

# Eklutna Hydroelectric Project

## Draft Fish and Wildlife Program



October 2023

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## Terms, Acronyms, and Abbreviations

1991 Agreement	1991 Fish and Wildlife Agreement
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AEA	Alaska Energy Authority
AF	acre-feet
AL&P	Anchorage Light & Power
APU	Alaska Pacific University
ARRC	Alaska Railroad Corporation
AWWU	Anchorage Water and Wastewater Utility
cfs	cubic feet per second
Chugach	Chugach Electric Association, Inc.
CIAA	Cook Inlet Aquaculture Association
EUOC	Anchorage Assembly Enterprise and Utility Oversight Committee
Federal and State Resource Management Agencies	USFWS, NMFS, ADFG, ADEC, and ADNR
FERC	Federal Energy Regulatory Commission
ft	feet
Governor	Governor of Alaska
IIP	Initial Information Package
MEA	Matanuska Electric Association, Inc.
MOA	Municipality of Anchorage
MW	megawatt
NMFS	National Marine Fisheries Service
NVE	Native Village of Eklutna
OHA	Office of History and Archaeology
OPCC	Opinion of Probable Construction Costs
Parties	MOA, Chugach, MEA, NMFS, USFWS, and the State of Alaska
PME	protection, mitigation, and enhancement
Project	Eklutna Hydroelectric Project
Project Owners	MOA, Chugach, and MEA
RM	river mile
State	State of Alaska
State Parks	ADNR Division of Parks and Outdoor Recreation
TEK	Traditional Ecological Knowledge
Transaction Date	October 2, 1997

TU	Trout Unlimited
TWG	Technical Work Group
USACE	U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
USFWS	U.S. Fish and Wildlife Service

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## Executive Summary

The Eklutna Hydroelectric Project (Project), located approximately 30 miles northeast of downtown Anchorage, is owned by the Municipality of Anchorage (MOA), Chugach Electric Association, Inc. (Chugach), and Matanuska Electric Association, Inc. (MEA), collectively the “Project Owners.” The Project is the lowest cost resource for power in Southcentral Alaska. It produces approximately 44% of MEA’s renewable generation portfolio and approximately 25% of Chugach’s renewable generation portfolio, increases grid reliability, and offsets approximately 72,500 metric tons of CO<sub>2</sub> equivalent each year.

The Project was constructed by the Federal government in the 1950s and then sold to the Project Owners in the 1990s. At that time, concerns were raised about the Project’s impacts to fish and wildlife, so as part of the sale, a binding agreement was entered into by the Project Owners, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and the State of Alaska (collectively the “Parties”) that requires the Project Owners to develop and propose to the Governor a program to protect, mitigate damages to, and enhance fish and wildlife impacted by the Project (1991 Agreement).

The Project Owners were required to initiate the consultation and study process outlined in the 1991 Agreement by 2022. However, in order to provide ample time for meaningful consultation and a comprehensive study program, the Project Owners started more than three years early in 2019. In addition, the 1991 Agreement required the Project Owners to consult with only specific agencies; however, the Project Owners felt it was important to invite all interested stakeholders to participate in the 1991 Agreement process.

As part of this process, the Project Owners compiled and summarized all relevant existing information, identified information gaps, and developed study plans in consultation with resource agencies, the Native Village of Eklutna (NVE) and other interested entities. The Project Owners then implemented a 2-year study program, including a total of 16 environmental and engineering studies, developed study reports, and conducted a comprehensive alternatives analysis.

The Project Owners subsequently developed this Draft Fish and Wildlife Program (Draft Program) based on the study results and alternatives analysis. In the Draft Program, the Project Owners propose to utilize the existing Anchorage Water and Wastewater Utility (AWWU) water supply infrastructure to provide a year-round base flow regime to 11 out of 12 miles of the Eklutna River. This will significantly benefit all four species of salmon that are currently observed in the lower river while implementing measures to protect the public water supply and minimizing impacts to ratepayers, taxpayers, carbon emissions, and recreation. The

Draft Program also proposes periodic peak flows to maintain downstream fish habitat, construction of eight new bridges for the AWWU water supply access road, a funding commitment for monitoring studies, and an adaptive management framework. Due to the significant costs, impacts, and uncertainty regarding the viability of introducing anadromous species above the Project dam, no fish passage related facilities or changes in operations are proposed at this time.

The Parties to the 1991 Agreement and NVE will have 30 days to review this Draft Program and provide comments to the Project Owners. The Project Owners will then meet with each of the Parties and NVE to attempt to resolve any differences giving due weight to their recommendations, expertise, and statutory responsibilities. During the week of January 15, 2024, the Project Owners will hold public meetings in Anchorage and the Matanuska Valley. The public meetings will be held in an open house style, and members of the public will have an opportunity to submit comments to the Project Owners.

The Project Owners plan to submit their Final Proposed Fish and Wildlife Program (Final Proposed Program) to the Governor in April 2024 along with all supporting information, including a summary of all comments received. The Parties will have an opportunity to provide comments directly to the Governor. The Project Owners will then have an opportunity to provide any final information to the Governor for consideration. When reviewing the Final Proposed Program, the Governor must give equal consideration to:

1. Efficient and economical power production
2. Energy conservation
3. The protection, mitigation of damages to, and enhancement of fish and wildlife (including related spawning grounds and habitat)
4. The protection of recreational opportunities
5. Municipal water supplies
6. The preservation of other aspects of environmental quality
7. Other beneficial public uses
8. Other requirements of State law

The Project Owners anticipate the Governor's issuance of a Final Fish and Wildlife Program by October 2024.

## 1.0 Introduction

Since it was constructed by the Federal government in the 1950s, the Eklutna Hydroelectric Project (Project) has been operated to maximize the generation of cost-effective, carbon-free, flexible hydroelectric energy for the electric customers in Southcentral Alaska.

In 1997, the Project was sold to and is currently owned by the Municipality of Anchorage (MOA), Chugach Electric Association, Inc. (Chugach), and Matanuska Electric Association, Inc. (MEA), collectively the “Project Owners.” MOA’s ownership share of the Project is 53.33%, Chugach’s ownership share is 30%, and MEA’s ownership share is 16.67%.<sup>1</sup> Both Chugach and MEA are non-profit cooperatives, formed to serve and provide affordable energy to their member-owners. The history of development in the Eklutna Basin and Project tailrace area is described in the Initial Information Package (IIP) developed for the Project and available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)).

As part of the sale of the Project, a binding agreement was entered into by the Project Owners, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and the State of Alaska (collectively the “Parties”) that requires the Project Owners to develop and propose to the Governor a program to protect, mitigate damages to, and enhance fish and wildlife impacted by the development of the Project (1991 Agreement). The Parties agreed that the process outlined in the 1991 Agreement obviated the need for the Project Owners to obtain a license from the Federal Energy Regulatory Commission (FERC). The 1991 Agreement was explicitly approved by Congress and was granted direction and authorization under federal law in the Alaska Power Administration Asset Sale and Termination Act of 1995 (APA Asset Sale Act).<sup>2</sup> The APA Asset Sale Act expressly maintained the Project’s exemption from the Federal Power Act’s hydropower licensing requirements (e.g., Federal Energy Regulatory Commission jurisdiction) and authorized the 1991 Agreement’s framework.

As required under the 1991 Agreement, the efforts undertaken by the Project Owners have been designed to generate information to allow the Governor to make a public interest determination to ensure that the Project is best adapted for power generation and other beneficial public uses. This document presents the Project Owners’ Draft Fish and Wildlife Program (Draft Program) for the Eklutna Hydroelectric Project for review and comment. The Project Owners developed this Draft Program over a four-year period in accordance with guidance provided in and requirements of the 1991 Agreement. This document describes the

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<sup>1</sup> The ownership share percentages differ from the current cost sharing agreement amongst the Project Owners.

<sup>2</sup> Public Law 104-58, 109 Stat 557 (1995).

process the Project Owners undertook to develop the Draft Program and contains supporting rationale for their draft proposal described herein.

## 1.1 Existing Project Facilities and Operations

The 40-megawatt (MW) Project is located in Southcentral Alaska, approximately 30 miles northeast of downtown Anchorage near the Native Village of Eklutna (NVE). The U.S. Bureau of Reclamation (USBR) constructed the Project in 1955, which included rehabilitation of the old dam at the outlet of Eklutna Lake. The rehabilitated dam was damaged in the 1964 earthquake, at which point a new and taller embankment dam was constructed just downstream. This new dam (the existing dam) is an earth and rockfill structure 815 feet long and 41 feet high with a rectangular concrete spillway that runs through the dam.

Eklutna Lake (the Project reservoir) is approximately seven miles long and one mile wide and is located within Chugach State Park. The lake is the source of water for the Project. The reservoir also provides almost 90 percent of the domestic water supply for the Municipality of Anchorage to the Anchorage Water and Wastewater Utility (AWWU) through the Project intake. Typically, the reservoir fills during the summer months from snow and glacial melt and is drained during the winter months to generate power. The reservoir is generally at its lowest elevation in May and peaks in September.

The Project facilities and operation are designed to minimize release of water to the Eklutna River from the existing dam by capturing runoff during late spring/summer and taking that water out of the storage reservoir/Eklutna Lake over the course of the year and sending it through the powerhouse located on the Knik Arm. The Project water right requires the Project Owners to operate the Project to fully utilize the water in Eklutna Lake for hydroelectric power production, except for the water that may be diverted for public water supply. The Project also provides other important benefits to electric customers including spinning reserve, frequency and voltage regulation, load following, and firming up electric generation from intermittent renewables. Additionally, the Project tailrace below the powerhouse provides a popular put-and-take Chinook and coho fishery. This fishery is public and handicap accessible.

Figure 1-1 below shows the Project location, legislative boundary for Chugach State Park, and the current extent of anadromy in the Eklutna River. The existing hydro project facilities are shown as red dots, an old hydropower project constructed in 1929 is represented by purple dots, and other non-project features such as the Eklutna Lake Campground, Eklutna Tailrace Day-Use Fishing Access Site, AWWU Water Treatment Plant, and the Native Village of Eklutna are represented by green dots. Other AWWU infrastructure shown in the figure includes the AWWU tunnel, portal valve, and buried pipeline. All three bridges in the lower river are also shown in Figure 1-1.

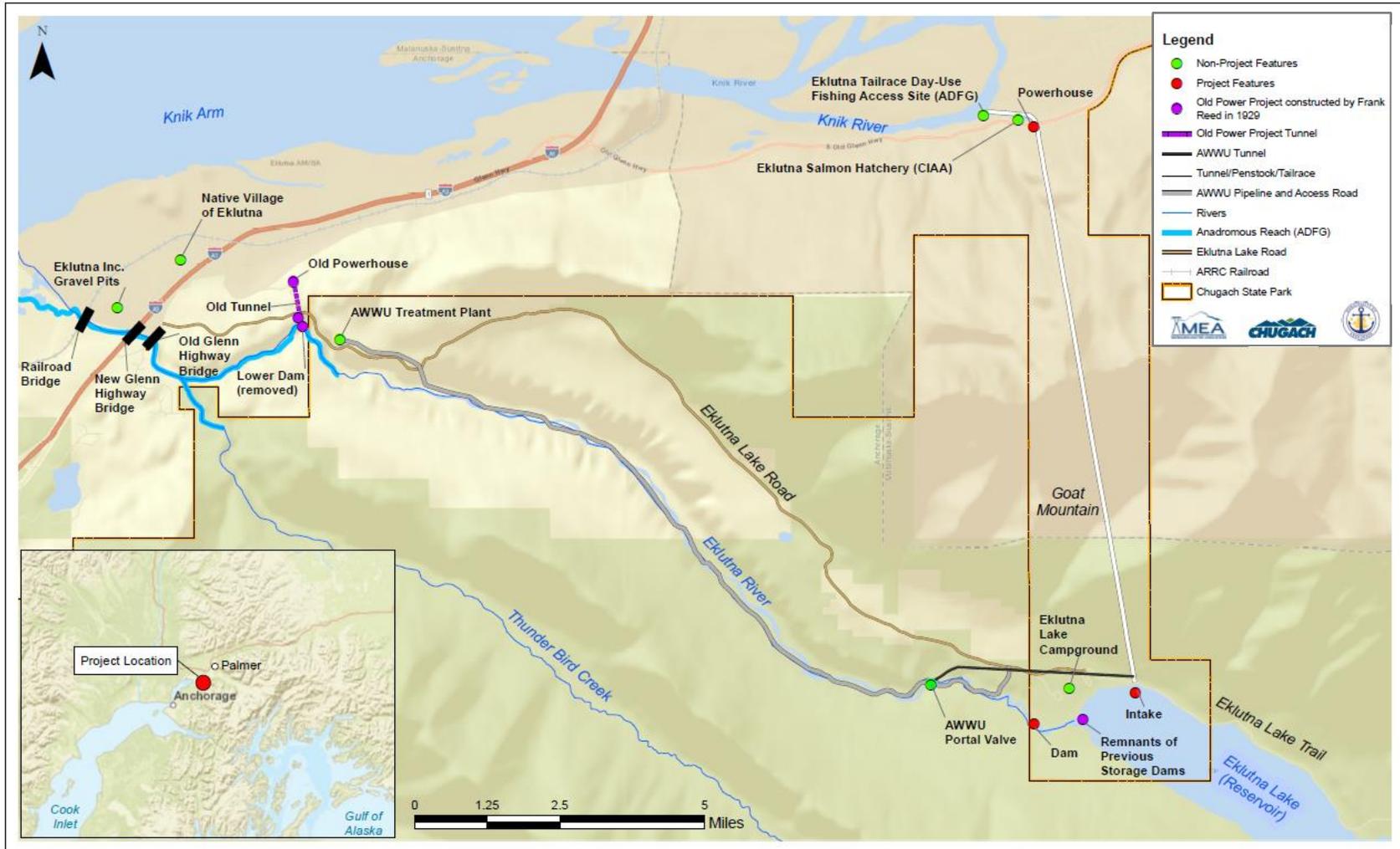


Figure 1-1. Project Location.

### 1.1.1 Existing Project Facilities

The Project consists of several components that allow water from Eklutna Lake to be diverted through a 4.5-mile-long tunnel to the powerhouse and eventually discharged into the Knik River for the purpose of power generation. The Project facilities and AWWU water supply infrastructure that is connected to Project facilities are briefly described below. More detailed information on Project facilities is provided in the IIP document available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)).

#### 1.1.1.1 Dam and Spillway

The existing dam is located approximately 1,400 feet downstream of the natural outlet of Eklutna Lake. It is an earth and rock fill embankment dam with a crest length of 815 feet, a crest width of 30 feet, and a crest elevation (EL.) of 891 feet<sup>3</sup>. The crest of the dam is finished with crushed rock material to form a stable road surface (Figure 1-2). An ungated overflow spillway is incorporated within the middle of the dam. The spillway crest is EL. 871 feet and the crest length is 18 feet. The dam allows for storage of water in Eklutna Lake for use throughout the year for power generation. The dam also prevents water from flowing into the Eklutna River unless the lake level exceeds the spillway crest elevation and water “spills” from the lake into the river via the spillway (see Section 1.1.2.3).



**Figure 1-2. Dam crest and ungated overflow spillway, looking north.**

There is a natural glacial moraine at the outlet of Eklutna Lake. When the lake level is below the crest of the moraine (EL. 860 feet), a pond is created between the moraine and the current dam (Figure 1-3). The water level in the pond is not monitored; however, the pond level can

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<sup>3</sup> Multiple vertical survey datums are reported in and around the main features of the Project. Throughout this document, the elevation datum that shall be used is the “local datum” tied to the crest of Eklutna Dam. Engineering documentation and design drawings, as presented in Appendix E utilizes the NAVD88, GEOID12B datum for consistency purposes throughout all of the Project Features, which is offset from the Local Datum by approximately 3.6-feet.

differ from the lake level by up to 30 feet in an average year. A small tributary entering the pond approximately 400-ft upstream of the dam keeps the water level steady in the pond when the lake is disconnected from the dam, with a small outflow leaving the pond and entering Eklutna Lake.

There is a 30-inch by 30-inch drainage outlet gate in the base of the spillway crest at El. 852 feet that was designed to drain the pond when water becomes trapped there during late fall or early winter. At the time, it was thought that this water would cause detrimental frost action against the toe of the current dam and at the spillway inlet. However, no detrimental frost action has been observed, and the gate is currently not used for this purpose. This cast iron gate was replaced in 2021 with a stainless-steel gate to allow for study flow releases that same year.



Figure 1-3. Pond between the natural glacial moraine and existing dam in May 2020.

