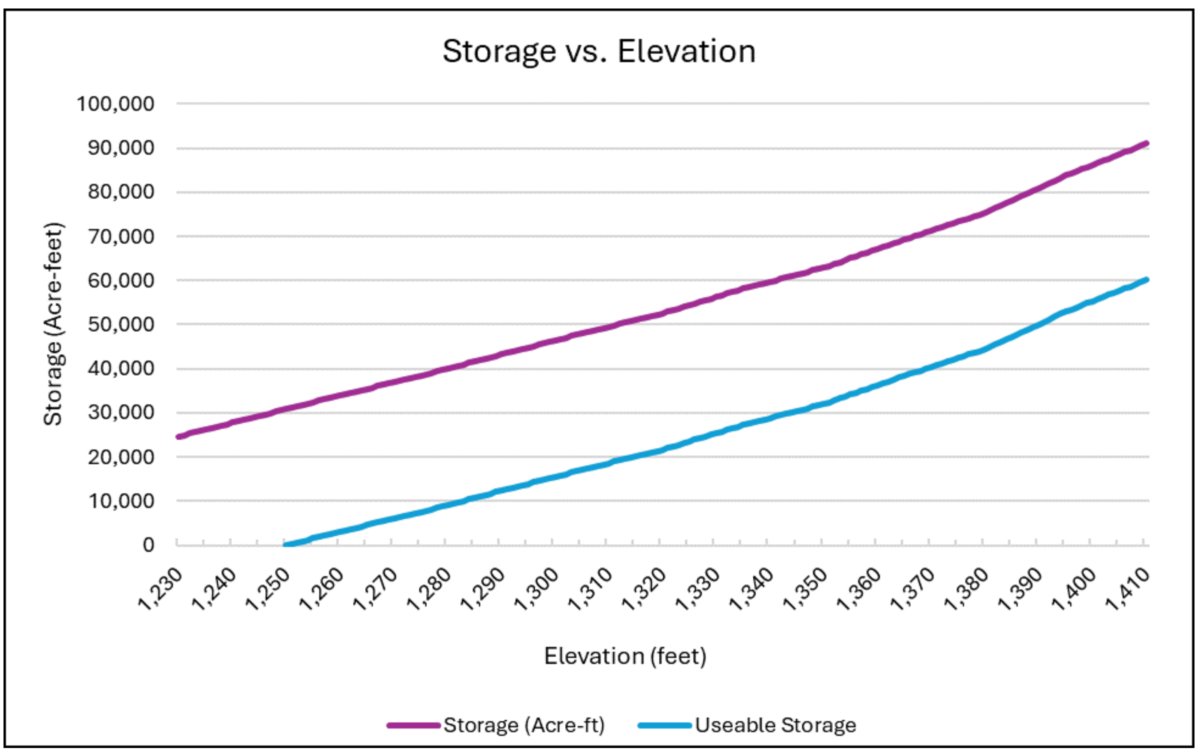

Figure 2-3 Storage-Elevation Curve. Source: TerraSond 2009.

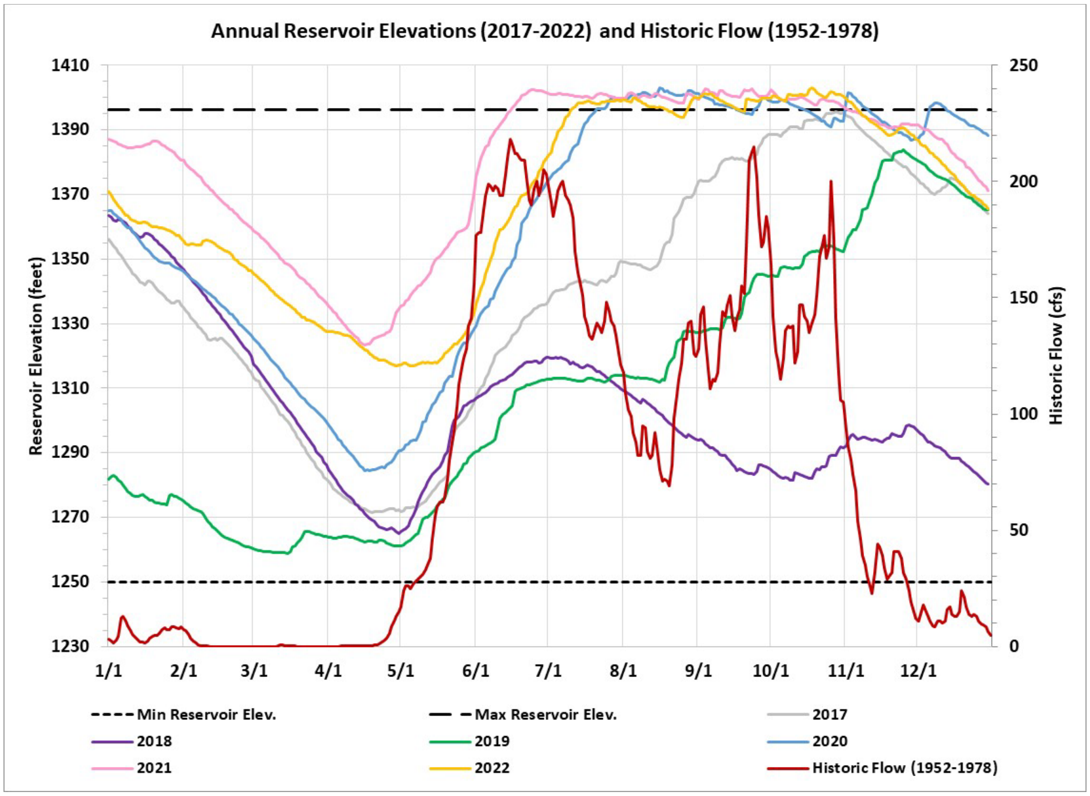

Figure 2-4 Tyee Lake Elevation (2017 to 2022) and Synthesized Historical Flow Data from Tyee Lake Outlet (1952-1978).

2.5 Estimated Hydraulic Capacity

"The estimated hydraulic capacity of the powerplant (minimum and maximum flow through the powerplant) in cubic feet per second;"

The maximum hydraulic capacity of each turbine, including both the two installed turbines and the proposed third unit, is 117 cfs and the existing power tunnel, penstock, and tailrace are sized to accommodate a flow corresponding to 30 MW (36 MVA)of capacity. The minimum hydraulic capacity is 3 cfs to maintain station service (100 kW).

2.6 Tailwater Rating Curve

The Tyee Project uses Pelton turbines, which are not dependent on tailwater elevation. Therefore, a tailwater rating curve is not applicable.

2.7 Power Plant Capability Versus Head

"A curve showing powerplant capability versus head and specifying maximum, normal, and minimum heads"

The Tyee Lake turbines have a rated speed of 720 rpms under an effective head of 1,275 ft with a rated output of no less than 12,190 kW. The weighted average efficiency is 91.53 percent. Tyee Lake can operate between elevation 1,250 ft and 1,396 ft, but typically maintains a Draft Limit at 1,260 ft. The turbine performances at a head of 1,300 ft, 1,275 ft, and 1,250 ft are presented in Figure 2-5, Figure 2-6, and Figure 2-7.

Table 2-4 Tyee Lake Turbine Performance and Characteristics

Flow (cfs)	Net Head (ft)	Theoretical Power (MW)	Guaranteed Efficiency (%)	Turbine Power (MW)	Weighting Factor	Incremental Efficiency (%)
84	1,300	9.24	91.52%	8.46	0.15	13.73%
75	1,300	8.25	91.58%	7.56	0.07	6.41%
67	1,300	7.37	91.49%	6.74	0.16	14.64%
117	1,275	12.62	90.29%	11.39	0.01	0.90%
84	1,275	9.06	91.60%	8.30	0.01	0.92%
75	1,275	8.09	91.66%	7.42	0.33	30.25%
117	1,250	12.37	90.29%	11.17	0.05	4.51%
75	1,250	7.93	91.71%	7.27	0.15	13.76%
67	1,250	7.09	91.64%	6.50	0.07	6.41%

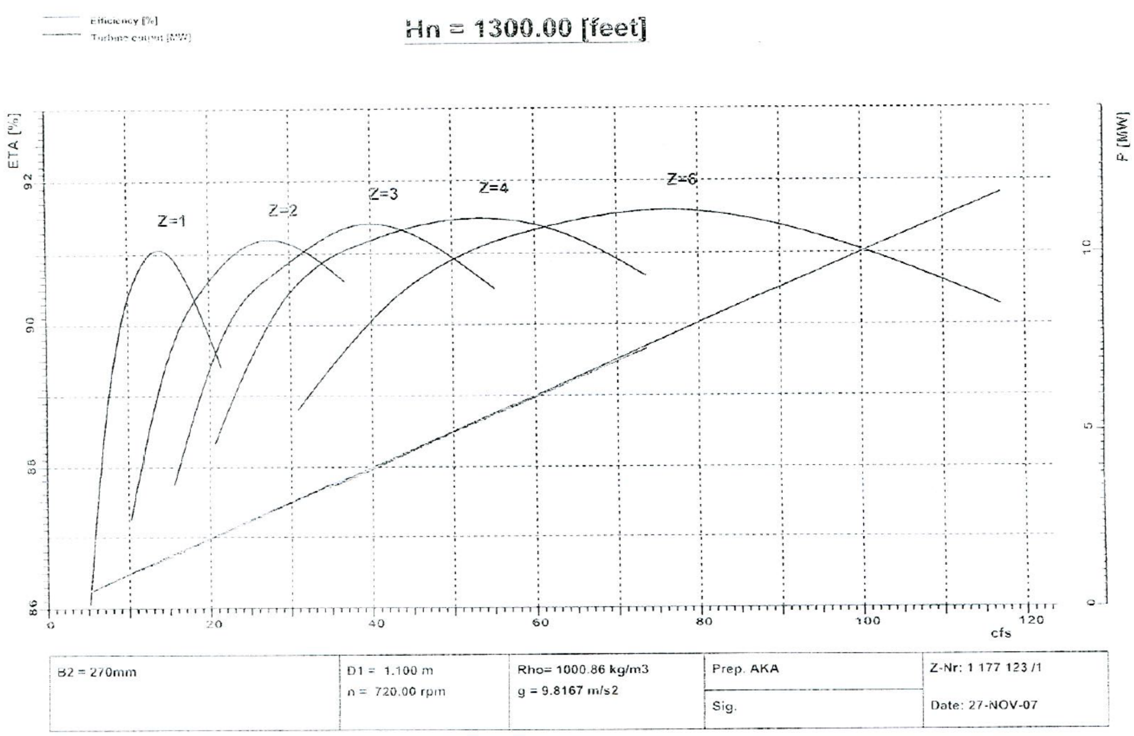

Figure 2-5 Tyee Lake Turbine Performance at a Head of 1,300 ft.

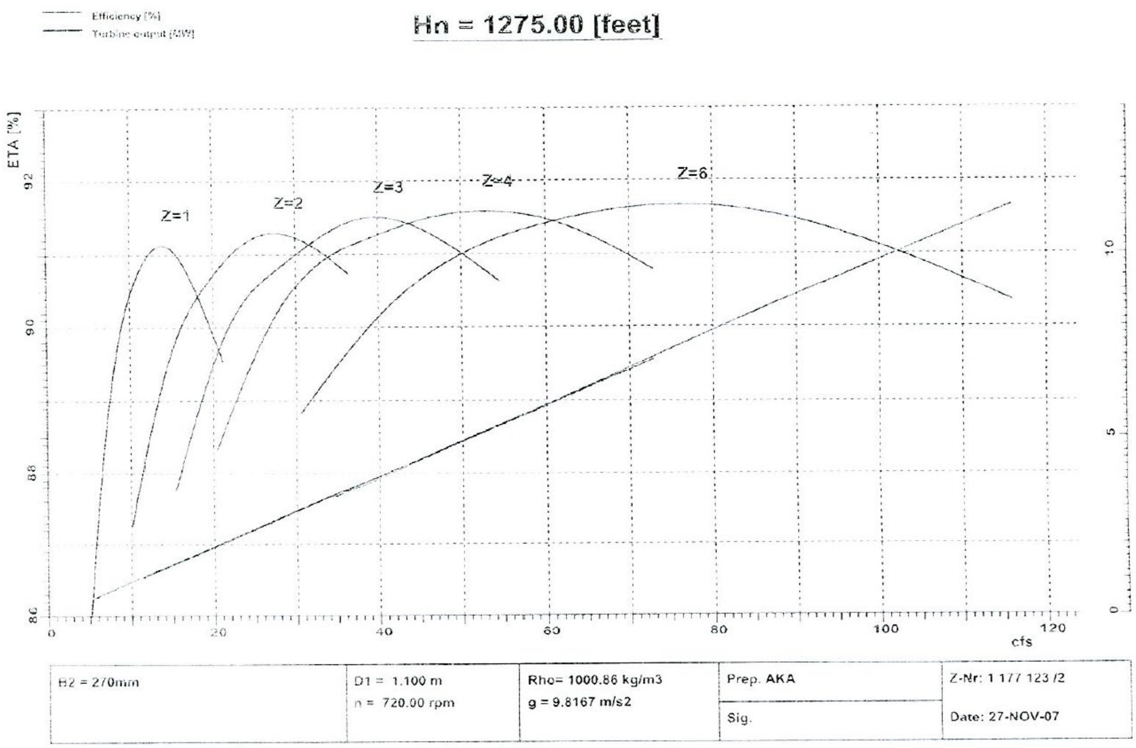

Figure 2-6 Tyee Lake Turbine Performance at a Head of 1,275 ft.

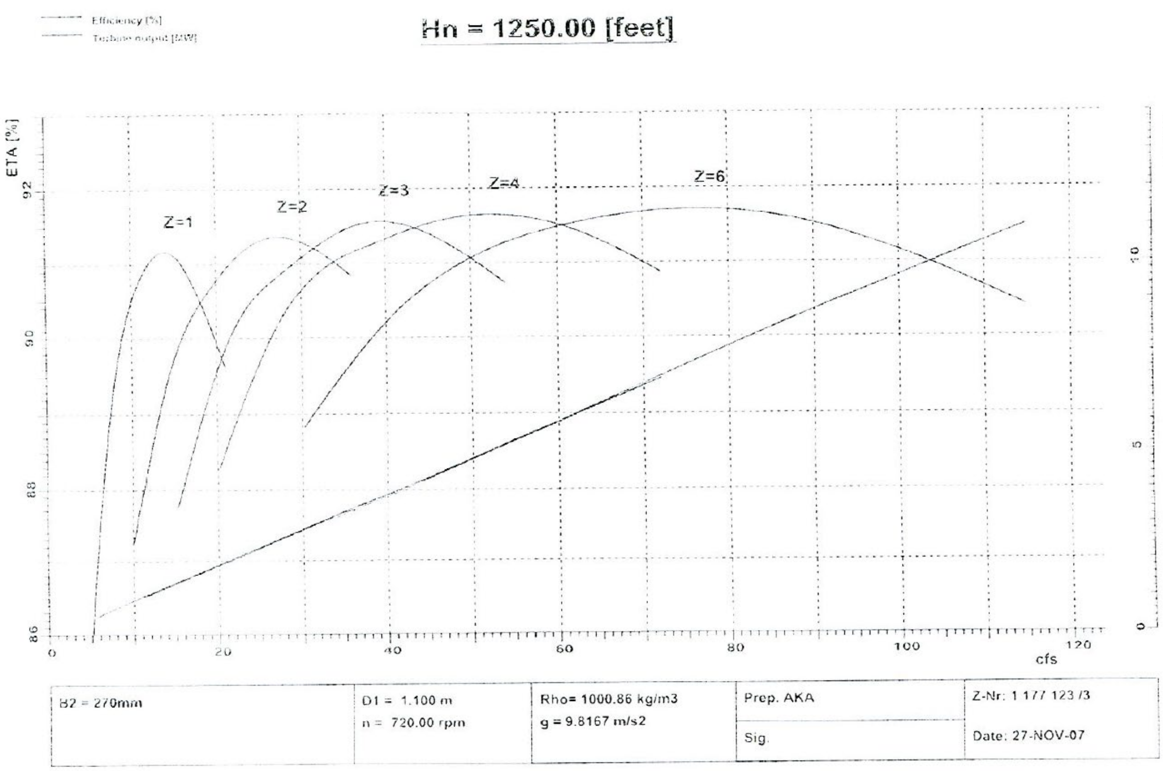

Figure 2-7 Tyee Lake Turbine Performance at a Head of 1,250 ft.

3.0 USE OF PROJECT POWER

"A statement, with load curves and tabular data, if necessary, of the manner in which the power generated at the project is to be utilized, including the amount of power to be used on-site, if any, the amount of power to be sold, and the identity of any proposed purchasers;"

The power used on-site is not metered. However, during routine annual maintenance 100 kW capacity is maintained to provide station service. Aside from limited power used on-site, all power generated by the Project is subject to a Power Sales Agreement with the municipalities of Petersburg, Wrangell, and Ketchikan.

SEAPA has power sales agreements with Petersburg Municipal Power and Light, Wrangell Municipal Light and Power, and Ketchikan Public Utility (KPU). Tyee Lake provides Dedicated Output to first meet Petersburg and Wrangell's Firm Power Requirements. If Tyee Lake has capacity to meet those utilities' Firm Power Requirements, it can sell power to KPU as Additional Dedicated Output. As part of its annual operations plan, SEAPA forecasts firm power requirements for each of the utilities and expected generation. For 2024, SEAPA estimated that Tyee Lake would generate 108,533 MWh and Petersburg and Wrangell's Firm Power Requirements would be 81,421 MWh (SEAPA 2023). The remaining power generated by Tyee Lake would be sold to KPU to meet its loads. There are no other purchasers.

4.0 PLANS FOR FUTURE DEVELOPMENT

"A statement of the applicant's plans, if any, for future development of the project or of any other existing or proposed water power project on the stream or other body of water, indicating the approximate location and estimated installed capacity of the proposed developments."

Aside from the proposed modifications associated with this application, SEAPA does not currently have any additional plans for future development of this Project during the current license term.

5.0 REFERENCES

International Engineering Company, Inc. (IECO). 1982. Design Criteria Tyee Lake Hydroelectric Project. Document No. 2145DC-1.2R1. September 24, 1982.

Southeast Alaska Power Agency. 2023. Operations Plan | 2024. Dated November 17, 2023.

TerraSond, Ltd. 2009. Tyee Lake Bathymetric Survey, Tyee Lake, Alaska, Hydrographic and Topographic Survey Report. Prepared for SEAPA.

United States Geological Survey (USGS). 2020. Tyee Lake Gage and Power House Survey, 1992-2019. Prepared by R. H. Host and E. H. Moran.USGS. 2024a. USGS 15019990 TYEE LK OUTLET NR WRANGELL AK. Available Online: https://waterdata.usgs.gov/nwis/inventory/?site_no=15019990. Accessed August 2024.

USGS. 2024b. USGS 15020100 TYEE C AT MOUTH NR WRANGELL AK. Available Online: https://waterdata.usgs.gov/nwis/inventory/?site_no=15020100. Accessed August 2024.

Appendix B1

MONTHLY FLOW DURATION CURVES FOR THE PERIOD

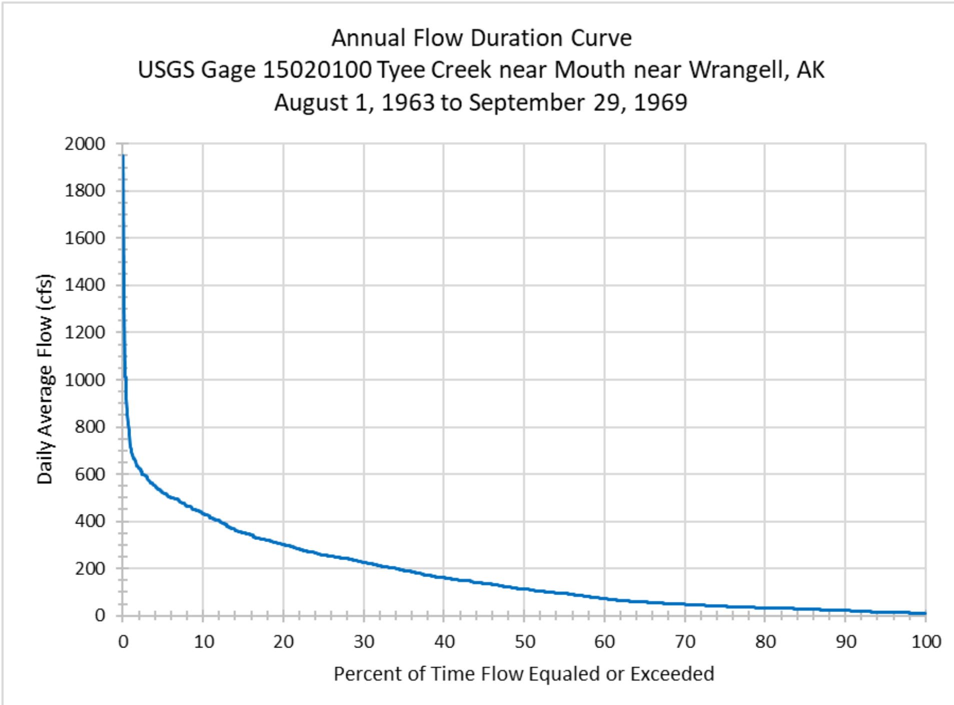

Figure B1-1 Annual Flow Duration Curve at Mouth of Tyee Creek USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