#### 1.1.1.2 Reservoir

Eklutna Lake is a natural lake formed by the retreating Eklutna glacier. It is approximately 7 miles long, one mile wide, and 200 feet deep at its deepest. The natural lake elevation is El. 850 feet.

The current dam raises the water level of Eklutna Lake by 21 feet to a maximum regulated lake level of El. 871 feet (the elevation of the spillway crest). At this elevation, the lake has a surface area of 3,420 acres. The minimum regulated lake level is El. 814 feet, which provides an active storage capacity of 174,800 acre-feet. Storage between the spillway crest (El. 871 feet) and the dam crest (El. 891 feet) is an additional 72,800 acre-feet.

#### **1.1.1.3 Intake**

The intake is located on the north shore of Eklutna Lake approximately one mile east of the dam. Water is diverted from the lake through an inlet channel 100 feet wide and originally about 720 feet long excavated at the lake bottom (the original intake structure and portions of the original intake conduit damaged in the 1964 earthquake remain in the intake channel). The intake channel leads to the intake structure, which consists of a rectangular reinforced concrete box structure, open and protected by trash racks on its top, front, and both sides. Elevation of the invert (i.e., the base elevation of the intake) is El. 793.6 feet.

#### **1.1.1.4 Tunnel and Surge Tank**

A 4.5-mile-long tunnel through Goat Mountain conveys water from the intake to the penstock. The tunnel is a circular, concrete-lined pressure tunnel with a 9-foot inside diameter. The tunnel terminates in a surge chamber located directly over the tunnel prior to entering the project penstock. The surge tank is used to dampen pressure surges within the conveyance during operation.

#### **1.1.1.5 Penstock**

Extending from the surge tank at the end of the tunnel is the penstock, which conveys water to the power plant turbines. The overall length of the penstock is about 1,088 feet. The penstock is a variable-diameter (91-, 83-, and 75-inch-outside-diameter) welded and coupled steel pipe encased in concrete in a tunnel extending from the surge tank to the power plant. At the powerplant, the penstock bifurcates into two 51-inch-diameter 23-foot-long branches, which are connected to the spiral cases of the turbines. A 66-inch butterfly valve is installed in each penstock branch upstream from the turbines to provide means of dewatering the turbines for servicing or maintenance. These valves also serve as emergency shutoff valves in the event of damage to the turbines.

#### **1.1.1.6 Power Plant and Switchyard**

The Eklutna Power Plant (Figure 1-4) is located on the Old Glenn Highway. It houses two vertical-shaft Francis-style hydroelectric generating units with an installed nameplate capacity

of 44.4 MW. The switchyard equipment, consisting of the power circuit breakers, disconnecting switches, and main buses, is on the roof of the Eklutna Power Plant.



Figure 1-4. Eklutna Power Plant.

#### 1.1.1.7 Tailrace

Water discharged from the turbines in the Eklutna Power Plant enters a 209-foot-long tailrace conduit through which the water is conducted under the Old Glenn Highway to a 2,000-foot-long open tailrace channel which discharges into the Knik River (Figure 1-5). The channel has a top width of about 75 feet, a bottom width of 25 feet, and a depth of about 12 feet 6 inches.



Figure 1-5. Fisherman at the Eklutna Tailrace.

### 1.1.1.8 AWWU Connection to Project Tunnel

A water supply project was constructed in 1988 to supply water to Anchorage from Eklutna Lake (Eklutna Water Project). It is now the main source of drinking water for the Anchorage service area. The Eklutna Water Project diverts Eklutna Lake water from the Project tunnel to a diversion tunnel that connects to a buried pipeline. Water flows by gravity through the one-mile-long diversion tunnel and the approximately six-mile-long buried pipeline down the Eklutna River valley to a 750-kW energy recovery station at the Eklutna Water Treatment Plant (Figure 1-1).

A portal valve at the intersection of the AWWU tunnel and pipeline, located approximately one mile downstream of the existing dam, is used to shut down the pipeline for emergency or maintenance purposes. The pipeline drain valve is located approximately six miles downstream of Eklutna Dam. AWWU maintains an access road that roughly parallels the pipeline and crosses the riverbed in a series of bridges and fords. After treatment, water flows by gravity through a 23-mile-long buried pipeline to the distribution system. This system supplies water to the Anchorage service area, from Eklutna Village to Potter Marsh in South Anchorage. Approximately 10% of the water diverted from Eklutna Lake provides up to 90% of the public water supply for the Municipality of Anchorage. The remaining 90% of water diverted from Eklutna Lake is used for power production.

### 1.1.1.9 Water Rights

When the Project was originally authorized in the Eklutna Project Act of 1950,<sup>4</sup> Congress also created a federal reserved water right in Eklutna Lake and its tributaries for the purposes of operating the Project. Under federal and state law, the Project's water right dates back to December 31, 1954, when the Project began operations.<sup>5</sup>

Later, after Alaska statehood, the then-federal owner of the Project, the Alaska Power Administration (APA), applied for a Certificate of Appropriation from the State of Alaska in order to comply with newly-created state law. This permanent Certificate of Appropriation (Certificate) was originally granted in 1973 and is now referred to as "ADL 44944." As subsequently amended, ADL 44944 mirrors the federal reserved water right and authorizes the Project Owners to use any and all of the natural inflow to Eklutna Lake for hydroelectric power generation subject to other terms of the Certificate.

In 1984, MOA sought to use Eklutna Lake for public water supply. Typically, under Alaska law, such a new use would be disallowed due to the senior water right of the APA, but Alaska law

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<sup>4</sup> Public Law 81-628, 64 Stat. 383 (1950).

<sup>5</sup> ALASKA STAT. § 46.15.050(b) (2022).

also permits the use of Alaska waters for public water supply even where there are prior appropriators given the importance of maintaining a sufficient water supply.<sup>6</sup> Such use is referred to as “preferred use”.<sup>7</sup> In acknowledgement that such use can harm a prior appropriator, Alaska law requires that such use be subject to compensation in order to minimize such damage.<sup>8</sup> Accordingly, the MOA and the then-owner (APA) entered a compensation agreement entitled “Agreement for Public Water Supply and Energy Generation from Eklutna Lake, Alaska” dated February 17, 1984.

Further, MOA and APA worked with Congress to amend the *Eklutna Project Act* to reflect the additional public water usage of the Eklutna Lake which was otherwise reserved for the purposes of the Project.<sup>9</sup> MOA also obtained a 40-year license from the State of Alaska to utilize water from Eklutna Lake, referred to as “LAS 2569.” LAS 2569 expires on December 31, 2025. In addition, the original 1950 federal legislation authorizing construction of the project was amended to “grant the appropriation of water for the purposes of public water supply in accordance with the same compensation agreement.”<sup>10</sup>

Upon the sale of the Project to the Project Owners, the federal reserved water right and ADL 44944 were conveyed to the Project Owners in a quitclaim deed.<sup>11</sup>

### 1.1.2 Existing Project Operations

The Project Owners operate the Project to provide low-cost, renewable energy. Project-generated renewable energy offsets approximately 72,500 metric tons of CO<sub>2</sub> equivalent each year and can be used to regulate other renewable energy sources like wind and solar in the future. The Eklutna Dam allows storage of spring and summer runoff for power generation in the winter when it is needed most.

#### 1.1.2.1 Reservoir Operations

Typical operation of the Project is to fill the reservoir during the summer and drain it during the winter months. The Project operators try to refill the reservoir as much as possible without

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<sup>6</sup> ALASKA STAT. § 46.15.150 (2022).

<sup>7</sup> ALASKA STAT. § 46.15.150 (2022). “Preferred use” is further defined under Title 11 of the Alaska Administrative Code Section 93.230, which provides: “Preferred use status allows the use of water for a preferred use when adequate water is not available from the same source to supply all lawful appropriators.”

<sup>8</sup> ALASKA ADMIN. CODE tit. 11 § 93.240 (2023).

<sup>9</sup> Public Law 98-552, 98 Stat. 2824 (1984).

<sup>10</sup> Memorandum from Gary J. Prokosch, Regional Water Officer, Alaska Dep’t of Nat. Res. to LAS 2569, Finding of Fact and Conclusion of Law: Application for Preferred Use – LAS 2564 AS 46.15.150 (Nov. 19, 1985), <https://eklutnahydro.com/wp-content/uploads/2020/03/ADNR-1985-AWWU-Preferred-Use-Water-Right-LAS-2569.pdf>.

<sup>11</sup> Chugach Elec. Ass’n, Inc., Annual Report (Form 10-K) (Mar. 31, 1998), Appendix A, No. 20, Quitclaim Deed, Federal Reserved-Water Right Under the Eklutna Project Act of 1950.

spilling, and the extent of winter drawdown is based on power requirements and the operator's estimates of the winter snowpack. The lake level is generally at its lowest elevation in May and then peaks in September. As shown in Figure 1-6, the lake level is drawn down below the natural lake level (El. 850 feet) for about six months out of the year, and below the crest of the natural glacial moraine (El. 860 feet) for about 9 months out of the year.

The lake level increases as a result of inflows (mostly glacial melt) and is drawn down by operation of the tunnel/penstock system. Assuming no inflow, the lake can be drawn down by approximately four inches per day when the Eklutna Power Plant is generating at max capacity (660 cfs). Water conveyance can be closed at the lake intake structure by closing the intake bulkhead gate or by closing the turbine wicket gates or the turbine inlet valves within the powerhouse.

Flows through the Eklutna Power Plant is the primary means of controlling the water level in Eklutna Lake. In addition, the 30-inch by 30-inch drainage outlet in the base of the spillway crest (see Section 1.1.1.1) is controlled by a manually operated slide gate conduit and can release up to 190 cfs (with reservoir at the spillway crest). Operation of the spillway slide gate is checked on an annual basis and the operating mechanism lubricated.

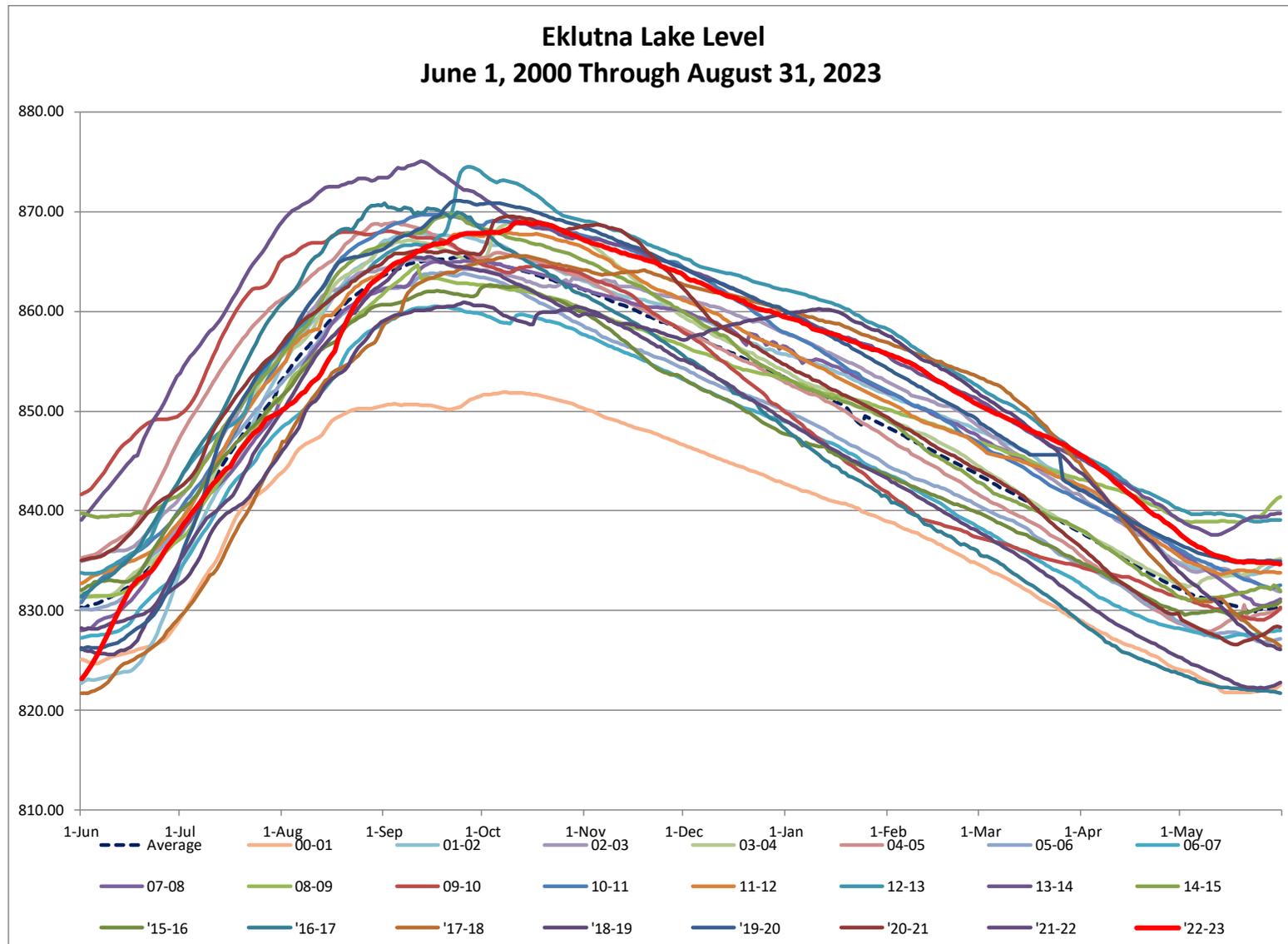
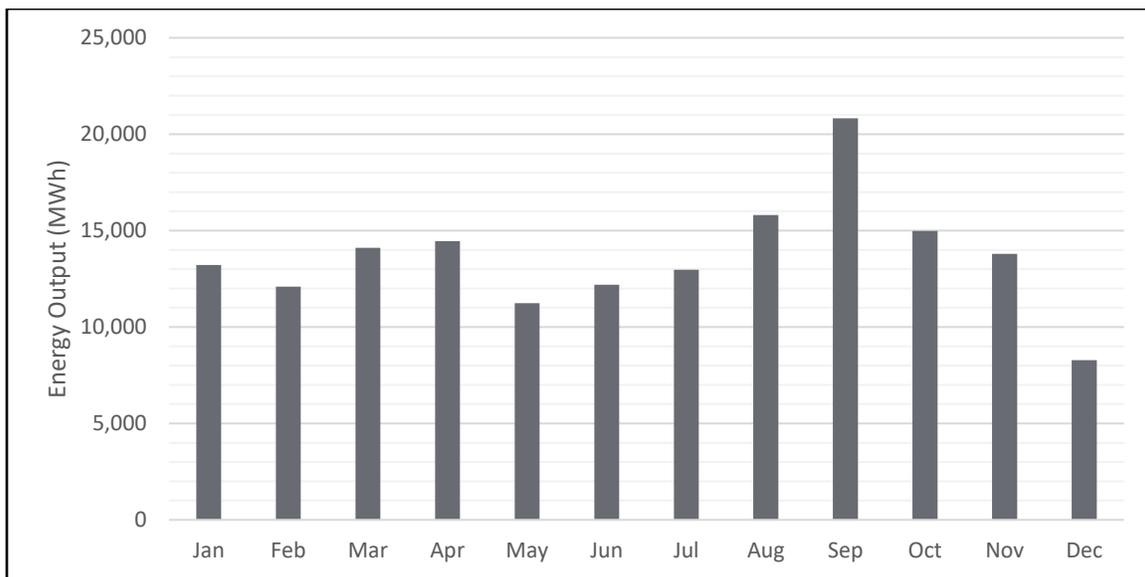


Figure 1-6. Eklutna Lake Level from June 1, 2000 through August 31, 2023.

### 1.1.2.2 Energy Generation and Cost of Power

The Project produces nearly 6% of the Project Owners' combined total generation portfolio, approximately 44% of MEA's renewable generation portfolio, and approximately 25% of Chugach's renewable generation portfolio. The Project is consistently the lowest-cost resource for power in the Railbelt (i.e., the inter-connected transmission line system that runs from Fairbanks to Homer) and is necessary for MEA to meet their power capacity reserve requirements. The average monthly energy generation output of the project is presented in Figure 1-7.



**Figure 1-7. Average Monthly Energy Output – Eklutna Power Plant.**

One of the other major benefits of the Project is increased grid reliability through diversification of fuel for generation. With an uncertain future regarding natural gas supply and costs, hydropower plays an important alternate energy source if there is an interruption to the availability of natural gas. In addition, Project generation offsets approximately 72,500 metric tons of CO<sub>2</sub> equivalent each year.

### 1.1.2.3 Spill Events

Spill occurs when water flows from Eklutna Lake into the Eklutna River via the ungated spillway (El. 871 feet). Since the spillway is ungated, the Project operators cannot control spill. Ten spill events have occurred since the existing dam was constructed in 1965. Table 1-1 summarizes the historical data and calculated values for each of these spill events.

**Table 1-1. Summary of Spill events at Eklutna Dam from 1965 to 2023.**

Year	Spill Period	Duration (Days)	Peak Lake Level Elevation (ft)	Average Lake Level Elevation (ft)	Peak Spillway Flow (cfs)	Average Spillway Flow (cfs)	Total Volume Spilled (AF)
1967	9/20 – 10/11	22	872.99	-	160	-	-
1977	8/15 – 9/26	43	874.60	-	396	-	-
1981	8/15 – 9/23	40	873.50	-	226	-	-
1989	9/5 – 10/7	33	873.73	872.40	259	107	7,018
1990	9/12 – 9/27	16	872.31	871.78	85	43	1,370
1995	9/21 – 10/20	30	877.62	874.40	1,022	426	25,356
1997	8/19 – 10/31	74	875.51	873.33	561	242	35,591
2012	9/23 – 10/19	27	874.52	873.10	383	188	10,055
2013	8/9 – 10/1	54	874.99	873.18	464	201	21,567
2023	9/1 – 9/8	8	871.51	871.36	18	10	157

The highest lake level elevation ever recorded in Eklutna Lake was 877.62 feet on September 25, 1995. At this elevation, the flow through the spillway was calculated to be 1,022 cfs. The longest spill event at Eklutna Dam occurred in 1997 and lasted for a total of 74 days. The calculated total volume of water spilled during this time was 35,591 acre-feet.

## 1.2 1991 Fish and Wildlife Agreement

The 1991 Agreement is the guiding document that the Project Owners have followed during development of this Draft Program. The Project Owners recognize that there is a high level of interest in the Eklutna River and are committed to meeting their obligations as outlined in the 1991 Agreement. The overarching goal of the Project Owners is to provide the information that will allow the Governor to make an informed decision with regard to the final Fish and Wildlife Program.

The main focus of the 1991 Agreement concerns protection, mitigation of damages to, and enhancement of fish and wildlife (including related spawning grounds and habitat) affected by hydroelectric development of the Eklutna Project. It specifies that the Project Owners are responsible for the consultation, study, and implementation provisions called for in the 1991 Agreement.

### 1.2.1 Procedural Requirements

The 1991 Agreement required the Project Owners to fund and conduct studies to examine and quantify, if possible, the impacts to fish and wildlife from the hydroelectric development of the Project. The studies were also designed to examine and develop proposed protection, mitigation, and enhancement (PME) measures to address those impacts. This examination also had to consider the impact of fish and wildlife measures on electric rate payers, municipal water utilities, recreational users, and adjacent land use, as well as available means to mitigate those impacts.

Per the 1991 Agreement, the study plans had to be developed by the Project Owners in consultation with the USFWS, NMFS, the Alaska Department of Fish and Game (ADFG), the Alaska Department of Environmental Conservation (ADEC), and the Alaska Department of Natural Resources (ADNR), collectively the “Federal and State Resource Management Agencies.” The study plans had to include a schedule for the consultation, comment, and decision making required by the 1991 Agreement to be adopted by the Parties<sup>12</sup> in consultation with the Governor. Prior to implementation of the studies, the Parties had to review the study plans and concur with their scope of work.

The Project Owners were required to seek input from the Federal and State Resource Management Agencies and other interested stakeholders as the studies progressed. The Project Owners were also required to provide the Federal and State Resource Management Agencies with an opportunity to comment on the Draft Study Reports. All comments and responses had to be included in the Final Study Reports.

After the Final Study Reports were prepared, the Project Owners were required to prepare a Draft Summary of Study Results and a Draft Fish and Wildlife Program. The Draft Program must include the PME measures recommended by the Project Owners and set a tentative schedule for their implementation. The Project Owners are required to provide the Federal and State Resource Management Agencies with an opportunity to comment on the Draft Summary of Study Results and the Draft Program and/or provide recommendations. If the Federal and State Resource Management Agencies' comments or recommendations differ from those of the Project Owners, the Project Owners must attempt to resolve such differences giving due weight to the recommendations, expertise, and statutory responsibilities of the Federal and State Resource Management Agencies.

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<sup>12</sup> The Parties to the 1991 Agreement as it pertains to the Eklutna Hydroelectric Project are Chugach Electric Association, Matanuska Electric Association, Municipality of Anchorage, National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the State of Alaska.

Once comments and recommendations have been received, the Project Owners are required to hold at least one public meeting each in Anchorage and the Matanuska Valley to receive public comment on the Draft Summary of Study Results, the Draft Program, and the comments and recommendations of the Federal and State Resource Management Agencies. The Project Owners are required to prepare a summary and analysis of all comments received, develop a Proposed Final Fish and Wildlife Program, and prepare an explanatory statement describing the basis for the Proposed Final Fish and Wildlife Program. All of this information must be provided to the Parties and the Governor.

The Parties then have 60 days to submit written comments on the Proposed Final Fish and Wildlife Program, and any alternative recommendations for the protection, mitigation, and enhancement of fish and wildlife resources, to the Governor. The Project Owners then have 30 days to submit written reply comments to the Governor. The Governor is required to review the Proposed Final Program as well as any comments or recommendations for alternative PME measures while giving equal consideration to:

1. Efficient and economical power production
2. Energy conservation
3. The protection, mitigation of damages to, and enhancement of fish and wildlife (including related spawning grounds and habitat)
4. The protection of recreational opportunities
5. Municipal water supplies
6. The protection of other aspects of environmental quality
7. Other beneficial public uses
8. Other requirements of State law

Based on his review and consideration, the Governor is required to establish a Final Fish and Wildlife Program that adequately and equitably protects, mitigates damage to, and enhances fish and wildlife resources (including affected spawning grounds and habitat) affected by the Project. The Project Owners are required to implement the Final Fish and Wildlife Program established by the Governor. Pursuant to the 1991 Agreement and APA Asset Sale Act, the Governor's decision regarding the provisions of the Final Fish and Wildlife Program is reviewable and enforceable by the Parties in the U.S District Court for the District of Alaska.

### **1.2.2 Schedule Requirements**

The 1991 Agreement gives deadlines for specific milestones in the consultation, program development, and implementation processes. These deadlines, listed below, are all relative to the date on which ownership of the Project was officially transferred from the Federal government to the current Project Owners (October 2, 1997). This date is referred to as the Transaction Date.

- Initiate the consultation process no later than 25 years after the Transaction Date (October 2, 2022)
- Issuance of the Final Fish and Wildlife Program by the Governor at least 3 years prior to implementation (October 2, 2024)
- Begin implementation of the Final Fish and Wildlife Program no later than 30 years after the Transaction Date (October 2, 2027)
- Complete implementation of the Final Fish and Wildlife Program no later than 35 years after the Transaction Date (October 2, 2032)

The Project Owners are required to repeat the process called for in the 1991 Agreement on a recurring basis every 35 years, beginning within 25 years of the time implementation of the Final Fish and Wildlife Program has been completed for the prior consultation process. In addition, the Project Owners are required to repeat the process called for in the 1991 Agreement prior to undertaking any major structural or operational modifications substantially affecting water usage or fish and wildlife at the Project.

## **1.3 Compliance Efforts to Date**

The Project Owners have fully met the procedural and schedule requirements of the 1991 Agreement to date. In fact, the Project Owners have gone well beyond the requirements of the 1991 Agreement in terms of consultation, documentation, and analysis of Draft Program alternatives. In terms of schedule requirements, the Project Owners began the process more than three years prior to the prescribed initiation date. The following sections describe the efforts undertaken by the Project Owners to date to comply with the 1991 Agreement and highlight the efforts that have gone beyond the requirements.

### **1.3.1 Early Consultation**

The 1991 Agreement states that the Project Owners shall consult with the USFWS, NMFS, ADF&G, ADEC, and ADNR regarding the development of study plans and that “the

consultation process shall be initiated no later than 25 years after the Transaction Date,” (i.e., October 2, 2022).

The Project Owners began the consultation process in 2019, three years earlier than required by the 1991 Agreement. Recognizing the high level of public and tribal interest in the Project, the Project Owners did not limit consultation to the five federal and state agencies identified in the 1991 Agreement, but they reached out to many other entities with an interest in the Project. Their consultation efforts included in-person meetings, quarterly calls and newsletters, technical work groups, and involvement of interested stakeholders in the alternatives analysis process. A summary of consultation undertaken by the Project Owners is included in Appendix A; early consultation efforts are highlighted below.

### **1.3.1.1 Initial Consultation Meetings**

In March and April of 2019, three years before the requirement of the 1991 Agreement, the Project Owners conducted in-person initial consultation meetings with multiple agencies and interested stakeholders. In total, the Project Owners met with 14 agencies and interested stakeholders as part of their initial consultation efforts, including:

- National Marine Fisheries Service (NMFS)
- U.S. Fish and Wildlife Service (USFWS)
- Alaska Department of Fish and Game (ADFG)
- Alaska Department of Environmental Conservation (ADEC)
- Alaska Department of Natural Resources (ADNR), including:
  - Division of Mining, Land, and Water
  - Division of Parks and Outdoor Recreation (State Parks)
  - Office of History and Archaeology (OHA)
- Alaska Department of Transportation & Public Facilities (ADOT&PF)
- Alaska Railroad Corporation (ARRC)
- Anchorage Water and Wastewater Utility (AWWU)
- U.S. Army Corps of Engineers (USACE)

- Eklutna, Inc.
- Native Village of Eklutna (NVE)
- The Conservation Fund

After these initial consultation meetings, the Project Owners identified additional interested stakeholders and consulted with them as appropriate, including Cook Inlet Region, Inc. (CIRI), Cook Inlet Aquaculture Association (CIAA), The Alaska Center, Trout Unlimited (TU), the Alaska Energy Authority (AEA), the Alaska Institute for Climate and Energy (ALICE), staff from Alaska Pacific University (APU), the Anchorage Watershed and Natural Resources Advisory Commission (WNRC), and the U.S. Bureau of Land Management (BLM).

Some entities, while interested in the Project, declined to participate in the consultation process, including the U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), National Weather Service (NWS), and the Anchorage Waterways Council.

#### **1.3.1.2 Group Stakeholder Meeting**

During the initial consultation meetings, several entities requested a follow-up group meeting to promote technical discussion amongst the agencies and interested stakeholders. In response to those requests, the Owners conducted an in-person follow-up group meeting on July 16, 2019. Discussion topics included a review of the contact list and existing information gathered to date, updates on on-going data collection by others, an overview of current Project operations, discussion regarding the initial comments and concerns of agencies and interested stakeholders, and next steps.

#### **1.3.1.3 Project Website**

In 2019 the Project Owners developed and launched a Project website, [www.eklutnahydro.com](http://www.eklutnahydro.com). The purpose of this website is to provide information on the efforts being undertaken by the Project Owners to comply with the 1991 Fish and Wildlife Agreement, including background information, the Project schedule, Project updates, reference and final documents, frequently asked questions, and a contact form.

#### **1.3.1.4 Quarterly Update Calls**

During the July 2019 Group Stakeholder Meeting, it was suggested that the Project Owners conduct quarterly calls to update the agencies and interested stakeholders on Project activities. The Project Owners conducted the first quarterly update call in November 2019, and since that time, have continued to conduct these calls approximately every three months.

### 1.3.1.5 Anchorage Assembly Updates

In February 2020, the Project Owners were invited to give a brief presentation to the Anchorage Assembly at a work session regarding the Eklutna River. The Project Owners have continued to provide subsequent updates to the Anchorage Assembly's Enterprise and Utility Oversight Committee on a quarterly basis.

### 1.3.1.6 Project Newsletter

In December 2020, the Project Owners published their first newsletter to continue to provide information and updates regarding the Project. These newsletters contain current information on the status of the Project Owners' effort under the 1991 Agreement and include pictures, maps, and a Project timeline. They have been published quarterly and are all available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)).

### 1.3.1.7 Engagement with NVE

The Native Village of Eklutna (NVE) is located near the mouth of the Eklutna River. NVE's historical and current presence in the area is described in the IIP. The Project Owners first met with NVE as part of their initial consultation efforts (Section 1.3.1.1) and have continued to engage with NVE throughout this process.

In April 2020, NVE requested formal recognition as a consulting government, with their Land and Environment Department analogous to other governmental signatories, for purpose and processes of the 1991 Agreement applicable to the Project. In a May 2020 letter to the Project Owners, NVE recognized that amending the 1991 Agreement may entail substantial time and effort, and as an alternative invited a joint letter from the Project Owners to the effect that the Project Owners will act in good faith to help mitigate impacts to the Eklutna River and that the Project Owners will recognize NVE as a consulting government on a basis comparable to the governmental signatories to the 1991 Agreement.

In June 2020, the Project Owners responded to NVE's request by committing to a review and participation framework that ensures information NVE and its members share regarding the Eklutna River and development of the Fish and Wildlife Program is appropriately considered and addressed. This includes:

- Providing significance and due weight to NVE's expertise throughout the development of the Fish and Wildlife Program
- Recognizing and including traditional ecological knowledge (TEK) in the review and development of the study plans and Fish and Wildlife Program

- Working with NVE to schedule additional meetings with the goal of hearing input from NVE and its members (one after the study program is completed and another following the development of the Draft Program) and coordinating with NVE on developing the agenda items for these meetings
- Recommitting to sharing all study plans, data, reports, and comments directly with NVE when developed to seek feedback
- Submitting an NVE-specific comment summary to the Governor for consideration along with the Project Owners' Proposed Final Fish and Wildlife Program

The Project Owners' letter also stated: "We value the unique perspectives of NVE's members regarding the Eklutna River, and we also understand that NVE is primarily interested in the presence of both water and salmon in the lower Eklutna River. While we are contractually and legally bound by the terms of the Agreement, please know that if the process set forth in the Agreement bears out the release of water from Eklutna Lake and the addition of salmon into the Eklutna River as part of the Fish and Wildlife Program, we will be prepared to support it."

Since then, NVE has been involved in all four Technical Work Groups (TWGs) (Section 1.3.3) and every alternatives analysis meeting (Section 2.3). The Project Owners have also met with the NVE Tribal Council on several occasions, including meetings with the Boards of Directors for both CEA and MEA and the Anchorage Assembly (Appendix A).

### **1.3.2 Initial Information Package**

Although not required by the 1991 Agreement, the Project Owners developed an Initial Information Package (IIP) document. The IIP established a baseline of existing information and informed the study planning process required by the 1991 Agreement. A draft IIP was distributed in March 2020, and interested stakeholders were invited to comment on the draft. Comments were received from 10 entities. After revising the document based on comments received, the final IIP was issued in September 2020. The IIP and reference documents used in preparation of the IIP are available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)).

### **1.3.3 Technical Working Groups**

In April 2020, a Technical Working Group (TWG) was established to ensure transparency and input at each stage of the planning process and scientific analysis. In 2021, the original TWG, with its focus on aquatics-related resources, became the Aquatics TWG, and three more TWGs were established as new studies were added to address additional resources. The new TWGs included the Terrestrial TWG, Cultural TWG, and Recreation TWG. Table 1-2 shows which entities participated in each of the TWGs.

**Table 1-2. Technical Working Group Members.**

Entity	Aquatics	Terrestrial	Recreation	Cultural
Native Village of Eklutna	x	x	x	x
Alaska Department of Fish and Game	x	x	x	
ADNR Chugach State Park			x	
ADNR Office of History and Archaeology				x
U.S. Fish and Wildlife Service	x	x		x
National Marine Fisheries Service	x			
Trout Unlimited	x		x	
Alaska Pacific University	x	x		
Project Owners	x	x	x	x

The TWGs met regularly to assist in study planning and review technical information developed by the study program and by others. Over 20 TWG meetings were held during the study program and alternatives analysis leading up to the development of the Project Owners' Draft Program (Appendix A).

#### 1.3.4 Study Program

Implementation of a study program was a requirement of the 1991 Agreement. Specifically, it required the Project Owners to fund studies to examine and quantify, if possible, the impacts to fish and wildlife from the Project. Per the 1991 Agreement, the studies had to examine and develop proposed PME measures to address those impacts. This examination had to also consider the impact of potential fish and wildlife measures on electric rate payers, municipal water utilities, recreational users, and adjacent land use, as well as available means to mitigate these impacts.