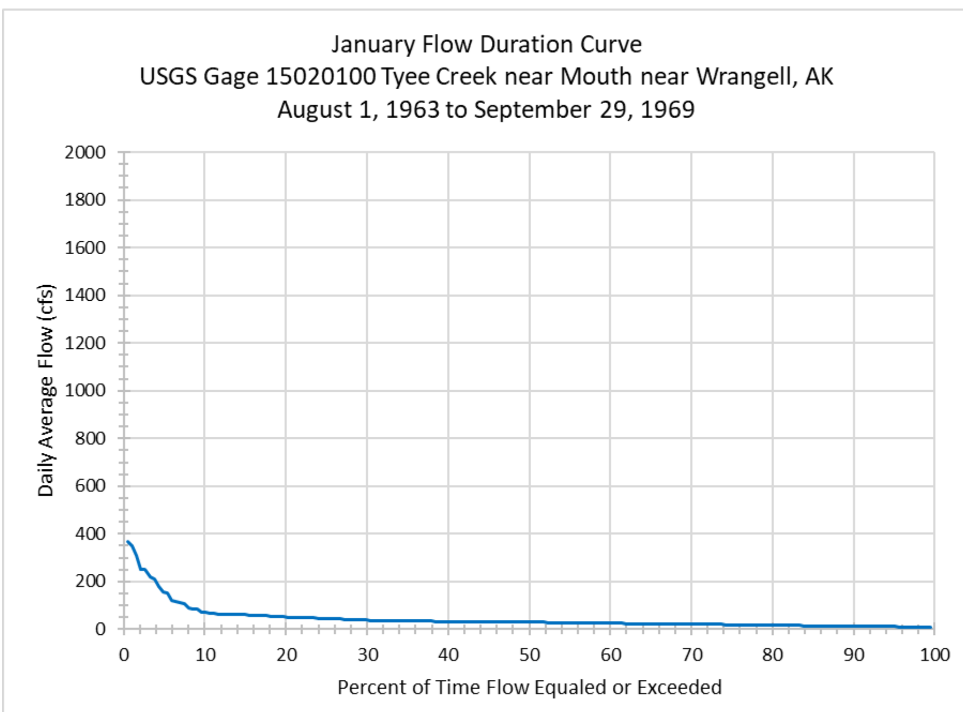

Figure B1-2 January Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

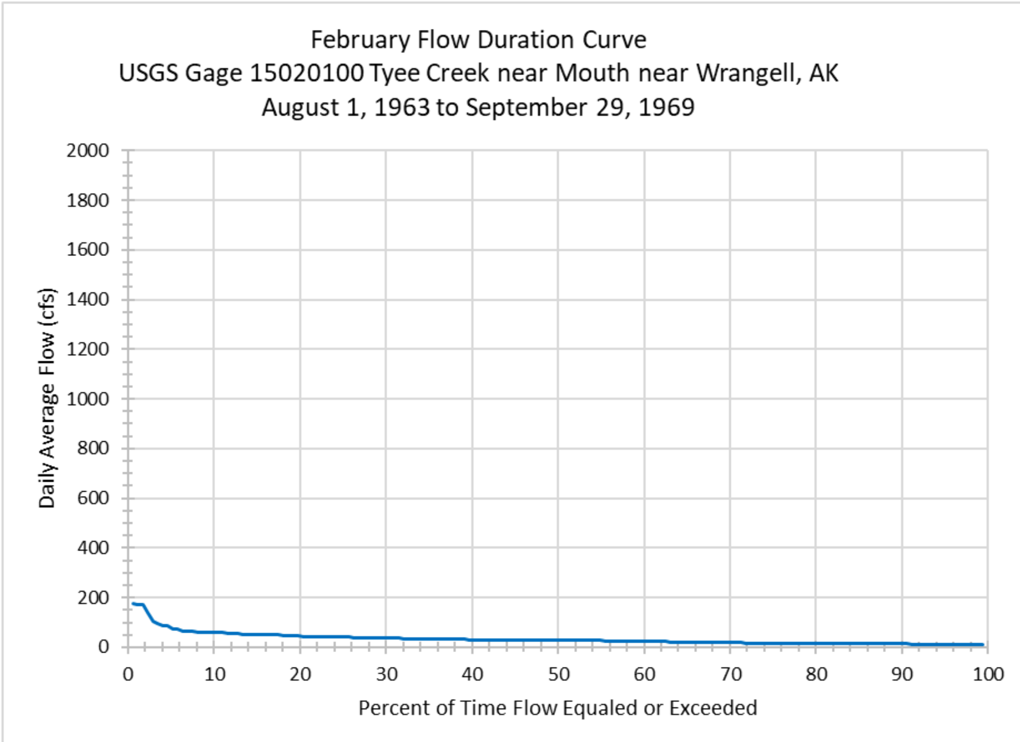

Figure B1-3 February Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

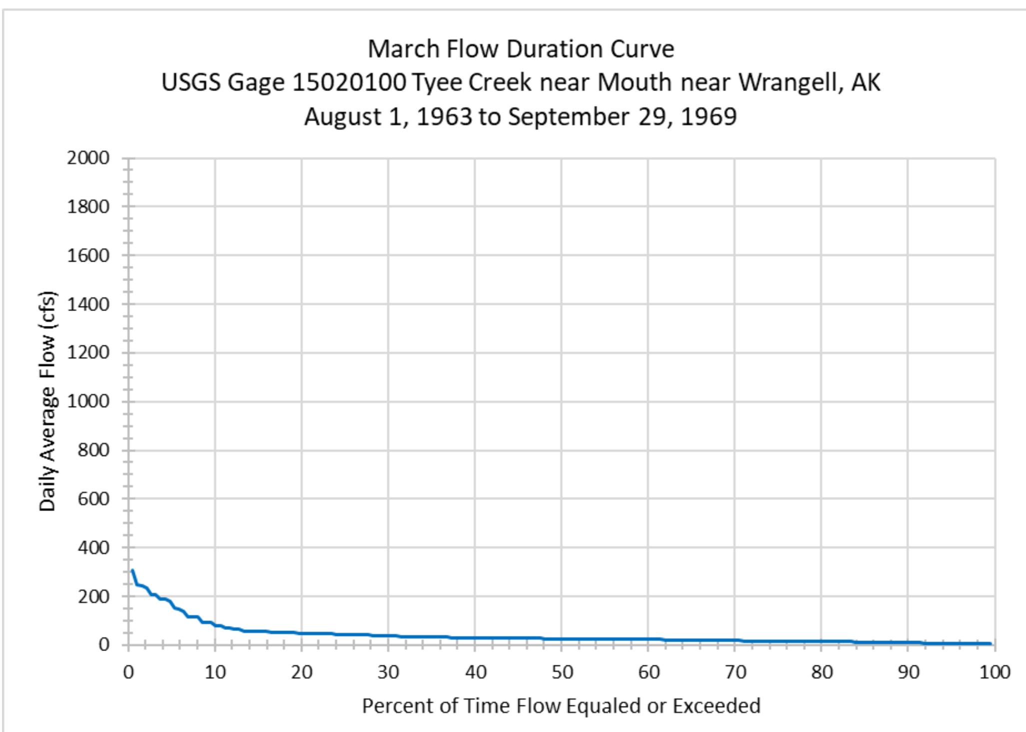

Figure B1-4 March Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

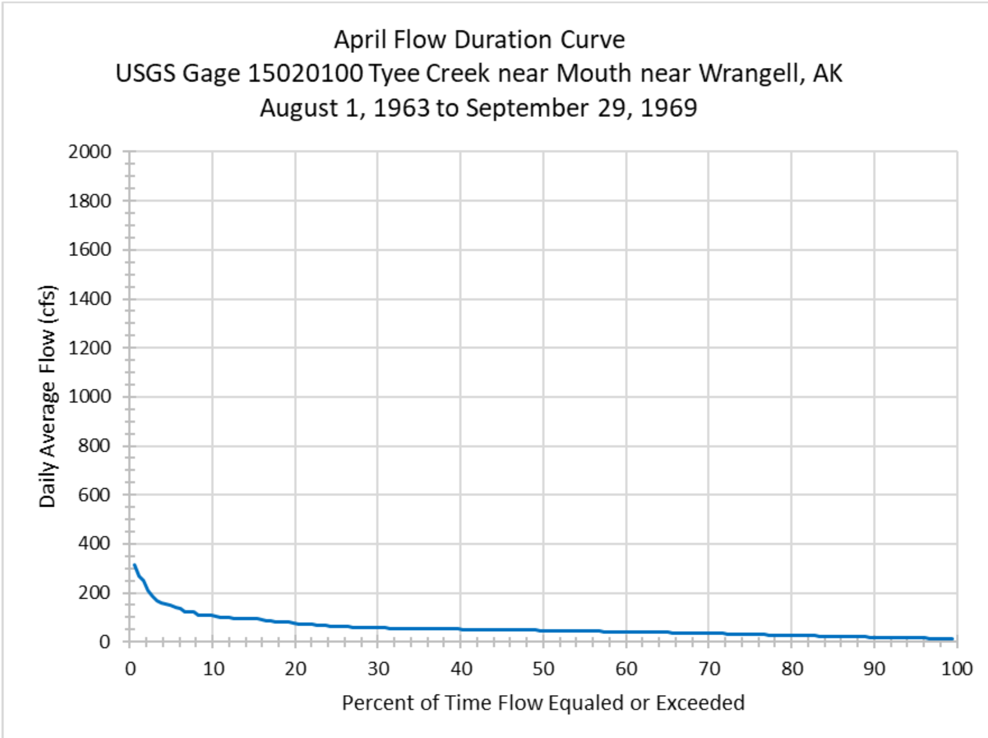

Figure B1-5 April Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

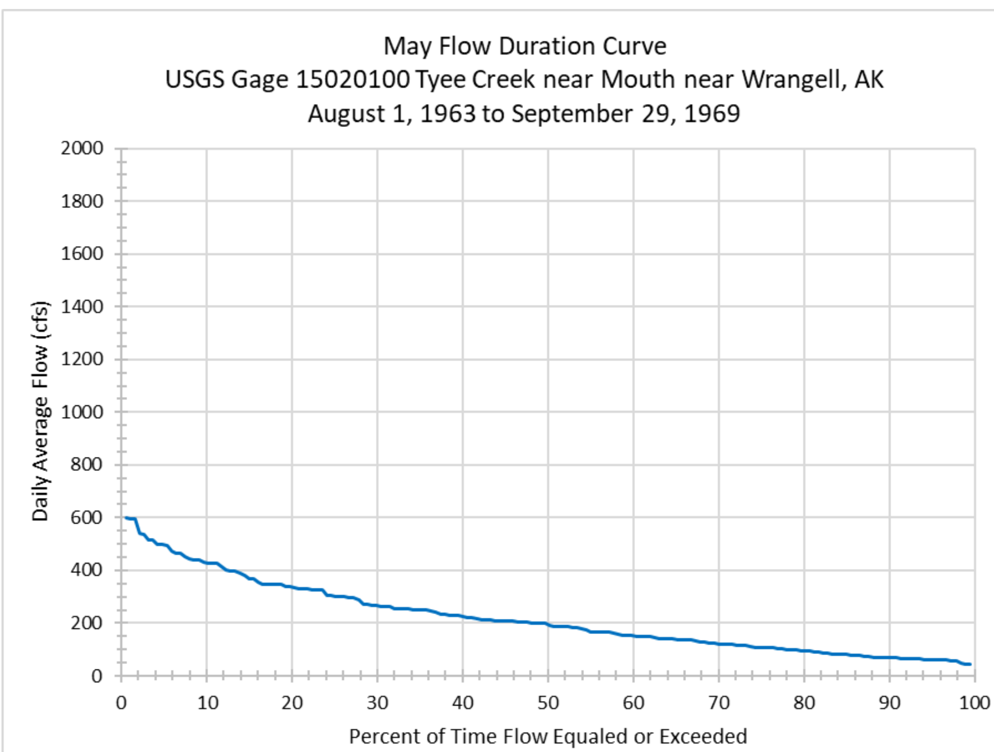

Figure B1-6 May Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

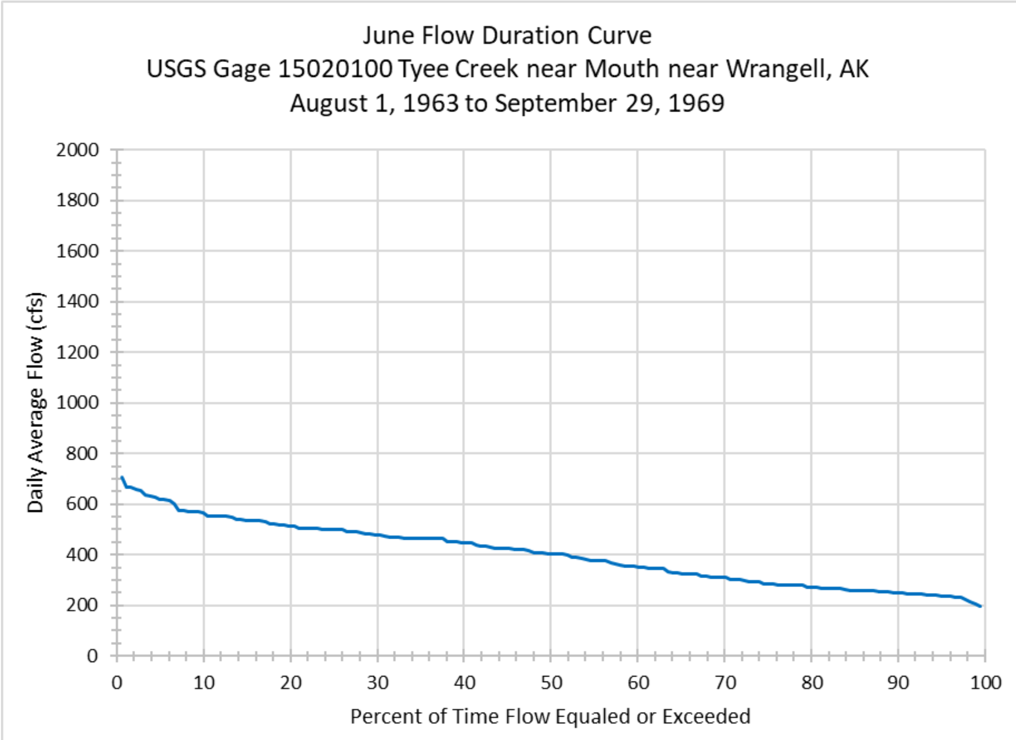

Figure B1-7 June Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

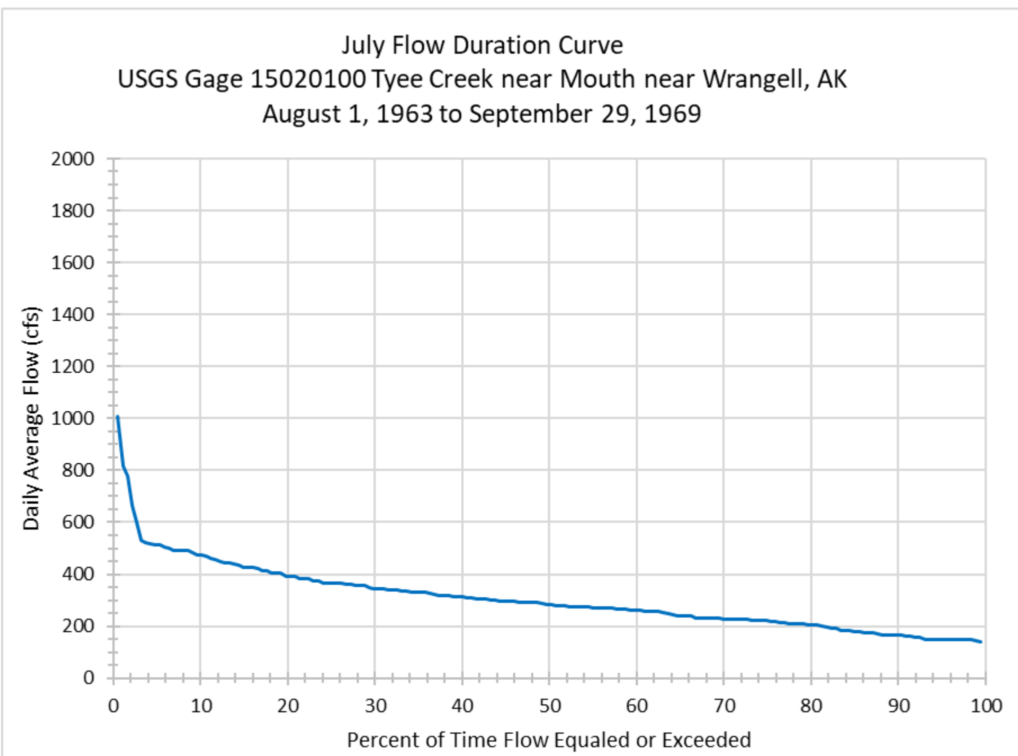

Figure B1-8 July Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

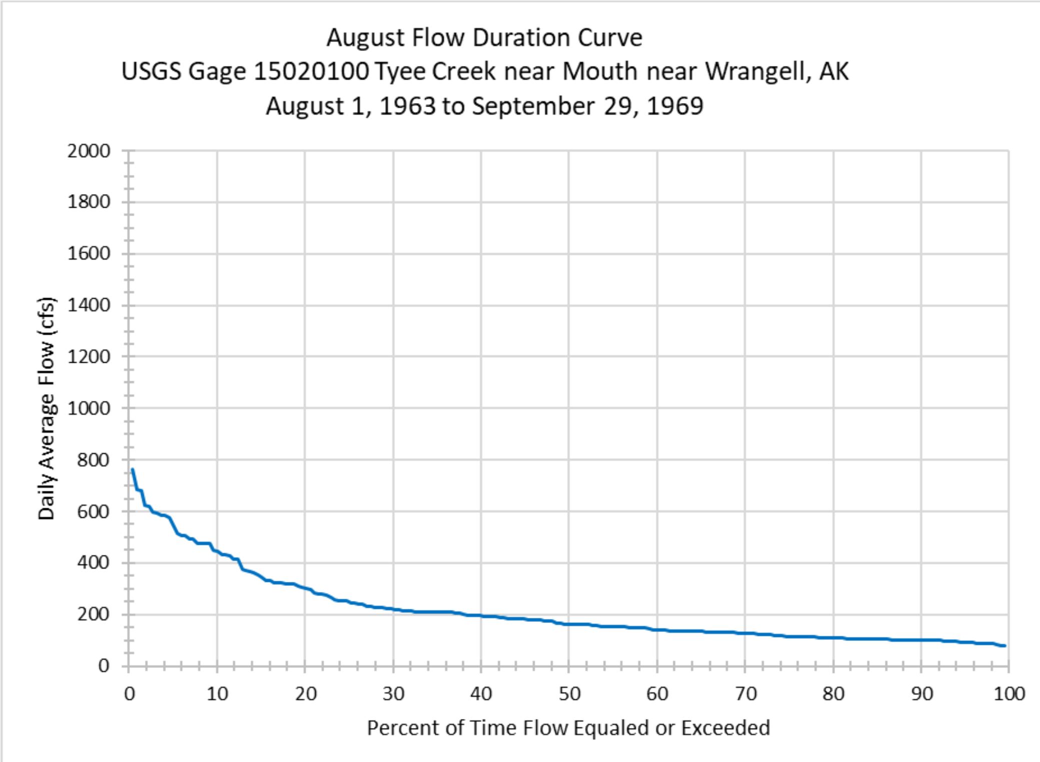

Figure B1-9 August Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

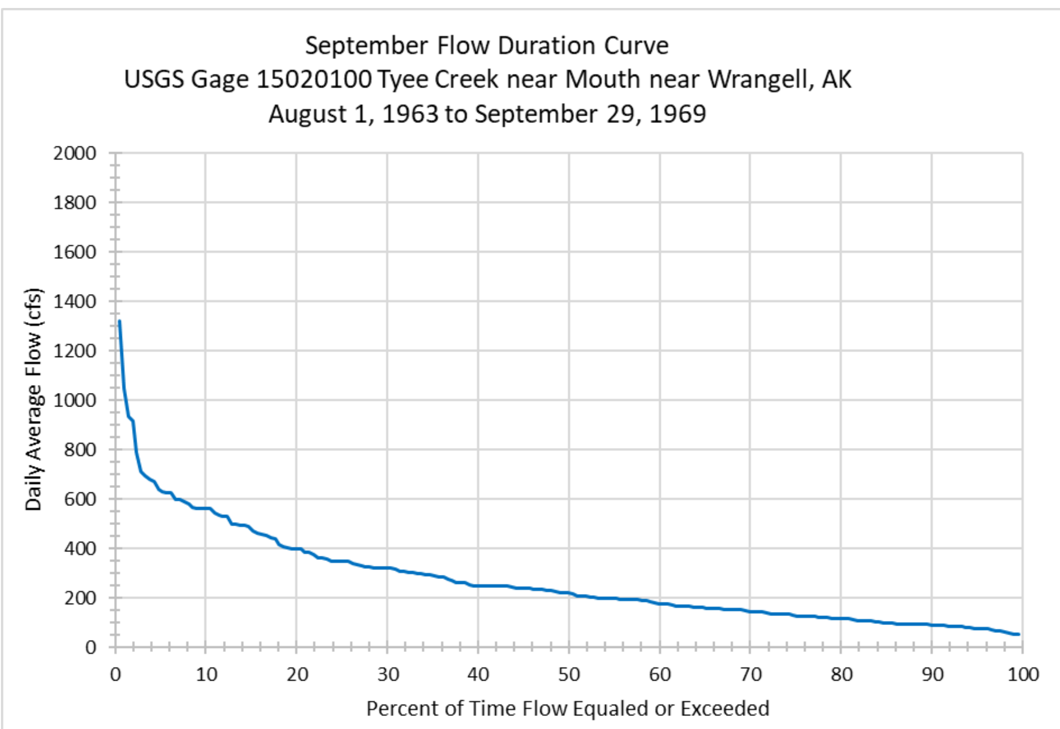

Figure B1-10 September Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

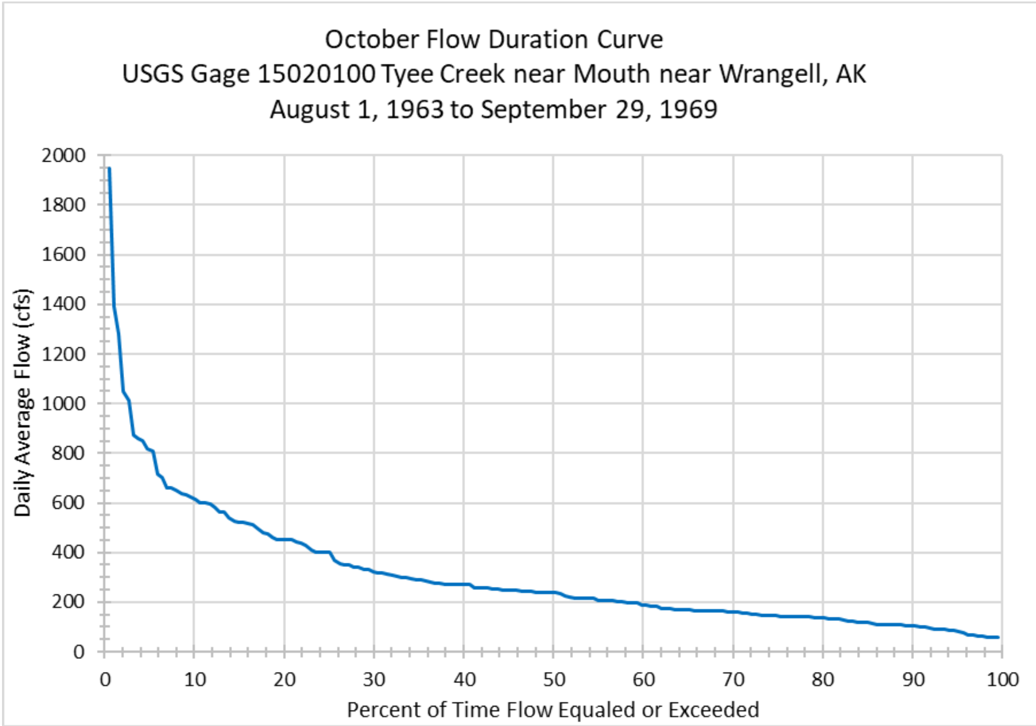

Figure B1-11 October Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

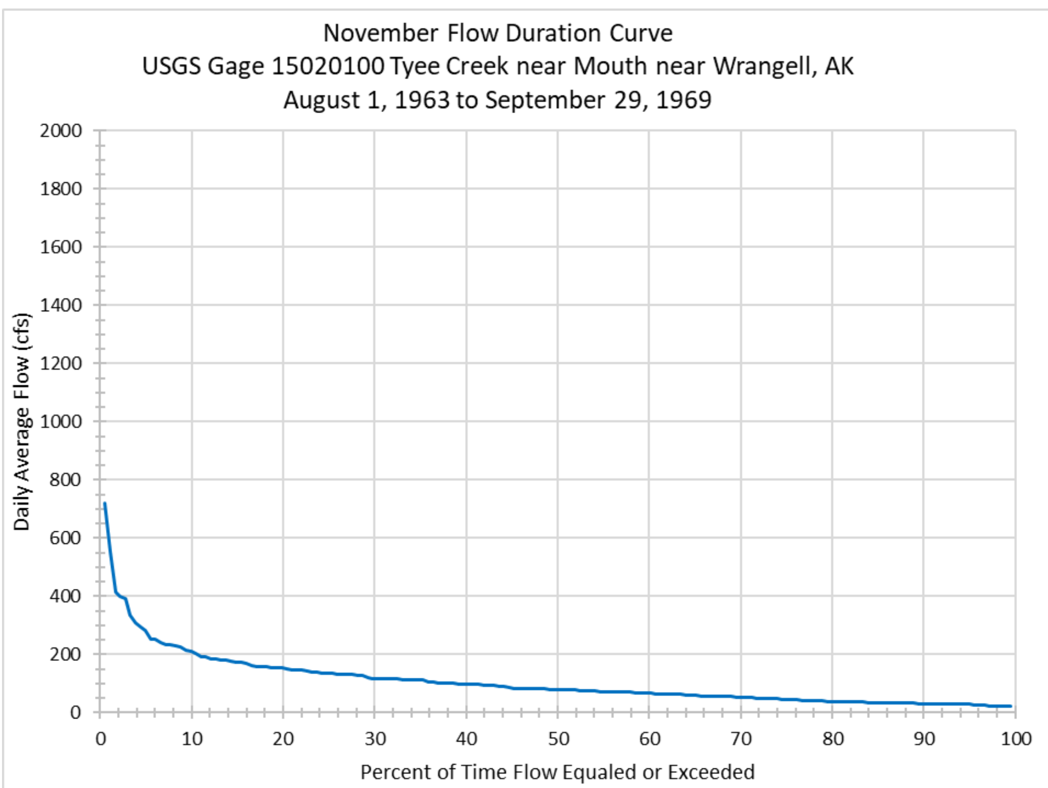

Figure B1-12 November Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK.

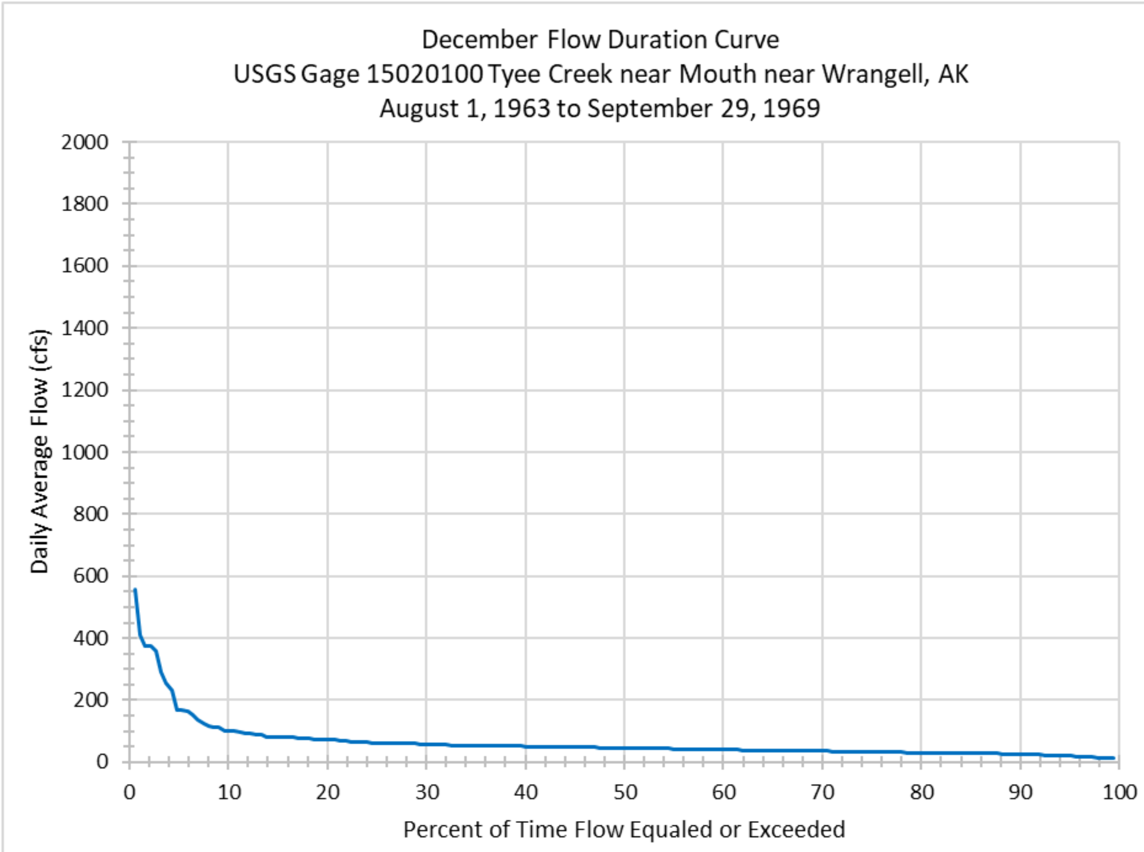

Figure B1-13 December Flow Duration Curve, USGS Gage 15020100 Tyee Creek near Mouth near Wrangell, AK

Tyee Lake Hydroelectric Project

FERC No. 3015

Exhibit C

Construction History

TYEE LAKE HYDROELECTRIC PROJECT
(FERC NO. 3015)

APPLICATION FOR LICENSE AMENDMENT
FOR MAJOR PROJECT – EXISTING DAM

EXHIBIT C
CONSTRUCTION HISTORY

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1.0 CONSTRUCTION HISTORY

1.1 Original Construction

The Tyee Lake Hydroelectric Project (Project) is located at the head of Bradfield Canal, approximately 40 miles southeast of Wrangell, 60 miles northeast of Ketchikan, and 70 miles southeast of Petersburg, Alaska. Construction of the Project began on October 20, 1981, and was completed in 1984, with commencement of commercial operations beginning in May 1984.

1.2 Modifications or Additions to the Existing Project

1.2.1 2013 Outlet Weir Construction

License Article 8 required the Licensee to maintain staff gages for flow measurement at the Project. Historically, the Licensee and the USGS worked together to measure the outflow above and below the Project, however the build-up of a logjam resulting in poor quality of the measurements necessitated removal and installation of a weir at the natural outflow of Tyee Lake to prevent future issues.

Removal of the logjam and installation of the weir and all necessary facilities was complete in October 2013, and by Order dated March 21, 2014 the FERC approved the as-built drawings for the weir.

1.2.2 2014 Weir Repair

The weir was inspected in 2014 following high flows and was found to have significant leakage around the left and right abutments of the weir. Due to the leakage in several locations, 45 yards of fill was placed in an attempt to preserve the flow monitoring capabilities of the weir.

2.0 PROJECT SCHEDULE OF NEW DEVELOPMENT

The following Table 2-1 presents the proposed schedule for installing the third turbine and generating unit.

Table 2-1 Proposed Schedule for Installation of Third Turbine Unit.

Task	Estimated Start	Estimated Finish
Mobilization	3/1/2027	6/29/2027
Equipment Lead Time	6/29/2027	6/28/2028
Install Turbine and Generator Embedded Parts	6/28/2028	7/28/2028
Concrete	7/28/2028	9/26/2028
Dewater Tunnel*	9/26/2028	10/6/2028
Install TSV**	10/6/2028	10/30/2028
Install Turbine and Generator Remaining Parts	10/30/2028	12/29/2028
Controls, Switchgear, and Misc. Systems	12/29/2028	2/27/2029
Switchyard Work	2/27/2029	4/8/2029
Contingencies and Wait Time for Loads to Decrease	4/8/2029	4/23/2029
Outage for Connection	4/23/2029	4/28/2029
Wet Test	4/28/2029	5/8/2029
Commissioning	5/8/2029	5/28/2029

*If necessary
** (Load Sensitive only if dewatering required)

Tyee Lake Hydroelectric Project

FERC No. 3015

Exhibit D

Statement of Costs and Financing

TYEE LAKE HYDROELECTRIC PROJECT
(FERC NO. 3015)

APPLICATION FOR LICENSE AMENDMENT
FOR MAJOR PROJECT – EXISTING DAM

EXHIBIT D
STATEMENT OF COSTS AND FINANCING

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1.0 ESTIMATED COST OF NEW DEVELOPMENT

1.1 Land and Water Rights

There are no costs associated with land purchase or fees for the proposed development. The Tyee Lake Hydroelectric Project (Project) was licensed, designed, and constructed with provisions for a third turbine; no ground-disturbing activities are proposed. The project occupies 1,174 acres of federal lands administered by the U.S. Forest Service within the Tongass National Forest (transmission only), and 1,418 acres of section 24 lands (256 acres transmission and 1,162 acres non-transmission). The proposed development would occur on state land within the Project boundary.

There are no costs associated with water rights for the proposed development. SEAPA has two permits from the Alaska DNR (ADL100887 and LAS 27045) for a total use of 135,000 acre-feet (ac-ft) of Tyee Lake water annually for purposes of hydroelectric power generation. Operation of the third unit would occur within SEAPA’s existing permitted water rights.

1.2 Cost of New Facilities

The cost of the new development work is:

Item or Task	Totals
30% Design SS and 15kV SWGR	$96,817
90% Design SS and 15kV SWGR	$99,131
100% Design SS and 15kV SWGR	$69,183
30% Design Turbine/Gen	$165,000
90% Design Turbine/Gen	$170,000
100% Design Turbine/Gen	$65,575
480V Switchgear Install	$2,382,228
15kV Switchgear	$1,020,954
U3 Transformer/Structure	$2,500,000
Powerhouse Structural and Second Stage Concrete	$975,000
Piping (all mechanical piping)	$877,500
Turbine Shut-off Valve	$1,100,000
Turbine-rotating Parts and Bearings and Shaft	$2,100,000
Turbine-nozzle Piping	$256,000
15kV Generator	$5,000,000
Ancillary equipment (external filters, high lift pump etc.)	$400,000
Governor	$750,000
Excitor	$800,000
Controls, Protective Relays, misc. Wiring	$635,000
Buss Work Switch Gear and Unit Breaker	$418,000
Turbine Bypass Valve and Air	$900,000
Licensing, Engineering, Legal and Administrative	$1,673,904
Total	**$22,454,292**

(A) *Total cost of each major item;*

(B) *Indirect construction costs such as costs of construction equipment, camps, and commissaries;*

(C) *Interest during construction; and*

(D) Overhead, construction, legal expenses, taxes, administrative and general expenses, and contingencies.

2.0 ORIGINAL COST OF EXISTING UNLICENSED FACILITIES

This section is not applicable.

3.0 ESTIMATED AMOUNT PAYABLE UPON TAKEOVER PURSUANT TO SECTION 14 OF THE FEDERAL POWER ACT

This section is not applicable.

4.0 ESTIMATED AVERAGE ANNUAL COST OF THE PROJECT

"A statement of the estimated average annual cost of the total project as proposed specifying any projected changes in the costs (life-cycle costs) over the estimated financing or licensing period if the applicant takes such changes into account, including:"

4.1 Capital Costs

No borrowing. debt

4.2 Taxes

The licensee is a Joint Action Agency under the laws of the State of Alaska, and is not subject to local, state, and federal taxes.

4.3 Depreciation and Amortization

As described above, the licensee is tax-exempt, and therefore, this section is not applicable.

4.4 Operation and Maintenance Expenses

"Operation and maintenance expenses, including interim replacements, insurance, administrative and general expenses, and contingencies"

SEAPA's budget for operation and maintenance of the Project with two turbines averages $1,274,758 annually. The total annual cost is anticipated to increase by about $350,000 for the operation and maintenance of the proposed third unit.

4.5 Costs of Proposed Environmental Measures

"The estimated capital cost and estimated annual operation and maintenance expense of each proposed environmental measure."

The project is not anticipated to result in any new costs associated with environmental measures. The Project was designed and constructed with provisions for a third turbine and the effects from construction and operation is expected to be *de minimis*. Construction of the proposed development would not require any new ground-disturbing activities and the aesthetic appearance of the facility would not be affected. The tailrace is intertidal and any additional flow from the third unit would not affect the water quality in the tailrace or Airstrip Slough and would not affect salmon spawning or rearing. No threatened or endangered species would be affected by the proposed development. The site is remote with very limited recreational use and the Project does not provide any recreational facilities.

5.0 ESTIMATED ANNUAL VALUE OF PROJECT POWER

"A statement of the estimated annual value of project power, based on a showing of the contract price for sale of power or the estimated average annual cost of obtaining an equivalent amount of power (capacity and energy) from the lowest cost alternative source, specifying any projected changes in the cost of power from that source over the estimated financing or licensing period if the applicant takes such changes into account."

Over the last five years (2019-2023), the Project has generated an average of approximately 100,000 MWh of energy annually. In 2022, the average number of kWh generated from petroleum liquid was 12.90 kWh per gallon or 0.08 gallons per kWh (EIA 2024). The exact amount per specific generator or power plant can vary considerably (EIA 2024). The average annual cost of equivalent diesel generation, assuming 0.08 gallons per kWh and $4.70/gallon in Wrangell and Petersburg, would be $37,600,000.

SEAPA would continue to coordinate the operations of the Tyee Lake Hydroelectric Project with its Swan Lake Hydroelectric Project to maximize generation from available water resources and optimize efficiency. The amount of annual power produced by the third unit would vary greatly from year to year, depending on Swan Lake generation, the amount of water available, water elevations at Tyee Lake, and demand. Operation of the third unit allow power to be generated from inflow that would have otherwise spilled during high runoff periods when Tyee Lake was full and only two units were operating. Spill typically occurs in response to precipitation events, the frequency and intensity of which are influenced by the El Nino Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO), as is the air temperature and demand for power. Spill does not occur during low-water years and may or may not occur during average water years. In addition to the natural variability in water availability and amount of spill, project operations are constrained by the allowable Tyee Lake draft limit and SEAPA's existing water rights. Over the past five years, the amount of power that could have been produced from spill without any limitations, ranged from 2 MWh to approximately 67,000 MWh annually and averaged approximately 30,000 MWh. Assuming operation of the third unit produced 30,000 MWh of additional power annually, and 0.08 gallons of diesel per kWh at a cost of $4.70/gallon, the average annual cost of equivalent diesel generation of the additional power generated by the third unit would be $11,280,000.

In addition to the value of the energy produced, the third unit would provide hydro generating redundancy and operational flexibility. Maintenance could be done on a unit while still meeting energy demands. During the summer shutdown, all operating units are taken off-line to perform routine maintenance. Minimizing the length of time of this shutdown, directly correlates to a reduction in diesel generation.

6.0 ENERGY SOURCE ALTERNATIVES

Load that is not met by hydropower generation is provided by diesel generators. Diesel is expected to be the primary alternative source of energy in the near future.

7.0 CONSEQUENCES OF DENIAL OF THE APPLICATION

A denial of the amendment application would result in increased diesel generation in the SEAPA member communities, increasing cost to customers. Unstable diesel fuel prices vary, creating unstable electric rates that hinder economic development. In addition, diesel generation emits NOx and particulate matter negatively impacting the air quality in the vicinity of the diesel powerhouses and human health. Carbon discharges would also increase as a result of increased diesel consumption.

8.0 SOURCES AND EXTENT OF FINANCING

"A statement specifying the sources and extent of financing and annual revenues available to the applicant to meet the costs identified in paragraphs (e) (3) and (4) of this section."

Anticipated Project Funding:

- $4M, State of Alaska, Alaska Energy Authority (AEA) Round 16 Grant;

- $5M, Dept. of Energy (DOE) Section 247 Grant (In negotiation phase with Grid Deployment Office);
- $5M, State of Alaska Legislative Grant Match ;
- $2.5M Inflation Reduction Act (IRA) tax incentives program ($2-3M);
- $6M, an Existing SEAPA reserves.

9.0 COST OF DEVELOPMENT OF AMENDMENT APPLICATION

The licensee anticipates spending $1.2M on tasks related to the amendment preparation, inclusive of engineering design.

10.0 ON-PEAK AND OFF-PEAK VALUE OF PROJECT POWER

"The on-peak and off-peak values of project power, and the basis for estimating the values, for projects which are proposed to operate in a mode other than run-of-river;"

There is no on-peak versus off-peak price differential for Project power.

11.0 REFERENCES

United State Energy Information Administration. 2024. How much coal, natural gas, or petroleum is used to generate a kilowatt hour of electricity? Available Online: Frequently Asked Questions (FAQs) - U.S. Energy Information Administration (EIA). Access Date: September 19, 2024.

Wiseman, Shana. 2024. "Negotiation for Maintaining and Enhancing Hydroelectricity Incentive Section 247 of EPAct 2005 (DE-FOA-0003088)." September 5, 2024.