Beginning in 2020, the Project Owners consulted with agencies and interested stakeholders regarding development of a study program. The study program that was developed by the Project Owners, agencies, and other interested stakeholders consisted of two primary years of studies and information gathering (2021 and 2022).

During the same time period that the Project Owners were developing and implementing their study program, several other entities were also conducting studies in the Eklutna basin. These studies included:

- Aquatic habitat monitoring conducted by ADFG, previously under an agreement with Eklutna Inc., now under a new agreement with Trout Unlimited

- Sediment transport monitoring at the highway and railroad bridges conducted by Eklutna, Inc.
- Adult salmon spawner surveys conducted by NVE
- Minnow trapping in the lower Eklutna River conducted by NVE
- Habitat assessment of the East and West Forks of Eklutna Creek conducted by NVE
- Glacier related study and stream gaging in the East and West Forks of Eklutna Creek conducted by APU
- State-wide Pumped Hydro Study conducted by AEA
- Pumped hydro system flow analysis and animation conducted by ALICE in coordination with NVE
- Formal TEK assessment of the historic and cultural importance of the Eklutna River conducted by NVE in partnership with TU

The Project Owners coordinated with each of these entities during study plan development regarding relevant study methodologies, monitoring locations, etc. When available, the Project Owners incorporated the results of these other studies in their study reports. Of note, NVE shared their fish survey and habitat study data with the Project Owners, which are included in the Fish Species Composition and Distribution Study Report and Eklutna Lake Aquatic Habitat and Fish Utilization Study Report.

#### **1.3.4.1 Early Study Efforts**

Study program development began in earnest in 2020. In May 2020 the Project Owners acquired aerial imagery, spherical videography, and LiDAR of the entire Eklutna River as well as the northeastern shoreline of Eklutna Lake along the lakeside trail. The spherical videography is available on the project website and at <https://biglook360.com/eklutna/>.

In July 2020, the Project Owners conducted a site reconnaissance with ADFG staff to support study planning efforts. The Aquatics TWG met on July 23, 2020, to review the observations made during the site reconnaissance and to kick-off the study planning process. This meeting included initial discussions regarding the planned Instream Flow Study, potential study methods, and associated challenges.

In August 2020, the Project Owners conducted an initial condition assessment of the drainage outlet gate at the base of the spillway and established several monitoring transects and

installed scour monitors in the Eklutna River in advance of any potential unplanned spill events to allow for subsequent data collection that could benefit the study program. There were no spill events in 2020; however, the established transects and scour monitors were later utilized during the Geomorphology and Sediment Transport Study to assess erosion and sediment transport through the Eklutna River downstream from Eklutna Lake and to help calibrate the sediment transport model.

#### **1.3.4.2 Year 1 Study Planning and Implementation**

Based on this early work, the Project Owners developed a Proposed Study Program Framework and presented it to Aquatics TWG on September 3, 2020. This meeting included discussion regarding how study efforts would occur over a two-year period, the goals and objectives, general study area, proposed methods for each study, the study plan outline, and the study planning schedule.

Draft Study Plans were distributed to the Aquatics TWG on October 26, 2020, for review and comment. The deadline for written comments was November 25, 2020. The Project Owners received comments from NVE, ADFG, USFWS, NMFS, TU, Erin Larson and Jason Geck with APU, and Brett Jokela with the WNRC. Two meetings were held with the Aquatics TWG on November 30, 2020, and December 21, 2020, to review and address the Aquatics TWG's comments on the Draft Study Plans.

The Project Owners revised the Draft Study Plans based on the other comments received, and the Revised Draft Study Plans were distributed to the Aquatics TWG on January 18, 2021, for review and comment. The deadline for written comments on the Revised Draft Study Plans was January 29, 2021.

Since several of the Aquatics TWG's comments on the Draft Study Plans were questions related to the operational capabilities of the Project, the Project Owners decided to start developing the proposed hydro operations model and presented the preliminary modeling results to the Aquatics TWG at a meeting on January 26, 2021, to help inform the Aquatics TWG's comments on the Revised Draft Study Plans. The Project Owners also addressed additional clarifying questions from the Aquatics TWG at the January meeting in advance of the comment deadline.

The Project Owners received comments from ADFG, NMFS, TU, and Erin Larson with APU and revised the study plans again based on comments received. As required by the 1991 Agreement, the Proposed Final Study Plans were distributed to the Parties on February 24, 2021, for review and concurrence on the scope of work.

A meeting amongst the State agencies involved in the Project was held on February 25, 2021 to determine how the State of Alaska, as a party to the 1991 Agreement, would concur on the scope of work in the study plans. The State agencies determined that it would be most appropriate for the Commissioners of each State agency (ADFG, ADEC, ADNR, and ADOT&PF) to sign a letter stating that they concur on the scope of work in the study plans, and then the Project Owners would send those concurrence letters to AEA, the Governor's representative, with the study plans for review and feedback.

The Project Owners received concurrence letters from all of the state and federal agencies, including the NMFS, USFWS, ADFG, ADEC, ADNR, and ADOT&PF. The State agency concurrence letters and the Proposed Final Study Plans were sent to AEA as the Governor's representative for review and feedback; however, the Project Owners did not receive any additional feedback from AEA.

Studies initiated during the 2021 field season included the following:

- **Instream Flow Study** – *informed how much habitat would be created by a range of potential flows for various species (Chinook, coho, sockeye) and life stages (spawning and rearing).*
- **Geomorphology and Sediment Transport Study** – *informed what peak flows might be needed in conjunction with year-round instream flows.*
- **Fish Species Composition and Distribution Study** – *identified what fish species were present in the Eklutna River, what habitat they were utilizing, and when.*
- **Water Quality Study** – *monitored various water quality parameters (temperature, dissolved oxygen, pH, turbidity, nutrients, etc.) in both the Eklutna River and Eklutna Lake.*
- **Macroinvertebrate Study** – *assessed the baseline community of aquatic organisms at three locations in the Eklutna River.*
- **Stream Gaging** – *collected continuous flow data at various points in the Eklutna River and select tributaries to Eklutna Lake.*
- **Lake Aquatic Habitat and Fish Utilization Study** – *examined the presence and health of fish in Eklutna Lake, as well as the availability of potential spawning habitat around the lake shoreline and in its tributaries.*
- **Lakeside Trail Erosion Study** – *identified areas along the Eklutna Lakeside Trail that were experiencing shoreline erosion and the potential causes.*

- **Hydro Operations Model Development** – *allows the assessment of different potential operational scenarios for the hydroelectric project.*
- **Existing Infrastructure Assessment** – evaluated the condition and hydraulic capacity of downstream infrastructure, including the AWWU infrastructure, railroad bridge, and highway bridges.

One of the major components of the year 1 study program was the need to conduct study flow releases for both the Instream Flow Study and the Geomorphology and Sediment Transport Study. With the current infrastructure, the drainage outlet gate at the base of spillway in the dam is the only mechanism for providing controlled flow releases from the lake into the river. However, this gate had not been used regularly, and upon inspection, it was determined that the gate needed to be replaced. The Project Owners were able to design, procure, permit, and install the new drainage outlet gate during the summer of 2021 before the planned study flow releases in the fall of 2021, which ranged from 150 cfs to 25 cfs over 3 weeks.

It should be noted that in 2018, another dam (non-operational since 1955) was removed from the lower stretch of the Eklutna River by Eklutna, Inc. After the removal of this lower dam, a significant portion of the sediment wedge that had accumulated behind the lower dam for decades was left in the river. During year 1 study planning, some TWG members requested a flushing flow as part of this study program to flush the remaining sediment from behind the lower dam site. It was determined that this flushing flow was not necessary for study purposes. However, the Project Owners did commit to evaluating the need for conducting a higher calibration flow as part of the second study year.

In June 2021, before the study flow releases, the Project Owners organized a site visit with the Aquatics TWG to identify and establish transect locations (Figure 1-8). A total of 30 transects were established throughout the river for the Instream Flow Study in relatively stable areas of the river that were not likely to change significantly as a result of the study flow releases. Additional transects were established throughout the river for the Geomorphology and Sediment Transport Study in relatively dynamic areas of the river that were more likely to change significantly as a result of the study flow releases.



**Figure 1-8. Site Visit with the Aquatics TWG in June 2021.**

In preparation for study flow releases, the Project Owners also requested consent and waiver of liability for the planned study flows and potential movement of Eklutna Inc.'s sediment wedge from the principal landowners downstream of the Project: Eklutna, Inc., The Alaska Department of Transportation and Public Facilities (ADOT&PF), Alaska Railroad Corporation (ARRC), and the MOA/AWWU. Among them, only the MOA/AWWU consented and waived such potential liability. ADOT&PF's, ARRC's, and Eklutna, Inc.'s refusals to consent and waive liability for study flows and movement of Eklutna, Inc.'s sediment was noted in the Project Owners' decisions to proceed with study flow releases.

#### **1.3.4.3 Year 2 Study Planning and Implementation**

Based on observations during the September/October 2021 site visits and preliminary results from the first year of studies, the Project Owners revised the Study Program Framework for year 2 and presented it to the TWGs on November 8-9, 2021. These meetings included discussion regarding preliminary results from Year 1 (if applicable), what studies were being proposed for Year 2 (Table 1-3), and the goals, general study area, and proposed methods for each study.

**Table 1-3. Year 2 Study Program.**

Studies Continued from Year 1 (2021)	Studies Initiated in Year 2 (2022)
Instream Flow Study	Engineering Feasibility and Cost Assessment
Geomorphology and Sediment Transport Study	Hydropower Valuation Study
Fish Species Composition and Distribution Study	Wetland and Wildlife Habitat Study
Lake Aquatic Habitat and Fish Utilization Study	Terrestrial Wildlife Study
Water Quality Study	Recreation Study
Stream Gaging	Cultural Resources Study
	<i>LiDAR and Ortho Imagery Acquisition</i>

Following their commitment in 2021, the Project Owners evaluated the need for a higher calibration flow in 2022. However, based on the data collected in year 1, it was determined that reasonably reliable models could be developed using the collected data, and that a higher calibration flow in 2022 was not necessary for study purposes.

The Draft Year 2 Study Plans were distributed to the Parties and TWGs on February 11, 2022, for review and comment. The deadline for written comments on the Draft Year 2 Study Plans was March 11, 2022. The Project Owners received comments from NVE, USFWS, NMFS, ADFG, ADEC, OHA, TU, and The Conservation Fund.

Meetings with the TWGs were held the week of March 21, 2022, to address substantive comments on the Draft Year 2 Study Plans that required further discussion. The Project Owners revised the study plans based on comments received, and the Proposed Final Year 2 Study Plans were distributed to the Parties on April 1, 2022, for review and concurrence.

The Project Owners again received concurrence letters from each of the state agencies. The NMFS and USFWS also provided concurrence letters but only concurred with 10 of the 12 study plans. The federal agencies did not concur with the Geomorphology and Sediment Transport Study Plan or the Instream Flow Study Plan due to their uncertainty about the Project Owners ability to model higher flows without a significantly higher calibration flow.<sup>13</sup> The Project Owners documented this area of non-agreement and distributed the Proposed Final Year 2 Study Plans and state concurrence letters to AEA as the Governor's representative for review and feedback; however, the Project Owners did not receive any additional feedback from AEA.

<sup>13</sup> The Project Owners acknowledge the uncertainty associated with any modeling effort. And after reviewing the modeling results, both federal agencies have confirmed the validity of both models.

#### **1.3.4.4 Study Reporting**

Study reports were prepared for each of the Year 1 and Year 2 studies. Interested stakeholders were invited to review and comment on each of the individual draft reports. The study reports were then revised and finalized based on comments received. To facilitate the review of the draft reports, the Project Owners held TWG meetings to provide an opportunity for questions and discussion (see Appendix A for a listing of TWG meetings). The draft study plans and reports, comments, and final study plans and reports for each of the Year 1 and Year 2 studies are all available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)).

In addition to the individual study reports, a Draft Summary of Study Results document was prepared per the requirement of the 1991 Agreement. This document, which accompanies this Draft Program, provides a summary of the study program results for each of the resources studied.

## 2.0 Alternatives Analysis

The study program showed the benefits of releasing water back into the Eklutna River, particularly in terms of providing fish habitat. Therefore, early in the alternatives analysis process, the Project Owners made a commitment to release water into the Eklutna River as part of the future Fish and Wildlife Program. Based on this commitment, primary considerations during the alternatives analysis were determining how to release water into the Eklutna River and how much water to release for both year-round flows and periodic channel maintenance flows.

The alternatives analysis process conducted by the Project Owners with the other Parties and stakeholders was not required by the 1991 Agreement; however, the Project Owners felt that it was necessary to bridge the gap between study reporting and issuance of a Draft Program as a means of ensuring that a broad range of alternatives were considered, and the evaluation would be conducted on a consistent basis of information.

The alternatives analysis process consisted of soliciting comprehensive alternatives from the Project stakeholders and analyzing each one from a cost/benefit perspective. Each alternative measure was developed to a conceptual level (5%) engineering design and coupled with a Class 5 Opinion of Probable Construction Costs (OPCC) with an accuracy range of -50% to +100%. The ecological lift in terms of gains in salmon spawning and rearing habitat was determined for each alternative based on the measure proposed and the flow levels released in the river.

The process helped to narrow down the list of comprehensive alternatives by removing those that either did not provide a significant ecological lift, or where multiple alternatives provided a similar ecological lift, those that were more costly could be removed from consideration. The following subsections detail the participants of the alternatives analysis process, the process used for analysis, and a summary of the alternatives analysis meetings held by the Project Owners.

### 2.1 Participation

The Project Owners reached out to the Parties, the TWGs, and other stakeholders to participate in the alternatives analysis process. The following entities participated in one or more of the alternatives analysis meetings.

- Alaska Energy Authority (AEA)
- Alaska Department of Fish and Game (ADFG)

- Alaska Department of Natural Resources (ADNR)
  - Water Section
  - Chugach State Park
  - Office of History and Archaeology
- National Marine Fisheries Service (NMFS)
- U.S. Fish and Wildlife Service (USFWS)
- Native Village of Eklutna (NVE)
- Eklutna, Inc.
- Anchorage Water and Wastewater Utility (AWWU)
- Trout Unlimited (TU)
- The Conservation Fund
- Project Owners

## 2.2 Cost Effectiveness / Incremental Cost Analysis Model

As part of the alternatives analysis process, a cost effectiveness and incremental cost analysis was performed to assess the relative benefits and costs of habitat improvement measures to help inform decision making. This method of analysis is an industry standard, developed by the U.S. Army Corp of Engineers (USACE) to compare environmental outputs and the economic costs of alternative plans for environmental restoration or mitigation projects. The cost effectiveness analysis compares the annual cost of a proposed alternative with the ecological lift it provides to help identify the least cost alternatives for a given level of environmental benefits. For the purposes of the Draft Program, the ecological lift used as a basis for comparison was the improvements in spawning and rearing habitat for Chinook, coho, and sockeye salmon as a result of providing flow to the Eklutna River, adding fish passage into and out of the lake, changing operation of the lake levels to provide additional lakeshore spawning habitat, or some combination of these measures. The specific gains in habitat were determined as part of the instream flow studies as well as the lake and river habitat studies.

To determine the costs of each proposed alternative, the total capital costs, operations and maintenance costs, and replacement energy costs were combined and annualized over 35 years with appropriate escalation factors as described in Appendix D.

## 2.3 Meetings

The alternatives analysis took place during a series of five meetings held monthly between April and August 2023. The general discussion topics for each meeting are summarized below, and the presentations from each meeting are available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)).

### 2.3.1 Meeting 1

The first alternatives analysis meeting was held on April 6, 2023. At this meeting, options for instream flow regimes were presented. Seven year-round flow levels that address minimum winter flow, minimum flow for barrier passage, and Chinook and coho spawning flow were considered. Seven channel maintenance flow levels that correspond to the seven year-round flow levels were also considered. The cost effectiveness and incremental cost analysis was also described (a detailed description is found in Appendix D). The analysis compares capital expenditure costs, annual operation and maintenance costs, and replacement energy costs to acres of habitat improvement for each target species at each life stage. At the end of the meeting, participants were asked to submit their suggested comprehensive alternatives for analysis before the next meeting. A form was provided to the participants that identified flow regime and infrastructure options for selection. A copy of the form is available in Appendix C.

### 2.3.2 Meeting 2

The second alternatives analysis meeting was held on May 17, 2023. The meeting began with a presentation of the conceptual engineering for a replacement dam. Consideration of a replacement dam was requested by NVE in March 2023. The conceptual engineering and Class 5 OPCC for the other infrastructure options had been presented at TWG meetings in the fall of 2022, but since a replacement dam had been suggested late and the engineering was a considerable undertaking, it was presented at the beginning of Meeting 2. Geomorphic considerations were also discussed. Channel maintenance flow regimes identified by participants in their alternatives were modeled to assess effects on substrate and results were presented to the group.

In response to their request for comprehensive alternatives for analysis at Meeting 1, the Project Owners received more than 33 alternatives from 8 entities (including the Project Owners' alternatives). Each alternative was reviewed and discussed at Meeting 2, including the results of the cost effectiveness and incremental cost analysis. Based on the information provided and discussed about each alternative, participants were provided an opportunity to revise their alternatives and resubmit them for analysis and discussion at Meeting 3.

### 2.3.3 Meeting 3

The third alternatives analysis meeting was held on June 14, 2023. The meeting began with a review of downstream fish migration options and fish habitat in Eklutna Lake and its tributaries in response to questions that had arisen about these topics.

The request for revisions to alternatives at Meeting 2 resulted in 36 alternatives received by the Project Owners. Three of the entities had no changes to their alternatives, but five entities submitted revisions, including the Project Owners. Because the cost effectiveness and incremental cost analysis showed that one of their alternatives, flow release from the lower end of the AWWU pipeline, was not cost effective for the habitat gained, the Project Owners excluded this alternative from further consideration. Each revised alternative was reviewed and discussed, including the results of the cost effectiveness and incremental cost analysis. At the end of the meeting, participants were asked to consider the information presented and submit their preferred alternative(s) prior to Meeting 4.

### 2.3.4 Meeting 4

The fourth alternatives analysis meeting was held on July 12, 2023. The meeting began with a discussion on potential velocity barriers in response to a question from ADFG about the possibility that higher flows (80 to 350 cfs) could be a barrier to upstream fish migration.

In response to the request for each participant to submit their preferred alternative(s), the Project Owners received 12 alternatives from seven entities; some entities provided more than one preferred alternative (see Section 2.4). Each of the preferred alternatives were reviewed. The total present value of annualized costs (capital, O&M, and replacement energy) for each alternative ranged from \$44 million to \$385 million for the 35-year period of analysis. Impacts to Chugach and MEA ratepayers and MOA taxpayers were also reviewed, along with results of the cost effectiveness and incremental cost analysis.

The final meeting topic was a review and discussion of potential effects, both positive and negative, of the preferred alternatives on other resources including wetlands and wildlife, public water supply, and recreational use and facilities.

### 2.3.5 Meeting 5

The final alternatives analysis meeting was held on August 9, 2023. The meeting began with a discussion on the potential effects, both positive and negative, of the preferred alternatives on cultural resources. That was followed by a discussion of a hybrid flow release alternative that was requested by The Conservation Fund. The final topic for discussion was monitoring and adaptive management. Use of water budgets was raised for discussion by the Project Owners

for both year-round and channel maintenance flows; a water budget establishes a total amount of water available for release into the Eklutna River each year based on the selected flow regimes. Adjustments to the flow regimes may be made as long as the total volume of water to be released does not exceed the water budget. An open discussion was then held on potential monitoring needs and methods. At the end of the meeting, the Project Owners invited stakeholders to revise and resubmit their preferred alternatives if needed.

## 2.4 Comprehensive Alternatives

Throughout the alternatives analysis process, over 36 comprehensive alternatives were proposed by stakeholders for evaluation. Over the course of the five alternative analysis meetings described in Section 2.3, the proposed flow regimes, required infrastructure and operations of each alternative were evaluated to determine annualized costs and their associated environmental benefits. The final list of preferred alternatives proposed by each stakeholder encompasses variations on infrastructural improvements, flow release regimes, and habitat improvement measures suggested to mitigate impacts from the Project per the 1991 Agreement. The following subsections detail the components of each stakeholder's preferred alternatives.

### 2.4.1 Infrastructure Modifications

To assess varying degrees of habitat improvements, various infrastructure modification measures were proposed. These measures encompassed physical modifications to existing infrastructure and/or construction of new infrastructure. The various modifications proposed<sup>14</sup> and analyzed throughout this process are as follows:

#### Instream Flow Measures

- Existing Dam Modifications
- Replacement Dam
- Siphon Bypass
- AWWU Portal Release Facility
- AWWU Pipeline Release Facility

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<sup>14</sup> During the Aquatics TWG meeting on November 9, 2022, three additional potential measures were discussed, including volitional downstream fish passage through the existing intake, trap and haul downstream fish passage utilizing a rotary screw trap and guide net, and a trapping facility with hatchery spawning, rearing, and release. However, none of these measures were selected by the Aquatics TWG for further evaluation.

- Bypass Tunnel
- Channel Excavation
- Lach Q'Atnu Creek Re-route

#### Channel Maintenance Flow Measures

- Existing Gate Release
- Tainter Gate Installation
- Fixed Wheel Gate Installation

#### Fish Passage

- Gravity Flow Fish Ladder
- Variable Exit Fish Ladder
- Pumped Supply and Slide Fish Ladder
- Hybrid Fish Ladder with Nature-like Entrance
- Trap and Haul Facility
- Floating Surface Collector
- Fish Exclusion Barrier

#### Habitat Improvements

- Physical Habitat Manipulation in Valley and Lower River

#### Other Improvements

- Lakeside Trail Improvements
- Mitigate Impacts of Flow Releases to AWWU Access Road

Each measure was evaluated, and comprehensive alternatives were developed by each stakeholder as part of the alternatives analysis process (Section 2.3). A list of the final 12 preferred alternatives by stakeholders is presented in Table 2-1. Where multiple alternatives exist for a single entity, the preferred alternatives are in descending order.

**Table 2-1. Stakeholders' Preferred Infrastructure Modifications.**

Entity	Instream Flow Measure	Peak Flow Measure	Fish Passage	Habitat Improvements	Other Improvements
NVE	Replacement Dam	Fixed Wheel Gate	Upstream: Hybrid Fish Ladder	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: Gate Releases (Spill)		Lakeside Trail Repair
USFWS Alt A	Replacement Dam	Fixed Wheel Gate	Upstream: Hybrid Fish Ladder	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: Recirculating Bypass		Lakeside Trail Repair
USFWS Alt B	Existing Dam w/ Fixed Wheel Gate	Fixed Wheel Gate	Upstream: Variable Exit Fish Ladder	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: Recirculating Bypass		Lakeside Trail Repair
USFWS Alt C <sup>15</sup>	Existing Dam w/ Fixed Wheel Gate	Fixed Wheel Gate	Upstream: None	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: None		Lakeside Trail Repair
USFWS Alt D <sup>13</sup>	AWWU Portal Release Facility	Fixed Wheel Gate	Upstream: None	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: None		Lakeside Trail Repair
TCF	Replacement Dam	Fixed Wheel Gate	Upstream: Hybrid Fish Ladder	None	None
			Downstream: Gate Releases (Spill)		

<sup>15</sup> USFWS alternatives C and D are in descending order of preference and are preferred if public and financial support for alternatives A and B are not obtained.

Entity	Instream Flow Measure	Peak Flow Measure	Fish Passage	Habitat Improvements	Other Improvements
NMFS <sup>16</sup>	AWWU Portal Release Facility	Fixed Wheel Gate	Upstream: None	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: None		Lakeside Trail Repair
	Replacement Dam	Fixed Wheel Gate	Upstream: Hybrid Fish Ladder	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: Floating Surface Collector		Lakeside Trail Repair
TU	Existing Dam w/ Fixed Wheel Gate	Fixed Wheel Gate	Upstream: Variable Exit Fish Ladder	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: Gate Releases (Spill)		Lakeside Trail Repair
ADFG	AWWU Portal Release Facility	Fixed Wheel Gate	Upstream: None	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: None		Lakeside Trail Repair
ADNR State Parks	AWWU Portal Release Facility	Existing Gate Release	Upstream: None	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: None		Lakeside Trail Repair
Project Owners	AWWU Portal Release Facility	Existing Gate Release	Upstream: None	Physical Habitat Manipulation	AWWU Bridge Crossings
			Downstream: None		Lakeside Trail Repair

<sup>16</sup> NMFS's comprehensive alternative involves implementing the AWWU Portal Valve and fixed wheel gate as an immediate action (within 5 years as required by the Agreement), followed by replacement of the existing dam with a new dam allowing for fish passage as a long-term action outside the implementation period of the Agreement.

## 2.4.2 Year-Round Instream Flow Regimes

For each of the comprehensive alternatives, stakeholders proposed various year-round flow regimes with seasonal variability to provide habitat within the Eklutna River. The monthly flows proposed by each entity are presented in Table 2-2 in ascending order.

**Table 2-2. Stakeholders' Preferred Instream Flow Regimes.**

Month	Flow Rate (cfs)								
	Project Owners	ADNR	ADFG Alt B	ADFG Alt A	NMFS	USFWS	TCF <sup>1</sup>	TU <sup>1</sup>	NVE <sup>1</sup>
Jan	27	27	31	35	75	75	60	61	65
Feb	27	27	31	35	75	75	60	61	65
Mar	27	27	31	35	75	75	60	61	65
Apr	27	27	31	35	75	75	60	61	65
May	34	34	41	50	75	75	100	134	160
Jun	40	40	50	65	160	160	180	206	255
Jul	40	40	60	80	160	160	180	206	350
Aug	40	40	60	80	160	160	180	206	350
Sep	40	40	48	57	160	160	180	134	150
Oct	40	40	48	57	160	160	100	61	150
Nov	34	34	39	46	75	75	60	61	108
Dec	27	27	31	35	75	75	60	61	65

<sup>1</sup> The NVE, TU, and TCF preferred alternatives include additional releases from the dam for downstream out- juvenile fish passage in April – June, which is not reflected in the instream flow regime presented. migrating

## 2.4.3 Channel Maintenance Flow Regimes

The channel maintenance flow is intended to preserve habitat and maintain channel morphology over the long term. Each stakeholder proposed variations of the channel maintenance flow magnitude, duration, and recurrence interval as presented in Table 2-3 in ascending order.

**Table 2-3. Stakeholders' Preferred Channel Maintenance Flows.**

Entity	Flow (cfs)	Duration (Hrs)	Recurrence (Yrs)
Project Owners	220	72	3 of 10
ADNR	220	72	3 of 10
ADFG Alt B	325	72	3 of 10
ADFG Alt A	400	72	3 of 10
TU	400	72	3 of 10
TCF	600	72	3 of 10
NMFS	700	72	3 of 10
USFWS	700	72	3 of 9
NVE	700	72	Annually

#### 2.4.4 Cost Benefit Summary

Each of the comprehensive alternatives were analyzed as part of the cost effectiveness and incremental cost analysis model. A summary of the estimated costs is presented in Table 2-4 and presented graphically in Figure 2-1.

**Table 2-4. Cost Summary for Stakeholders' Preferred Alternatives.**

Stakeholder	Capital Cost (\$M) <sup>1</sup>	O&M Cost (\$M)	Replacement Energy Cost (\$M)	35-Year Annualized Cost (\$M)	35-Year Present Worth (\$M)
Project Owners	8.9	0.2	1.3	2.7	44
ADNR	8.9	0.2	1.3	2.7	44
ADFG Alt B	16.9	0.2	1.7	3.8	63
ADFG Alt A	16.9	0.2	2.0	4.3	70
USFWS Alt D	16.9	0.2	2.0	4.3	70
USFWS Alt C	18.0	0.5	5.2	8.7	142
TU	28.9	0.6	7.2	13.5	221
USFWS Alt B	88.6	2.1	5.2	17.7	289
TCF	118.1	0.3	6.9	18.9	310
NVE	122.9	0.3	8.4	21.1	346
USFWS Alt A	158.7	1.7	4.9	22.4	366
NMFS	170.8	1.7	4.9	23.5	385

<sup>1</sup> Capital costs are based on Class 5 OPCC's and carry an expected accuracy range of -50% to +100%.

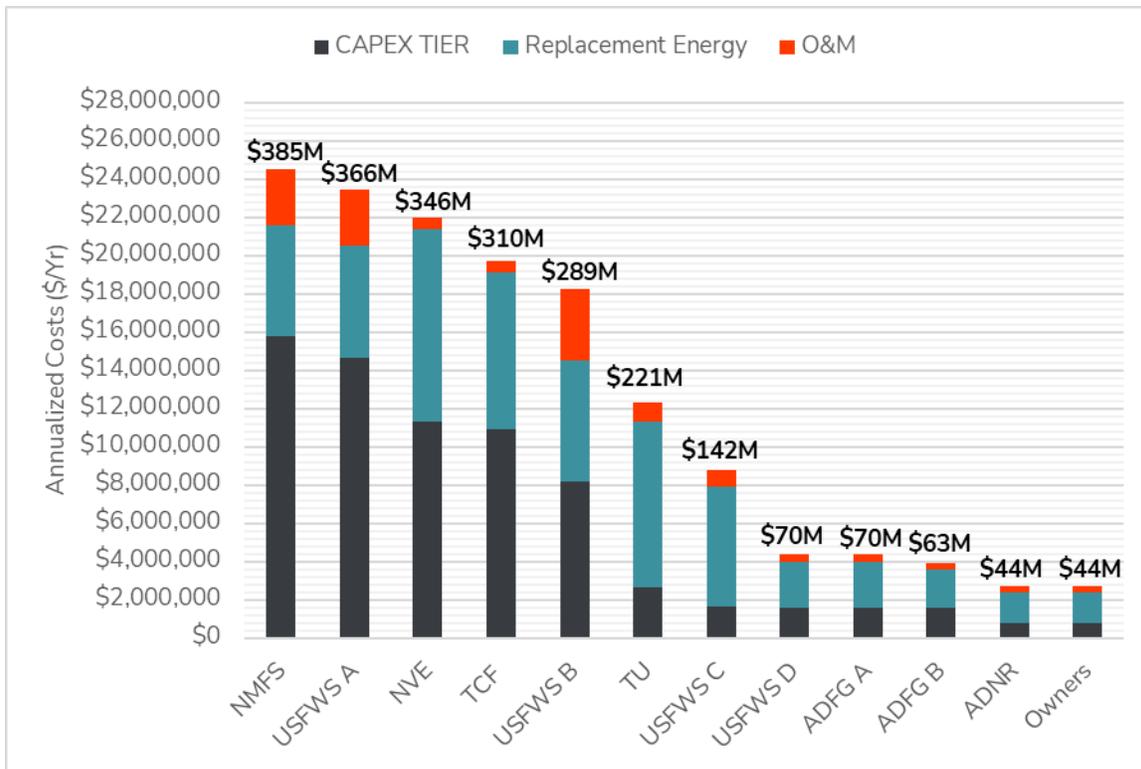


Figure 2-1. Comparison of Annualized Costs and Present Worth for Stakeholders’ Preferred Alternatives.

The associated ratepayer impacts by utility are presented in Table 2-5 in ascending order. The supporting data for the cost effectiveness modeling is provided in Appendix D.

Table 2-5. Ratepayer/Taxpayer Impacts for Stakeholders’ Preferred Alternatives.

Stakeholder	Ratepayer Impacts		Property Tax Increase	
	Chugach Electric Association	Matanuska Electric Association	Municipality of Anchorage	
	(%)	(%)	(mils)	(\$/100k)
Project Owners	+ 0.53%	+ 0.84%	0.005	\$0.51
ADNR	+ 0.53%	+ 0.84%	0.005	\$0.51
ADFG Alt B	+ 0.76%	+ 1.13%	0.008	\$0.81
ADFG Alt A	+ 0.84%	+ 1.31%	0.008	\$0.81
USFWS Alt D	+ 0.84%	+ 1.31%	0.008	\$0.81
USFWS Alt C	+ 1.70%	+ 2.96%	0.011	\$1.13

TU	+ 2.38%	+ 4.11%	0.016	\$1.60
USFWS Alt B	+ 3.53%	+ 4.66%	0.052	\$5.23
TCF Alt A	+ 3.80%	+ 5.29%	0.045	\$4.46
NVE	+ 4.24%	+ 6.10%	0.046	\$4.62
USFWS Alt A	+ 4.53%	+ 5.45%	0.072	\$7.21
NMFS	+ 4.73%	+ 5.81%	0.076	\$7.63

As part of the instream flow and habitat modeling performed throughout the study program, each proposed flow regime results in habitat gains throughout the river and lake by month while varying by species and life stage. A summary of the habitat gains modeled for each comprehensive alternative by species and life stage is presented in Table 2-6.