Tyee Lake Hydroelectric Project

FERC No. 3015

Exhibit E

Environmental Report

Tyee Lake Hydroelectric Project
(FERC No. 3015)

Application For License Amendment
For Major Project – Existing Dam

Exhibit E
Environmental Report

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ACRONYMS

A

ac	Acres
ACCS	Alaska Center for Conservation Science
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADOT&PF	Alaska Department of Transportation and Public Facilities
Advisory Council	Advisory Council on Historic Preservation
AEA	Alaska Energy Authority
AEIDC	Alaska Environmental Information and Data Center
AKEPIC	Alaska Exotic Plants Information Clearing House
AMHS	Alaska Marine Highway System
APA	Alaska Power Authority
APE	Area of Potential Effect
ASCE	American Society of Civil Engineers
AWC	Anadromous Waters Catalogue

B

BMP	Best management practices

C

°C	Degrees Celsius
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Commerce	U.S. Department of Commerce
CO	carbon monoxide
CWA	Clean Water Act
CZMA	Coastal Zone Management Act

D

DLA	Draft License Application
DNR	Department of Natural Resources
DO	dissolved oxygen
DPS	distinct population segment

E

EFH	Essential Fish Habitat
El	elevation
EJ	environmental justice

ESA	Endangered Species Act
EV	Electric vehicle

F

°F	Degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FL	Fork length
ft	Feet or foot
FPA	Federal Power Act
fps	feet per second

H

hp	horsepower
HPMP	Historic Properties Management Plan
HUD	U.S. Department of Housing and Urban Development

I

Interior	U.S. Department of the Interior

K

KPU	Ketchikan Public Utility
kVA	kilovolt-ampere
kW	kilowatt

L

LUD	Land Use Designations

M

Mg/L	milligrams per liter
mi	mile
mm	millimeter
MMPA	Marine Mammal Protection Act
msl	mean sea level
MW	megawatt
MWh	Megawatt per hour

N

NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRCS	Natural Resource Conservation Service

NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen oxide
NRHP	National Register of Historic Places
NWI	National Wetland Inventory

O

OHW	ordinary high water
O&M	Operations and maintenance

P

PPT	Petroleum Product Terminal
PM	particulate matter
PME	Protection, mitigation and enhancement measure

R

RM	river mile
RPM	revolutions per minute

S

SEAPA	Southeast Alaska Power Agency
SEC	Southeast Conference
sq mi	square mile

U

UAF	University of Alaska Fairbanks
U.S.	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

W

WCA	Wetland Conservation Act
WSE	water surface elevation

1.0 INTRODUCTION

1.1 Application

Southeast Alaska Power Agency (SEAPA) is filing a draft application with the Federal Energy Regulatory Commission (Commission or FERC) for a Capacity-Related License Amendment to add an additional unit to the Tyee Lake Hydroelectric Project (FERC Project No. 3015) (Tyee Lake Project or Project). The 20-megawatt (MW) project is located at the head of Bradfield Canal, approximately 40 miles southeast of Wrangell, 70 air miles southeast of Petersburg, and 60 miles northeast of Ketchikan, Alaska (Figure 1-1).

The Tyee Lake Project started operation in May 1984 under a license issued by FERC in 1981 which expires July 2031. The Tyee Lake Project originally supplied power to the communities of Wrangell and Petersburg. In 2009, SEAPA completed the 57-mile-long Swan-Tyee Intertie (Intertie) connecting the Tyee Lake Project to SEAPA's Swan Lake Hydroelectric Project (FERC Project No. 2911) and the community of Ketchikan (Figure 1-1). Since completion of the Intertie and the Swan Lake Dam raise in 2017, the average annual generation at Tyee Lake has been 105,805 megawatt hours (MWh).

The Project boundary (Figure 1-2), including approximately 69 miles of overhead transmission line and 11 miles of submarine line extending from the switchyard near the head of Bradfield Canal to the Petersburg substation, contains 3,094 acres of federal, state, borough, and private lands. The Proposed Action would not affect the transmission line and no work would occur along the transmission line right-of-way. Therefore, this portion of the Project boundary is not analyzed within this application. The Project Area considered in this application consists of the non-transmission portion of the Project boundary and includes Tyee Creek, Hidden Creek, and Bradfield Canal.

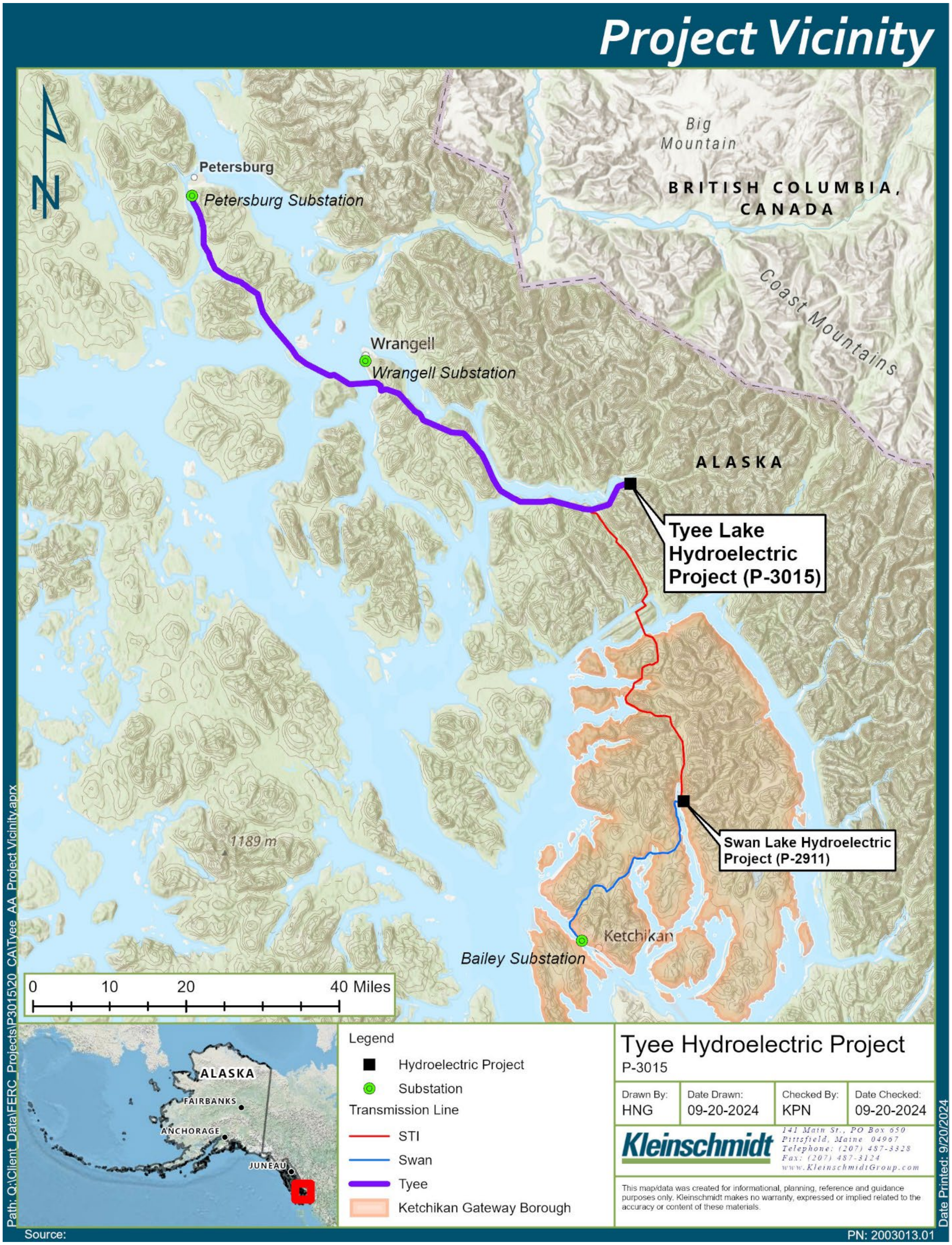

Figure 1-1 Project Vicinity.

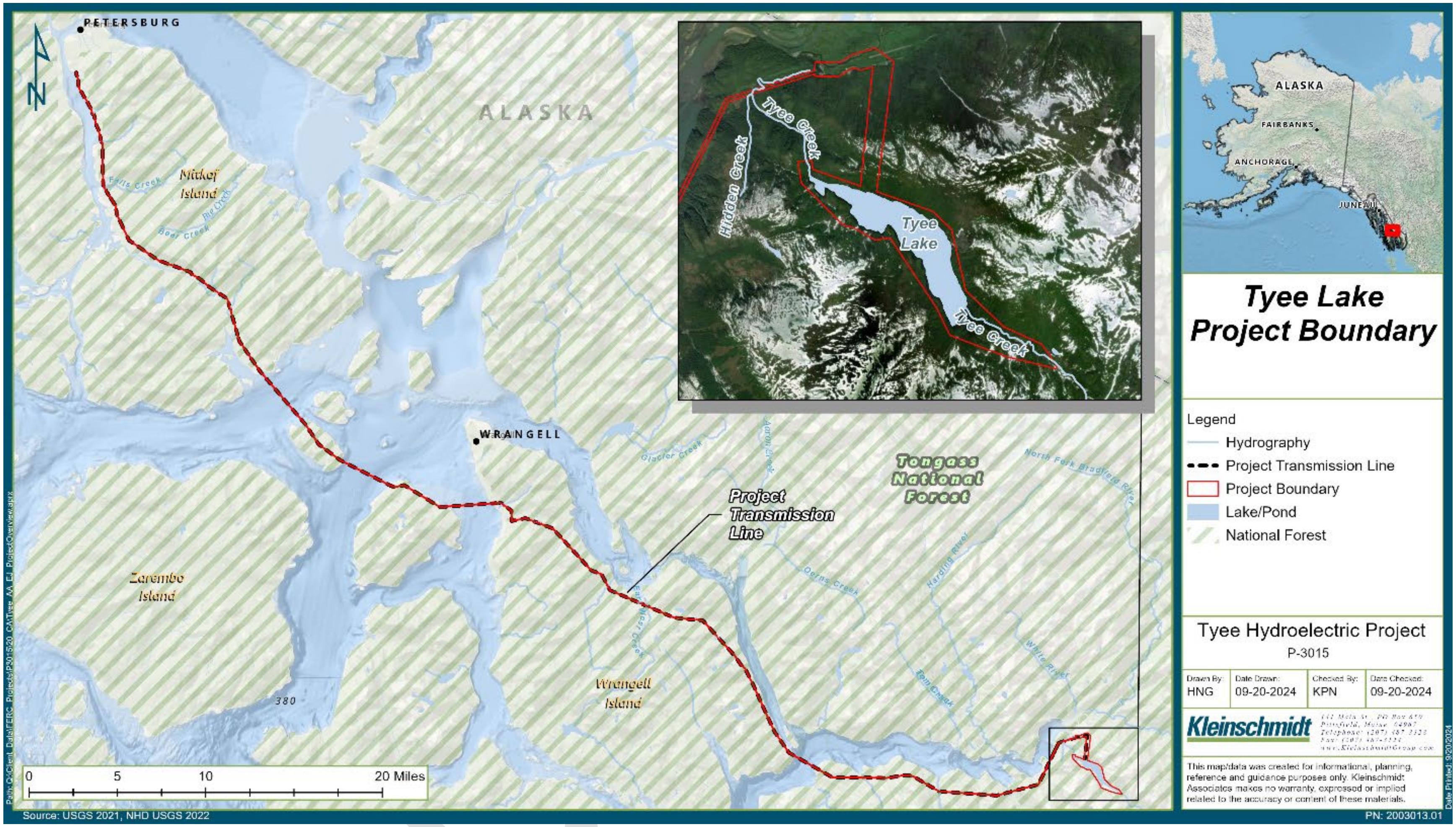

Figure 1-2 Tyee Lake Project Boundary.

1.2 Purpose and Need

1.2.1 Purpose of Action

This Draft Amendment Application addresses installation of a third generating unit at the Tyee Lake Project within an existing open bay at the powerhouse and a transformer within the switchyard as provided for during original construction. When constructed, the Tyee Lake Project provided for the near-term load needs of Wrangell and Petersburg but was designed and constructed with provisions to add a third generating unit (Third Unit) to meet future demands. The Tyee Lake Project at its full capacity was included as part of the Southeast Alaska Integrated Resource Plan (Black & Veatch and HDR 2012). Adding a third turbine would increase the Tyee Lake Project's installed capacity by 50 percent, for a total of 30 MW, which requires SEAPA to apply for a Capacity-Related License Amendment from FERC.

1.2.2 Need

The electricity demand of the communities of Wrangell, Petersburg, and Ketchikan currently exceeds the capacity of the region's hydroelectric projects, including SEAPA's Tyee Lake and Swan Lake projects, during portions of the year. The electricity demand that cannot be met by the hydro projects is provided by the community utilities through diesel generation. Any outage of one of the Tyee Lake generating units would require additional diesel generation to supply power to the communities; the current demand precludes unit cycling at Tyee Lake, negatively affecting the longevity of the equipment at Tyee. Moreover, as described below, there are several investments underway to support the continuing trend in Southeast Alaska of converting heating oil or electric baseboard to electric heat pumps and expansion of electric vehicles (EVs) that will further increase the demand for electricity within SEAPA's grid during Tyee Lake's current FERC license term. Foreseeable electrification of heating systems and transportation, and potential for shore power at cruise ship berths, would exceed the capacity of the hydro projects serving these communities.

Addition of the Third Unit at the Tyee Lake Project would provide added generation to meet current and future demands, reduce the need for and reliance on diesel generation, increase operational flexibility, increase reserves and system reliability, and provide redundancy to the two existing units.

Through a U.S. Environmental Protection Agency Climate Pollution Reduction Grant, Southeast Conference (SEC), the regional economic development organization for Southeast Alaska, is currently investing $38.6 million in the region to assist more than 6,000 households convert from residential oil-heating systems to energy-efficient heat pumps (SEC 2024 b). Alaska Housing Finance Corporation also plans to offer home energy rebates for converting electric resistance heat to energy-efficient heat pumps and replacing older heat pump units (C. Lister pers. comm. September 9, 2024).

In the last five years, the number of EVs registered in Southeast Alaska communities has doubled (Chugach Electric Association 2024). The relatively mild climates, small, isolated road systems, and high fuel costs are conducive to EV use in Southeast but most communities lack public EV charging infrastructure. To support EV adoption, the state is investing in charging infrastructure in the region through multiple programs. Using Volkswagen settlement funds, SEC is currently accepting applications for the Southeast Alaska EV Charging Station Implementation Program to install 6 to 10 publicly available level 2 chargers in Southeast communities where none currently exist (SEC 2024a). As part of the National Electric Vehicle Infrastructure formula program established by the Bipartisan Infrastructure Law, Alaska Energy Authority (AEA) and Alaska Department of Transportation and Public Facilities (ADOT&PF) developed the State of Alaska Electric Vehicle Infrastructure Implementation Plan (AEA and ADOT&PF 2022). Phase 2 of the state's plan, to be implemented from 2025 through 2027, includes investing approximately $15 million to install fast chargers in communities served by the Alaska Marine Highway System (AMHS); all three communities within SEAPA's grid are part of the AMHS served by state ferries. In addition, ADOT&PF and SEC were granted $38.5 million for a pilot study investigating the feasibility of replacing aging AMHS ferry vessels with low emission or electric ferries (ADOT&PF 2022).

Because Tyee Lake was designed and constructed with provisions for a Third Unit, it is cost-effective and the least environmentally damaging alternative for meeting the growing energy demand in the region. As proposed, the addition of the Third Unit would not require modifying the upper or lower operating range of Tyee Lake, increasing the storage capacity at Tyee Lake, or obtaining additional water rights.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 Existing Facilities and Operations

Tyee Lake is a natural lake with a drainage area of approximately 14.4 square miles (sq. mi.). Water from Tyee Lake supplies the hydroelectric project via a lake tap. The Project boundary is 3,094 acres and contains Tyee Lake, intake structure, spillway weir, power tunnel and penstocks, powerhouse, tailrace, switchyard, crew housing, maintenance buildings, airstrip, docks and ramps, bulkhead for barge access, and transmission lines (Figure 2-1 and Photo 2-1).

Per the FERC License, the normal full pool elevation is 1,396 feet (ft) mean sea level (msl) (FERC 1981). The Project is operated between the normal full pool elevation and a minimum surface elevation of 1,250 ft, providing a usable storage capacity of 52,400 acre-feet (ac-ft). At normal full pool, Tyee Lake has a surface area of approximately 481 acres (ac) (TerraSond 2009). A spillway weir was constructed in 2013 at the natural outlet of Tyee Lake to measure outflow into Tyee Creek to comply with License Article 8 (Photo 2-2). Based on a U.S. Geological Survey (USGS) survey completed in 2020, the elevation of the weir invert is 1398.3 ft (USGS 2020).

An intake structure, located on the northern shore of Tyee Lake approximately 2,000 ft east of the natural outlet of Tyee Lake at an approximate elevation of 1,225 ft, directs water through an unlined power tunnel that extends in a north-northwest direction for 8,300 ft to a 1,350-ft-long steel penstock to the powerhouse located near tidewater at the Bradfield Canal.

The penstock trifurcates within the powerhouse, where the first two portions connect to turbine-generating units 1 and 2. The third leads to a closed valve in the existing empty bay within the powerhouse. The powerhouse contains two horizontal-axis, Pelton-type (impulse) turbines, each operating at 720 revolutions per minute (rpm) with a rated capacity of 16,750 horsepower (hp) and 12,500 kilovolt-ampere under a net effective head of 1,306 ft. The total installed capacity is 20,000 kilowatts. The units operate at average net heads ranging from 1,163 to 1,384 ft.

The powerhouse discharges water into the tailrace channel, which extends approximately 1,100 ft from the powerhouse to Airstrip Slough, a small natural intertidal side channel of

Hydro Creek, which enters Bradfield Canal about 0.5 miles east of where Hidden Creek enters Bradfield Canal. The entire tailrace channel is intertidal. The normal tailwater elevation fluctuates with the tides, and typically ranges from elevation 22 to 24 ft in the upper concrete portion of the tailrace under the powerhouse, and a few feet lower near Airstrip Slough downstream of the powerhouse. The tailrace was constructed to accommodate the operation of three turbines operated at full capacity.

Generated power is delivered to a switchyard and substation 200 ft west of the powerhouse. Power is delivered to the north along approximately 68.1 miles of overhead transmission line and 11.4 miles of submarine cables which interconnect to the communities of Wrangell and Petersburg. Power is also delivered in a southerly direction to the community of Ketchikan through the 57-mile-long Swan-Tyee Intertie that was completed in 2009.

The Tyee Lake Project is operated as a conventional hydroelectric plant and, since completion of the Swan-Tyee Intertie, it has been operated in conjunction with the Swan Lake Project. Because of the generational flexibility required in this closed-loop system, water levels in Tyee Lake vary based on loads and inflow to the system. Under current operations of the two turbines, more than 90 percent of the inflow into Tyee Lake is diverted to the powerhouse. When the facility is operated at capacity, Tyee Lake may be drawn down approximately 135 ft to 140 ft below the normal lake surface level, with the lowest levels occurring in spring prior to snowmelt. Under normal water years, the lake refills during the summer months and peaks during late summer or fall but is not expected to spill into the lake's outlet stream except during heavy rainfall events. When inflow causes Tyee Lake elevations to exceed 1,398.3 ft, excess water is spilled over the weir at the natural outlet of Tyee Lake into Tyee Creek. Between 2017 and 2023, spill occurred during four years for a total of 2 to 130 days per year. There are no minimum flow requirements into Tyee Creek, however, substantial unmeasured flow enters Tyee Creek at the natural Tyee Lake outlet underneath and around the weir when lake elevations exceed approximately 1,360 ft.

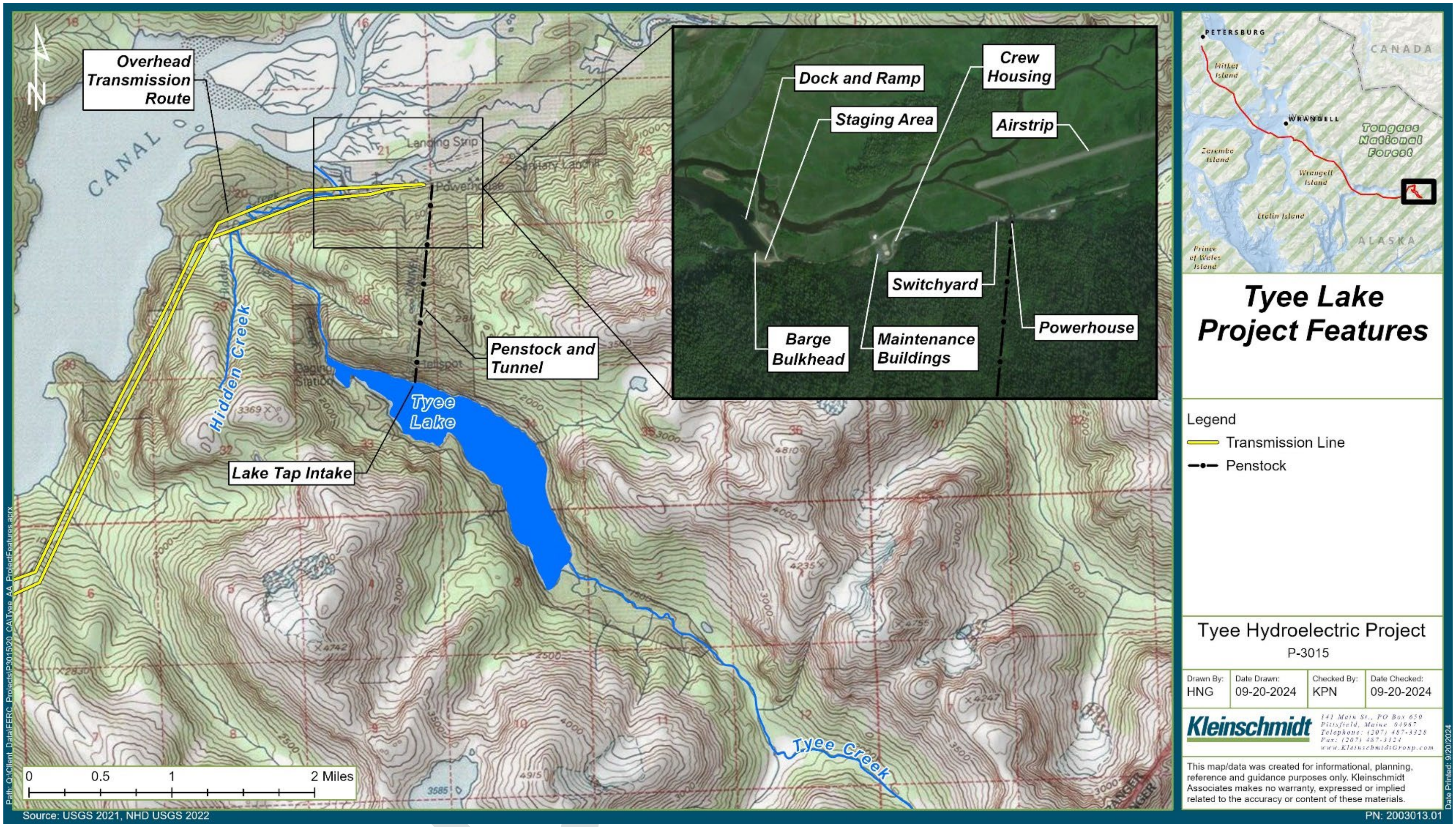

Figure 2-1 Tyee Lake Project Features.

Photo 2-1 Tyee Lake Hydroelectric Project Development.

Photo 2-2 Tyee Lake Spillway Weir.

2.2 Proposed Action

SEAPA is proposing to install a third Pelton-style turbine-generating unit (i.e., the Third Unit) in an existing empty bay at the existing powerhouse. The Third Unit would be rated at 12.5 MVA at 13.8 kV with a 0.9 power factor and a rated discharge of 117 cubic feet per second (cfs), producing 10 MW at 0.90 power factor (12.5 MVA); SEAPA is also proposing a new transformer in the existing switchyard. The capacity of the Tyee Lake Project would increase by 50 percent, from 20 MW to 30 MW with the additional unit. SEAPA would operate the Third Unit to maximize output from SEAPA hydro facilities and optimize water resources and efficiency of the generating units to better manage peak loads, meet growing energy demands, and reduce the need for diesel generation. The Proposed Action would occur within the Project boundary and involve the existing powerhouse, electrical substation, maintenance buildings, access road, staging and laydown areas, airstrip, barge bulkhead, dock and ramp, and contractor housing.

The existing Project was designed and constructed with provisions for the third turbine. There would be no change to Tyee Lake levels (1,250 ft to 1,398.3 ft elevation), usable storage capacity (52,400 ac-ft), power tunnel, penstocks, or tailrace. Construction activities would occur within the existing powerhouse, the footprint of the existing switchyard, and developed areas within the immediate vicinity. Construction activities would not require new ground disturbance, new roads or staging areas, removal of vegetation, or need for placement or discharge of dredged and/or fill material into waters of the U.S. There would be no construction in the tailrace and no work conducted below the ordinary high water (OHW) level of Airstrip Slough.

Equipment and supplies would be barged up the Bradfield Canal to an existing barge bulkhead on site. Transportation up the Bradfield Canal would occur during high tides. It is expected that there would be five to six barge trips from Wrangell in late spring/early summer to complete the Proposed Action. Barges would be off-loaded by forklift or front-end loader already on site. Equipment and materials may be temporarily placed in the existing staging area near the barge bulkhead or transported directly to the powerhouse area using the existing road. No ground-disturbing activities or upgrades to the existing roads or staging areas are anticipated.

Most of the installation work would occur within the existing powerhouse. A small concrete batch plant or mix trucks from Wrangell may be barged in to the site. Concrete work may last up to a total of two weeks depending on the type of turbine installed.

Concrete footings for the third transformer would be installed within the existing switchyard footprint.

Up to approximately 15 workers may be on site at one time. Construction workers would be either flown to the airstrip or transported to the dock or barge bulkhead by private ferry. Construction crew and engineers would be housed in SEAPA's existing onsite bunkhouse or at existing U.S. Forest Service (USFS) cabins under SEAPA's Special Use Permit. It is anticipated that commissioning would occur within a year of initiation of construction activities.

SEAPA would continue to operate Tyee Lake within the same lake level elevations as the current license (1,250 ft to normal full pool) and would coordinate operation of the Tyee Lake and Swan Lake hydroelectric projects to maximize output and optimize water resources. Operation of the Third Unit would occur in parallel with the two existing units to allow the usable capacity of Tyee Lake to be better used to meet system needs which may occur at different times than current operations without resulting in an increase in annual water used for generation. Operation of three units at Tyee Lake would also allow SEAPA to capture water that would have otherwise been spilled to meet demand, which would increase the volume of Tyee Lake water used for generation. SEAPA currently has water rights permits to use 135,000 ac-ft of Tyee Lake water annually for purposes of hydroelectric power generation. Operation of the three units would not exceed SEAPA's existing annual water rights. Water spills from Tyee Lake over a weir into Tyee Creek when the lake level reaches 1,398.3 ft elevation. Spill does not occur every year. Under current operations (2017-2023), spill has occurred in above-average water years (2020-2022) during precipitation events when the lake was full. Spill did not occur in below-average years (2018-2019) or average year 2017 and occurred on 2 days in 2023 with minimal amount of water on each occurrence.

2.1 No Action Alternative

Under the No Action Alternative, a Third Unit would not be installed at the Tyee Lake Project. Operations would continue as currently permitted. Load in excess of SEAPA's current capacity would continue to be provided via diesel generators. The recent and projected increased demand for electricity would make the use of diesel generators more frequent. If a unit outage occurs at the SEAPA Project, all power would need to be provided by diesel generators. Under the No Action Alternative, resiliency of the grid would be reduced compared to the Proposed action.

Additionally, the No Action Alternative may affect environmental justice (EJ) in communities within areas surrounding the locations of the diesel generators. Increased use of the generators requires additional fossil fuel inputs, further exacerbating climate change, and potentially decreasing the area's climate resiliency and access to electricity going forward if the region were to become dependent on the generators to meet energy demands. Diesel generators also produce emissions that hydropower does not produce, resulting in air quality degradation, including an increase in airborne particulate matter (PM), nitrogen oxides (NOx), and carbon monoxide (CO) (Vital Power n.d.). The increase in concentration of these pollutants would not be temporary and would get worse over time, potentially causing cumulative effects to EJ communities nearby. In addition, energy produced by diesel is more costly than hydropower and the cost of diesel fluctuates with market rates, generally trending upward over the long term. Disadvantaged communities and low income households would be most impacted by increases in energy rates from additional diesel generation under the No Action Alternative.

The No Action Alternative would not significantly affect resources with exception of EJ resources, as such the No Action Alternative is not discussed for each resource below. The effects of the No Action Alternative on Environmental Justice are discussed in Section 4.10 below.

2.2 References

Alaska Department of Transportation and Public Facilities (ADOT&PF). 2022. Low Emission and Electric Ferry Research Project Selected for DOT&PF Funding. Press Release 22-0021. Issued May 2, 2022. https://dot.alaska.gov/comm/pressbox/arch2022/PR22-0021.shtml. Accessed September 6, 2024.

Alaska Energy Authority (AEA) and Alaska Department of Transportation and Public Facilities (ADOT&PF). 2022. State of Alaska Electric Vehicle Infrastructure Implementation Plan. https://www.akenergyauthority.org/Portals/0/Electric%20Vehicles/2022.07.29%20State%20of%20Alaska%20NEVI%20Plan%20(Final).pdf?ver=2022-06-29-152835-320. Accessed September 6, 2024.

Black & Veatch and HDR. 2012. Southeast Alaska Integrated Resource Plan. Prepared for Alaska Energy Authority. July 2012.

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Federal Energy Regulatory Commission (FERC). 1981. Final Environmental Impact Statement for the Tyee Lake Project FERC No. 3015 – Alaska. June 1981.

Southeast Conference (SEC). 2024a. Southeast Alaska Electric Vehicle Charging Station Implementation Program Request for Applications. RFA #2024-01. Issued February 16, 2024. https://www.seconference.org/wp-content/uploads/2024/07/RFA-2024-01-EV-Chargers.pdf.

SEC. 2024b. Alaska wins Climate Pollution Reduction Grant, awarded $38.6M for heat pumps. Press Release issued July 22, 2024. https://www.seconference.org/wp-content/uploads/2024/07/CPRG-NEWS-RELEASE-v4.pdf.

TerraSond, Ltd. 2009. Tyee Lake Bathymetric Survey Hydrographic and Topographic Survey Report. Prepared for Southeast Alaska Power Agency. September 25, 2009.

U.S. Geological Survey. 2020. Tyee Lake Gage and Power House Survey, 1992-2019. Prepared by R. H. Host and E. H. Moran.

Vital Power. N.d. The Environmental Impact of Diesel Generators. Available online: The Environmental Impact of Diesel Generators | Vital Power. Accessed September 3, 2024.

3.0 CONSULTATION AND COMPLIANCE

3.1 Review and Consultation

SEAPA held initial conference calls to discuss the Proposed Action with several key agencies. Representatives from National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries or NMFS), U.S. Fish and Wildlife Service (USFWS), and Alaska Department of Fish and Game (ADF&G) attended a call on August 15, 2024. A second meeting was held on September 25, 2024, with a representative of the USFS. At each conference SEAPA provided an overview of the Tyee Lake Project, the Proposed Action, and schedule and presented a proposed expedited license amendment process due to the anticipated minimal potential effects of installing and operating the Third Unit.

Additional agency consultation will be documented in the Final Amendment Application.

3.2 Regulatory Compliance

3.2.1 Water Rights

SEAPA currently has two water rights permits from the Alaska Department of Natural Resources (DNR; permit #'s: ADL100887 and LAS 27045) for the use of 135,000 ac-ft of Tyee Lake water annually for purposes of hydroelectric power generation. SEAPA's existing water rights are sufficient to make installation of the Third Unit viable. Following approval of this amendment application, SEAPA will work with the DNR to finalize the details of its water rights to ensure continued compliance.

3.2.2 Clean Water Act (CWA)

Under section 401(a)(1) of the Clean Water Act, 33 U.S.C. § 1341(a)(1), a license applicant must obtain either a water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the Clean Water Act, or a waiver of the certification by the appropriate state agency. The failure to act on a request for certification within a reasonable period of time, not to exceed one year after receipt of the request, constitutes a waiver.

For the existing Tyee Lake Project, the Alaska Department of Environmental Conservation (ADEC) found no evidence of significant adverse effects on waters of the U.S. from construction and operation of the original Project and therefore decided not to act on the water quality certificate application (FERC 1981). Since then, on August 10, 1999, ADEC filed a letter with FERC waiving all water quality certifications for FERC jurisdictional hydroelectric projects in Alaska. Pursuant to State law, the State of Alaska does not issue 401 certifications for hydropower projects. Nonetheless, SEAPA will consult with ADEC to seek confirmation that the Proposed Action will be waived from certification.

3.2.3 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a hydropower project within or affecting a state's coastal zone unless the state's coastal zone management 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 6 months of its receipt of the applicant's certification.

The federally approved Alaska Coastal Management Program (ACMP) expired on July 1, 2011, resulting in Alaska's withdrawal from the CZMA's National Coastal Management Program. On July 7, 2011, NOAA issued a notice regarding the ACMP withdrawal from the CZMA program. There is no state department in effect to apply for a determination of consistency and section 307 of the CZMA does not currently apply in Alaska.

3.2.4 Section 18 Fishway Prescription

Section 18 of the FPA, 16 U.S.C. § 811, states that the Commission is to require a licensee to construct, operate, and maintain fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce (Commerce) for anadromous salmon species or the U.S. Department of the Interior (Interior) for non-salmon fish species.

Tyee Lake is a naturally formed lake. The Tyee Lake Project does not impede anadromous fish migration because it is several miles upstream of an anadromous fish passage barrier located approximately 460 ft from the mouth of Hidden Creek that prevents upstream fish passage (ADF&G 2018).

While resident fish species have been documented in Hidden Creek above the falls, Tyee Creek from its confluence with Hidden Creek upstream to Tyee Lake is categorized as a

Class 3 non-fish-bearing stream by the USFS (USFS 2024). Arctic grayling (*Thymallus arcticus*) eggs and fry were stocked in Tyee Lake by ADF&G in the 1960s (ADF&G 2018). No other fish species were known to occur in the lake (FERC 1981). Prior to constructing the original Project, it was proposed to move the grayling to another lake. However, these plans were abandoned when the fish were sampled in 1982 and found to have bacterial kidney disease and enteric red mouth (ADF&G 2018). Opportunistic sampling of the lake by ADF&G in 2015 documented the presence of Arctic grayling in the lake (ADF&G 2018). Fish and aquatic resources are discussed further in Section 4.4.

No fishway prescriptions or reservations of authority were filed with FERC for the original Project. SEAPA will include a summary of any such prescriptions, or reservations of authority to prescribe fishways, if made for the Proposed Action, in the Final Amendment Application.

3.2.5 Section 10(j) Recommendations

Under section 10(j) of the FPA, 16 U.S.C. § 803(j), 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.

SEAPA will include a summary of any such recommendations, if made for the Proposed Action, in the Final Amendment Application.

3.2.6 Endangered Species Act

Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. The National Marine Fisheries Service (NMFS or NOAA Fisheries) has jurisdiction over ESA-listed species in the marine environment and anadromous fish species while USFWS has jurisdiction over terrestrial and freshwater species. ESA-listed species are discussed in Section 4.6.

No ESA-listed threatened, endangered, or candidate species occur within the freshwater or terrestrial portions of the Project area. According to the USFWS Information for

Planning and Conservation's (IPaC) official species list for the Tyee Lake Project Area, the only ESA-listed species under USFWS jurisdiction with a potential range in the area is the short-tailed albatross (*Phoebastria albatrus*), a seabird listed as endangered under the ESA in 2000 (USFWS 2024a). There is no critical habitat designated for this species (ADF&G 2024b). The short-tailed albatross spends most of its time at sea, is very rare, and has only a few active breeding colonies remaining, none of which occur in the state of Alaska. It is unlikely to occur within the Project Area or be affected by the Proposed Action (ADF&G 2024c, USFWS 2024b).

The Mexico Distinct Population Segment (DPS) of the humpback whale (*Megaptera novaeangliae*), listed as threatened under the ESA (81 FR 62259, September 2016), occurs in the marine waters of Southeast Alaska (NMFS 2021, ADF&G 2024b). Humpback whales are common in Southeast Alaska; the probability of an encountered humpback whale being from the Mexico DPS is 2 percent (NMFS 2021). ESA-listed whales have a low likelihood of being present between Wrangell and Bradfield Canal and are not likely present in the very shallow intertidal areas at the head of the canal.

SEAPA will request to be FERC's Designated Non-Federal Representative pursuant to the ESA to consult with the USFWS and NMFS regarding any listed and candidate species. A summary of consultation and any recommendations, if made, will be included in the Final Amendment Application.

3.2.7 Marine Mammal Protection Act of 1972

This act protects all marine mammals, prohibiting "take" in U.S. waters and by U.S. citizens on the high seas, and import of marine mammals and marine mammal products into the U.S.

Marine mammals are common in Southeast Alaska. Information on the species potentially present in the vicinity of Bradfield Canal is provided in Section 4.5. The Proposed Action is expected to have minimal effects on marine mammals.

3.2.8 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) mandates consultation with NMFS for any activities that "may adversely impact" Essential Fish Habitat (EFH) for federally managed marine, estuarine, and anadromous fish species. Water bodies used by salmon, historically or currently, are included as EFH. The

ADF&G's Anadromous Waters Catalog (AWC) designates EFH for salmonids in Alaska. A stream, river, or lake are included in the AWC because they "*are important to anadromous fish species and therefore afforded protection under the [Anadromous Fish Act] AS 16.05.871*" (ADF&G 2024). AS 16.05.871 requires ADF&G to "specify," or list, "t*he various rivers, lakes, and streams or parts of them that are important for the spawning, rearing, or migration of anadromous fish.*" It also requires anyone wanting to construct a hydraulic project; use, divert, obstruct, pollute, or change the natural flow or bed of a specified water body; or operate a vehicle in these specified water bodies to contact ADF&G for written approval before beginning the construction, activity, or use.

Bradfield Canal has been designated EFH for various life stages of Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye salmon (*O. nerka*). The Alaska AWC lists the lower approximately 460 ft of Hidden Creek (AWC Stream No. 107-40-10538) as providing habitat for chum, coho, and pink salmon (ADF&G 2024a). The tailrace (Tailrace Creek AWC Stream No. 107-40-10537-2008) and Hydro Creek (AWC Stream No. 107-40-10537) are listed for presence of chum and pink salmon and rearing coho salmon (ADF&G 2024a). EFH is discussed further in Section 4.4.1.2.

The Proposed Action is not anticipated to affect EFH in the Bradfield Canal or the listed anadromous waters. SEAPA will request to be FERC's Designated Non-Federal Representative pursuant to the Magnuson-Stevens Act to consult with NMFS regarding EFH. A summary of consultation and any recommendations, if made, will be included in the Final Amendment Application.

3.2.9 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, requires that a federal agency consider how 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 or NRHP).

SEAPA will consult with the Alaska State Historic Preservation Office (SHPO) and local Alaska Native tribes to determine any potential effects of the Proposed Action on cultural or historic resources. A summary of consultation and any recommendations, if made, will be included in the Final Amendment Application.

3.3 References

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4.0 ENVIRONMENTAL ANALYSIS

4.1 General Description of the River Basin

4.1.1 Major Land and Water Uses

The Tyee Lake Project is located on the mainland in a remote area of Southeast Alaska, approximately 40 mi southeast of Wrangell. The non-transmission portion of the Project occupies state land and the transmission line transverses primarily Tongass National Forest and state lands, with a short section occupying City of Wrangell and Cook Inlet Regional Corporation-owned lands. The major land use within the FERC project boundary is electric generation from the Tyee Lake Project and transmission to Wrangell, Petersburg, and Ketchikan.

The state land is surrounded by Tongass National Forest which is managed under the guidance of the 2016 Tongass Land and Resource Management Plan (Tongass Plan) and the delineated Land Use Designations (LUDs; USFS 2016). The Tongass Plan includes specific guidelines and goals for each of the LUDs, for transmission line and energy projects, and vegetation and wildlife management approaches. The adjacent USFS land surrounding Tyee Lake is classified as Remote Recreation. Tyee and Hidden creeks flow through the Semi-Remote Recreation LUD. The management objective of these LUDs is to provide for recreation in remote or natural-appearing settings where opportunities for solitude and self-reliance are high or moderate to high, respectively (USFS 2016). The USFS land to the east of the Project Area is managed for Timber Production.

4.1.2 Climate

Tyee Lake is located in a maritime climate zone (UAF 2024). Weather conditions vary in this area due to the complex mountainous terrain. Summers are usually cool and cloudy with moderate temperatures ranging from an average of 47 to 64 °F between June and September (UAF 2024, U.S. Climate Data 2024) Winter temperatures range from an average 30 to 44 °F between November and March. Precipitation is highest between the months of September to January and the average annual precipitation is 141 inches (U.S. Climate Data 2024). Heavy snowfall occurs along the coasts, including the Tyee Lake drainage area, due to the moisture rich air being lifted over the coastal mountains. Winds are strongly affected by the local landscape features, ocean temperature contrast and pressure systems moving across the area. High winds are more common in the fall and winter compared to the spring and summer (UAF 2024).

4.1.3 References

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4.2 Geological and Soil Resources

4.2.1 Affected Environment

The Tyee Lake Project is located within the Bradfield Canal in the southwestern portion of the Coast Mountains. The Project is sited in rugged mountainous terrain, altered by glaciation. The area has steep mountains with deep U-shaped valleys and fjords. Features tend to align northwestward, parallel to gneissic banding in bedrock (Callahan and Wanek 1969 as cited in FERC 1981).

Tyee Lake is a naturally formed lake that sits in a glacially scoured bedrock basin about 1,400 ft above the Bradfield Canal (APA 1979). The shorelines are steep, rising at 50-to-70-degree angles to an average elevation of 3,500 ft with several nearby peaks reaching just under 5,000 ft (FERC 1981). Tyee Lake drains from the north end through the deep and narrow gorge of Tyee Creek.

The Tyee Lake Project is within the Tracy Arm terrane, a batholithic complex in Southeast Alaska’s Coast Range Mountains (APA 1979). When the granitic rocks were intruded, they were granitized and magmatized, fractured and injected, faulted and folded, and highly regionally metamorphosed (APA 1979). Because of the high metamorphism, the igneous and metamorphic geology is difficult to differentiate near Tyee Lake (APA 1979). Most of the rocks at Tyee Lake likely have the chemical and mineralogical composition of a quartz diorite, though the texture and appearance are highly variable (APA 1979).

The bedrock at the Tyee Lake Project is dense, impermeable igneous and metamorphic rock. The igneous rocks, part of the Coast Range batholith, includes quartz diorite, granodiorite, and hornblendite; and the metamorphic rocks are a composite gneiss (FERC 1981). The 1979 field investigations conducted for the License Application further divided the quartz diorite into two categories: massive homogeneous quartz diorite with little to no foliation and distinctly foliated and/or lightly banded quartz diorite (APA 1979). Rocks considered gneiss were heavily banded, with alternating layers of light schistose and dark crystalline mineralization, of both igneous and metamorphic origin (APA 1979). The hornblendite, less resistant to erosion than other rock types at the Project, is a coarse-grained rock composed of 75 to 100 percent euhedral black hornblende with up to 25 percent interstitial plagioclase (APA 1979).

Sediments at the surface at the Tyee Lake area include alluvial and glaciofluvial sediments, rock and landslide debris, talus, fanglomerate, colluvium, organics and some man-made fill (APA 1979). Glacial deposition in the alluvial valley at the head of Tyee Lake is primarily sandy gravels and perhaps coarser deposits at depths (APA 1979). The margins of Tyee Lake and the valley of Bradfield Canal include numerous rockslide and landslide deposits carrying talus deposits and large rubble (APA 1979).

Soils are relatively young and of shallow depth in the Tyee Lake area; 1 to 3 ft of organic material is present in typical soil profiles and directly overlies bedrock or talus and rubble (APA 1979). The organic layer of material develops down to a dark moist peat, overlaying a poorly developed A-horizon, which is only present where there are fine-grained soils (APA 1979). Alluvial valley fills, such as the Tyee Lake inlet area, have a more natural soil profile and consist of sandy gravels, are well drained, and support more vegetation (APA 1979).

U.S. Department of Agriculture Natural Resource Conservation Service (USDA NRCS) soil types mapped near the Project are listed in Table 4-1 below. Soils near the powerhouse and tailrace are NRCS type "80 - Cryaquents-Cryaquepts complex, 0 to 3 percent slopes" (USDA NRCS 2024). Cryaquents and Cryaquepts soil types occur in deltas and depressions, in concave areas, and have alluvium parent material; their composition is typically silt loam or loam and they are poorly drained (USDA NRCS 2024). Soil types 11D and 36B occur on the hillside adjacent to the powerhouse area, rather than the flat lowlands the Powerhouse is sited on (Table 4-1).

Table 4-1 USDS NRCS Soil Types near the Project.

Location	NRCS Soil Type	
Lowlands Near Powerhouse	80	Cryaquents-Cryaquepts complex, 0 to 3% slopes
	11D	Kupreanof-Tolstoi association, 35 to 75% slopes
	36B	Kupreanof silt loam, 5 to 35% slopes
Surrounding Tyee Lake	410X	Lithic Cryosaprists-Lithic Humicryods association, 15 to 120% slopes, alpine
	411X	Typic Cryumbrepts, loamy-skeletal, 15 to 75% slopes
	415X	Cryofluvent and Typic Cryaquent soils, 0 to 15% slopes, alpine
	422X	Lithic Cryaquods-Lithic Cryosaprists association, 35 to 120% slopes
	425X	Typic Humicryods-Typic Cryumbrepts, loamy-skeletal complex, 15 to 75% slopes
	436X	Lithic Humicryods, 75 to 120% slopes
	437X	Cryaquods-Lithic Humicryods complex, 5 to 35% slope

Source: USDA NRCS 2024

Landslides and other forms of soil mass movement are common throughout the area, as slopes have been over-steepened by glacial erosion and other geologic influences and are often steeper than the stable angle for the slope materials (FERC 1981). Mass movement typically occurs during or after periods of heavy rainfall or during snowmelt when soils are saturated (FERC 1981).

Alaska is the most seismically active state in the U.S. so earthquakes at the Tyee Lake Project are possible. However, the Wrangell area has a relatively low chance of having a damaging earthquake in the next 100 years (USGS 2024a). A magnitude 7.1 to 7.6 earthquake occurred in 1972 near Sitka, about 175 miles from the Tyee Lake Project (APA 1979). None of the geologic faults near the Project are considered active (FERC 1981). A ground motion of 0.1 gravitational acceleration is estimated for an earthquake event that has a 2 percent probability of exceedance in 50 years (approximate return period of 2,475 years) (ASCE 2024). The mean earthquake magnitude associated with this return period is magnitude 6.9 (USGS 2024b).

The 370-mile-long Coast Range lineament is the closest recognized major fault structure near the Tyee Lake Project, traversing the whole length of the Southeast Alaska panhandle (APA 1979). There is no evidence of recent movements along the lineament (APA 1979). The Coast Range lineament runs west of Tyee Lake through the Eagle River valley and delineates the boundary between the Taku and Tracy Arm terranes (APA 1979).

4.2.2 Environmental Analysis

4.2.2.1 Construction

The Proposed Action would have no effect on geology or soil resources at the Tyee Lake Project, as no new ground disturbing activities would occur. All construction activities would occur on existing laydown areas and roads, or within the existing powerhouse footprint. Barge activity would have no effect on geological and soil resources.

4.2.2.2 Project Operations

Operation of the Tyee Lake Project as proposed would have no effect on geology and soil resources around Tyee Lake. Tyee Lake drawdown rates may be more rapid at times with the operation of all three turbines but the Project would continue to be operated between the existing full pool elevation and the minimum allowable surface elevation of 1,250 ft as has occurred since operations began in 1984. The intertidal tailrace was designed and constructed to accommodate the discharge from the operation of all three turbines at full capacity. Operation of all three turbines would not cause erosion along the side slopes of the tailrace or overflow to the adjacent areas.

4.2.3 Applicant-Proposed Measures

No applicant-proposed measures for geological or soil resources are anticipated for this proposed capacity amendment.

4.2.4 References

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4.3 Water Quality and Quantity

4.3.1 Affected Environment

4.3.1.1 Overview

Tyee Lake is part of the 16.1 sq mi Hidden Creek watershed (USGS 2016). Tyee Lake is a natural lake that drains a 14.4-sq mi area (USGS 2016) that ranges in elevation from approximately 1,250 to 5,005 ft msl. The watershed, primarily covered by dense coniferous forest below the alpine, feeds water into Tyee Lake. The lake is located at the lower end of a northwest-trending glacial valley which extends approximately 6 miles above the lake outlet (IECO 1979).

A spillway weir was constructed in 2013 at the natural outlet of Tyee Lake (Photo 2-2) to measure outflow into Tyee Creek to comply with License Article 8. The elevation of the weir invert is 1398.3 ft (USGS 2020). Based on a Tyee Lake bathymetry survey completed in 2009, Tyee Lake has a surface area of approximately 481 ac and a gross storage of 86,660 ac-ft at normal full pool (TerraSond 2009).

From the Tyee Lake outlet, Tyee Creek extends approximately 1.2 mi through a steep-gradient canyon until its confluence with Hidden Creek, which flows northeast about 1 mi before entering a slough of the Bradfield Canal (ADF&G 2018).

The intake structure is located on the northern shore of Tyee Lake, approximately 2,000 ft east of the natural outlet of Tyee Lake, at an elevation of approximately 1,225 ft. Water from Tyee Lake is diverted through the intake structure into a drop shaft, and through an unlined power tunnel extending 8,300 ft to a 1,350-ft-long steel penstock to the powerhouse. The powerhouse discharges water into the tailrace, which extends approximately 1,100 ft to Airstrip Slough, a small natural intertidal side channel of Hydro Creek that flows into Bradfield Canal about 0.5 mi east of where Hidden Creek enters Bradfield Canal (FERC 1981).

Bradfield Canal is a tidally influenced inlet that extends approximately 19 mi west from the Bradfield River to Earnest Sound, approximately 30 mi southeast of Wrangell. Depths in Bradfield Canal reach over 200 ft but are very shallow in the vicinity of the Project (NOAA 2011). The area's hydrology is influenced by significant semi-diurnal tidal fluctuations in Bradfield Canal.

4.3.1.2 Water Quantity

4.3.1.2.1 Inflow to Tyee Lake

There are currently no gages that record the inflow into Tyee Lake or the amount of water available for generation. There was a USGS gage (USGS Gage No. 15020100) that operated August 1, 1963, to September 29, 1969, at the mouth of Hidden Creek near Bradfield Canal, downstream from Tyee Lake and Tyee Creek's confluence with Hidden Creek representing a drainage area of 16.1 square miles. Through correlation with concurrent records available for the Harding River USGS Gage (located about 5 mi west of the mouth of Tyee Creek), records for flow at the mouth of Hidden Creek were expanded to cover water years 1952 through 1978 and inflow from Tyee Lake was then synthesized from drainage area proportioning and adjusted for elevation and runoff differences between the upper and lower portions of the basin (IECO 1982). The estimated mean monthly and daily discharge from Tyee Lake across the period of record is presented in Table 4-2.

Runoff from spring snowmelt and seasonal precipitation is the primary water source for Tyee Lake, as no glaciers are present within the watershed. Approximately 70 percent of the runoff in the Tyee Lake basin occurs from June through October (IECO 1982). Historical mean monthly flows peaked in June, July, September, and October, and were lowest in February and March, highlighting the seasonal variability in water availability. The runoff pattern shows a high volume of flow occurring during June and July, the magnitude and duration of which depend on the depth of the snow in the basin, the temperatures during the melting season, and the occurrence of rain. Extremely high flows also occur in September and October, and to a lesser extent August, resulting from heavy rain events.

Table 4-2 Synthesized Average Monthly and Daily Discharge at Tyee Lake Outlet (1952-1978).

Month	Average Monthly Discharge (cfs)	Average Daily Discharge (cfs)
January	47	5.8
February	36	1.0
March	28	0.1
April	53	2.2
May	193	66.9
June	350	199.1
July	293	159.4

Month	Average Monthly Discharge (cfs)	Average Daily Discharge (cfs)
August	238	98.7
September	218	154.0
October	275	143.1
November	113	40.9
December	76	12.8
Annual	161	73.8

Source: IECO 1982.

Exceedance flows (Table 4-3) and an annual flow duration curve (Figure 4-1) were derived from the 7-year (1963 to 1969) daily flow record from USGS Gage 15020100 (USGS 2024b) at the mouth of Hidden Creek near Bradfield Canal. The hydrograph pattern at the mouth of Hidden Creek would be slightly different from the Tyee Lake outlet. The winter flow recorded at the mouth of Hidden Creek would primarily represent melting snow pack below Tyee Lake where the temperatures are lower and there would be less snowpack in the lower basin unlike the significant snowmelt runoff that occurs in June and July from the upper watershed above the Tyee Lake outlet (IECO 1982).

Table 4-3 Estimated Exceedance Flows at the Mouth of Hidden Creek Based on Data from USGS Gage 15020100 (August 1963 to September 1969).

Percent of Time Flow is Equaled or Exceeded	Daily Average Discharge (cfs)
5%	523
10%	433
20%	300
30%	226
40%	161
50%	112
60%	72
70%	48
80%	32
90%	21
95%	15

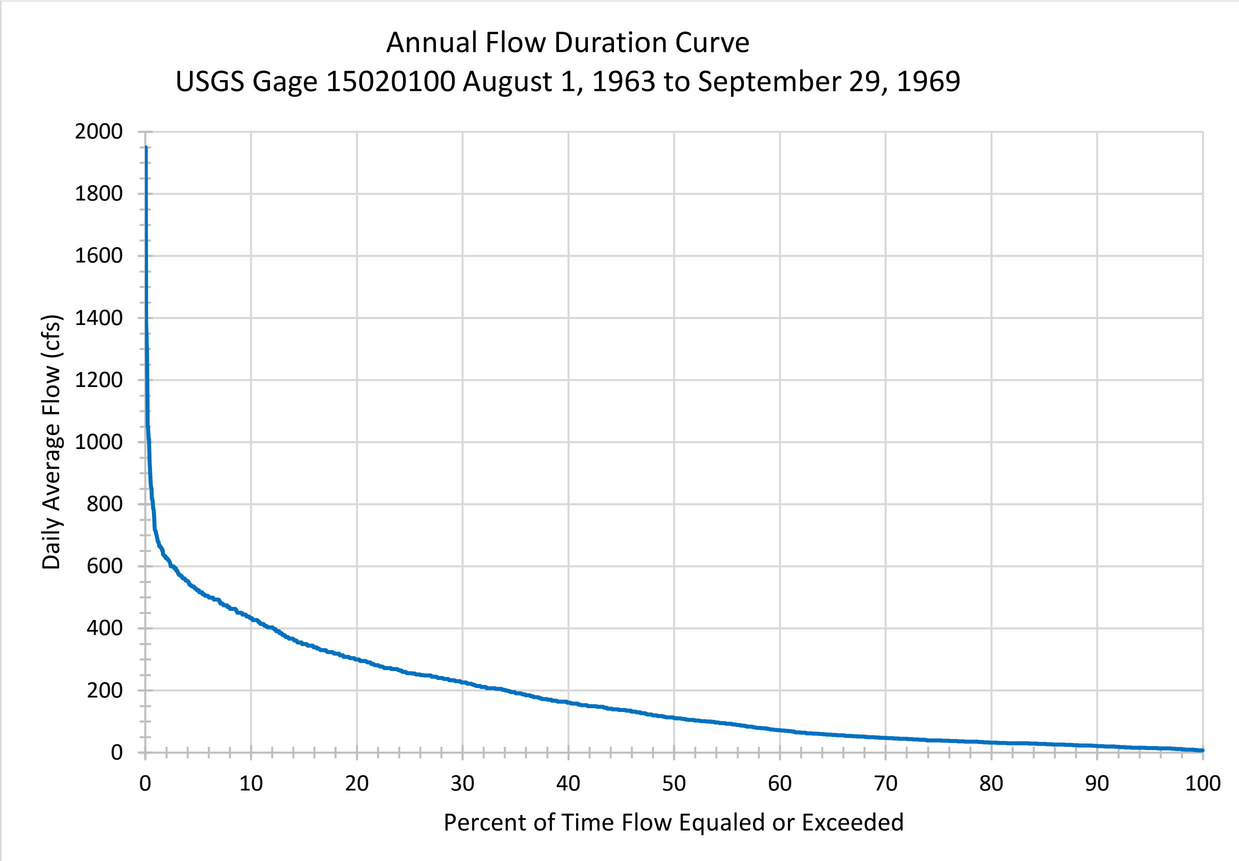

Figure 4-1 Annual Flow Duration Curve at Mouth of Hidden Creek from USGS Gage 15020100 (August 1, 1963, to September 29, 1969).

4.3.1.2.2 Outflow from Tyee Lake

Lake levels at the Tyee Lake Project range between 1,250 ft and the full pool at spillway weir invert elevation of 1,398.3 ft (USGS 2020) to store runoff during the summer and fall (mid-May through October) and release flows for power generation year-round. SEAPA has water rights permits to use 135,000 ac-ft of Tyee Lake water for hydroelectric power generation annually.

4.3.1.2.2.1 Tyee Lake Powerhouse

Water generation data, including the monthly minimum, mean and maximum discharge are provided in Table 4-4 from 2017 through 2022. The average monthly discharge ranged from 76 cfs (4,523 ac-ft) in June to 171 cfs (10,482 ac-ft) in December. Over the period of record, an average of 88,354 ac-ft of water was used for power generation annually.

Table 4-4 Monthly Discharge through Tyee Lake Powerhouse (2017 to 2022).

Month	Min(cfs)	Mean (cfs)	Max (cfs)	Mean (ac-ft)
January	47	154	226	9,480
February	47	157	212	8,758
March	20	139	212	8,522
April	41	136	216	8,080
May	35	97	170	5,981
June	0	76	158	4,523
July	56	116	188	7,158
August	48	112	177	6,885
September	1	82	184	4,899
October	0	93	138	5,724
November	78	132	195	7,860
December	97	171	222	10,482
Annual	**-**	**122**	**-**	**88,354**

4.3.1.2.2.2 Spillway Weir

A spillway weir was constructed in 2013 at the Tyee Lake outlet to comply with License Article 8 to measure Tyee Lake outflow. The weir was further modified in 2015 in an effort to reduce the amount of unquantified flow leaking under and around the weir to Tyee Creek. However, an unquantified flow to Tyee Creek continues to leak from underneath the weir or around the large boulders at the outlet when Tyee Lake elevations exceed approximately 1,360 ft.

USGS Gage 15019990 has measured Tyee Lake water surface elevations since 1979 (USGS 2024a). When Tyee Lake elevations exceed the spillway weir invert at 1,398.3 ft (USGS 2020), excess water is spilled over the weir into Tyee Creek. Spill typically occurs in response to precipitation events, the frequency and intensity of which are influenced by the El Nino Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO), as is the air temperature and demand for power. Spill does not occur during low-water years and may or may not occur during average water years.

Monthly minimum, mean, and spill data are provided in Table 4-5. Figure 4-2 shows the daily Tyee Lake surface elevations over a period of six years (2017 to 2022) representing current operations. Over the period of record, no spill occurred in 2017 (average year) or 2018–2019 (dry years). During above average water years (2020-2022), spill over the weir occurred from June through November. The monthly mean spill ranged from 7 cfs in

November to 80 cfs in August. Monthly maximum spill flows ranged from 350 cfs in November to 637 cfs in August.

Table 4-5 Monthly Discharge Spilled over Weir at Tyee Lake Outlet (2017 to 2022).

Month	Min (cfs)	Mean (cfs)	Max (cfs)	Average # Days of Spill
January	0	0	0	0
February	0	0	0	0
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	0	23	514	2
July	0	42	357	8
August	0	80	637	12
September	0	75	571	11
October	0	59	600	11
November	0	7	350	2
December	0	0	0	0

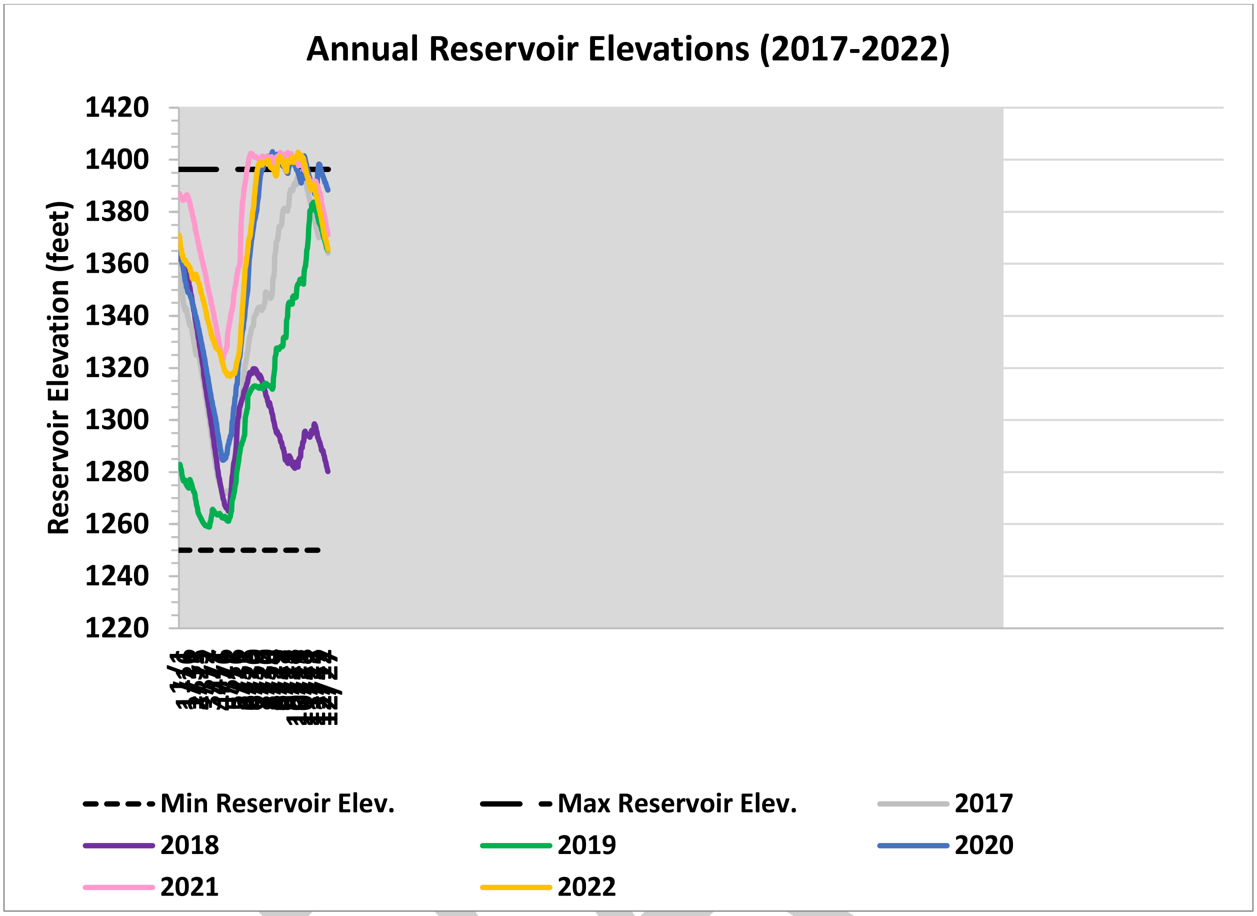

Figure 4-2 Tyee Lake Elevations 2017 through 2022.

4.3.1.2.2.3 Unquantified Outflow to Tyee Creek

Water from Tyee Lake flows to Tyee Creek from underneath the weir and around the boulders at the lake outlet, as shown in Photo 4-1 and Photo 4-2. This typically occurs during the summer and fall when Tyee Lake elevations exceed approximately 1,360 ft.

Photo 4-1 Tyee Creek at Tyee Lake Outlet Weir Looking Downstream when no Water is Flowing from Tyee Lake over the Weir.

Photo 4-2 Tyee Creek at Tyee Lake Outlet Weir looking Upstream when no Water is Flowing from Tyee Lake over the Weir.

4.3.1.3 Water Quality

4.3.1.3.1 Tyee Lake

Tyee Lake is a cold, near neutral, and oligochemical system (AEIDC 1980). Historically, Tyee Lake had a pH that varied from neutral to slightly acidic (6.2 to 7.0), with little variation and low values (≤10 micromhos/cm) of specific conductance, low dissolved solids, and low suspended solids (≤ 1.4 mg/L) (AEIDC 1980). Surface water temperature varied from 4.5 degrees Celsius (°C) in May to 13 °C in July at Tyee Lake and dissolved oxygen (DO) saturation was 100 percent (AEIDC 1980).