**Table 2-6. Summary of Habitat Gains for Stakeholders' Preferred Alternatives.**

Stakeholder	Habitat Gains (Acres)				
	Chinook Spawning	Coho Spawning	Sockeye Spawning	Chinook Rearing	Coho Rearing
Project Owners	1.5	1.6	1.2	6.3	9.9
ADNR	1.5	1.6	1.2	6.3	9.9
ADFG Alt B	1.5	1.6	1.2	7.7	11.6
ADFG Alt A	1.6	1.6	1.2	8.7	12.7
USFWS Alt D	1.5	1.2	0.5	12.6	18.5
USFWS Alt C	2.0	2.1	1.1	19.1	28.2
TU	4.7	5.0	4.2	18.2	27.1
USFWS Alt B	4.9	5.0	4.0	19.1	28.2
TCF	3.8	3.9	2.7	19.0	28.1
NVE	3.1	3.6	2.5	21.0	31.0
USFWS Alt A	3.9	4.0	3.0	15.5	22.8
NMFS	3.9	4.0	3.0	15.5	22.8

To further assess each comprehensive alternative, the incremental costs were analyzed to determine the annual spending per acre of habitat gained in the river and lake. This exercise helps to inform the consequences of increasing unit costs to achieve additional habitat gains. A summary of the alternative incremental costs is presented in Table 2-7.

Table 2-7. Incremental Costs Per Acre of Habitat for Stakeholders' Preferred Alternatives.

Stakeholder	Incremental Cost (\$/Yr/Acre)				
	Chinook Spawning	Coho Spawning	Sockeye Spawning	Chinook Rearing	Coho Rearing
Project Owners	\$1,800,000	\$1,700,000	\$2,300,000	\$400,000	\$300,000
ADNR	\$1,800,000	\$1,700,000	\$2,300,000	\$400,000	\$300,000
ADFG Alt B	\$1,800,000	\$1,700,000	\$2,300,000	\$400,000	\$300,000
ADFG Alt A	\$2,500,000	\$2,400,000	\$3,200,000	\$500,000	\$300,000
USFWS Alt D	\$2,700,000	\$2,700,000	\$3,600,000	\$500,000	\$300,000
USFWS Alt C	\$4,400,000	\$4,100,000	\$7,900,000	\$500,000	\$300,000
TCF Alt B	\$3,600,000	\$3,500,000	\$4,400,000	\$900,000	\$600,000
TU	\$2,900,000	\$2,700,000	\$3,200,000	\$700,000	\$500,000
USFWS Alt B	\$5,200,000	\$5,100,000	\$7,300,000	\$1,000,000	\$700,000
TCF Alt A	\$7,100,000	\$6,100,000	\$8,800,000	\$1,000,000	\$700,000
NVE	\$5,700,000	\$5,600,000	\$7,500,000	\$1,400,000	\$1,000,000
USFWS Alt A	\$6,000,000	\$5,900,000	\$7,800,000	\$1,500,000	\$1,000,000
NMFS	\$1,800,000	\$1,700,000	\$2,300,000	\$400,000	\$300,000

### 3.0 Draft Fish and Wildlife Program

This section presents the Project Owners' proposed Draft Fish and Wildlife Program and supporting rationale. The Project Owners are proposing what the results of the study program, consultation, and alternatives analysis support as the most cost-effective alternative for improving fish habitat affected by the Project. The Project Owners' Draft Program includes release of year-round flows from Eklutna Lake into the Eklutna River as a PME measure to significantly improve fish habitat in the Eklutna River below Eklutna Dam, which will indirectly benefit wildlife in the area, while retaining the important operational and energy benefits of the Project. The Draft Program also includes measures to offset impacts of releasing water into the Eklutna River to the existing AWWU road and infrastructure and a monitoring and adaptive management plan.

The Project Owners developed this Draft Program based on results of the two-year study program, in-depth alternatives analysis, and extensive consultation. As required by the 1991 Agreement, the Draft Program gives equal consideration to the purposes of:

1. Efficient and economical power production
2. Energy conservation
3. The protection, mitigation of damages to, and enhancement of fish and wildlife (including related spawning grounds and habitat)
4. The protection of recreational opportunities
5. Municipal water supplies
6. The protection of other aspects of environmental quality
7. Other beneficial public uses
8. Other requirements of State law

The Draft Summary of Study Results of the two-year study program has been released concurrently with this Draft Program. The complete study reports and presentations from the alternatives analysis meetings are available on the Project website ([www.eklutnahydro.com](http://www.eklutnahydro.com)). A summary of the consultation record is included in Appendix A.

### 3.1 Impacts to Fish and Wildlife

This section provides an overview of development on the Eklutna River dating back to 1914. Although the 1991 Agreement is focused on the impacts of the Project on fish and wildlife, there have been many other developments on the Eklutna River that have impacted fish and wildlife and created conditions today that are relevant in assessing PME measures included in the Draft Program.

In 1914, the U.S. Congress authorized construction of the Alaska Railroad, which was completed in 1923. This included the construction of a bridge over the Eklutna River. The current railroad bridge at the Eklutna River creates a significant channel constriction in the natural alluvial fan in the lower river.

In 1929, a privately owned company constructed the first hydroelectric project on the Eklutna River. This project included a 60-foot-tall concrete arch diversion dam (also referred to as the lower dam) located at river mile (RM) 4. The construction of this earlier project effectively eliminated any upstream passage of salmon or resident fish populations to the upper 8 miles of river and into Eklutna Lake.

In 1955, USBR constructed the existing hydroelectric project and diverted all outflows from Eklutna Lake through the tunnel/penstock system to the powerhouse on the Knik Arm (Figure 1-1). This impacted salmon populations in the Eklutna River below the lower dam. The reduced flows to the Eklutna River led to loss of winter rearing habitat, poor sediment transport, excessive siltation of stream channels, gravel starved stream channels, reduced water quality, and insufficient water depth for Chinook salmon spawning (USACE 2011). In addition to impacting fish habitat, the Project also impacted wetlands downstream of Eklutna Dam, both riparian wetlands that existed in the upper river and estuarine wetlands below the railroad bridge. Impacts to salmon and wetlands likely had an indirect impact on the wildlife that depend on the salmon and utilize those wetlands. However, the original impact of the Project on fish and wildlife resources is difficult to quantify since no fish or wildlife studies were conducted pre-construction.

In 1969, the Alaska Railroad diverted the Eklutna River north to a new stream channel and started gravel mining in the Eklutna River below the railroad bridge. This significantly impacted both fish and wildlife habitat in the area.

In 1975, the New Glenn Highway was constructed. The northbound and southbound bridges create another channel constriction in the natural alluvial fan of the lower river, although not as significant as the railroad bridge.

In 1988, construction of the Eklutna Water Project (now owned and operated by AWWU) was completed. Construction of the buried water supply pipeline and access road for the Eklutna Water Project impacted both fish and wildlife habitat and constricted channel migration in the river above the canyon reach.

In 1989, Chugach Electric, Matanuska Electric, and the Municipality of Anchorage agreed to buy the Project. However, they did not officially buy the Project from the federal government until 1997.

In 2018, Eklutna, Inc. removed the lower dam. However, the majority of the sediment that had accumulated behind the lower dam for decades was left in the river. Even without the lower dam serving as a barrier to fish passage, the lack of flow releases from Eklutna Lake into the Eklutna River still limits adult salmon from accessing potential habitat above the Thunderbird Creek confluence and is an ongoing impact of the Project.

### **3.2 PME Measures for Fish and Wildlife**

The Project Owners recognize that as the holder of significant water rights in the basin and the operator of the current hydroelectric facilities that control such water, only the Project Owners can provide water in the Eklutna River for the protection, mitigation, and enhancement of fish and wildlife habitat. Because of this, and based on the study results, TEK, and input from Parties and stakeholders, the Project Owners have committed to providing instream flows to the Eklutna River while balancing costs and other impacts in accordance with the 1991 Agreement.

The Project Owners will provide year-round release of water and periodic channel maintenance flows from Eklutna Lake into the Eklutna River as PME measures for fish and wildlife habitat affected by the Project. Water for the annual base flow regime will be released from a new facility constructed adjacent to the AWWU portal valve, located approximately one mile downstream from Eklutna Dam. Release of water from the portal valve will provide year-round flow to 11 of the 12 river miles (Figure 1-1). Flow levels will vary throughout the year to meet specific seasonal habitat needs of fish while maximizing cost efficiency. Periodic channel maintenance flows to complement the base flow regime will be provided through a combination of water released from the base flow release facility and water released through the recently replaced maintenance gate in the existing Eklutna Dam.

This is the most cost-effective alternative of the 12 final alternatives analyzed with significant gains in spawning and rearing habitat within the river and simultaneously has the least impact to Chugach and MEA ratepayers and MOA property taxpayers. This will also allow continued year-round operation of the Project, and protect its associated benefits of cost-effective,

carbon-free, flexible hydroelectric power for the electric customers in Anchorage and the surrounding area, although less water (213,500 acre-feet) will be available for energy production on average.

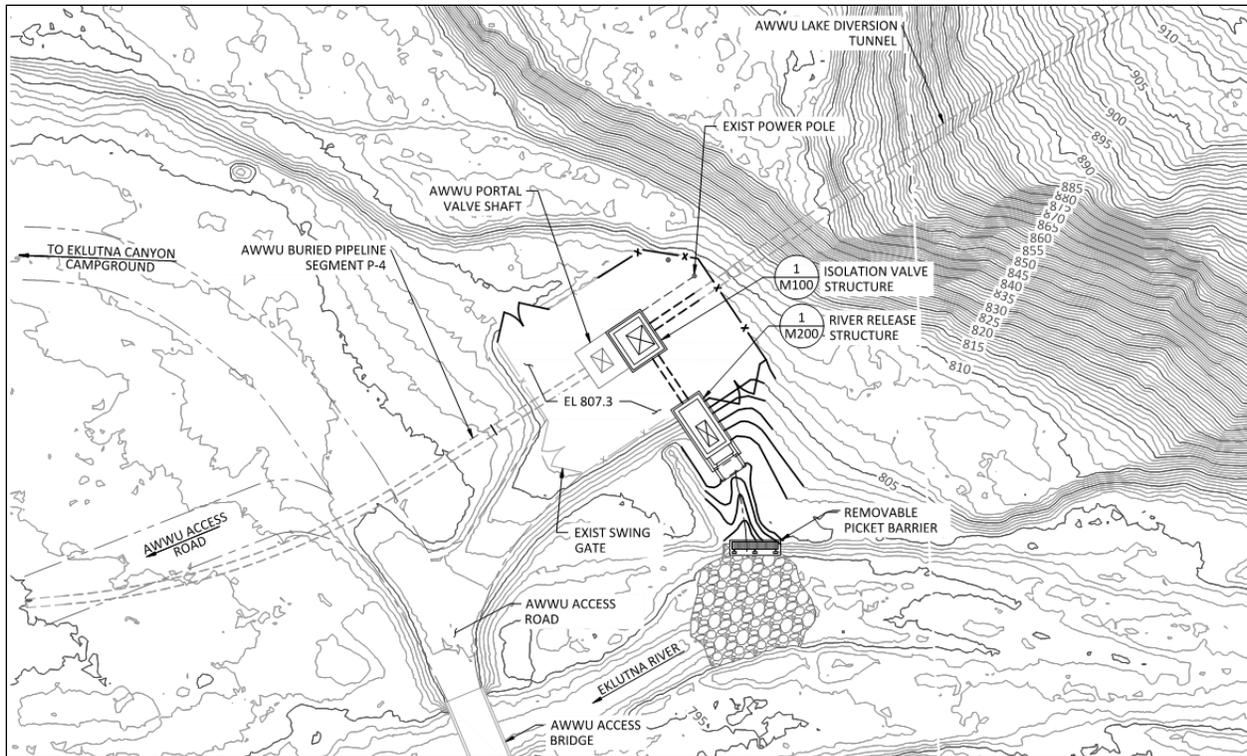
### **3.2.1 Year-Round Instream Flows**

The Instream Flow Study successfully developed a set of models and analytical tools that were used in the alternatives analysis in formulating and comparing different flow release alternatives and the amounts of increased salmon habitat relative to baseline conditions. Building on this understanding, as well as consideration of results from other resource studies, a flow release prescription has been developed that is focused on restoring habitat for Pacific salmon in the Eklutna River to productive levels, but at the same time, and in accordance with the 1991 Agreement, is balanced with the needs of other water resource users in the basin (e.g., wildlife, electric rate payers, municipal water utilities, recreation, and others).

Flow releases into the Eklutna River will be implemented year-round (Section 3.2.1.2) to provide rearing habitat to juvenile Pacific salmon and resident fishes throughout 11 miles of the Eklutna River below the AWWU portal valve (Section 3.2.1.1). During periods when adult salmon are migrating, flow levels will be augmented to facilitate access into the Eklutna River above the confined canyon reach, and sufficient flows to promote successful spawning of adult Chinook, coho, pink, and chum salmon. As discussed previously, the flow regime proposed in this Draft Program was selected to achieve a significant amount of the potentially available habitat in the Eklutna River within prudent capital, O&M, and replacement energy costs, and within the capacity of existing AWWU infrastructure to release the water.

#### **3.2.1.1 Eklutna River Release Facility**

The proposed infrastructural modification for providing continuous, year-round flow from Eklutna Lake to the Eklutna River involves the addition of a new valve and release structure located adjacent to AWWU's portal valve one mile below the Eklutna Dam. The proposed infrastructure, referred to as the Eklutna River Release Facility, would consist of a tee off the existing 54-inch pipeline that diverts water from Eklutna Lake as part of AWWU's Eklutna Water Project (Section 1.1.1.8) and new control valves to bypass water into the Eklutna River. A plan view of the site with proposed infrastructure changes is presented in Figure 3-1. The 15% design drawings for the Eklutna River Release Facility are provided in Appendix E.



**Figure 3-1. Eklutna River Release Facility Site Layout.**

The infrastructure included as part of the 15% level of design for the Eklutna River Release Facility is as follows:

- Construction of a new isolation gate structure immediately upstream of the AWWU portal valve shaft;
- Replacement of approximately 25-ft of existing pipeline with a newly fabricated steel 54-inch x 42-inch tee;
- Installation of a 54-inch gate valve on the main segment of pipe intended to provide dual means of isolation for AWWU's pipeline segment P-4;
- Installation of a 42-inch gate valve on the branch segment intended to provide isolation to the river release structure;
- Installation of a draining and filling system around each isolation valve;
- Installation of a pressure monitoring system and flow meter to provide dual redundancy to AWWU's portal release valve facility;

- Construction of a new river release structure approximately 30-ft downstream of the isolation gate structure;
- Installation of a 30-inch sleeve valve or alternative energy dissipation valve to control flow into the Eklutna River;
- Installation of a flow monitoring system to monitor flow releases into the Eklutna River;
- Construction of a bypass channel from the river release structure to the Eklutna River; and
- Upgrades to communication infrastructure to provide direct communication between the Eklutna River Release Facility, AWWU portal valve shaft, AWWU intake valve shaft, Eklutna Water Treatment Facility, and the Eklutna Power Plant.

Releasing water from the proposed Eklutna River Release Facility would water approximately 11 out of 12 miles of the Eklutna River and provide continuous flow year-round for fish and wildlife. With the water supply being supplied from the existing Eklutna Lake intake structure, no significant change to the annual operating regime of the reservoir is anticipated and the Eklutna Power Plant will be able to operate year-round. Further details of the Eklutna River Release facility and associated infrastructure are provided in Appendix E.

Flow releases through the facility will be limited to a maximum of 80 cfs to protect the AWWU valves and pipeline. The closure rate of the proposed river release valve will be set to keep transient pressures within the rating of the lake diversion tunnel and AWWU pipeline. Additional instrumentation including new flow meters and pressure transducers will be installed to monitor the new facility and protect AWWU infrastructure in the event of an emergency. The addition of this release facility on the existing Eklutna Water Project will not reduce or impact flow available for water supply purposes, as required by state law.

### **3.2.1.2 Flow Regime**

The flow releases into the Eklutna River are anticipated to vary seasonally with a winter flow of 27 cfs and a summer flow of 40 cfs with appropriate ramping rates keeping downramping within the river at a rate of less than 1 to 2 inches per hour between flow levels. The total volume of water to be released annually from Eklutna Lake into the Eklutna River for year-round base flows is 24,280 acre-ft/yr, equivalent to approximately 10% of the average annual inflow to the lake. The seasonal flows released into the river are presented in Figure 3-2 and tabulated in Table 3-1.

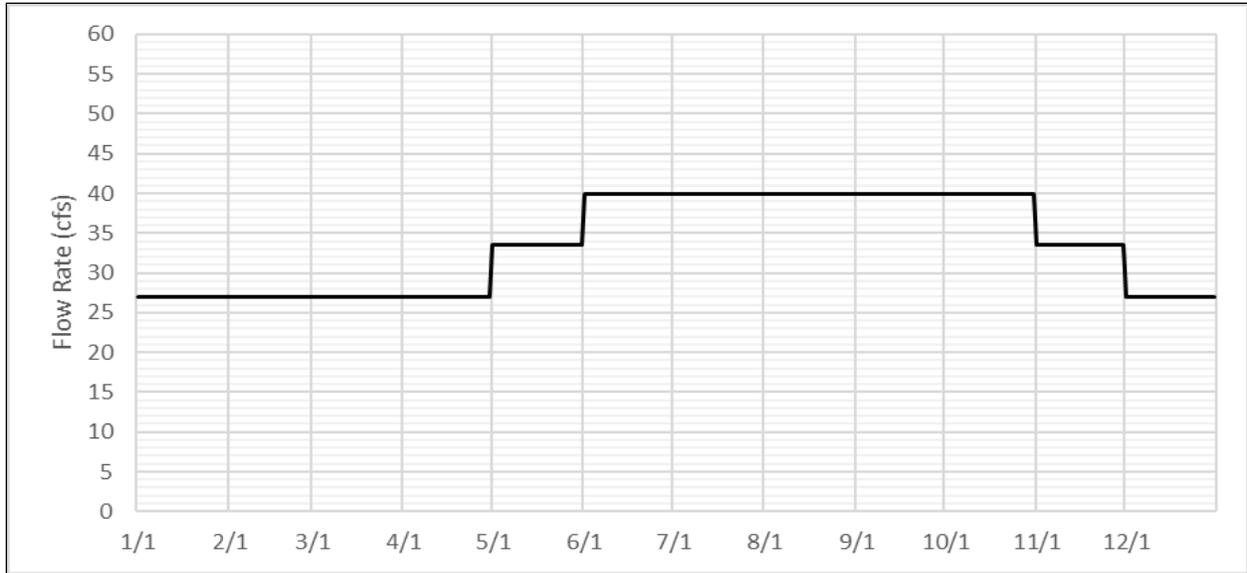


Figure 3-2. Eklutna River Flow Regime.

Table 3-1. Eklutna River Flow Regime by Month.

Month	Flow Rate (cfs)
Jan	27
Feb	27
Mar	27
Apr	27
May	34
Jun	40
Jul	40
Aug	40
Sep	40
Oct	40
Nov	34
Dec	27

The flow regime selected promotes new spawning and rearing habitat for salmon in the Eklutna River while maintaining carbon-free energy production through the Eklutna Power Plant. The expected spawning and rearing habitat gain for Chinook and coho salmon are presented in Table 3-2.

**Table 3-2. Chinook and Spawning and Rearing Habitat Gains.**

Criteria	Chinook Habitat		Coho Habitat	
	Spawning	Rearing*	Spawning	Rearing*
Baseline Habitat (Acres)	0.7	11.8	2.5	14.7
Total Habitat with Proposed Base Flows (Acres)	2.2	18.1	4.1	24.6
Percent Gain	209%	53%	65%	67%
% of Maximum Available Habitat Below the AWWU Portal Valve	96.5%	n/a	99.6%	n/a
% of Maximum Available Habitat in the Eklutna River	81.7%	n/a	83.7%	n/a

\*The % of maximum available habitat is not shown for Chinook or coho rearing habitat because the flow needed to achieve maximum rearing habitat for both species appears to be higher than the range of flows that was modeled.

The spawning habitat curves for Chinook and coho salmon habitat downstream of the AWWU Portal Valve are presented in Figure 3-3. Spawning and rearing habitat gains are presented graphically in Figure 3-4 and Figure 3-5, respectively. Additional habitat gains for pink and chum salmon are expected to be similar to the prior two species but were not quantified as part of the study program. While these flow releases may create potential spawning habitat for sockeye in the river, they are unlikely to create rearing habitat for sockeye since sockeye typically rear in lakes. Therefore, the potential spawning habitat for sockeye in the river is not shown.

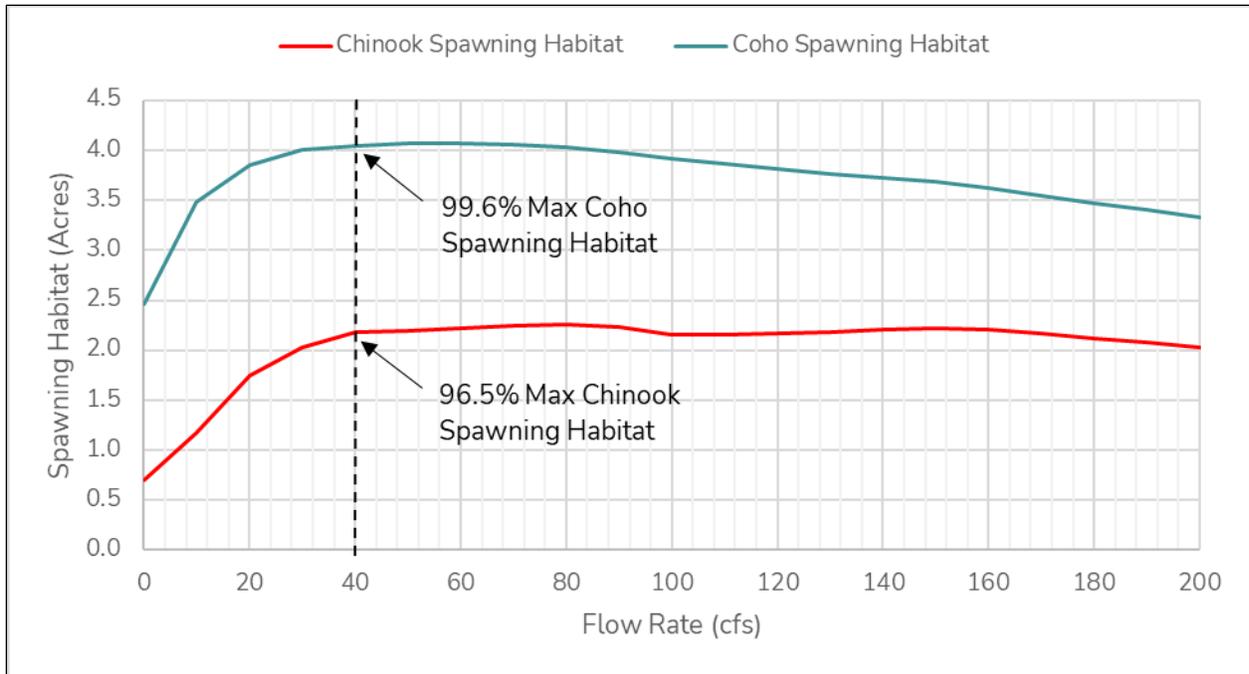


Figure 3-3. Spawning Habitat Curves for the Eklutna River below the AWWU Portal Valve.

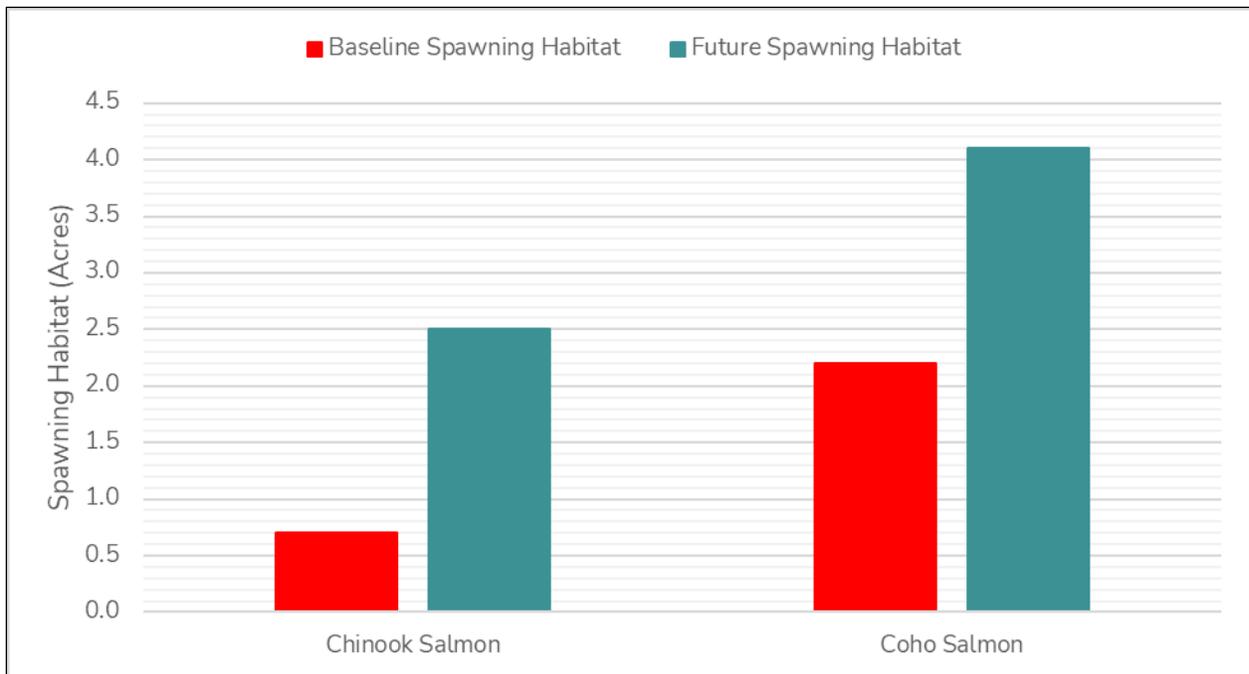
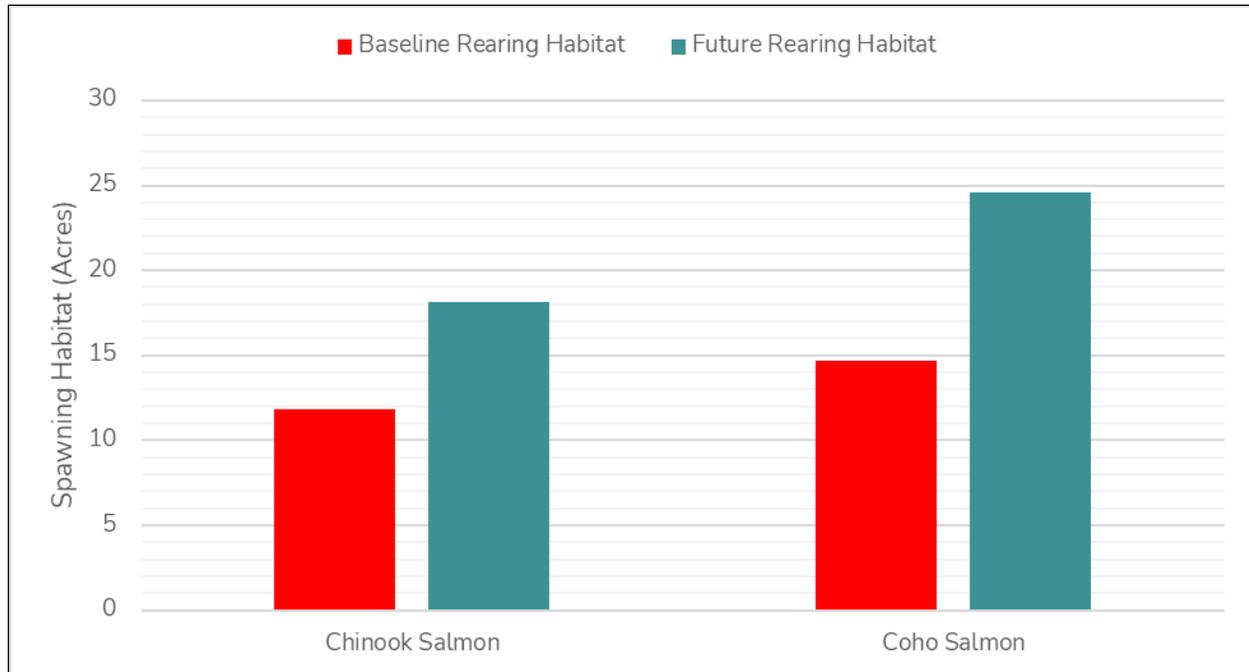


Figure 3-4. Spawning Habitat Comparison, Baseline vs. Future Flow Conditions.



**Figure 3-5. Rearing Habitat Comparison, Baseline vs. Future Flow Conditions.**

Increased flow and salmon abundance will also directly or indirectly benefit several ecologically and/or culturally important wildlife species, including:

- Bears, especially brown bears (direct foraging)
- Moose (increased plant nutrients and forage; however, moose could also be negatively impacted as a result of increased bear densities)
- Wolves (direct foraging and potentially higher prey base)
- River otters and mink (direct foraging)
- Beavers (beaver dams would also create salmon rearing habitat)
- Piscivorous birds
- Marine mammals

### 3.2.2 Channel Maintenance Flows

A channel maintenance flow regime was developed to help create and maintain channel dimensions and substrate characteristics to support physical fish habitat over the long term. The channel maintenance flow regime was developed based on field studies, modeling, and

peak flow statistics in similar unmanaged Alaskan rivers and is designed to complement the base flow regime discussed in Section 3.2.1.2.

### 3.2.2.1 Infrastructure

The proposed infrastructural modification to provide periodic channel maintenance flows in the Eklutna River includes automating the existing outlet gate within the base of the spillway at Eklutna Dam. The existing outlet gate, replaced in 2021 as part of the study program, has a maximum capacity of approximately 190 cfs at the normal maximum water surface elevation of El 871.0 ft. The Eklutna River Release Facility is designed to provide a maximum potential flow release of 80 cfs without impacting operations of the AWWU water supply project. A channel maintenance flow with a peak of 220 cfs is anticipated to be released through a combination of flow released through the dam outlet gate and flow releases at the Eklutna River Release Facility (Section 3.2.1.1). The infrastructure to provide channel maintenance flows to the river is as follows:

- Replacement of existing manual actuator for the dam outlet gate with electric motor actuator with position sensing;
- Construction of new access platform and stilling well with level transducer to measure water surface elevation in Eklutna Lake; and
- Installation of 0.5 miles of new buried power line from Eklutna Lake Road to Eklutna Dam.

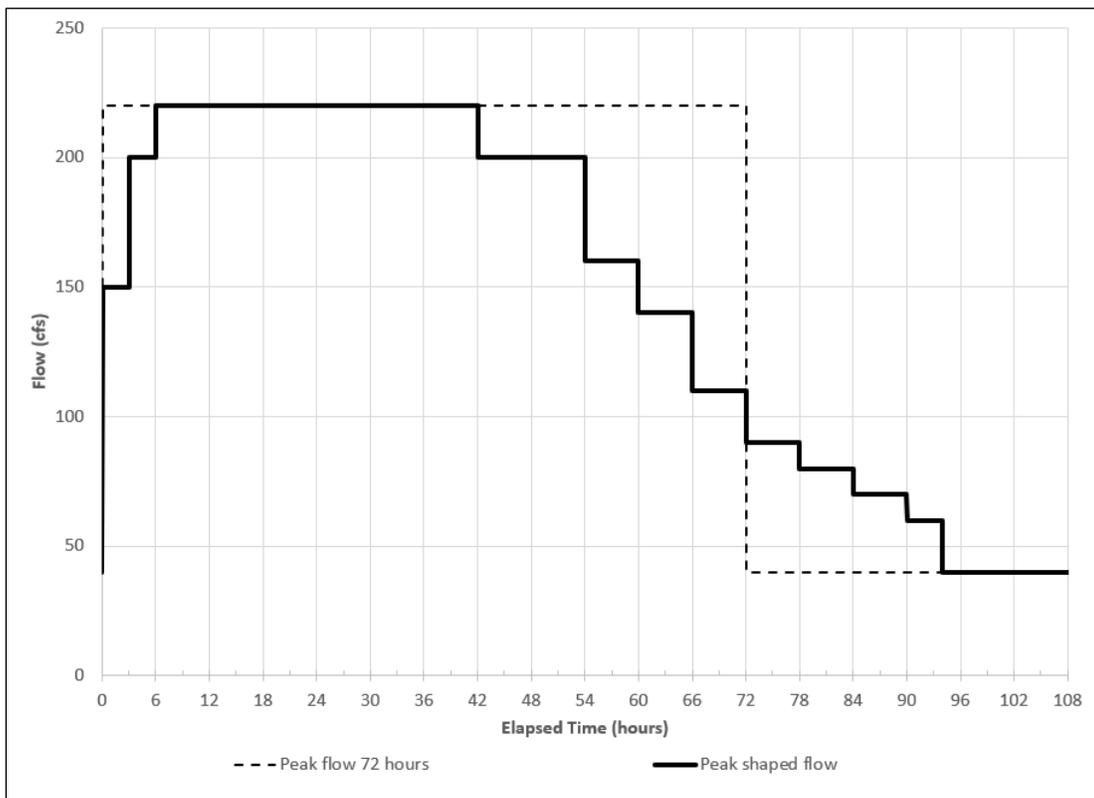
### 3.2.2.2 Channel Maintenance Flow Regime

The proposed channel maintenance flow regime is a 220 cfs flow in three out of every 10 years in order to take advantage of wet water years. The channel maintenance flow regime may be provided by spill events. In the absence of any natural high flow events or spill events, flow releases to meet the channel maintenance flow regime will be made. It shall be noted that for this channel maintenance flow to occur, operations of the reservoir may change to raise the water surface higher to achieve the desired flow rate.