Currently, neither the U.S. Environmental Protection Agency (USEPA) nor ADEC have listed Tyee Lake for any impairments (ADEC 2022). USGS began recording water temperature data at Gage 15019990 at the Tyee Lake outlet August 24, 2023. Since then, instantaneous surface water temperature measured at the gage ranged from a low of 3.6 °C in May of 2024 to 7.8 °C in November of 2023.

4.3.1.3.2 Hidden Creek

Historical sampling found little difference in the water quality between the Tyee Lake outlet, Tyee Creek, and Hidden Creek (FERC 1981). The lowermost reach of Hidden Creek below the falls is tidally influenced. In April 2010, ADF&G collected a single measurement of DO and temperature in a pool directly below the falls during low tide when water was not flowing from the Tyee Lake outlet; the DO was 13.54 mg/L and the temperature was 4.4 °C (ADF&G 2010). Water quality in the lowermost intertidal reach is expected to be similar to the tailrace.

4.3.1.3.3 Tailrace

ADF&G monitored the intertidal tailrace surface water quality in 2010-2011 (ADF&G 2010) and 2015-2016 and found that the data were similar to the 1980s monitoring showing characteristics of colder freshwater during low tide and warmer brackish water during high tide with seasonal variation (ADF&G 2018). In April 2016, ADF&G collected water temperature, DO, salinity, conductivity, and pH data from the Project tailrace at five transect locations during a +19.0 ft tide (ADF&G 2018). The tailrace water temperature ranged from 3.5 to 8.3 °C and was lowest during low tides (ADF&G 2018). DO concentrations ranged from 8.8 to 17.0 mg/L with the greatest DO concentrations occurring at the surface for all tide stages and the lowest during high tide near the channel bottom (ADF&G 2018). The salinity of the tailrace ranged from 0 to 17 parts per thousand and conductivity varied from 1 to 19,000 microsiemens/cm; both generally increased downgradient during high tide with the greatest concentrations occurring along the channel bottom. The pH of the tailrace ranged from 6.0 to 7.6. Freshwater from Tyee Lake and saline water from the tidal influence are thought to be fully mixed before reaching Airstrip Slough. These data fall within the natural range of variability (ADF&G 2018).

4.3.2 Environmental Analysis

4.3.2.1 Water Quantity

4.3.2.1.1 Construction

Construction activities would have no effect on the quantity of water flowing out of Tyee Lake into Tyee and Hidden creeks or Bradfield Canal. Construction activities would be limited to the transport and installation of the Pelton-style turbine generating unit at the powerhouse and transformer and associated equipment at the switchyard. The existing units may be shut down for up to 7-10 days during the installation, which is similar to the annual shutdown that occurs each year to perform routine maintenance. Water not used for purposes of generation during that time would be stored in Tyee Lake for later use.

Water may be withdrawn from the powerhouse outflow for purposes of mixing concrete on site. A temporary water use permit would be obtained from ADNR and a Fish Habitat Permits would be obtained from ADF&Gs Division of Habitat for the water withdrawal. Because the powerhouse was constructed with provisions for the Third Unit, the amount of concrete needed would be minimal and all concrete work is anticipated to be completed in less than a total of 2 weeks. Water withdrawal during construction would be minimal in both volume and duration and is anticipated to not have any effect on the water quantity in the tailrace or Airstrip Slough.

4.3.2.1.2 Project Operations

SEAPA would continue to coordinate operation of the Tyee Lake and Swan Lake hydroelectric projects to maximize output, optimize water resources and efficiency of the generating units, and minimize the need for diesel generation. The Tyee Lake Project would continue to operate between the normal full pool elevation and a lower draft limit of. 1,250 ft and the usable storage capacity would not change with the Proposed Action.

When all three units are generating, the reservoir water surface elevation may be drawn down at a faster rate than under existing conditions.

The amount of water that would be used to generate power with three turbines would depend on the amount and timing of snowmelt/rainfall, Tyee Lake levels, and demand. The annual volume of water used for generation may increase in above average-water years and some average water years because the Project would be able to generate with inflow that would have otherwise spilled during high runoff periods when Tyee Lake was full and only two units were operating. From 2017 through 2022, SEAPA has used an average of 88,354 ac-ft annually to generate power, ranging from approximately 69,000 ac-ft to 109,000 ac-ft each year, with spill occurring during three of those years. Spill typically occurs during years with high snowpack (June and July) or rain events (August-November). At times, SEAPA would be able to capture water that would otherwise have been spilled and remain well within their existing Tyee Lake permitted water rights.

The frequency or magnitude of spill into Tyee Creek may be reduced in some years with the additional generating capacity of three turbines but this is not anticipated to have significant effects on water quantity. There is no instream flow reservation into Tyee Creek under the current license. Under current operations, spill does not occur every year. It has historically happened during above-average water years typically during precipitation events that occur when the lake is full or near full. Leakage into Tyee Creek underneath the weir at lake elevations at or exceeding approximately 1,360 ft would continue under the Proposed Action.

The Project tailrace was designed to accommodate the flows corresponding to three turbine units running simultaneously at maximum output. The tailrace flow would increase from a maximum output of 234 cfs to 351 cfs (117 cfs per turbine) if all three turbines were operating simultaneously at full capacity

4.3.2.2 Water Quality

4.3.2.2.1 Construction

Installation of the Third Unit would not require any ground-disturbing activities and there is no proposed in-water construction. The presence and operation of construction equipment and barge operations could increase the potential for fuel and hazardous substance spills. However, Best Management Plans (BMPs) to protect water quality would be implemented (e.g., erosion and sediment control plan, spill prevention and control plan, no refueling adjacent to the waterbodies, etc.). With implementation of BMPs, the effects on water quality are expected to be negligible during construction activities.

4.3.2.2.2 Project Operations

As no significant operational changes in Tyee Lake are proposed, it is unlikely that water quality would be affected. Changes in tailrace water quality are anticipated to be minimal. The introduction of more freshwater into the tailrace could result in minor changes to water temperature and salinity, while DO levels may increase slightly due to the typically higher oxygen content in freshwater compared to brackish or saline water. It is expected that full mixing of the freshwater with the saline water would continue to occur before reaching Airstrip Slough.

For construction of the original Tyee Lake Project, ADEC had found no evidence of significant adverse effects on waters of the U.S. from construction or operation and therefore decided not to act on the water quality certificate application (FERC 1981). ADF&G monitoring of the intertidal tailrace has shown characteristics of colder freshwater during low tide and warmer brackish water during high tide with seasonal variation and has concluded that these conditions fall within the natural range of variability and have not been found to have any deleterious effects on the fish using the tailrace, Airstrip Slough or Hydro Creek (ADF&G 2018). Freshwater from Tyee Lake and saline water from the tidal influence are thought to be fully mixed before reaching Airstrip Slough. Because additional generation from the Third Unit would have less of an incremental effect on the existing baseline water quality of Airport Slough compared to the original Project, water quality is not anticipated to be an issue.

Over time, more fines have been deposited in the tailrace from the tidal influence, with higher levels in a downgradient direction towards Airstrip Slough. While no scour is anticipated in Airstrip Slough, higher flow velocities that may occur in the tailrace at times when all three units would be operating may result in some minor scouring of the tailrace channel bed, temporarily increasing suspended sediment and exposing more suitable spawning gravel in the tailrace. The mobilized fines would be transported downstream and deposited at the lower end of the tailrace or to Airstrip Slough. The deposition of these fines in the intertidal area at the lower tailrace would mirror the natural sedimentation processes typical of that intertidal area.

4.3.3 Applicant-Proposed Measures

No applicant-proposed measures are for water resources are anticipated for this proposed capacity amendment.

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4.4 Fish and Aquatic Resources

4.4.1 Affected Environment

4.4.1.1 Aquatic Habitat

4.4.1.1.1 Bradfield Canal

Bradfield Canal is a tidally influenced inlet in southeast Alaska that extends approximately 19 miles west from the Bradfield River to Earnest Sound, approximately 30 miles southeast of Wrangell. Depths in Bradfield Canal reach over 200 ft but are much shallower in the vicinity of the Project (NOAA 2011). Bradfield Canal habitat varies as it contains numerous tributaries and backwater sloughs, offering a diverse array of habitat types that support various aquatic species. Hidden Creek and Hydro Creek enter the head of Bradfield Canal within 0.5 mi of each other (Photo 4-3).

Photo 4-3 Head of Bradfield Canal. Bradfield River (left) and Tyee Lake Hydroelectric Project Tailrace, Airstrip Slough, and Hydro Creek (right). Source: ADF&G 2018.

4.4.1.1.2 Tyee Lake

Tyee Lake is a naturally occurring freshwater lake that is used as a storage reservoir (SEAPA 2024). Lake levels are dependent on runoff stored and drawdowns to support powerhouse operations.

The shoreline contains alluvial deposits of gravels, cobbles, and larger boulders (Photo 4-4). The substrate in the deeper portions of the lake is generally comprised of fine-grained sediments with particle size decreasing from the inlet of Tyee Lake to the outlet, as the heavier particles tend to settle out closer to the inlet. Fine sandy silt is present at the upper end of the lake, and silt, silty clay, and clayey soil with some organic content is present near the outlet of the lake (TerraSond 2009).

Photo 4-4 Tyee Lake Shoreline. Source: TerraSond 2009.

4.4.1.1.3 Tyee Creek

Tyee Creek, located on the northwest side of Tyee Lake, serves as the natural outlet extending approximately 1.2 mi through a steep narrow gorge composed of a series of waterfalls and cascades until its confluence with Hidden Creek. Figure 4-3 shows the profile of Tyee Lake, Tyee Creek and Hidden Creek. During the low flow period when Tyee Lake levels are low, water may not flow from the Tyee Lake outlet. Minor tributaries contribute flow to Tyee Creek between the lake outlet and Hidden Creek. The average gradient of Tyee Creek exceeds 17 percent.

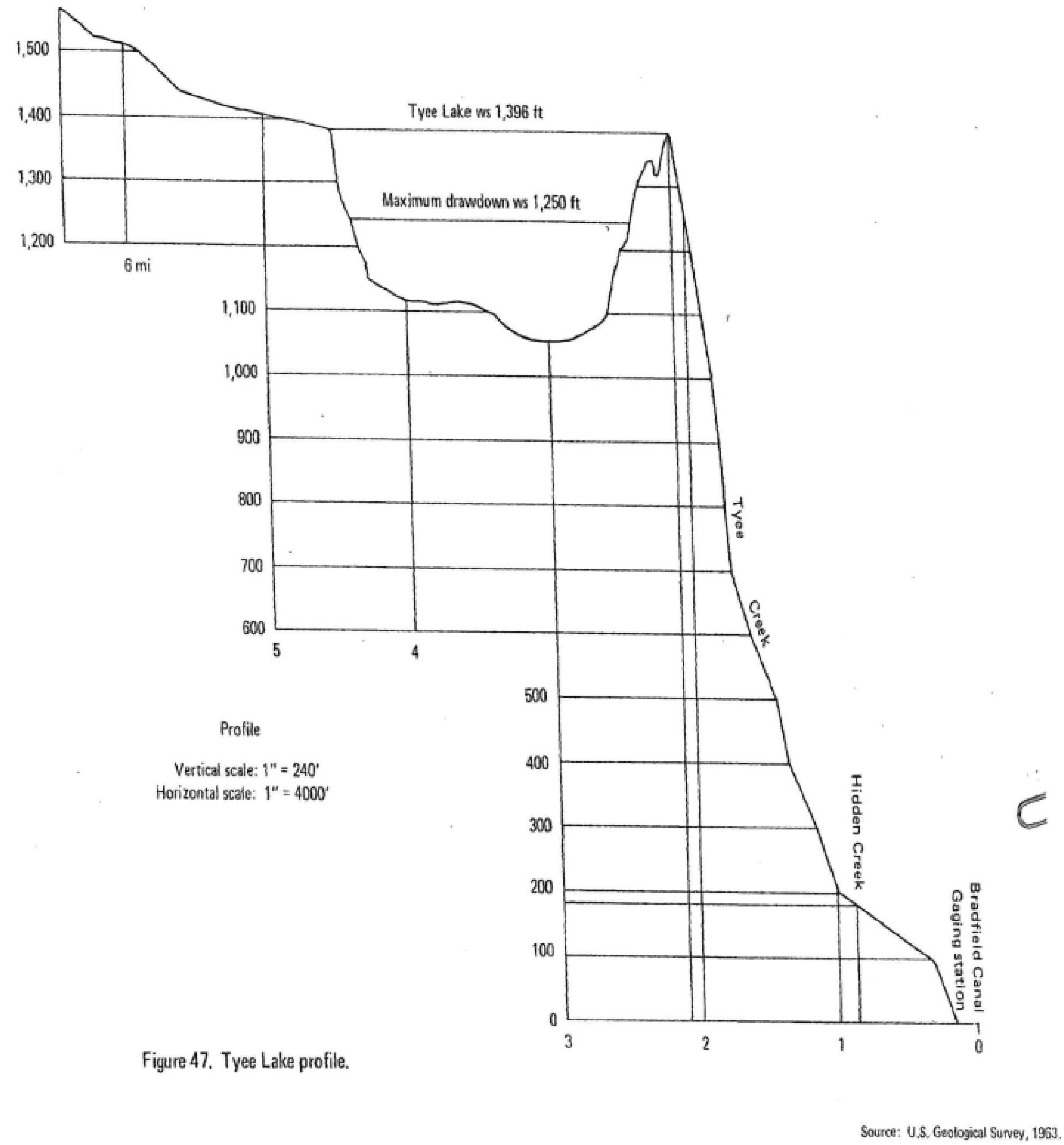

Figure 4-3 Tyee Lake Profile and Tyee Creek and Hidden Creek Slope. Source: USGS 1963 as cited in ADF&G 2010.

4.4.1.1.4 Hidden Creek

From its confluence with Tyee Creek, Hidden Creek flows northeast approximately 1 mi before entering a slough at the head of the Bradfield Canal (ADF&G 2018). There is a 30-ft-high waterfall about 460 ft upstream of the mouth that prevents upstream fish passage

(Photo 4-5). Upstream of the waterfall barrier, the average gradient is moderate at about 4 percent. The habitat consists of cascades over boulders and pockets of pools with gravel substrate.

Downstream of the waterfall, Hidden Creek is a low-gradient intertidal stream with widths varying from 50 to 108 ft. Photo 4-6 and Photo 4-7 show Hidden Creek looking upstream at the waterfall barrier during low and mid-tide. The substrate near the waterfall is primarily bedrock and boulders, while near the stream's mouth, it consists of cobble, gravel, sand, and mud (ADF&G 2018; Photo 4-8).

When the Project was constructed, there was concern that diversion of Tyee Lake water for hydropower generation would result in the loss of anadromous fish habitat in Hidden Creek. However, Hidden Creek has continued to flow year-round since Tyee Lake Project began operations in 1984. After 40 years of operation, ADF&G (2018) concluded that the Project has had *de minimis* impact on anadromous fish habitat and fish populations and that fisheries mitigation for the Project was not necessary.

Photo 4-5 Waterfall at Hidden Creek Creating Barrier to Upstream Fish Passage. Source: ADF&G 2018.

Photo 4-6 Hidden Creek at Low Tide, Looking Upstream at the Waterfall. Source: ADF&G.

Photo 4-7 Hidden Creek at Mid-tide, Looking Upstream at the Waterfall. Source: ADF&G 2018.

Photo 4-8 Hidden Creek at Low Tide, Downstream View of the Mouth. Source: ADF&G 2018.

4.4.1.1.5 Tailrace and Airstrip Slough

Water from Tyee Lake flows into the tailrace after passing through the powerhouse units. This man-made channel, carved into a tidal wetland, extends approximately 1,100 ft from the powerhouse to Airstrip Slough, a tidally influenced side channel to Hydro Creek (ADF&G 2018; Photo 4-9). The tailrace channel has a bed gradient of less than 1 percent and a bottom width of approximately 30 ft with 2:1 sloped sides. As described in Section 4.3.1.3, the tailrace is tidally influenced and exhibits characteristics of colder freshwater during low tide and warmer brackish water during high tide with seasonal variation (ADF&G 2018). Photo 4-10 and Photo 4-11 show views of the tailrace from the powerhouse at -1.5 ft tide and +18.5 ft tide, respectively.

As required fisheries mitigation for the potential loss of salmon spawning habitat in Hidden Creek from operation of the existing Tyee Lake Project, gravel was added to the tailrace channel to provide suitable pink salmon spawning habitat (ADF&G 2018). ADF&G has periodically monitored the experimental spawning channel collecting data between August 2010 and May 2011, August 2015 and May 2016, and in August 2018. Over time the tailrace bed has deepened and developed shallow riffles and scour pools (ADF&G 2018). During low tide, water depths generally ranged from 0.5 to 2.5 ft. Water velocities measured at low tide in April 2016 ranged from 1.43 to 4.40 ft/s and were lowest at riffles near the channel margins, providing suitable pink salmon spawning habitat (ADF&G 2018). The percent of fines in the channel substrate has increased, with samples consisting of <10 percent fines near the powerhouse increasing to 17 percent fines closer to Airstrip Slough.

ADF&G concluded that without a continual source for gravel recruitment, the spawning habitat quality would decrease over time. However, ADF&G also concluded that creation of the tailrace experimental spawning channel was not necessary because fisheries mitigation was not necessary because Hidden Creek has continued to provide anadromous spawning habitat since the Project began operations in 1984.

Photo 4-9 Tyee Lake Project Tailrace, Looking Upstream towards the Powerhouse. Source: ADF&G 2018.

Photo 4-10 Tyee Lake Project Tailrace at -1.5 ft tide, Looking Downstream from the Powerhouse. Source: ADF&G 2018.

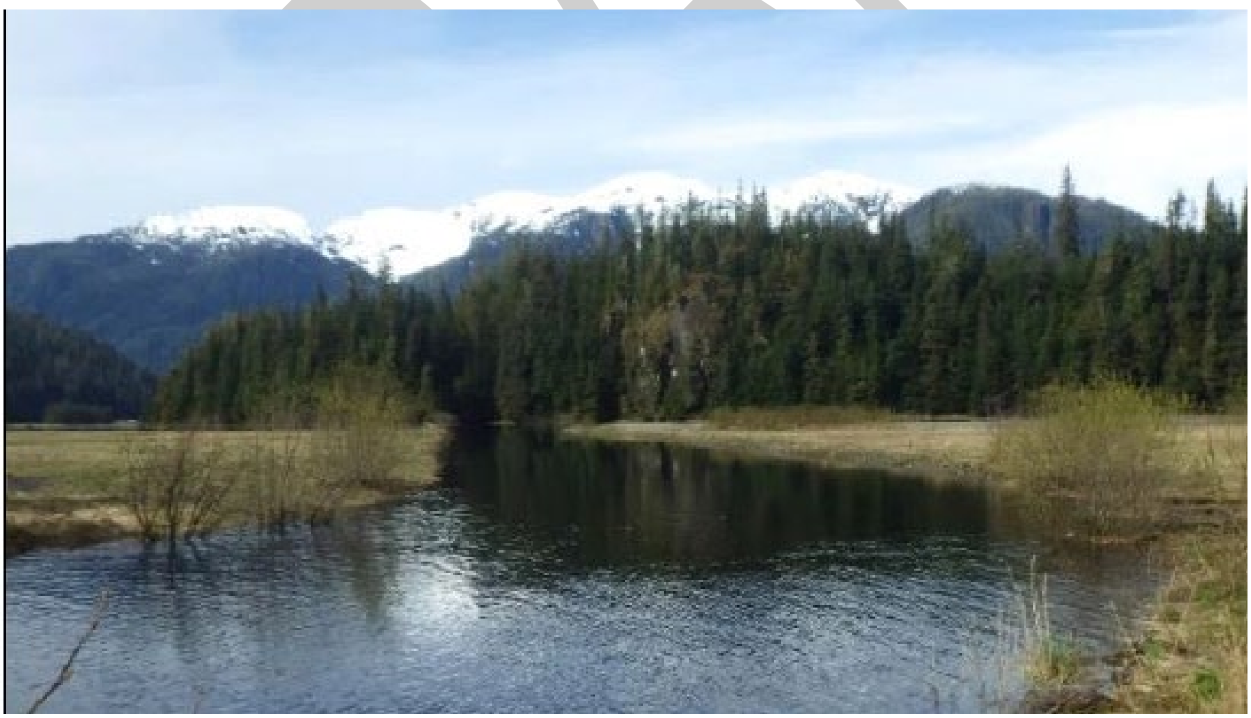

Photo 4-11 Tyee Lake Project Tailrace at +18.5 ft tide, Looking Downstream from the Powerhouse. Source: ADF&G 2018.

4.4.1.2 Essential Fish Habitat

Bradfield Canal has been designated EFH for various life stages of Chinook, sockeye, coho, chum, and pink salmon (Table 4-6) (NOAA 2024).

Table 4-6 Essential Fish Habitat by Species and Life stage for Bradfield Canal.

Species	Life stage(s) Found
Chinook Salmon	Marine Immature Adult Marine Mature Adult
Sockeye Salmon	Marine Immature Adult Marine Juvenile Marine Mature Adult
Coho Salmon	Marine Juvenile Marine Mature Adult
Chum Salmon	Marine Immature Adult Marine Juvenile Marine Mature Adult
Pink Salmon	Marine Juvenile Marine Mature Adult

The tailrace (referred to as Tailrace Creek) and Hidden Creek are listed in the Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes – Southeast Region, Effective June 2024 (ADF&G 2024). Waterbodies that fall into this category also fall under the jurisdiction of AS 16.05.871. The Alaska AWC lists the lower approximately 460 ft of Hidden Creek (AWC Stream No. 107-40-10538) as providing habitat for chum, coho, and pink salmon (ADF&G 2024a). The tailrace (Tailrace Creek AWC Stream No. 107-40-10537-2008) and Hydro Creek (AWC Stream No. 107-40-10537) are listed for presence of chum and pink salmon and rearing coho salmon (ADF&G 2024a).

4.4.1.3 Aquatic Species

4.4.1.3.1 Tyee Lake

Surveys conducted in 1980, documented an Arctic grayling (grayling) population of approximately 5,000 fish in Tyee Lake. No other fish species were known to occur in the lake (FERC 1981). ADF&G planted Arctic grayling eggs in the main inlet of Tyee Lake in 1962 and 20,000 grayling fry were stocked in the lake in 1967 and 1968 (FERC 1981).

During licensing studies for the existing Project, biologists identified primary spawning habitats in several inlet streams at the head of the lake and documented spawning activity and fry development. Adults spawned in the major lake tributaries and both adults and fry dispersed into the shallow littoral zones of the lake during the summer while grayling remained in the tributary streams (FERC 1981). At the time, it was thought that the Arctic grayling population would be affected by limited access between lake and tributary habitats from operations and changes to lake levels. Prior to constructing the original Project, it was proposed to move the grayling to another lake. However, these plans were abandoned when the fish were sampled in 1982 and found to have bacterial kidney disease and enteric red mouth (ADF&G 2018). In 2015, ADF&G opportunistically sampled Tyee Lake and documented the continued presence of Arctic grayling in the lake (ADF&G 2018).

4.4.1.3.2 Tyee Creek

While resident fish species have been documented in Hidden Creek above the falls, Tyee Creek from its confluence with Hidden Creek upstream to Tyee Lake is categorized as a Class 3 non-fish-bearing stream by the USFS (USFS 2024).

fishery biologists documented two age classes of steelhead (*Oncorhynchus mykiss*) less than 130 mm fork length (FL) in Hidden Creek upstream of the waterfall (Dwight 1980). ADF&G documented the waterfall as an anadromous fish barrier that prevents upstream steelhead migration, so the fish are from a self-sustaining rainbow trout population, of which some individuals may drop below the waterfall barrier and become anadromous steelhead (ADF&G 2018).

4.4.1.3.3 Hidden Creek

The natural waterfall in Hidden Creek acts as a barrier, preventing anadromous fish species from migrating upstream. Above the Hidden Creek waterfall, fishery biologists documented rainbow trout (*O. mykiss*) less than 130 mm fork length (FL) during Project planning and licensing studies conducted in the early 1980s.

During the same investigations, biologists documented spawning chum (600 fish) and pink (250 fish) salmon downstream of the waterfall in early August 1980 and early September 1980, respectively (Dwight 1980). Dolly Varden, cutthroat trout (*O. clarkii*), and sculpin (*Cottidae spp.*) were also observed (Dwight 1980).

ADF&G conducted surveys for adult pink and chum salmon during low tides in Hidden Creek in 2010 and 2018. In 2010, three pink salmon were observed near the mouth of Hidden Creek, but not within the creek itself. In August 2018, three surveys were performed, revealing no evidence of adult salmon presence or spawning activity. However, a school of juvenile coho salmon and a few sculpin were observed near the mouth (ADF&G 2018). A single rainbow trout (130 mm FL) was captured by ADF&G in 2010 downstream of the waterfall (ADF&G 2010). In 2018, ADF&G reported that Hidden Creek substrates were generally unsuitable for chum and pink salmon spawning (ADF&G 2018).

4.4.1.3.4 Tailrace

Article 43 of the original FERC project license required a plan to mitigate potential effects of Project operations on fishery resources resulting, including the reduction of water entering Hidden Creek. In 1983, a Revised Fisheries Mitigation Plan was approved by FERC that resulted in the tailrace being used as an experimental spawning channel to mitigate potential spawning impacts to chum and pink salmon. After tailrace construction, biologists captured juvenile coho salmon, Dolly Varden, and sculpin in the tailrace and observed spawning chum and pink salmon (Kelly 1987). Spawning habitat quality has decreased over the years, which has been attributed to an increasing proportion of sand transported by tide from the Bradfield River delta (Kelly 1987). ADF&G and the 1987 Kelly report that the best spawning habitat is in the upper half of the tailrace, which is less often influenced by salt water.

In 2010, a study was conducted to determine if any negative effects to pink salmon spawning occurred following the increased flow in the tailrace from Project operations (ADF&G 2018). ADF&G biologists found that the creek had low quality spawning habitat without a continual source of gravel. Spawning habitat quality was degraded due to sand dispersion from tidal movements (Kelly 1987). The study found that manual input of gravel substrate or increased scouring could expose intertidal flat gravel, ultimately improving spawning habitat. ADF&G concluded that the tailrace would not benefit from additional artificial spawning habitat and stated that tailrace discharge could expose tidal flat gravel suitable for spawning (ADF&G 2018).

4.4.2 Environmental Analysis

4.4.2.1 Construction

Because the Tyee Lake Project was originally designed for a Third Unit, there would be limited impacts on fish and aquatic resources resulting from construction. All proposed construction activities are within the powerhouse or switchyard outside of the OHW. The Proposed Action would not affect fishery resources or aquatic habitat in Tyee Lake, Tyee Creek, Hidden Creek. During installation of the Third Unit is installed, the facility may be temporarily shut down for up to 5 to 10 days, similar to what occurs annually during routine maintenance activities.

No in-water or new ground-disturbing work would occur that would impact fish and aquatic resources. Use of equipment and storage of fuel, lubricants, or other hazardous substances below the OHW is not proposed; however, the presence and operation of construction equipment and barge operations could increase the potential for fuel and hazardous substance spills. BMPs to protect water quality (and subsequently fish and aquatic resources) would be implemented (e.g., erosion and sediment control plan, spill prevention and control plan, no refueling adjacent to the waterbodies, etc.). There would be no effects of construction on the tailrace with implementation of BMPs.

There is no work expected to occur below the OHW. In the event that unexpected work below OHW would need to occur, SEAPA would consult with ADF&G, and would limit any unexpected work required below the OHW to within the “fish window” (May 15 to July 15) to avoid any potential effects on salmonids.

4.4.2.2 Project Operations

The addition of the Third Unit could cause scouring from the increased flow in the tailrace, which could improve spawning habitat by removing sand and sediment that may be covering spawning gravel (ADF&G 2018). The potential for increased flow resulting from the Proposed Action could improve pink salmon spawning habitat quality, resulting in a permanent net beneficial change.

Proposed Tyee Lake operations would not change from existing conditions. While Tyee Lake may experience a more rapid drawdown during operations, this is not likely to affect Arctic grayling inhabiting the lake as they have been successfully reproducing with the current lake drawdown.

Frequency or magnitude of spill into Tyee Creek may be reduced with the additional generating capacity during above average runoff years and some average runoff years. Spill typically occurs during significant snowmelt (June to July) or rainfall events (August through November) when Tyee Lake is full or near full. It is not likely that a reduction in the amount or frequency of spill in average to above-average water years would affect resident trout or sculpin in Hidden Creek or salmon downstream of the waterfall. When the lake elevation exceeds approximately 1,360 ft, a significant amount of water enters Tyee Creek from the lake outlet underneath and around the spillway weir. While fish are not known to be present in Tyee Creek, its water provides habitat for fish downstream in Hidden Creek. Spill typically occurs when flows in the contributing tributaries to both Tyee Creek and Hidden Creek are also high, attenuating any potential effect in a downstream direction. Effects on salmon are anticipated to be negligible in the tidally-influenced reach of Hidden Creek downstream of the waterfall barrier.

4.4.3 Applicant-Proposed Measures

No applicant-proposed measures for fishery resources are anticipated for this proposed capacity amendment.

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4.5 Wildlife, Botanical, and Wetland Resources

4.5.1 Affected Environment

4.5.1.1 Wildlife Resources

4.5.1.1.1 Terrestrial Wildlife

A wide variety of terrestrial wildlife can be found within the Project Area and surrounding vicinity, with most species native to Southeast Alaska represented. Big game animals include brown bear (*Ursus arctos*), black bear (*Ursus americanus*), moose (*Alces alces*), mountain goat (*Oreamnos americanus*), Alexander Archipelago grey wolf (*Canis lupus ligoni*), wolverine (*Gulo gulo*), and Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) (APA 1979, ADF&G 2024). Furbearers are generally common area-wide and include beaver (*Castor canadensis*), American marten (*Martes americana*), mink (*Neovision vision*), ermine (*Mustela ermine*a), river otter (*Lutra canadensis*), and red fox (*Vulpes vulpes*) (APA 1979, ADF&G 2024). Small mammals are also well represented (APA 1979, ADF&G 2024).

4.5.1.1.1.1 Big Game

The brown bear is one of the largest land carnivores in the world. The brown bear range includes throughout Alaska except for the Aleutian Islands beyond Unimak Island, the islands of the Bering Sea, and the islands south of Frederick Sound (ADF&G 2024). The population of brown bear in the Bradfield Canal area appears to be stable to increasing. Based on a study involving DNA mark-recapture techniques, ADF&G estimates that the Bradfield Canal and Unuk River brown bear population is approximately 50 bears (ADF&G 2009). During late summer and fall, brown bears occur frequently near salmon spawning streams (ADF&G 2024).

Black bears are smaller than brown bears but are more abundant in Southeast Alaska and within the Project Area (APA 1979). Preferred habitats include forests, meadows, riparian areas, alpine areas, and coastal beaches (ADF&G 2024). Black bears are opportunistic omnivores and, depending on the season, will primarily eat grasses, carcasses, moose calves, salmon, berries, ants, and grubs (ADF&G 2024). Black bears usually enter dens located in rock cavities, hollow tree, self-made excavations, or on the ground in the fall or winter for hibernation (ADF&G 2024). In southern ranges, like near the Project Area, sometimes the bears will emerge from their dens during the winters, otherwise they emerge when food becomes available again in the spring (ADF&G 2024).

Moose are uncommon in Southeast Alaska but could occur within the Project Area since suitable moose habitat is available (APA 1979). Moose are generally abundant on timberline plateaus, along major rivers, and recently burned areas that have dense stands of aspen, willow, and/or birch shrubs (ADF&G 2024). In spring and summer, moose forage on wetland vegetation, grasses, sedges, forbs, and leaves of hardwoods, primarily birch, willow, and aspen (ADF&G 2024). During the fall and winter, they primarily eat twigs, branches, and bark from willow, birch, and aspen (ADF&G 2024).

Mountain goat populations are relatively low and usually occur in remote and rugged alpine country, generally isolated from human activity (APA 1979). During the summer period, they inhabit high alpine meadows and talus slopes around Tyee Lake but in winter move to lower elevations, usually at or near tree line (APA 1979). Mountain goats forage on numerous species of grasses, forbs, and low growing shrubs which occur in the high alpine meadows (ADF&G 2024). In winter, goats diet consists of more browse species and lichen, as well as dried grasses (ADF&G 2024).

The grey wolf range includes most of Alaska, including the Southeast and within the Project Area (ADF&G 2024). Grey wolves are very adaptable. Although little information is available on their movements or habitat requirements within the Project Area, they are most abundant in regions with high prey densities, especially deer (APA 1979). In Southeast Alaska, Sitka black-tailed deer, mountain goats, and beaver are important sources of food for grey wolves (ADF&G 2024).

The wolverine is the largest North American land member of the weasel family (Mustelidae) and occurs throughout Alaska, including within the Project Area (APA 1979). Wolverines are illusive and relatively shy of humans, making them difficult to observe. Wolverines are opportunistic scavengers and hunters that eat almost anything, including small mammals, birds, and carrion (ADF&G 2024). The wolverine is listed as threatened under the ESA in the contiguous United States, but populations in Alaska are not threatened (USFWS 2023).

Sitka black-tailed deer are found throughout Southeast Alaska (ADF&G 2024). Their populations go through severe fluctuations associated with harsh winter weather, but they are nevertheless the most abundant species of big game in Southeast Alaska (ADF&G 2024). Sitka black-tailed deer utilize a variety of habitats but are most often associated with the coastal temperate rainforest (ADF&G 2024). During winter and early spring, most Sitka black-tailed deer are concentrated near sea level along the forest edge and upper beach zone; as spring progresses and snow recedes, Sitka black-tailed deer movements increase; and as summer approaches, they begin their ascent toward the productive alpine zone (APA 1979).

4.5.1.1.1.2 Furbearers

Beavers are found in most of the forested portions of Alaska, preferring riparian and wetland areas, and may be found in the Project Area (ADF&G 2024). Beavers eat bark, aquatic plants, roots, and grasses and will move their colony to a new location after exhausting food resources in an area (ADF&G 2024). Beavers require 2 to 3 ft of water year-round as a refuge from predators and to float heavy objects like logs for food or shelter. If water levels are not adequate, beavers will construct dams (ADF&G 2024).

The American marten, mink, and ermine are three species of weasel that occur throughout Southeast Alaska (APA 1979). They are all predators, which consume a variety of small mammals, birds, fish, eggs, and crustaceans (ADF&G 2024). Marten prefer forests, mink prefer to be near water, and ermine are adapted to a wide variety of habitats including forests and riparian areas (ADF&G 2024). All three species could be present within the Project Area.

River otter habitat includes rivers, tidal lagoons, and the coastline. River otters occur throughout Southeastern Alaska including within the Project Area (ADF&G 2024). Otters feed primarily on freshwater and marine fish and invertebrates, and to a limited extent are predatory on small mammals and birds (ADF&G 2024). Tidal lagoons with connecting streams containing significant salmon runs, such as the Bradfield Canal, are favored habitats of river otters and often dens will be located near these areas (APA 1979). Otters are moderately tolerant of human activity and are relatively abundant throughout the Project area (APA 1979).

Red foxes are common throughout Northern American and Alaska, but populations are sparse within Southeastern Alaska (ADF&G 2024). However, red foxes have been seen within the Stikine River Valley, located near Wrangell, and therefore could be found within the Project Area (ADF&G 2024). Red fox are curious of humans, adaptable to a wide range of habitats, and generally prefer open expanses, lowland marshes, and crisscrossed hills and draws (ADF&G 2024).

4.5.1.1.1.3 Small Mammals

A number of small mammals could occur within in the Project Area. Muskrat (*Ondatra zibethicus*) are associated with wetlands and streams and are found most regularly where beaver are present (APA 1979, ADF&G 2024). Hoary marmots (*Marmota caligata*) occur throughout suitable alpine habitat (APA 1979, ADF&G 2024). Red squirrels (*Tamiasciurus hudsonicus*) occur throughout the spruce-hemlock forests (APA 1979, ADF&G 2024). Several species of Northern flying squirrel (*Glaucomys sabrinus* spp.) occur throughout forested areas of Southeast Alaska (ADF&G 2024). Snowshoe hare (*Lepus americanus*) occur in mixed spruce forests, wooded swamps, and brushy areas (ADF&G 2024). North American porcupine (*Erethizon dorsatum*) occur in forested areas (ADF&G 2024). Several species of mice are likely also present.

4.5.1.1.1.4 Bats

Two species of bat have been observed near the Project Area, in limited numbers (ADF&G 2024). Little brown bat (*Myotis lucifugus*) has been found in a variety of habitats including temperate forests, spruce-birch forests, and treeless shrub-dominated communities, and migrates out of Alaska in the winter (ADF&G 2024). Silver-haired bat (*Lasionycteris noctivagans*) is thought to occur in temperate rainforests, roosting in forested areas adjacent to water bodies, and may migrate to Southeast Alaska in winter (ADF&G 2024).

4.5.1.1.2 Avian Species

Avian species that may occur within the vicinity of the Project Area are listed in Table 4-7 Nearly all of Alaska's birds, including those within the Project vicinity, are protected under provisions of the Migratory Bird Treaty Act[1] (MBTA).

4.5.1.1.2.1 Waterfowl

Waterfowl are present within the Tyee Lake Project Area year-round. Large numbers of diving ducks, mallards (*Anas platyrhynchos*), mergansers (*Mergus* spp.), and Vancouver Canada geese (*Branta canadensis fulva*) winter in the estuaries of the area (APA 1979). The Project Area is within the Pacific flyway, so many migrants pass through to rest and eat. Southeast Alaska accommodates most of the Vancouver Canada geese of the world and substantial numbers of mallards, mergansers and other ducks (APA 1979). Nesting waterfowl occur throughout the heads of most Southeast Alaska bays and fjords, in the

[1] Migratory Birds Treaty Act of 1918 (MBTA) (16 U.S.C. 703-12)

numerous lakes, muskegs, and along streams (APA 1979). There are only a few areas of extensive habitat, but there are many smaller pockets of habitat, making the total overall amount of waterfowl habitat considerable (APA 1979).

4.5.1.1.2.2 Raptors

Raptors are predatory birds such as eagles, hawks, and owls. Many species of raptors potentially breed in or migrate through the Project area (Table 4-7). All of these species are protected under the MBTA and eagles are further protected under the Bald and Golden Eagle Protection Act[2] (BGEPA). In addition, the Queen Charlotte goshawk (*Accipiter gentilis laingi*) is listed as a USFS Alaska Region Sensitive Species (USFS 2009).

Golden eagles have a limited and scattered distribution in Southeast Alaska but may be encountered in the Project Area (ADF&G 2024). Golden eagles nest on cliffs and prefer open habitat such as prairie, tundra, open wooded country, and barren areas, in particularly hilly or mountainous regions (ADF&G 2024).

Bald eagles are very common in Southeast Alaska (ADF&G 2024) and the Project Area supports a large population of residents (APA 1979). Bald eagles nest in large trees located in old-growth timber along the salt-water shoreline and larger mainland rivers (ADF&G 2024). Though nests are generally situated in the shoreline trees, they have been occasionally found 500 yards inland and prefer clear flight paths from the nest to the shoreline and open water (APA 1979). Nesting sites can be reused for multiple years. USFWS has identified and mapped several bald eagle nests on the south shore of Bradfield Canal (APA 1979). High concentrations of bald eagles can be seen feeding on the spring smelt runs in the Stikine River near Wrangell (APA 1979).

4.5.1.1.2.3 Seabirds

Seabirds have adapted to live most of their lives at sea; some species only come ashore to breed. They are strong fliers, and some are also strong swimmers. Relatively little is known about seabirds in Southeast Alaska as they are difficult to research due to inaccessibility of their sites and the birds' behavior (APA 1979). Rookeries are often located on steep rocky headlands, small rocky islands, or islets that provide refuge from mammalian predators and easy access to the sea (APA 1979). Breeding populations of the storm petrels, auklets, and puffins present in the Project area are seldom enumerated

[2] Bald and Golden Eagle Protection Act of 1940 (BGEPA) (16 U.S.C. 668-668d)

because these birds nest in burrows or under vegetation and some are nocturnal (APA 1979). Marbled murrelets are a federally listed threatened species in Washington and Oregon and endangered in California, but are not listed in Alaska (ADF&G 2024). Marbled murrelets are known to nest along the coast from Southeast Alaska to northern California in old growth trees (ADF&G 2014). Short-tailed albatross may range within the near shore areas of the outer coast of the Tongass National Forest (USFWS 2024) and are discussed in the Rare, Threatened, and Endangered Species Section.

4.5.1.1.2.4 Shorebirds

Shorebirds occupy essentially the same habitat as waterfowl, commonly found along shorelines and mudflats. They tend to have long beaks and long legs that help them wade and catch insects or crustaceans in shallow waters.

4.5.1.1.2.5 Passerines

Passerines are perching birds and songbirds often found in forested habitats (APA 1979). Species that would be found within Sitka spruce-hemlock forests and may occur in the Project Area are identified Table 4-7.

Table 4-7 Avian Species that May Occur in the vicinity of the Tyee Lake Project Area.

Common Name	Scientific Name	Presence in Project Area	Occurrence	Status
Waterfowl				
American wigeon	*Mareca americana*	Migrant; occasional wintering and/or breeding	C	
Arctic loon	*Gavia arctica*	Migrant; occasional wintering and/or breeding	C	
Barrow's goldeneye	*Bucephala islandica*	Winter; Rarely breeding	C	
Black brant	*Branta bernicla*	Migrant; occasional wintering and/or breeding	UC to VR	
Black scoters	*Melanitta americana*	Migrant; occasional wintering and/or breeding	UC to VR	
Blue-winged teal	*Spatula discors*	Migrant; occasional wintering and/or breeding	UC to VR	
Buffleheads	*Bucephala albeola*	Winter; Rarely breeding	C	
Cackling geese	*Branta hutchinsii*	Migrant; occasional wintering and/or breeding	UC to VR	
Canvasback	*Aythya valisineria*	Migrant; occasional wintering and/or breeding	UC to VR	
Common eider	*Somateria mollissima*	Migrant; occasional wintering and/or breeding	UC to VR	
Common goldeneye	*Bucephala clangula*	Winter; Rarely breeding	C	
Common loon	*Gavia immer*	Resident	C	
Common mergansers	*Mergus merganser*	Winter; Rarely breeding	C	
Eared Grebes	*Podiceps nigricollis*	Migrant; occasional wintering and/or breeding	UC to VR	
Gadwalls	*Mareca strepera*	Migrant; occasional wintering and/or breeding	UC to VR	
Greater scaup	*Aythya marila*	Winter; Rarely breeding	C	
Greater white-fronted geese	*Anser albifrons*	Migrant; occasional wintering and/or breeding	C	
Green-winged teal	*Anas crecca*	Migrant; occasional wintering and/or breeding	C	
Harlequin ducks	*Histrionicus histrionicus*	Resident	C	
Hooded mergansers	Lophodytes cucullatus	Migrant; occasional wintering and/or breeding	UC to VR	
Horned grebes	*Podiceps auritus*	Migrant; occasional wintering and/or breeding	C	
King eider	*Somateria spectabilis*	Migrant; occasional wintering and/or breeding	UC to VR	
Lesser scaup	*Aythya affinis*	Migrant; occasional wintering and/or breeding	C	
Long-tailed duck	*Clangula hyemalis*	Winter; Rarely breeding	C	
Mallards	*Anas platyrhynchos*	Resident	C	
Northern pintails	*Anas acuta*	Migrant; occasional wintering and/or breeding	C	
Northern shovellers	*Spatula clypeata*	Migrant; occasional wintering and/or breeding	UC to VR	
Pelagic cormorants	*Urile pelagicus*	Winter; Rarely breeding	C	
Pied-billed grebes	*Podilymbus podiceps*	Migrant; occasional wintering and/or breeding	UC to VR	
Red-breasted merganser	*Mergus serrator*	Resident	C	

Common Name	Scientific Name	Presence in Project Area	Occurrence	Status
Redhead	*Aythya americana*	Migrant; occasional wintering and/or breeding	UC to VR	
Red-necked grebes	*Podiceps grisegena*	Winter; Rarely breeding	C	
Red-throated loon	*Gavia stellata*	Migrant; occasional wintering and/or breeding	C	
Ring-necked ducks	*Aythya collaris*	Migrant; occasional wintering and/or breeding	UC to VR	
Ruddy ducks	*Oxyura jamaicensis*	Migrant; occasional wintering and/or breeding	UC to VR	
Snow geese	*Anser caerulescens*	Migrant; occasional wintering and/or breeding	UC to VR	
Surf scoters	*Melanitta perspicillata*	Winter; Rarely breeding	C	
Tundra swans	*Cygnus columbianus*	Migrant; occasional wintering and/or breeding	C	
Vancouver Canada geese	*Branta canadensis fulva*	Resident	C	
White-winged scoters	*Melanitta deglandi*	Winter; Rarely breeding	C	
Wood ducks	*Aix sponsa*	Migrant; occasional wintering and/or breeding	UC to VR	
Yellow-billed loons	*Gavia adamsii*	Migrant; occasional wintering and/or breeding	UC to VR	
Raptors				
American kestrel	*Falco sparverius*	Migrant; occasional breeding	C	
Bald eagle	*Haliaeetus leucocephalus*	Resident	C	
Barred owl	*Strix varia*	Resident	UC to R	
Boreal owl	*Aegolius funereus*	Resident	UC to R	
Golden eagle	*Aquila chrysaetos*	May be present	UC to R	
Great gray owls	*Strix nebulosa*	Occasional breeders	UC	
Great horned owl	*Bubo virginianus*	Migrant	C	
Gyrfalcon	*Falco rusticolus*	Nonbreeders	UC to R	
Merlin	*Falco columbarius*	Occasional breeders	UC	
Northern harrier	*Circus hudsonius*	Migrant	C	
Northern hawk owl	*Surnia ulula*	Resident	UC to R	
Northern pygmy owl	*Glaucidium gnoma*	Occasional breeders	UC	
Northern saw-whet owl	*Aegolius acadicus*	Occasional breeders	UC	
Osprey	*Pandion haliaetus*	Occasional breeders	UC	
Peregrine falcon	*Falco peregrinus*	Resident	C	
Queen Charlotte Goshawk	*Accipiter gentiles laingi*	Resident, Breeder	UC	S
Red-tailed hawk	*Buteo jamaicensis*	Occasional breeders	UC	
Rough-legged hawk	*Buteo lagopus*	Nonbreeders	UC to R	
Sharp-shinned hawk	*Accipiter striatus*	Migrant; occasional breeding	C	
Short-eared owl	*Asio flammeus*	Migrant	C	

Common Name	Scientific Name	Presence in Project Area	Occurrence	Status
Snowy owl	*Bubo scandiacus*	Nonbreeders	UC to R	
Swainson's hawks	*Buteo swainsoni*	Occasional breeders	UC to R	
Western screech owl	*Megascops kennicottii*	Occasional breeders	UC	
Seabirds				
Ancient murrelet	*Synthliboramphus antiquus*	Nonbreeder	UC to R	
Cassin's auklet	*Ptychoramphus aleuticus*	Residents	UC	
Fork-tailed storm petrel	*Hydrobates furcatus*	Nonbreeders	C	
Horned puffin	*Fratercula corniculate*	Nonbreeders	UC to R	
Marbled murrelet	*Brachyramphus marmoratus*	Residents and breeders	UC	
Rhinocerous auklet	*Cerorhinca monocerata*	Breeders	C	
Short-tailed albatross	*Phoebastria albatrus*	Occasional breeders	R	E
Tufted puffins	*Fratercula cirrhata*	Breeders	R	
American coots	Fulica americana	Migrant	UC to VR	
Shorebirds				
American golden plovers	*Pluvialis dominica*	Migrant	UC to VR	
Black oystercatchers	*Haematopus bachmani*	Migrant	UC to VR	S
Black turnstones	*Arenaria melanocephala*	Breeding	C	
Black-bellied plovers	*Pluvialis squatarola*	Migrant	UC to VR	
Dunlin	*Calidris alpina*	Migrant	C	
Greater yellowlegs	*Tringa melanoleuca*	Breeding	C	
Hudsonian godwit	*Limosa haemastica*	Migrant	UC to VR	
Killdeer	*Charadrius vociferus*	Migrant	C	
Least sandpiper	*Calidris minutilla*	Migrant	C	
Lesser yellowlegs	*Tringa flavipes*	Migrant	C	
Long-billed dowitcher	*Limnodromus scolopaceus*	Migrant	UC to VR	
Red phalarope	*Phalaropus fulicarius*	Migrant	UC to VR	
Red-necked phalarope	*Phalaropus lobatus*	Migrant	C	
Rock sandpiper	*Calidris ptilocnemis*	Migrant	C	
Ruddy turnstone	*Arenaria interpres*	Migrant	UC to VR	
Sanderling	*Calidris alba*	Migrant	UC to VR	
Sandhill crane	*Antigone canadensis*	Migrant	UC to VR	
Semipalmated plover	*Charadrius semipalmatus*	Breeding	C	
Semi-palmated sandpiper	*Calidris pusilla*	Migrant	UC to VR	

Common Name	Scientific Name	Presence in Project Area	Occurrence	Status
Sharp-tailed sandpiper	*Calidris acuminata*	Migrant	UC to VR	
Short-billed dowitcher	*Limnodromus griseus*	Migrant	C	
Sora rail	*Porzana carolina*	Migrant	UC to VR	
Spotted sandpiper	*Actitis macularius*	Breeding	C	
Stilt sandpiper	*Calidris himantopus*	Migrant	UC to VR	
Surfbird	*Calidris virgata*	Migrant	UC to VR	
Wandering tattler	*Tringa incana*	Migrant	UC to VR	
Western sandpiper	*Calidris mauri*	Migrant	C	
Whimbrel	*Numenius phaeopus*	Migrant	UC to VR	
Wilson's snipe	*Gallinago delicata*	Breeding	C	
Passerines				
American crow	*Corvus brachyrhynchos*	Breeding	C	
American dipper	*Cinclus mexicanus*	Breeding	C	
American robin	*Turdus migratorius*	Breeding	C	
American tree sparrow	*Spizelloides arborea*	Migrant; Non-breeding	C	
Barn swallow	*Hirundo rustica*	Breeding	C	
Belted kingfisher	*Megaceryle alcyon*	Breeding	C	
Bohemian waxwing	*Bombycilla garrulus*	Migrant; Non-breeding	C	
Chestnut-backed chickadee	*Poecile rufescens*	Breeding	C	
Common raven	*Corvus corax*	Breeding	C	
Common redpoll	*Acanthis flammea*	Migrant; Non-breeding	C	
Dark-eyed junco	*Junco hyemalis*	Breeding	C	
Fox sparrows	*Passerella iliaca*	Breeding	C	
Golden-crowned kinglet	*Regulus satrapa*	Breeding	C	
Lincoln's sparrows	*Melospiza lincolnii*	Breeding	C	
Pine grosbeak	*Pinicola enucleator*	Migrant; Non-breeding	C	
Red crossbill	*Loxia curvirostra*	Breeding	C	
Ruby-crowned kinglet	*Corthylio calendula*	Breeding	C	
Rufous hummingbird	*Selasphorus rufus*	Breeding	C	
Rusty blackbird	*Euphagus carolinus*	Migrant; Non-breeding	C	
Thrushes	*Turdidae family*	Breeding	C	
Tree swallow	*Tachycineta bicolor*	Breeding	C	
Violet-green swallow	*Tachycineta thalassina*	Migrant; Non-breeding	C	

Common Name	Scientific Name	Presence in Project Area	Occurrence	Status
Warblers	*Parulidae family*	Breeding	C	
Western flycatcher	*Empidonax difficilis*	Breeding	C	

*Sources: APA 1979, Cornell University 2024, USFS 2016

4.5.1.1.3 Marine Mammals

Several marine mammals occur in Southeast Alaska and may occur in Bradfield Canal. All marine mammals are protected by the Marine Mammal Protection Act (MMPA) of 1972. Rare, Threatened, and Endangered marine mammals are discussed below in Section 4.6. Species statuses and descriptions, unless otherwise noted, have been summarized from species profiles available on NOAA's website (NOAA 2024).

Northern sea otter (*Enhydra lutris kenyoni*) are the smallest marine mammals and in the weasel family. They are social species and tend to form colonies in a suitable habitat. Sea otters frequent coastal areas, including the Bradfield Canal, where sea urchins and other food sources are present. The sea otter population in Southeast Alaska does not have any additional protection other than the MMPA (the Southwest Alaska population is federally threatened [USFWS 2024]). The Southeast Alaska stock of sea otters was decimated by commercial harvest in the 1700s; translocation efforts in the 1960s helped to bring the species back to Southeast Alaska. In 2022, the total population of the Southeast Alaska stock of sea otters was estimated at 22,359 individuals (Schuette et al. 2023).

Harbor seals (*Phoca vitulina*) frequent most marine habitat and coastlines in Southeast Alaska, including Bradfield Canal. Harbor seals have no additional protections other than the MMPA. Seals are relatively small and agile marine mammals, often well-adapted to human presence and boat traffic. They can be frequently found in boat harbors and marinas. The Steller sea lion Eastern DPS occurs in marine waters of Southeast Alaska and haulout areas. The Steller sea lion Eastern DPS is not ESA-listed but is include on the USFS Alaska Region Sensitive Species list (USFS 2009). Sea lions are relatively small and agile marine mammals, often well-adapted to human presence and boat traffic. They can be found frequently in boat harbors and marinas. No major haul outs or rookeries are known to occur in the Bradfield Canal or the Wrangell area.

Eleven species of whales, dolphins, and porpoises may occur in the Wrangell and Bradfield Canal areas; however, only two are likely to be observed there: humpback whale and minke whale (*Balaenoptera acutorostrata*). There are two Distinct Population Segments of humpback whales present in Southeast Alaska – the non-listed Hawaii DPS and the threatened Mexico DPS (ADF&G 2024). The probability of encountering a humpback whale in Southeast Alaska from the Hawaii DPS is 98 percent and 2 perecnt for a whale from the threatened Mexico DPS (NMFS 2021). Humpback whales can be seen in Southeast Alaska at any time of the year but are migratory. Humpbacks whales migrate to tropical and sub-tropical waters for mating and calving. Humpbacks typically then migrate to the Alaska area in the spring where food is abundant. Humpback whales are further discussed under Section 4.6. Minke whales are often observed on whale-watching tours in Southeast Alaska. Other whale, dolphin, or porpoise species that range throughout the Gulf of Alaska may infrequently travel in the Southeast Alaska panhandle, but would not likely enter Bradfield Canal include: blue whale (*Balaenoptera musculus*), sperm whale (*Physeter macrocephalus*), sei whale (*Balaenoptera borealis*), North Pacific right whale (*Eubalaena japonica*), fin whale (*Balaenoptera physalus*), gray whale (*Eschrichtius robustus*), Dall's porpoise (*Phocoenoides dalli*), orca (*Orcinus orca*), and false killer whale (*Pseudorca crassidens*).

4.5.1.2 Botanical Resources

The Tyee Lake Project is in the coastal temperate rainforest, which occurs in western Oregon, Washington, British Columbia, and along the Southeastern coast of Alaska. Coastal temperate rainforest is dominated by Western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sitchensis*) with small portions of Western red cedar (*Thuja plicata*) and yellow cedar (*Callitropsis nootkatensis*) (APA 1979). In the usual mixed stand, hemlock with some cedar forms a dense stand overtopped by the more light-demanding spruce, which occurs individually or in small groups (APA 1979). Small bushy saplings of shade-resistant hemlock and cedars, various species of blueberry (*Vaccinium* spp.), devil's club (*Oplopanax horridus*), and other shrubs species form a dense understory (APA 1979). The forest has a surplus downed trees which decay slowly due to saturation from an abundant rainfall (APA 1979). A carpet of moss often 6 inches or more in thickness covers the decaying logs and forest floor (APA 1979).

Forest vegetation near the Project is dominated by dense stands of Sitka spruce, western hemlock, and mountain hemlock, where shrub and forb flora are frequently shaded out by the dense coniferous canopy (APA 1979). A mosaic of muskeg (bogs), where drainage is restricted, are interspersed in the low elevation areas (APA 1979). The wetter sites are composed of more open stands of spruce-hemlock interspersed with yellow cedar. Groundcover is very dense (APA 1979).

Alpine areas near the Project support sedges (Cyperaceae family), grasses (Poaceae family), heather (Ericaceae family), prostrate shrubs, and lichens (APA 1979). The estuarine meadows support a multitude of grasses, sedges, and forbs (APA 1979).

The shoreline of Tyee Lake and Tyee Creek consist of some areas covered with closely packed mosses. Alder (*Alnus* spp.) 6 to 7 ft in height and willow (*Salix* spp.) 3 to 4 ft in height form dense thickets beyond the southeastern end of the lake and tributary streams (APA 1979). The coniferous forest adjacent to Tyee Creek is dominated by Sitka spruce which provides a 60 to 70 percent canopy cover (APA 1979). The understory consists of thick layers of moss, blueberry, devil's club, skunk cabbage (*Lysichiton americanus*), ferns and other herbaceous vegetation (APA 1979). Portions of the north shoreline at the creek mouth are vegetated by American dune grass (*Elymus mollis*) (APA 1979).

The west and east shoreline of Tyee Lake are steep, having a 60 to 70 percent slopes up to snow-capped peaks (APA 1979). The forested mountain sides are vegetated predominantly by Sitka spruce (APA 1979). The understory of the forested areas are dominated by blueberry, devil's club, and intermixing of skunk cabbage, salmonberry (*Rubus spectabilis*), and ferns (APA 1979). Several avalanche or slide areas occur along both the west and east side of the lake; these areas are vegetated by shorter growths of willow and alder (APA 1979).

There are no known non-native plant species in the Project Area. Alaska Exotic Plants Information Clearinghouse (AKEPIC) does not have any non-native (invasive) plant occurrences mapped in or near the Project Area (ACCS 2023). The nearest mapped non-native species is an observation of reed canarygrass (*Phalaris arundinacea*) at the mouth of Bradfield Canal.

4.5.1.3 Wetlands

Wetlands and waterbodies occupy a significant portion of the Tyee Lake Project. The USFWS (1986) National Wetland Inventory (NWI) mapping indicates several wetland and water types occur in the Project Boundary, as listed in Table 4-8. NWI-mapped wetlands within and surrounding the Project Boundary are shown on Figure 4-4.

Tyee Lake itself is the largest water feature in the Project Boundary accounting for 423.14 acres of lacustrine wetland (66 percent Table 4-8). A mosaic of forested, scrub-shrub, and emergent wetlands occur adjacent to Tyee Lake near the mouths of large tributaries and in valleys between mountain ridges in the area. Estuarine wetlands surrounding the powerhouse, maintenance buildings, access roads, and staging area encompass another large portion of the Project Area and total to 67.45 acres (10.5 percent).

Table 4-8 NWI Wetland Types Mapped within Tyee Lake Project Boundary (Non-Transmission).

Wetland ID	Wetland Type	Description	Acres
E1UBL	Estuarine and Marine Deepwater	Estuarine, Subtidal, Unconsolidated Bottom, Subtidal	9.26
E2EM1P	Estuarine and Marine Wetland	Estuarine, Intertidal, Emergent, Persistent, Irregularly Flooded	58.20
L1UBH	Lake	Lacustrine, Limnetic, Unconsolidated Bottom, Permanently Flooded	423.14
PEM1C	Freshwater Emergent Wetland	Palustrine, Emergent, Persistent, Seasonally Flooded	11.74
PFO4/EM1B	Freshwater Forested/Shrub Wetland	Palustrine, Forested, Needle-Leaved Evergreen / Emergent, Persistent, Seasonally Saturated	12.29
PFO4B	Freshwater Forested/Shrub Wetland	Palustrine, Forested, Needle-Leaved Evergreen, Seasonally Saturated	30.40
PSS1/EM1B	Freshwater Forested/Shrub Wetland	Palustrine, Scrub-Shrub, Broad-Leaved Deciduous / Emergent, Persistent, Seasonally Saturated	4.07
PSS1A	Freshwater Forested/Shrub Wetland	Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Temporarily Flooded	1.48
PSS1B	Freshwater Forested/Shrub Wetland	Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Saturated	43.32
PSS4/EM1B	Freshwater Forested/Shrub Wetland	Palustrine, Scrub-Shrub, Needle-Leaved Evergreen / Emergent, Persistent, Seasonally Saturated	35.13
R3UBH	Riverine	Riverine, Upper Perennial, Unconsolidated Bottom, Permanently Flooded	5.41
R4SBC	Riverine	Riverine, Intermittent, Streambed, Seasonally Flooded	0.22
R5UBH	Riverine	Riverine, Unknown Perennial, Unconsolidated Bottom, Permanently Flooded	6.82
Upland	Upland	Upland	520.2

* Does not include the transmission lines, see Figure 4-3 below for the Project Boundary (non-transmission)

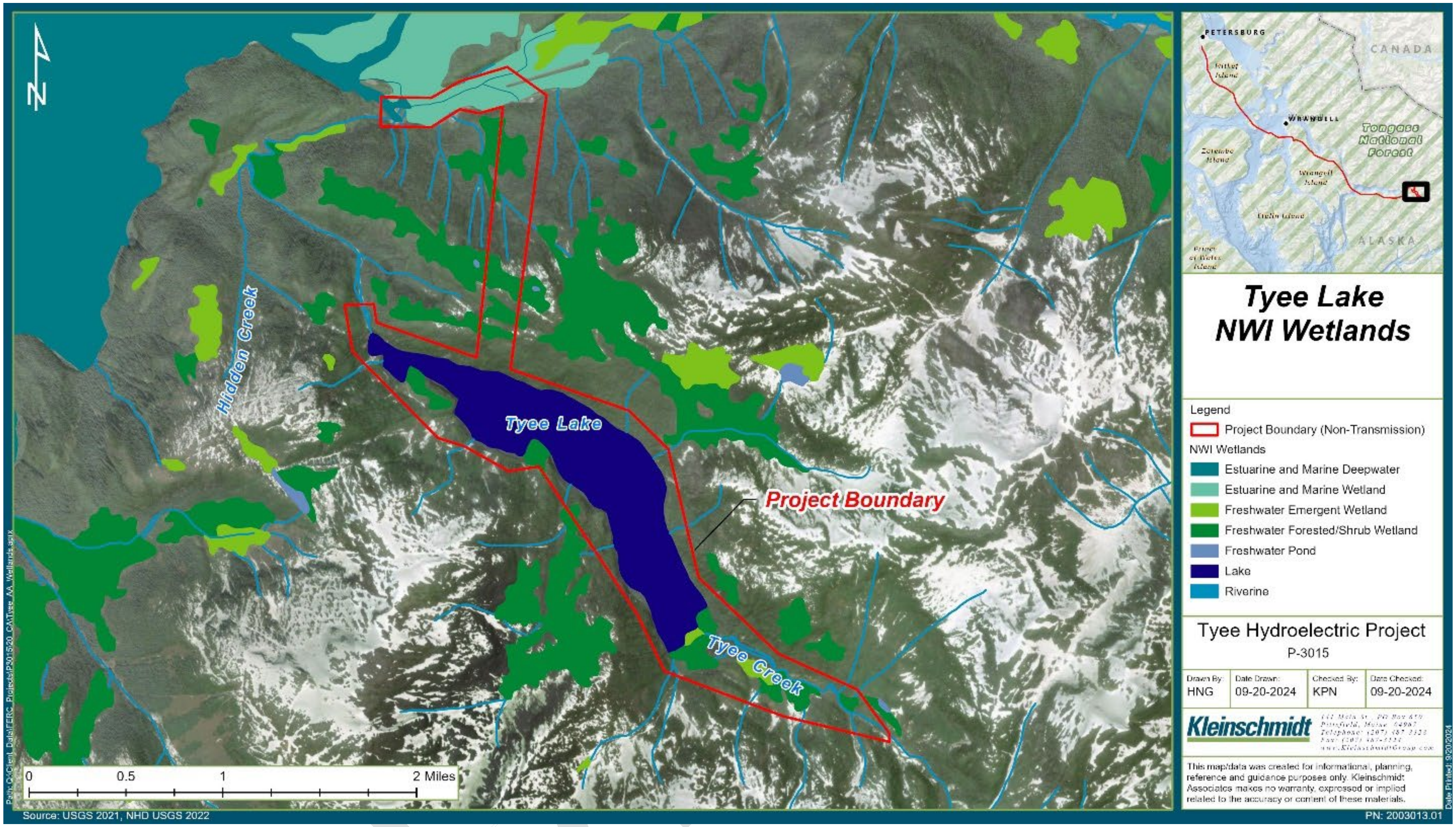

Figure 4-4 NWI-Mapped Wetlands within and Surrounding the Project Boundary.

4.5.2 Environmental Analysis

4.5.2.1 Wildlife Resources

4.5.2.1.1 Construction

The construction of the Third Unit would not affect wildlife resources. Since the Project was designed for a Third Unit, there would be limited effects resulting from construction. Effectively, the Project will continue with the status quo, or current baseline. No in-water or ground disturbing work would occur. The presence and operation of construction equipment and barge operations could increase the potential for fuel and hazardous substance spills. However, BMPs to protect water quality would be implemented (e.g., erosion and sediment control plan, spill prevention and control plan, no refueling adjacent to the waterbodies, etc.). Noise levels would increase slightly during the construction period and could cause temporary disturbance to birds and mammals from noise. Therefore, SEAPA would implement PMEs to protect sensitive species, like minimize duration of noise disturbing activities and timing restrictions. Construction is not expected to create any adverse impacts to wildlife resources.

4.5.2.1.2 Project Operations

Operation of the Tyee Lake Project would have no effect on wildlife in the Project Area. The Project is operated between the natural full pool elevation and the minimum surface elevation; no operational changes in water withdrawals are proposed. The existing tailrace was built for the capacity of the proposed third turbine, no wildlife impacts would occur from its operation.

4.5.2.2 Botanical Resources

4.5.2.2.1 Construction

Construction under the Proposed Action would have no effect on botanical resources within the Project Boundary, as no new ground disturbing activities would occur. No new infrastructure is proposed outside of the existing disturbed area at the Powerhouse, access roads, maintenance buildings, and staging area. All construction activities would occur within the existing powerhouse footprint.

4.5.2.2.2 Project Operations

Operation of the Tyee Lake Project would have no effect on botanical resources of the Project Area. The Project would continue to be operated between the natural full pool elevation and the minimum surface elevation; no operational changes in water withdrawals are proposed.

4.5.2.3 Wetlands

4.5.2.3.1 Construction

Construction under the Proposed Action would have no effect on wetlands within the Project Boundary, as no new ground disturbing activities would occur. No new infrastructure is proposed outside of the existing disturbed area at the powerhouse, switchyard, access roads, maintenance buildings, or staging area.

4.5.2.3.2 Project Operations

Operation of the Tyee Lake Project would have no effect on wetlands in the Project Boundary. The Project is operated between the natural full pool elevation and the minimum surface elevation; no operational changes in water withdrawals are proposed. The existing tailrace was built for the capacity of the proposed third turbine, no wetland impacts would occur from its operation.

4.5.2.4 Marine Mammals

4.5.2.4.1 Construction

Construction activity will require an estimated 5-6 barge round trips from Wrangell to the Project site to transport materials. Given the shallow nature of the bay, the barges would likely dock during high tide only. The minimal increase in vessel traffic is not anticipated to affect marine mammals from vessel strikes or disturbance. Seals and Stellar sea lions would not be affected because they are adapted to the presence of boat traffic and no major sea lion haul outs or rookeries are known to occur in the Bradfield Canal or the Wrangell areas.

4.5.2.4.2 Project Operations

Operation of the Tyee Lake Project would have no effect on marine mammals.

4.5.3 Applicant-Proposed Measures

No applicant-proposed measures for wildlife, botanical, or wetland resources are anticipated for this proposed capacity amendment.

4.5.4 References

Alaska Department of Fish and Game (ADF&G). 2009. Brown Bear Management Report of survey-inventory activities, 1 July 2006 – 30 June 2008. Retrieved from: Brown Bear Management Report of survey-inventory activities 1 July 2006-30 June 2008, Grants W-33-5 and W-33-6, 2009 set (arlis.org)

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4.6 Rare, Threatened, and Endangered Species

4.6.1 Affected Environment

4.6.1.1 Federally Listed Species

The ESA provides a program for the conservation of threatened and endangered plants and animals and their habitats. The USFWS and NMFS are the lead federal agencies that implement the ESA. The law requires federal agencies, in consultation with the USFWS (terrestrial and freshwater species) or NMFS (marine species), to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law prohibits any action that causes “taking” of any listed species of endangered fish or wildlife. There are two ESA-listed species that occur in Southeast Alaska that could potentially occur in the vicinity of the Tyee Lake Project area – the short-tailed albatross and the humpback whale (Mexico DPS).

4.6.1.1.1 Short-tailed Albatross

According to the USFWS’ IPaC official species list for the Tyee Lake Project Area, the only federally-listed species under USFWS jurisdiction with a potential range in the area is the short-tailed albatross (USFWS 2024a, 2024b). The short-tailed albatross was listed as endangered under the ESA in July 2000 with a recovery plan published in September 2008. It is also listed as endangered by the State of Alaska (ADF&G 2024). This species is widely distributed across its historical range, with the population estimated to be 1,200 birds, 600 of which are of breeding age. Currently, most of the world’s breeding nests are on Torishima Island, Japan. Nesting sites are typically on steep sites on soils with loose volcanic ash, usually with grasses that stabilize the soils and provide nesting materials. They breed on remote islands of the Pacific and the only known nesting in the United States is in Hawaii (USFWS 2024c). However, the marine range of short-tailed albatross extends into the open ocean of the Gulf of Alaska, Aleutian Islands, and the North Pacific Ocean (USFWS 2012) where they feed along the shelf, from 0 to 200 meters in depth, and in shelf break areas (USFWS 2008). Juveniles and younger sub-adults (up to 2 years old) use the wider geographic range that encompasses Alaska compared to the adults (O’Connor et al. 2013). This species is unlikely to occur within the Project Area because it spends most of its time at sea, is very rare, and has only a few active breeding colonies remaining, none of which are near the Project Area (ADF&G 2024, USFWS 2024c). There is no critical habitat designated for this species (ADF&G 2024).

4.6.1.1.2 Humpback Whale Mexico DPS

There are 14 Distinct Population Segments of humpback whales (81 FR 62259, September 2016); the threatened Mexico DPS is the only listed stock potentially encountered off the coast of Southeast Alaska (NMFS 2021). Humpback whales are common in Southeast Alaska; the probability of an encountered humpback whale being from the Mexico DPS is 2 percent (NMFS 2021). Humpback whales from the Mexico DPS breed along the Pacific coast in Mexico and migrate north to feed across a large area from California north to the Aleutian Islands.

4.6.1.2 Federally Designated Critical Habitat and Habitat Use

There is no federally designated critical habitat within the vicinity of the Tyee Lake Project Area (USFWS 2024a, 2024b).

4.6.1.3 Federally Protected Species Under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act

As discussed in Section 4.5.1.1.2, Avian Species, nearly all of Alaska’s birds are protected under provisions of the MBTA and eagles are further protected under the BGEPA.

4.6.1.4 USFS Alaska Region Sensitive Species

The USFS Alaska Region Sensitive Species List was last updated in 2009 (USFS 2009) and is included in the 2016 Land and Resource Management Plan for the Tongass National Forest (USFS 2016). In addition to the ESA-listed species noted above, three USFS Alaska Region Sensitive Species may occur in the vicinity of the Project: Queen Charolotte goshawk subspecies of the Northern goshawk, Black oystercatcher (*Haematopus bachmani*), and Stellar sea lions of the Eastern DPS. Sea lions were previously discussed in Section 4.5.1.11.3.

The Northern goshawk is a medium-sized raptor found throughout Alaska, including Southeastern Alaska and may occur in the Project Area (ADF&G 2024). The Queen Charlotte goshawk subspecies is a comparatively small, dark subspecies that occurs only in Southeast Alaska and British Columbia (USFWS 2024d). Goshawks are predators that can eat prey as large as snowshoe hare, grouse, ptarmigan, and ducks (ADF&G 2024).

They prefer to nest in mixed stands of coniferous and deciduous trees and they will occasionally reuse an old nest (ADF&G 2024). The Queen Charlotte goshawk DPS of the northern goshawk is not listed under the ESA (USFWS 2024d).

The black oystercatcher is a seabird that occurs along rocky shorelines of the North American Pacific coast from Baja California to the Aleutian Islands (USFS 2016). They feed exclusively on intertidal macroinvertebrates. During the breeding season, breeding pairs are widely distributed and form small winter flocks in ice-free tidal flats or rocky islets with dense mussel beds (USFS 2016). Half of the global population occurs in the Prince William Sound and the Kodiak Archipelago. There have been 57 incidental sightings between Baranof Island and the Canadian border, most of which were at the Forrester Islan group along the outer coast.

4.6.1.5 State Listed Species

ADF&G is responsible for determining and maintaining a list of endangered species in Alaska under AS 16.20.190. A species or subspecies of fish or wildlife is considered endangered when the Commissioner of ADF&G determines that its numbers have decreased to such an extent as to indicate that its continued existence is threatened. The State Endangered Species List currently includes the ESA-listed species mentioned above – the short-tailed albatross and the humpback whale Mexico DPS.

4.6.1.6 Botanical

Nawrocki et al. (2013) published a field guide documenting known sightings of Alaska's rare plants. Of the 80 rare plants documented in the guide, 8 have been sighted in Southeast Alaska within the same general ecoregion as the proposed Project; however, the sightings were not near the Project. The nearest Nawrocki et al. (2013) record of a rare plant is Calder's licorice-root (*Ligusticum calderi*), mapped on the southwest side of Prince of Wales Island, approximately 90 miles from the Project Boundary.

4.6.2 Environmental Analysis

4.6.2.1 Construction

The construction of the Third Unit would not affect rare, threatened, or endangered wildlife or botanical resources. No in-water work, ground disturbing work, or tree removal would occur.

The presence and operation of construction equipment and barge operations could increase the potential for fuel and hazardous substance spills. However, BMPs to protect water quality would be implemented (e.g., erosion and sediment control plan, spill prevention and control plan, no refueling adjacent to the waterbodies, etc.). Humpback whales can be injured or killed from inadvertent vessel strikes. However, it is not anticipated that the ESA-listed Mexico DPS would be impacted due to the limited increase in barge traffic (about 5 to 6 round trips between Wrangell and the Project) and the low probability (2 percent) of humpback whales potentially present being from the ESA-listed Mexico DPS.

Most of the construction activities would occur within the powerhouse. Noise levels associated with those activities as well as transporting materials and equipment from the barge area to the powerhouse area are not anticipated to be above ambient noise levels currently experienced at the Tyee Lake facility. Noise levels may temporarily increase for a short duration during concrete mixing activities but are not anticipated to significantly disturb wildlife.

4.6.2.2 Project Operations

Operation of the Tyee Lake Project would not affect rare, threatened, or endangered wildlife in the Project Area. The Project would be operated between the natural full pool elevation and the current minimum surface elevation of 1,250 ft; no operational changes to the usable lake storage area are proposed. The existing tailrace was designed and constructed to accommodate the maximum output from three turbines operating concurrently.

Continued Project operations at the Tyee Lake Project would have no effects on rare, threatened, or endangered marine mammals in the Project Area and Bradfield Canal.

4.6.3 Applicant-Proposed Measures

No applicant-proposed measures are known or anticipated for this proposed capacity amendment.

4.6.4 References

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4.7 Recreation, Land Use, and Aesthetics

4.7.1 Affected Environment

The Tyee Lake Project is located in a remote area of Southeast Alaska along a narrow bench of land between the tidal estuary of the Bradfield River and a steep mountainside and is accessible only by air or boat (SEAPA 2024). The non-transmission portion of the Project occupies state lands that are surrounded by the Tongass National Forest, which is managed by the USFS. The Tongass National Forest is the nation's largest national forest and covers most of Southeast Alaska (USFS 2024b).

The Tyee Lake Hydroelectric Project has no developed recreation facilities associated with it, and due to its remote location, supports little to no recreation use. As part of the original license agreement for project mitigation, the State of Alaska provided the USFS with funds that were used to develop a recreation site at Blind Slough on Mitkof Island over 100 miles from the Tyee Lake Project. However, this site is completely owned and managed by the USFS (Alaska Energy Authority 1997).

The adjacent USFS land surrounding Tyee Lake is classified as Remote Recreation (USFS 2024b). Tyee and Hidden creeks flow through the Semi-Remote Recreation LUD. The management objective of these LUDs is to provide for recreation in remote or natural-appearing settings where opportunities for solitude and self-reliance are high or moderate to high, respectively (USFS 2016). Recreation in these areas includes, but is not limited to, hiking, hunting, fishing, camping, photograph, skiing, snowmachining, exploring forest roads, wildlife viewing, using recreational cabins, beachcombing, kayaking, canoeing, and enjoying the marine environment adjacent to forest lands (USFS 2016). The USFS land to the east of the Project Area is managed for Timber Production.

There are opportunities for recreation in the surrounding area with guided and self-guided tours (USFS 2024a). Two Nature viewing sites are located at the confluence of Bradfield Canal and Ernest Sound: the Anan Creek Wildlife Viewing Site and Anan Wildlife Observatory Site (USFS 2024a). Additionally, Alaska Winter Cruises uses the Bradfield Canal for tours during the daytime hours (Sea Venture 2024). The Bradfield Canal is home to marine mammals and fishes. The Bradfield Canal and adjacent waters can be used for recreational, subsistence, and commercial fishing. Especially in Bradfield Canal, pink salmon abundance is high (Thynes et. al 2022). Recreational users can also utilize the

Harding River Cabin on the Bradfield Canal, which supports wildlife viewing, fishing, hunting, camping, and boating in the area (Recreation.gov 2024).

The surrounding area of the Tongass National Forest also offers opportunities for dispersed recreation. Dispersed recreation refers to activities that occur in an area of a national forest with limited or no amenities provided for recreational users. In the Tongass National Forest, dispersed recreation includes activities such as camping outside of established campgrounds, fishing, and exploring undeveloped coastal areas (USFS 2024c)

The Tyee Lake Project is approximately 40 miles southeast of Wrangell. The community of Wrangell developed a Sustainable Outdoor Recreation Plan in 2012 to guide continued growth of outdoor recreation opportunities in the area, with the goal to improve the community's outdoor recreation opportunities to help support economic expansion in the area. There are extensive existing outdoor recreation opportunities available in the community of Wrangell, including trail systems, lake access, docks that support on-the water activities, parks, and kayak routes and facilities (Wrangell 2012). The community of Wrangell offers extensive outdoor recreation opportunities in the vicinity of the Project.

4.7.2 Environmental Analysis

4.7.2.1 Construction

Proposed construction could have minor, temporary effects on recreation, land use, and aesthetic resources within the Project Boundary. Construction activities are largely limited to the transport and installation of the Pelton-style turbine generating unit, which would result in an increased presence and operation of construction equipment and barges in the Project area. The presence of construction equipment could have short term impacts to recreation and aesthetics in the construction area. Noise levels would increase slightly during the construction period and could cause temporary disturbance to any recreational users in the immediate vicinity of the Project. However, the remote nature of the Project and limited recreational use in the Project vicinity would limit these effects. These effects would be limited to the immediate area of construction and during the time of construction, as construction activities would not require ground-disturbance, new roads or staging areas, the removal of vegetation, or the need for placement or discharge of dredged or fill material into waters.

4.7.2.2 Project Operations

Operation of the Tyee Lake Project under the Proposed Action would have no effect on recreation, land use, and aesthetic resources within the Project Boundary. The Project would continue to be operated between the natural full pool elevation and the minimum surface elevation of the Project, with no changes in water withdrawals proposed. The existing tailrace was built for the capacity of the proposed third turbine, no effects on recreation, land use, or aesthetics would occur from operation.

4.7.3 Applicant-Proposed Measures

No applicant-proposed measures are known or anticipated for this proposed capacity amendment.

4.7.4 References

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4.8 Cultural and Tribal Resources

4.8.1 Affected Environment

Due to the rugged and remote geography of southeastern Alaska, there is limited information about the early human settlement of the region. Archeologists have long debated the peopling of the North American continent, with some furthering the Bering Land Bridge Theory that people walked down an inland corridor between large glaciers of western Canada around 13,500 years ago, and others arguing that sea travel is likely to have occurred much earlier, based on earlier dates of human occupation in other parts of North and South America. In the last 20 years, studies are accumulating that suggest the latter, although direct evidence has still been hard to find.

New research dating rocks and animal bones suggests that southeastern Alaska was largely ice-free and full of plant and animal life as early as 17,000 years ago (Wade 2018). Genetic evidence supports a theory that the ancestors of contemporary indigenous people in the area lived for 15,000 years on the Bering Land Bridge until the last ice age ended (Elias 2014). A recent underwater discovery of a submerged stone fish weir on the west side of Prince of Wales Island reveals that people have lived in what is now southeastern Alaska for at least 11,000 years (Archaeology Magazine 2022).

The project area is within the traditional territory of the Stikine Tlingit, or *Kaachxana aakw* (People of the Bitter Water) (Goldschmidt and Haas 1998, Wrangell Cooperative Association n.d.). Historically, the Stikine Tlingit lived, hunted, fished, and trapped in the lower Stikine River basin and throughout the islands of the Alexander Archipelago. Traditional Native use of the area for subsistence activities prompted settlement along shorelines and stream banks. The earliest known settlements date to 8,000 years ago, and descendants believe that they migrated from the Canadian interior along the Stikine River, traveling beneath glaciers to escape the great floods of the last Ice Age (Alaska Natives without Land 2024). After settling in the Wrangell area, the Stikine Tlingit established trading networks extending into the interior of Canada and up the Copper River (Alaska Natives without Land 2024).

In the mid to late 1700s, the Alexander Archipelago was visited, explored, mapped, and colonized by the Russians, Spanish, and British. It soon became the center of the Maritime Fur Trade, in which the Stikine were active participants. As early as 1775, the effects of Spanish colonization were felt by the local indigenous populations with the introduction of smallpox (Andrews 1980). Gold was discovered on the upper Stikine River in 1861, and the following year prospectors arrived at the Native village in Wrangell. With the Alaska Purchase of 1867, the United States gained control of the region from Russia and prospecting increased. Today, tourism, fishing, and logging are the main industries in the area.

4.8.1.1 Previous Research in the Project Vicinity

There have been few systematic and comprehensive archaeological surveys in the region. Most of the known archaeological sites in the vicinity are associated with traditional use and occupation of the area by the Stikine Tlingit, their ancestors, and possible earlier indigenous populations (Andrews 1980, Grieser 2013). These include prehistoric sites, petroglyph sites, and post-contact sites such as winter villages, other seasonal settlements, forest/outposts, burials, fishing traps and weirs, canoes, a cedar source, and a garden (Andrews 1980). The Coffman Cove site (PET-067), located on Prince of Wales Island, was found to contain multiple human burials. Archaeological excavations at this site in the 1970s yielded radiocarbon dates of 1685 B.C. with diagnostic slate projectile points dating to 2500 to 800 B.C. (Andrews 1980). Historic sites in the region include multiple canneries, forts dating to 1834-1877 in the Wrangell area, educational institutions, fur farms, a goat and cattle ranch, and a marble mining site on Blake Island (Andrews 1980).

Interviews with two Stikine Tlingit men in 1946 indicated that the upper end of Bradfield Canal belonged to the *Naanyaa.aayi* clan, although at least one other clan also made claim to streams in the area. Both men indicated that historically, two white men lived at the mouth of the Harding River and controlled access to the area. While there is evidence of Native American seasonal use along Bradfield Canal, there is no indication of sites in the vicinity of Tyee Lake (Andrews 1980, Goldschmidt and Hass 1998). No Native burial or cemetery sites were identified in the Tyee Lake area in Sealaska’s 1975 report, *Native Cemetery and Historic Sites of Southeast Alaska* (Sealaska 1975, Gieser 2013).

The Tyee Lake area has been subjected to a few previous archaeological investigations associated with the development of the Tyee Lake Hydroelectric project (Arndt 1979, Andrews 1980, Roberts 1981, 1988, Greiser 2013). In 1979, Katherine Arndt prepared a background study for the Tyee Power Project (Arndt 1979). Arndt reported there were no known cultural resource sites on or near Tyee Lake and indicated that most sites could be expected to be located near the coast. However, she did recommend some archaeological survey in areas of lower archaeological potential near Tyee Lake.

In 1980, the Artic Environmental Information and Data Center sponsored a cultural resource survey that inspected 47 localities along the proposed routes of the Tyee Lake Power Project, including some areas around Lake Tyee (Andrews 1980). The survey did not locate any cultural resources around Tyee Lake (Andrews 1980).

The 1981 and 1988 reports (Roberts 1981, 1988) were for the Campbell Study Area, Bradfield Canal and the Bradford Hydroelectric Line. These studies did not identify any resources in the Tyee Lake area.

In 2013, T. Weber Greiser prepared a background research report for a lake tap intake project at the Tyee Hydroelectric facility. The study was a review of existing research and resources and evaluated the likelihood of encountering cultural resources in the area. No confirmed or unconfirmed sites were identified in or near the area. No evidence of historic structures or features, such as cabins or mines, were found during review of public land records (Geiser 2013). Gieser concluded that based on the rugged topography and elevation at 1,300 to 1,400 ft, the project area is within the low sensitivity zone for probability of encountering cultural resources, as defined in the *Third Amended Programmatic Agreement Among the USDA Forest Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer Regarding Heritage Resource Management on National Forests in the State of Alaska*. programmatic agreement (Programmatic Agreement 2010). The Alaska SHPO determined that no pedestrian survey would be required and that there would be *no historic properties affected* as a result of the lake tap intake project (File No. 3130-IRFERC).

The hydroelectric facility's buildings and components were constructed in 1978, less than 50 years ago, and do not qualify as potential historic properties.

4.8.2 Area of Potential Effects

The area of potential effects (APE) for archaeological resources is typically defined as the extent of ground disturbance associated with the proposed project, plus a 50- or 100-foot buffer. There is no ground disturbance associated with the project.

The APE for historic built environment resources, including historic buildings, objects, districts, landscapes, and linear features, is typically defined as a half mile from the proposed project where visual, auditory, vibratory, or atmospheric effects may impact historic properties.

4.8.3 Tribal Consultation

If the project is subject to Section 106 of the NHPA, then FERC, as the federal lead agency, would be responsible for conducting formal government-to-government tribal consultation with applicable tribes. SEAPA is providing this document to Tribes to and is requesting information regarding any tribal cultural resources in the vicinity that may be impacted by the project. The following Tribes have indicated that they are interested in projects occurring in Wrangell Borough (HUD 2024):

- Craig Tribal Association
- Hydaburg Cooperative Association
- Klawock Cooperative Association
- Metlakatla Indian Community, Annette Island Reserve
- Organized Village of Kake
- Petersburg Indian Association
- Wrangell Cooperative Association

4.8.4 Environmental Analysis

4.8.4.1 Construction

No archaeological sites have been identified in the vicinity of the Project and the area has a low probability of containing archaeological resources. Installation of a third turbine would take place within the existing powerhouse and there would be no ground-disturbing activities associated with transport, staging, or construction. Therefore, it is likely that there would be no effect on archaeological resources from Project construction.

Construction may include temporary impacts to the visual, auditory, vibratory, and atmospheric environment. However, no historic environment resources have been identified in the vicinity of the Project. Therefore, it is likely that there would be no effect on historic built environment resources from the Project.

No tribal resources have been identified in the vicinity of the project from previous cultural investigations or from the original development of the Tyee Hydroelectric Project. It is unlikely that the installation of a third turbine in an existing facility would affect tribal cultural resources; however, tribal notification has not been conducted for this project. Any issues identified by the Tribes following distribution of this document will be presented in the Final Amendment Application.

4.8.4.2 Project Operations

There are no known archaeological or historic environment resources in the project APE. Tribal cultural resources are not anticipated from the vicinity of the Project, but tribal notification is recommended. With the addition of the third turbine, the facility would have a similar appearance and would continue to operate in a similar fashion. It is likely that project operations would have no effect on historic properties or tribal cultural resources. Any issues identified by the Tribes following distribution of this document will be presented in the Final Amendment Application.

4.8.5 Applicant-Proposed Measures

No applicant-proposed measures are known or anticipated for this proposed capacity amendment.

4.8.6 Cultural References:

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4.9 Socioeconomics

4.9.1 Affected Environment

4.9.1.1 Population Patterns

The Tyee Lake Project is located at the head of Bradfield Canal within the City and Borough of Wrangell, approximately 40 miles southeast of downtown Wrangell, Alaska. The Project started operation in 1984 and supplies power to the communities of Wrangell and Petersburg. Following completion of the Swan-Tyee Intertie in 2009, the Tyee Lake Project is also connected to SEAPA's Swan Lake hydro project and the community of Ketchikan.

Southeast Alaska is divided into four boroughs, three consolidated cities and boroughs, one municipality, and two Census Areas (CAs). Boroughs in Alaska correspond with the county governments found elsewhere in the United States, but unlike counties in other states, the boroughs in Alaska do not cover the entire state. The remaining unorganized areas are allocated to CAs, which are statistical units that are generally recognized as county equivalents from a data reporting standpoint. The cities of Ketchikan and Petersburg are located in Ketchikan Gateway Borough and Petersburg Borough, respectively. The City and Borough of Wrangell is a consolidated city/borough government.

The City and Borough of Wrangell had a total estimated population of 2,039 in 2023 (Table 4-9). The cities of Ketchikan and Petersburg had estimated populations of 7,083 and 3,023 in 2023, respectively. The population is estimated to have decreased in all three communities from 2020 to 2023. The population also decreased in City and Borough of Wrangell and the City of Petersburg from 2010 to 2020 (Table 4-9).

Table 4-9 Population, 2010, 2020, and 2023

Geographic Area	2010	2020	2023	2010 to 2020		2020 to 2023	
				Net Change	Percent Change	Net Change	Percent Change
Ketchikan Gateway Borough	13,477	13,948	13,475	471	3.5%	-473	-3.4%
City of Ketchikan	8,050	8,192	7,803	142	1.8%	-389	-4.7%

Geographic Area	2010	2020	2023	2010 to 2020		2020 to 2023	
				Net Change	Percent Change	Net Change	Percent Change
Petersburg Borough	3,815	3,398	3,367	-417	-10.9%	-31	-0.9%
City of Petersburg	2,948	3,043	3,023	95	3.2%	-20	-0.7%
City and Borough of Wrangell	2,369	2,127	2,039	-242	-10.2%	-88	-4.1%
Alaska	**710,231**	**733,391**	**736,812**	**23,160**	**3.3%**	**3,421**	**0.5%**

Note:
1/ Data for 2010 and 2020 are decennial census counts. Data for 2023 are estimates.
Source: U.S. Census Bureau 2010, Alaska Department of Labor and Workforce Services 2024a

There are no communities located near the Tyee Lake Project. Review of population data provided via the USEPA's Environmental Justice Screening and Mapping Tool (EJScreen) identified no population within 10 miles of the Project.

4.9.1.2 Employment Resources in the Vicinity of the Project

An estimated 1,190 people were employed in the City and Borough of Wrangell in 2022 (Table 4-10). Government and retail trade were the largest sectors by employment accounting for 18 percent and 12 percent of total jobs, respectively. An estimated 9,674 and 2,394 people were employed in the Ketchikan Gateway and Petersburg boroughs, respectively. Government and retail trade were also the largest employers in these boroughs. Health care and social assistance was also important in Ketchikan Gateway Borough (Table 4-10).

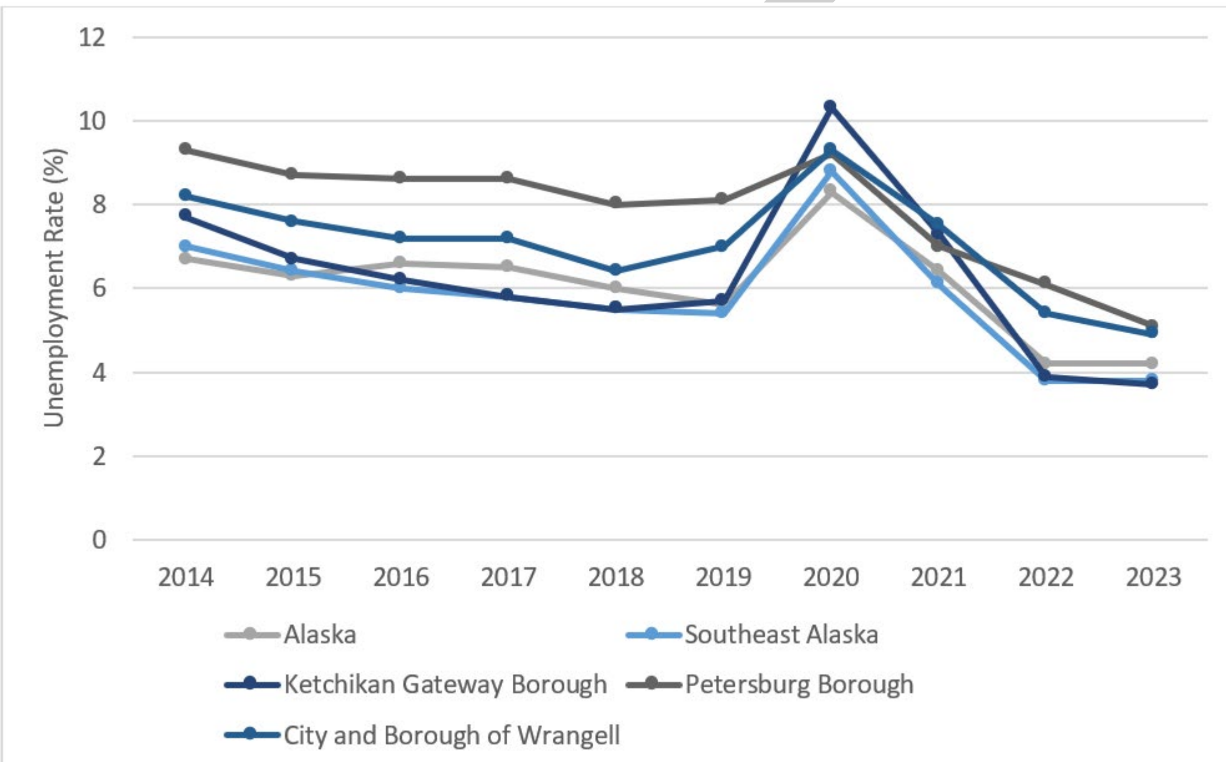
Table 4-10 Employment in the City and Borough of Wrangell in 2022.

Economic Sector	Alaska	Ketchikan Gateway Borough	Petersburg Borough	Wrangell City and Borough
Total employment (number of jobs)	457,687	9,674	2,394	1,190
Percent of Total				
Agriculture	0%	0%	0%	0%
Forestry, fishing, and related	2%	(D)	(D)	(D)
Mining	3%	(D)	(D)	2%
Utilities	1%	(D)	0%	0%

Economic Sector	Alaska	Ketchikan Gateway Borough	Petersburg Borough	Wrangell City and Borough
Construction	5%	5%	4%	(D)
Manufacturing	3%	4%	9%	5%
Wholesale Trade	2%	(D)	(D)	1%
Retail Trade	9%	11%	10%	12%
Transportation and Warehousing	7%	8%	(D)	5%
Information	1%	1%	2%	2%
Finance and Insurance	3%	3%	1%	1%
Real estate and Rental and Leasing	4%	6%	3%	2%
Professional, Scientific, and Technical Services	5%	3%	(D)	(D)
Management of Companies	1%	1%	0%	0%
Administrative and Waste Services	4%	3%	(D)	(D)
Educational Services	1%	1%	(D)	(D)
Health care and Social Assistance	12%	11%	(D)	(D)
Arts, Entertainment, and Recreation	2%	3%	2%	1%
Accommodation and Food Services	8%	9%	6%	6%
Other Services	5%	3%	5%	6%
Government	22%	22%	22%	18%

Notes:
(D) Not shown to avoid disclosure of confidential information; estimates for this item are, however, included in the totals.
1/ Employment estimates include self-employed individuals. Employment data are by place of work, not place of residence, and, therefore, include people who work in the area but do not live there. Employment is measured as the average annual number of jobs, both full- and part-time, with each job counted at full weight.
2/ Percentages for Ketchikan Gateway and Petersburg boroughs and the City and Borough of Wrangell do not sum to 100 because employment counts are not provided for some sectors to avoid disclosing confidential information (identified by [D] in the table).
Source: U.S. Bureau of Economic Analysis 2023

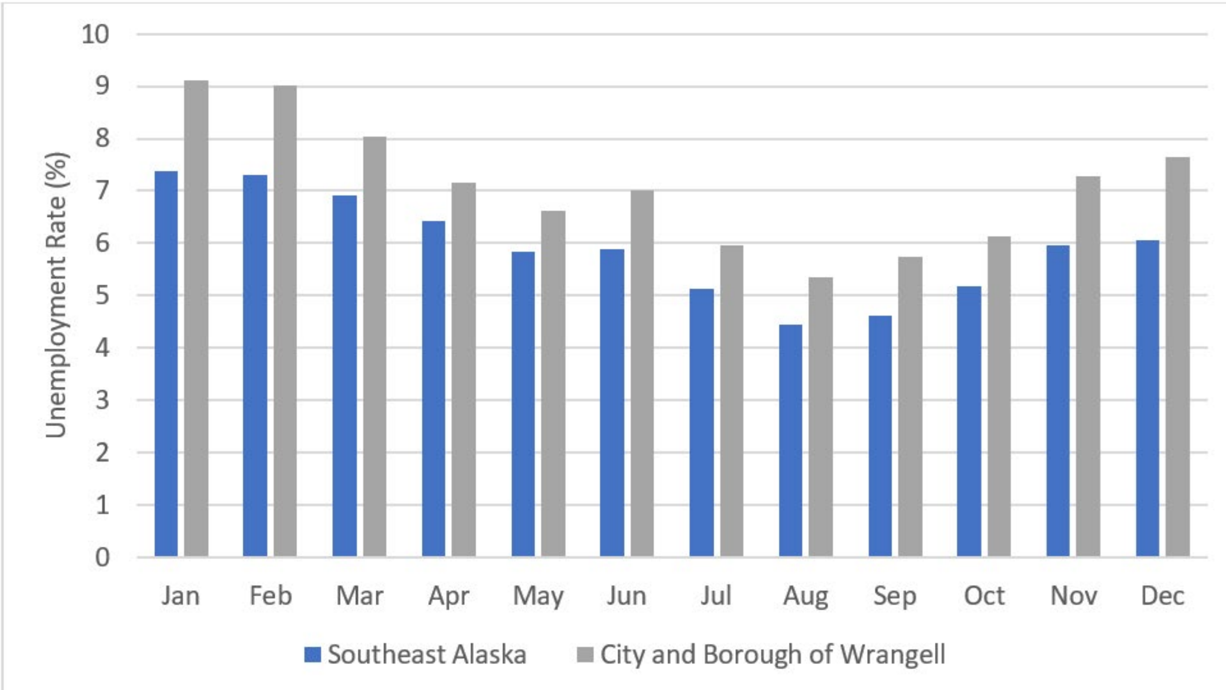
Annual average unemployment rates for Alaska, Southeast Alaska, Ketchikan Gateway and Petersburg boroughs, and the City and Borough of Wrangell are presented from 2014 to 2023 in Figure 4-5. Unemployment rates in all five areas peaked in 2020 as a result of the COVID-19 pandemic and have since trended downward. Unemployment rates were lower than pre-pandemic levels in 2023 in all five areas, ranging from 3.7 percent in Ketchikan Gateway Borough to 5.1 percent in Petersburg. The annual average unemployment rate in the City and Borough of Wrangell in 2023 was 4.9 percent (Figure 4-5).



Note:
1/ Data are not seasonally adjusted.
Source: Alaska Department of Labor and Workforce Services 2024b

Figure 4-5 Average Annual Unemployment Rates, 2014 to 2023.

Southeast Alaska's economy is highly seasonal. Average monthly unemployment rates from 2014 to 2023 ranged from 4.5 percent in August to 7.4 percent in January (Figure 4-6). Monthly unemployment rates were higher in the City and Borough of Wrangell, ranging from 5.4 percent in August to 9.1 percent in January, with a larger range between low and high values, 3.8 percent compared to 2.9 percent (Figure 4-6).



Note: 1/ Data are not seasonally adjusted.
Source: Alaska Department of Labor and Workforce Services 2024b

Figure 4-6 Average Monthly Unemployment Rates, 2014 to 2023.

4.9.2 Environmental Analysis

4.9.2.1 Construction

Construction crew members and engineers would be housed at SEAPA's existing bunkhouse or existing USFS cabins under SEAPA's Special Use Permit and would either be flown to the airstrip or transported to the dock or barge bulkhead by private ferry. Equipment and supplies would be barged up the Bradfield Canal to an existing barge bulkhead on site. Construction activities associated with SEAPA's Proposed Action is expected to employ 10-15 individuals over the course of 8 months.

4.9.2.2 Project Operations

Operation of the project will not directly affect socioeconomics but may lower energy costs for the three member utilities (the cities of Ketchikan, Petersburg, and Wrangell) by increasing the share of electricity demand that can be met by hydroelectric power and reducing the need for diesel generation.

Two diesel generating stations, located in Wrangell and Petersburg, are currently used in combination with the Tyee Lake Project to meet electricity demand. Potential reductions in the use of these stations would result in reduced air quality-related impacts for residents of the surrounding communities. This potential effect is discussed further with respect to environmental justice in Section 4.10.3.2.

Increased hydroelectric capacity would also support economic development and ongoing trends in energy use including conversion from oil heat to electric heat pumps or baseboard heat and the increased use of electric vehicles.

4.9.3 Applicant-Proposed Measures

No applicant-proposed measures are known or anticipated for this proposed capacity amendment.

4.9.4 References

Alaska Department of Labor and Workforce Services. 2024a. Alaska Population Estimates by Borough, Census Area, City, and Census Designated Place (CDP), 2020 to 2023. Available online at: https://live.laborstats.alaska.gov/data-pages/alaska-population-estimates

Alaska Department of Labor and Workforce Services. 2024b. Unemployment Rates by Area Not Seasonally Adjusted. Available online at: https://live.laborstats.alaska.gov/data-pages/labor-force-area-data?a=0&s=31

U.S. Bureau of Economic Analysis. 2023a. CAEMP25N Total full-time and part-time employment by industry, November 16. Available online at: http:www.bea.gov.

U.S. Census Bureau. 2010. P1 Total Population. 2010: DEC Redistricting Data (PL 94-171). Available online at: https://data.census.gov.

4.10 Environmental Justice

Consistent with the National Environmental Policy Act (NEPA) Phase 2 Rule, effective July 1, 2024,[3] the licensee provides the following Environmental Justice (EJ) analysis for the Proposed Action. This overview is meant to provide an understanding of the number of EJ communities present within the Tyee Lake Project (EJ Project Area) area, and potential effects to them from the proposed work at the Project, including socioeconomic and/or sociocultural impacts.

Identification of Environmental Justice Communities

The geographic scope of analysis for this environmental justice overview is a 5-mile zone around the existing project boundary. Consistent with FERC recommendations in recent relicensing efforts, the methods outlined in the USEPA Promising Practices for EJ Methodologies in NEPA Reviews (USEPA 2016) have been applied to the geographic scope to identify EJ communities near the Tyee Lake Project.

The thresholds used for populations meeting EJ status are as follows:

- The "meaningfully greater analysis" and the "50 percent" methods were used to determine EJ status based on race:
  - To meet EJ criteria using the "meaningfully greater analysis," a block group qualifies as having EJ communities if the total minority population for a block group is at least 10 percent greater than that of the county population as follows:

    (County minority population) x (1.10) = threshold above which a block group minority population must be for inclusion as an environmental justice community.
  - To meet EJ criteria using the "50 percent" method, the total minority population must be greater than 50 percent to qualify as an EJ community.
- The "low-income threshold criteria" was used to identify environmental justice communities based on income level, where the block group must have a higher percentage of low-income households than the county.

[3] 89 FR 35442 (https://www.federalregister.gov/d/2024-08792)

4.10.1 Affected Environment

Within a 5-mile zone around the Project boundary there is one census block group that could potentially be affected by construction operations. The single block group within the EJ Project Area does not include EJ communities related to race or poverty level (Table 4-11) (Figure 4-7), and there are no sensitive receptor locations within the geographic scope.

As a measure to ensure the public can be fully engaged in the NEPA process, non-English-speaking populations, regardless of their location within or outside of EJ block groups are also identified. Within the Tyee Lake EJ Project Area there are no such populations (Table 4-11).

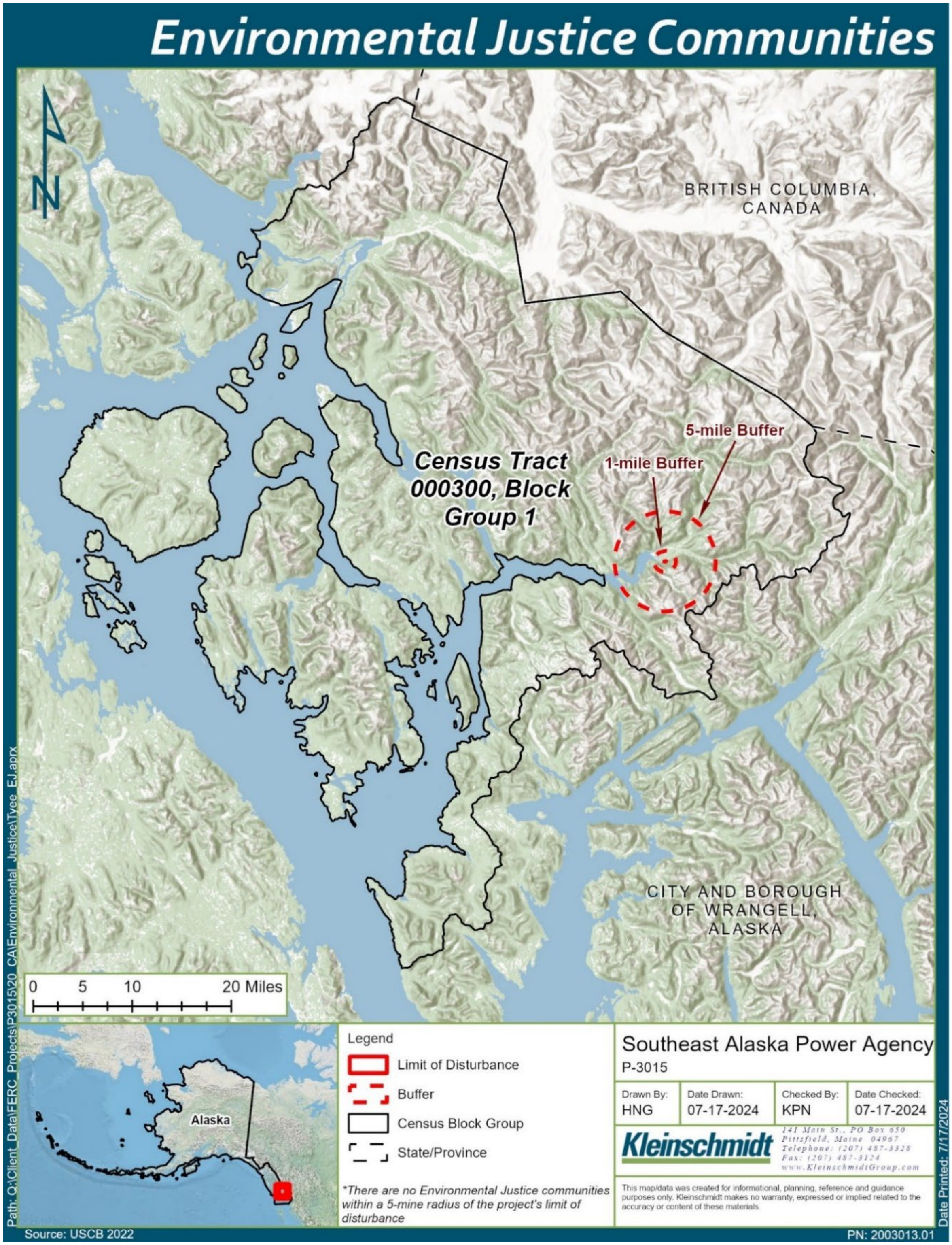


Figure 4-7 Census Tracts and Block Groups within a 5-mile Buffer Around the Tyee Lake Project Area.

Table 4-11 Environmental Justice Data within the 5-mile radius around the Project Boundary.

	Race And Ethnicity Data										**Low-Income Data**	**Language Data**
Geographic Area	Total Population (count)	White Alone, not Hispanic (count)	African American/ Black (count)	Native American/ Alaska Native (count)	Asian (count)	Native Hawaiian & Other Pacific Islander (count)	Some Other Race (count)	Two or More Races (count)	Hispanic or Latino (count)	Total Minority Population (%)	Below Poverty Data (%)	Non-English Speaking Persons Aged 5 Years and Greater (%)
Alaska	734,821	428,802	22,400	102,445	46,507	10,940	3,808	65,029	54,890	42%	10%	0%
City and Borough of Wrangell	2,134	1,187	1	465	18	46	0	294	123	44%	5%	0%
Census Tract 000300, Block Group 1	406	304	0	23	0	0	0	79	0	25%	1%	0%

Source: U.S. Census 2022

4.10.2 Environmental Analysis

Environmental justice communities are not present within the EJ Project Area, therefore no further environmental analysis related to EJ is warranted.

4.10.3 Distribution of Effects

4.10.3.1 Proposed Action

There are no EJ communities present within 5 miles of the Tyee Lake Project, therefore, the Proposed Action would not disproportionately affect EJ communities in the Project Area. No further analysis related to EJ at the Tyee Lake Project is necessary.

4.10.3.2 No Action Alternative

The No Action Alternative may increase effects to EJ communities within areas surrounding the locations of the diesel generators. Increased use of the generators requires additional fossil fuel inputs, further exacerbating climate change, and potentially decreasing the area's climate resiliency and access to electricity going forward if the region were to become dependent on the generators to meet energy demands. Diesel generators also produce emissions that hydropower does not produce, resulting in a decrease to air quality, and an increase in airborne particulate matter (PM), nitrogen oxides (NOx), and carbon monoxide (CO) (Vital Power n.d.). The increase in concentration of these pollutants would not be temporary, as the proposed construction would be, and would get worse over time, potentially causing cumulative effects to EJ communities nearby.

The two diesel generating stations potentially used in lieu of Tyee Lake's hydropower, or in combination with Tyee Lake to meet increased demand, are located in Wrangell and Petersburg, Alaska. Each generating station is supplied by a Petroleum Product Terminal (PPT), requiring transportation of fuel between the terminals and the generators. If the Proposed Action does not move forward, potentially resulting in an increased demand on the diesel generating units, there would be three EJ communities (1 low income, and 2 minority) within 5 miles of the Petersburg generating station (Figure 4-8; Table 4-12), and two EJ communities (1 low income, and 1 minority) within 5 miles of the Wrangell generating station (Figure 4-9; Table 4-13) that may be affected by an increase in air pollutants, traffic between the supply and generating stations, and decreased grid resiliency.

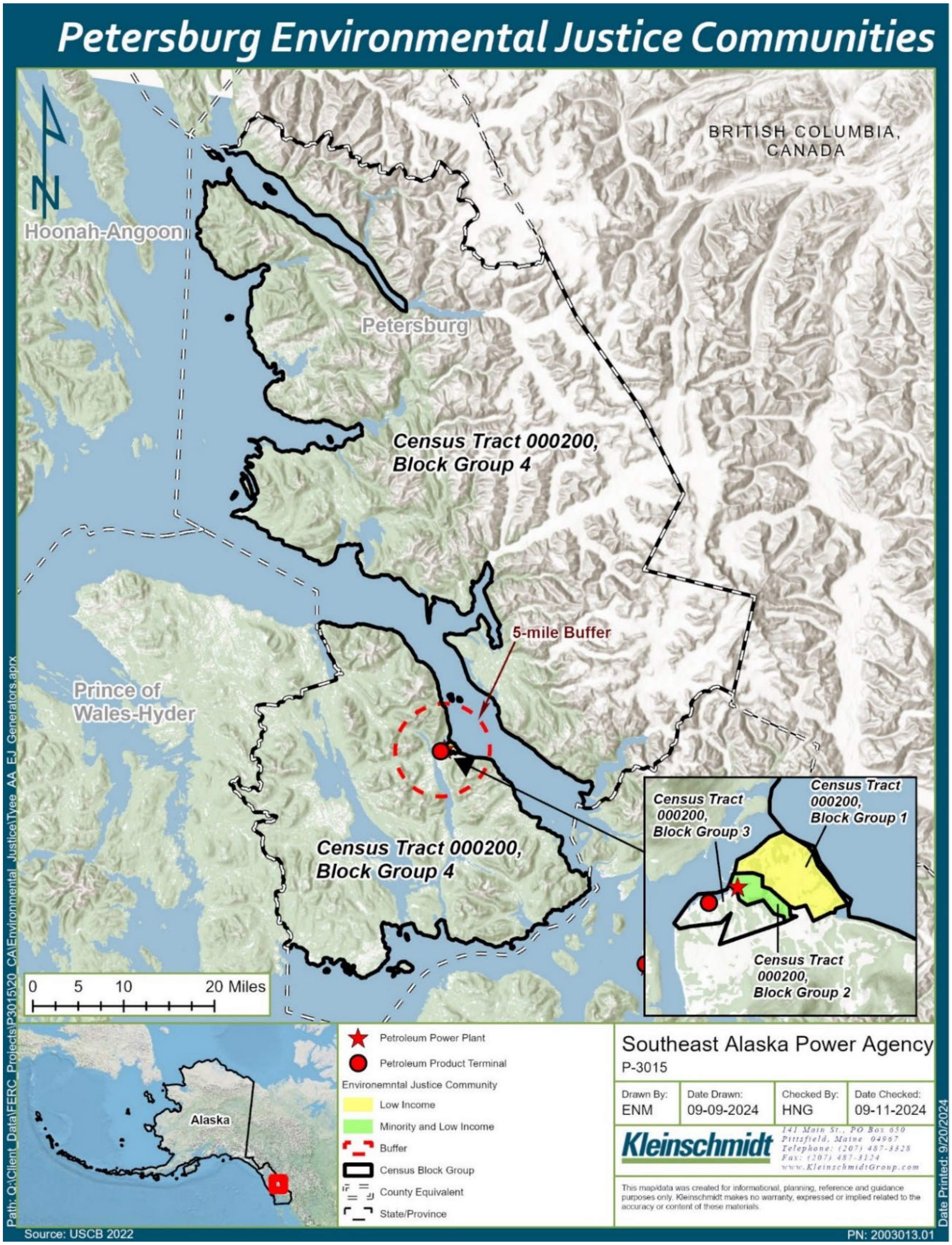


Figure 4-8 EJ Communities within 5 Miles of the Petersburg, Alaska Diesel Generating Station and Petroleum Product Terminal (PPT).

Table 4-12 EJ Communities within 5 Miles of the Petersburg Generating Station and PPT.

	Race and Ethnicity Data										Low-Income Data	Language Data
Geographic Area	Total Population (count)	White Alone, not Hispanic (count)	African American/ Black (count)	Native American/ Alaska Native (count)	Asian (count)	Native Hawaiian & Other Pacific Islander (count)	Some Other Race (count)	Two or More Races (count)	Hispanic or Latino (count)	Total Minority Population (%)	Below Poverty Data (%)	Non-English Speaking Persons Aged 5 Years and Greater (%)
Alaska	734,821	428,802	22,400	102,445	46,507	10,940	3,808	65,029	54,890	42%	10%	0%
Petersburg Borough[a][e]	3,374	1842	39	224	602	16	11	334	306	45%	5%	0%
Census Tract 000200, Block Group 3	887	457	1	32	215	4	11	114	53	48%	4%	0%
Census Tract 000200, Block Group 4	650	402	0	62	3	0	0	58	125	38%	1%	0%

	Race and Ethnicity Data										**Low-Income Data**	**Language Data**
Geographic Area	Total Population (count)	White Alone, not Hispanic (count)	African American/ Black (count)	Native American/ Alaska Native (count)	Asian (count)	Native Hawaiian & Other Pacific Islander (count)	Some Other Race (count)	Two or More Races (count)	Hispanic or Latino (count)	Total Minority Population (%)	Below Poverty Data (%)	Non-English Speaking Persons Aged 5 Years and Greater (%)
Census Tract 000200, Block Group 1	946	590	24	49	116	7	0	77	83	38%	6%	0%
Census Tract 000200, Block Group 2	891	393	14	81	268	5	0	85	45	56%	7%	1%

Source: U.S. Census 2022

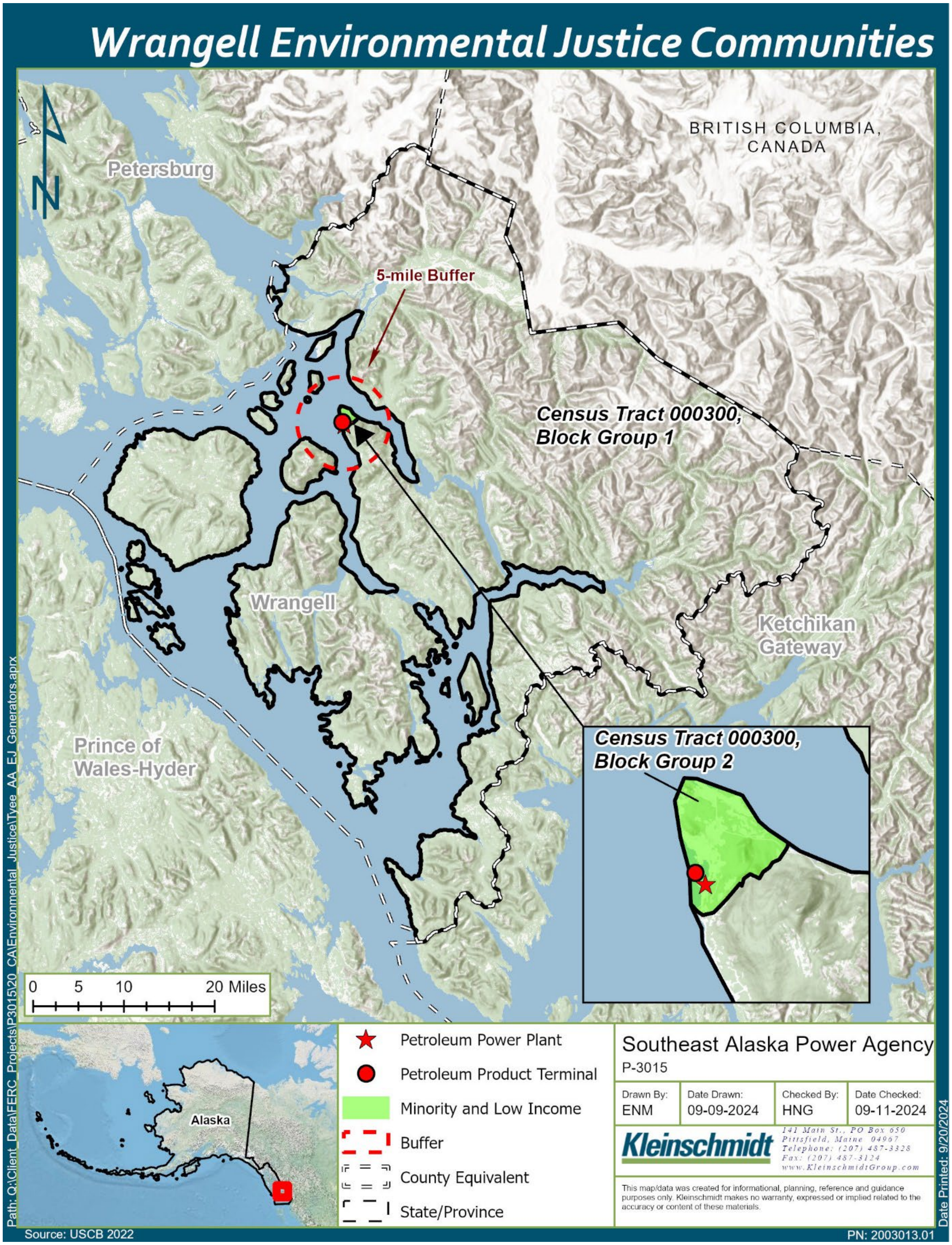


Figure 4-9 EJ Communities within 5 Miles of the Wrangell, Alaska Diesel Generating Station and PPT.

Table 4-13 EJ Communities within 5 Miles of the Wrangell Generating Station and PPT.

	Race and Ethnicity Data										Low-income Data	Language Data
Geographic Area	Total Population (count)	White Alone, not Hispanic (count)	African American/ Black (count)	Native American/ Alaska Native (count)	Asian (count)	Native Hawaiian & Other Pacific Islander (count)	Some Other Race (count)	Two or More Races (count)	Hispanic or Latino (count)	Total Minority Population (%)	Below Poverty Data (%)	Non-English Speaking Persons Aged 5 Years and Greater (%)
Alaska	734,821	428,802	22,400	102,445	46,507	10,940	3,808	65,029	54,890	42%	10%	0%
City and Borough of Wrangell	2134	1187	1	465	18	46	0	294	123	44%	5%	0%
Census Tract 000300, Block Group 1	406	304	0	23	0	0	0	79	0	25%	1%	0%
Census Tract 000300, Block Group 2	1728	883	1	442	18	46	0	215	123	49%	6%	0%

Source: U.S. Census 2022

4.10.4 Applicant-Proposed Measures

No applicant-proposed measures are known or anticipated for this proposed capacity amendment.

4.10.5 References

United States Census Bureau (U.S. Census). 2022. American Community Survey 5-Year data. Available online: https://www2.census.gov/programs-surveys/acs/summary_file/2022/table-based-SF/data/5YRData/. Accessed March 1, 2024.

United States Environmental Protection Agency (USEPA). 2016. Promising Practices for EJ Methodologies in NEPA Reviews. Online [URL]: https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf. Accessed July 19, 2024.

Vital Power. N.d. The Environmental Impact of Diesel Generators. Available online: The Environmental Impact of Diesel Generators | Vital Power. Accessed September 3, 2024.

5.0 DEVELOPMENTAL ANALYSIS

5.1 Power and Economic Benefits of the Project

The long-term benefit of the Proposed Action is that it increases the Tyee Lake Project's installed capacity by 50 percent, for a total of 30 MW, allowing SEAPA to manage peak loads and meet the projected increase in demand. Additionally, adding the Third Unit would provide redundancy if one unit has an outage.

The electricity demand of the communities of Wrangell, Petersburg, and Ketchikan currently exceeds the capacity of the region's hydroelectric projects, including SEAPA's Tyee Lake and Swan Lake projects, during portions of the year. The electricity demand that cannot be met by the hydro projects is provided by the community utilities through diesel generation. Any outage of one of the Tyee Lake generating units would require additional diesel generation to supply power to the communities; the current demand precludes unit cycling at Tyee Lake, negatively affecting the longevity of the equipment at Tyee. Moreover, as described in Section 1.2, there are several investments underway to support the continuing trend in Southeast Alaska of converting oil heat to electric heat pumps or electric baseboard heat and expansion of electric vehicles that will further increase the demand for electricity within SEAPA's grid during Tyee Lake's current FERC license term. Foreseeable electrification of heating systems and transportation, and potential for shoreline power, would exceed the capacity of the hydro projects serving these communities.

5.1.1 Proposed Action

The communities of Wrangell, Petersburg, and Ketchikan will derive an economic benefit from additional generation from the project. This benefit is from the avoided cost of serving load with diesel generation because the increased Tyee Lake generating capacity will capture spill events that otherwise would have occurred. An annual increase in hydro production of 30,000 MWh is predicted, although actual production will be dependent on the water year, Swan Lake generation, and demand.

The total project cost including all license amendment, permitting, engineering and construction costs is forecasted to be $22.5 million. When annual cost of capital and O&M costs are combined, the annual cost of the project is $1.3 million. The total annual cost is anticipated to increase by about $350,000 for the operation and maintenance of the proposed Third Unit.

This additional hydropower generation is anticipated to replace 2.4 million gallons of diesel fuel that would otherwise be needed to meet demand, assuming 0.08 gallons of diesel fuel per kWh. At a cost of $4.70 per gallon, this represents an annual savings of $11.28 million in diesel fuel costs.

5.1.2 No Action Alternative

The No Action Alternative would not enable additional generation to capture future spill events. The No Action alternative increases the future carbon footprint of Southeast Alaska, compared to the Proposed Action.

5.2 Cost of Environmental Measures

This section will be complete in the Final Amendment Application.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Comparison of Alternatives

This section will summarize the effects on the developmental and non-developmental resources for the Proposed Action and No Action/alternatives; this information will be completed for the Final Amendment Application. Developmental values include the impacts associated with operating the project, while non-developmental values include the impacts on fish and wildlife, recreational opportunities, and other environmental aspects.

6.2 Comprehensive Development and Recommended Alternative

FERC is required to consider all uses of the waterway on which the project is located according to Sections 4(e) and 10(a)(1) of the FPA. This includes the fish and wildlife, recreational, and other non-developmental resources. All resources are considered equally with the hydroelectric project’s electric energy or other developmental values. FERC must weigh various economic and environmental considerations involved in approving or rejecting the Proposed Action.

The following section provide SEAPA’s summary and rational for recommendations to FERC for the approval of this project.

6.2.1 Recommended Alternative

Based on the review and evaluation of the Proposed Action and the No Action alternative, SEAPA selected the Proposed Action as the preferred and recommended alternative.

The Proposed Action alternative was selected because it is likely the most cost-effective and least environmentally damaging alternative for meeting the growing energy demand in the region. As proposed, addition of the Third Unit would not require modifying the upper or lower operating range of Tyee Lake, increasing the storage capacity at Tyee Lake, or obtaining additional water rights.

6.3 Cumulative Effects

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR §1508.7), an action may cause a cumulative effect if its effects overlap in space and/or time with effects of other past, present, and reasonably foreseeable future actions.

Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities. The licensee did not identify any resources that may be cumulatively affected by the Proposed Action.

6.4 Unavoidable Adverse Effects

The licensee did not identify any unavoidable adverse effects related to the Proposed Action.

6.5 Fish and Wildlife Agency Recommendations

This section will be completed in the Final Amendment Application.

6.6 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. The following list names the comprehensive plans that are applicable to the Project. No inconsistencies were found.

1. Alaska Department of Fish and Game. 2011. Alaska Anadromous Waters Catalog – Southeastern Region. Anchorage, Alaska. June 1, 2011.
2. Alaska Administrative Code. 2012. 5 AAC § 39.222 Policy for the management of sustainable salmon fisheries. Juneau, Alaska.
3. Alaska Administrative Code. 2003. 5 AAC § 75.222 Policy for the Management of Sustainable Wild Trout Fisheries. Juneau, Alaska.
4. Alaska Department of Natural Resources. 2000. Central/Southern Southeast Area Plan. Anchorage, Alaska. November 2000
5. Forest Service. 2016. Tongass National Forest Land and Resource Management Plan. Department of Agriculture, Ketchikan, Alaska. December 2016
6. Southeast Alaska Fish Habitat Partnership. 2017. Conservation Action Plan 2017-2021. Juneau, AK. 2017.
7. 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.

7.0 FINDING OF NO SIGNIFICANT IMPACT

SEAPA will complete this section in the Final Amendment Application.