Based on geomorphic and fisheries studies and modeling, the proposed default channel maintenance flow is a shaped hydrograph (as shown in Table 3-3 and Figure 3-6) which is designed to closely resemble a natural peak flow hydrograph. Figure 3-6 also shows a flow of 220 cfs for 72 hours for comparison with the proposed shaped hydrograph.

**Table 3-3. Proposed Channel Maintenance Flows.**

Duration (hours)	Flow (cfs)
Start	40
3	150
3	200
36	220
12	200
6	160
6	140
6	110
6	90
6	80
6	70
4	60
End	40



**Figure 3-6. Proposed Channel Maintenance Flows.**

The timing of channel maintenance flows will be during the fall when Eklutna Lake levels are highest and take into consideration limitations of inflow volumes and allow for year-round hydropower operations.

### 3.2.3 Water Balance

The proposed instream flows and channel maintenance peak flows to be provided as part of the Fish and Wildlife Program modify the water balance of Eklutna Lake. The baseline and future water balance detailing the percent of flows provided to hydropower, public water supply and instream flows is provided in Table 3-4.

**Table 3-4. Eklutna Lake Water Balance, Baseline vs. Future Condition.**

Condition	Eklutna Water Volume (Acre-Ft)					Percent of Total Volume (%)		
	Inflows	Hydro	Public Water Supply	Base Flows	Peak Flows (Avg)	Hydro	Public Water Supply	Instream Flows
Baseline	262,456	238,444	24,670	0	0	91%	9%	0%
Future	262,456	212,804	24,670	24,280	323	81%	9%	10%

## 3.3 Other Mitigation Measures

The 1991 Agreement requires the Project Owners to consider the impact of fish and wildlife PME measures on electric rate payers, municipal water utilities, recreational users, and adjacent land use, as well as available means to mitigate these impacts. The impacts of providing year-round and periodic channel maintenance flows as a PME measure for fish and wildlife on other resources is described below.

### 3.3.1 Public Water Supply

A portion of the water supplied to Eklutna Lake is diverted for public water supply purposes through AWWU's diversion tunnel and pipeline as part of the Eklutna Water Project (Section 1.1.1.8). Under the 1984 Agreement for Public Water Supply and Energy Generation from Eklutna Lake, Alaska, the Project Owners may not take any action that will reduce the water quality of Eklutna Lake or "take or authorize any other actions with regard to Eklutna Lake which may have the effect of reducing its present suitability for use as a public water supply."

Future operations of Eklutna Lake and the proposed Eklutna River Release Facility will not reduce the water supply, adversely impact water quality, or restrict the ability of AWWU to

withdraw water from the lake. Hydraulic restrictions will be in place limiting the maximum flow able to be released from the Eklutna River Release Facility while still maintaining the maximum flow able to be withdrawn for treatment at the Eklutna Water Treatment Facility. Additional safeguards to be implemented to protect public water supply include upgrades to the existing communications system from the AWWU portal and intake valve shafts to the water treatment facility to provide increased resiliency, as well as the inclusion of redundant flow meters and pressure transmitters for monitoring and control of the system.

Flow releases in the river will impact the ability for AWWU to access their pipeline for maintenance purposes, as the existing maintenance road consists of eight river ford style road crossings. It is anticipated that flow within the river will make these impassable for most of the year. To allow year-round access to the pipeline for maintenance, new bridges will be constructed at each of the eight crossings.

### **3.3.2 Recreational Use and Facilities**

Continuation of existing reservoir operations as proposed could cause some continuing erosion of the non-motorized portions of the lakeside trail at higher lake levels. Chugach State Park has secured funding to address trail erosion. Therefore, the Project Owners are not proposing mitigation for this impact.

The Project Owners note that the public cannot access most of the Eklutna River; the land under and surrounding the Eklutna River is largely owned by Eklutna, Inc. The Project Owners cannot ensure public access to the Eklutna River.

Increased salmon populations in the Eklutna River will likely attract increased numbers of both black and brown bears. This may provide increased opportunities for wildlife viewing, but it could also increase the likelihood of bear-human interactions near the campground. However, releasing flows from the AWWU portal valve approximately one mile downstream from the dam will reduce this potential impact on the users of nearby developed recreational facilities in Chugach State Park.

Stocked Chinook and coho returning to the Eklutna tailrace first pass by the mouth of the Eklutna River. As documented by ADFG, all of the Chinook salmon carcasses recovered by the Project Owners and NVE during spawning surveys in 2021 and 2022 originated from the Eklutna Tailrace Fishery and are therefore considered strays. A significant increase in the straying of adult Chinook and coho from the Eklutna Tailrace into the Eklutna River after implementation of the new flow regime may represent a loss of recreational fishing opportunities at the tailrace fishery, and there is currently no public access to the Eklutna

River<sup>17</sup> that would allow new recreational fishing opportunities for fish returning to the river. Because fish straying from the tailrace to the Eklutna River is anticipated and could affect recreational fishing opportunities, the Project Owners will conduct a study to determine hatchery fish straying from the Eklutna Tailrace to the Eklutna River as part of their Monitoring and Adaptive Management Plan. This study is described in Section 3.4.3.2.

### **3.3.3 Carbon Emissions**

Flow releases to the Eklutna River will result in a reduction in generation at the Eklutna Power Plant. It is assumed that this generation will be replaced by natural gas to meet demand. Therefore, The Project Owners' Draft Program would result in increased carbon emissions of 6,900 metric tons of CO<sub>2</sub> equivalent annually. It should be noted that the social cost of carbon is not included in the overall Program costs presented in Section 3.5.

## **3.4 Monitoring and Adaptive Management Program**

The PME measures described in the previous sections are based on the results of the 2-year study program, modeling, and extensive consultation. However, the Project Owners recognize there is some inherent uncertainty in modeling and data analysis. Therefore, following the implementation of the PME measures for fish and wildlife (Section 3.2), the following monitoring and adaptive management plan will be implemented to document both the implementation of PME measures and response of the Eklutna watershed to the introduction of instream flows. This approach allows for some flexibility and adjustments to PME measures, if needed.

### **3.4.1 Adaptive Management Committee**

A committee will be established to execute the monitoring and adaptive management component of the Program. The Committee will review the results of the monitoring program, maintain a monitoring database/archive, and decide on any appropriate actions under the adaptive management portion of the program as further described below. The Committee will consist of representatives from Parties to the 1991 Agreement (excluding the Project Owners) and the Native Village of Eklutna (NVE) and will be chaired by the Governor's designee.

### **3.4.2 Water Budgets**

Use of a water budget is proposed for both year-round and channel maintenance flows; a water budget establishes a total volume of water available for release into the Eklutna River each water year (June 1 to May 31) based on the selected flow regimes. Adjustments to the

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<sup>17</sup> The majority of the land around the Eklutna River is owned by Eklutna, Inc.

flow regimes may be made so long as the total volume of water to be released does not exceed the annual water budget.

### 3.4.2.1 Year-Round Instream Flows

The water budget for the year-round instream flow has a total volume of water available for release throughout the year of 24,280 acre-feet. The monthly volumes are shown in Table 3-5.

**Table 3-5. Default Flow Regime and Water Budget for Year-Round Instream Flows.**

Month	Flow (cfs)	Volume (acre-feet)
January	27	1,660
February	27	1,500
March	27	1,660
April	27	1,607
May	34	2,060
June	40	2,380
July	40	2,460
August	40	2,460
September	40	2,380
October	40	2,460
November	34	1,993
December	27	1,660
<b>Total</b>	-	<b>24,280</b>

If the entire water budget is not released into the Eklutna River in a given water year, then that “banked water” can be released in the subsequent water year. Up to 20% of the water budget from the previous water year can be banked for the subsequent water year. Water can only be banked for 1 year. If the water released into the Eklutna River in a given year exceeds the water budget, then that deficit will be carried over into the next water year.

### 3.4.2.2 Channel Maintenance Flows

The proposed channel maintenance flow regime is equivalent to a water budget of 971 acre-feet per channel maintenance flow event, or 2,913 acre-feet of water for each 10-year period. The water budget for each 10-year period must be used within that period and cannot be carried over to the following 10-year period. The first 10-year period starts the first full water year following the completion of the Eklutna River Release Facility.

### **3.4.3 Monitoring**

The monitoring plan for the Eklutna River is described below.

#### **3.4.3.1 Flow Monitoring**

Accurate monitoring of the flow releases into the Eklutna River is essential to maintain compliance with the Program. A flow meter will be installed on the river release pipeline within the Eklutna River Release Facility. The accuracy of this meter is anticipated to utilize the ultrasonic transit time method and have an accuracy of  $\pm 1\%$ .

To provide accurate monitoring of flow released through the dam outlet gate during a channel maintenance flow event, a rating curve tied to the design of the outlet gate shall be utilized, determining flow is a function of gate position and water surface elevation in the reservoir. The gate position will be monitored remotely via a new position feedback sensor within the electric motor operator of the gate. To monitor the water surface elevation of the reservoir, a new stilling well and pressure transducer will be located upstream of the gate within the entrance to the Eklutna Dam spillway channel. The addition of this transducer will avoid any potential inaccuracies with the existing USGS gauge measuring water surface elevation near the intake. The flow measurement at the gate is anticipated to have an accuracy of  $\pm 2\%$ .

#### **3.4.3.2 Other Monitoring Efforts**

The Project Owners will provide a total of up to \$270,000 to the Governor's designee to fund additional monitoring efforts in the Eklutna River over the length of the Program. This funding commitment is based on the estimated costs to conduct the monitoring efforts described below. These monitoring efforts are recommended by the Project Owners, but the Committee may revise the monitoring plan or seek supplemental funding to conduct additional monitoring efforts if desired.

#### **Timing and Distribution of Returning Adult Salmon**

Following the implementation of the Program, which includes release of year-round flows into the Eklutna River, it is recommend that the presence and distribution of spawning adult salmon be monitored. The methodology for these surveys should be identical to those completed during the Year 1 and Year 2 Eklutna River Fish Species Composition and Distribution Study, with the noted exception that surveys should continue beyond the confined canyon reach to assess not only whether salmon can pass through the canyon reach successfully to reach upstream habitats but also whether there are any changes in the timing of spawning migrations and spawning behavior over the monitoring period

It's recommended that surveys be conducted for a total of 5 years (need not be consecutive) at weekly intervals between June and October within the boundaries of safe river access for survey teams. The presence and disposition (i.e., live fish, carcass, completed redd) of anadromous salmon spawning should be documented.

### **Winter Egg Incubation and Juvenile Rearing Habitat**

In stream systems like the Eklutna River, the complex interaction between winter water temperature, low stream flow, ice formation, habitat accessibility and suitability for stream-dwelling fish species all play a role in successful egg incubation and juvenile rearing. Therefore, the Project Owners recommend implementing a 3-year temperature monitoring study to evaluate whether winter rearing habitat for salmon is adequate to maintain survival, and whether winter conditions are adequate to maintain survival of incubating eggs in completed redds (spawning nests) observed during the adult spawning surveys.

It is recommended that temperature monitoring be implemented using continuous temperature loggers (thermistors) deployed at three to five locations that represent potential overwintering habitats for juvenile rearing and egg incubation. These sites should include established redds in glide habitat, deep pools such as the beaver pond complex in the lower river, and intermediate rearing habitats between Thunderbird Creek and the AWWU portal valve. Thermistors should be deployed in the fall in rearing habitats, and 1-2 weeks following redd construction for egg-incubation sites. They should be removed in the spring when access is possible. Temperature patterns indicative of freezing conditions would suggest unsuitable winter conditions at that site. The presence of accessible ice-free refuge for overwintering fish and ice-free or groundwater-fed incubation temperatures for eggs represents a suitable winter condition.

### **Sediment Grain Size in Spawning Reaches**

The substrate goals of the channel maintenance flow regime are to maintain: (1) substrate in salmon spawning areas in the preferred grain size range for spawning (16-128 mm); (2) sub-surface substrate characteristics in spawning areas with a low percent of fine sediments (less than 12 percent of sub-surface material finer than 0.83 mm); and (3) substrate in spawning and rearing areas with low embeddedness (spawning and rearing visual embeddedness less than 25%).

The Project Owners recommend monitoring of substrate characteristics at selected monitoring transects to assess the effectiveness of the channel maintenance flow regime at meeting the substrate goals. Monitoring transects should include spawning and rearing areas within geomorphic reaches 2, 3, 4, 7, 8, and 9 (two transects per reach; geomorphic reaches are

shown in Dubé 2023). Specific transect locations should be selected in coordination with the Adaptive Management Committee and should include transects already established in these reaches as part of the Eklutna Geomorphology and Sediment Transport Study if feasible.

The monitoring should take place during low flows and include:

- Surficial grain size (pebble counts): measured prior to initial flow release and then after flows are established, total of 5 years (need not be consecutive). The pebble counts should be performed by selecting a clast every foot across the bankfull width of each transect. A minimum of 100 clasts (pebbles) should be measured; if less than 100 clasts are measured across the transect, another pass across the river should be made 1 foot downstream from the transect. Passes across the stream should continue until at least 100 clasts are measured and each pass should continue across the entire bankfull width of the river. Pebble size should be measured by passing through a gravelometer.
- Sub-surface sampling in spawning-sized gravel to assess percent fines: sample sub-surface substrate annually for a total of 5 years (need not be consecutive). One sub-surface bulk sample should be collected at each spawning transect and sieved to determine grain size distribution using the methods of Church et. al, (1987), with the hybrid method of Rice and Haschenburger (2004) applied to characterize the coarse tail of the bulk grainsize distribution as needed to minimize sub-surface sample size. The coarse fraction should be field-sieved and a sub-sample of the fine fraction taken for lab sieving.
- Visual assessment of substrate embeddedness in spawning and rearing habitat areas: measured prior to initial flow release and then after flows are established, total of 5 years (need not be consecutive). A visual assessment of embeddedness to the nearest quartile should be made at each transect prior to any pebble counts or sub-surface sampling.

### **Hatchery Fish Straying from the Eklutna Tailrace to the Eklutna River**

All Chinook and coho carcasses (heads) observed in the Eklutna River during the adult salmon surveys should be collected and delivered to ADFG for stock origin analysis. The Project Owners will also coordinate annually with the ADFG Sportfish Division on whether there have been substantial changes to Tailrace Fishery escapement (as measured via angler days, catch per unit effort, etc.) that might result from Chinook and coho straying into the Eklutna River. If significant straying is observed, the Project Owners will work with ADFG to evaluate and determine the appropriate mitigation. Costs related to any mitigation for impacts to the tailrace fishery are not included in the anticipated costs described below in Section 3.5.

### 3.4.3.3 Reporting

The Project Owners will prepare an annual report that summarizes the water available for release in the subsequent water year and provide it to the Adaptive Management Committee by February 28 each year. An annual report that summarizes the monitoring results should be prepared by the Governor's designee and provided to the Project Owners and the Adaptive Management Committee by the same date.

### 3.4.4 Adaptive Management

The Adaptive Management Committee will meet annually in April of each year to review the results of the monitoring efforts conducted in the previous calendar year and determine what monitoring efforts should be conducted in the upcoming calendar year. The Committee must notify the Project Owners of the planned monitoring efforts for the upcoming year by July 1 of the previous year so that the Project Owners can budget accordingly.

Based on the results of the monitoring program, the Committee may request modifications to the default flow regime each year, as long as 1) the requested flows do not exceed the operational limitations of the Project infrastructure, 2) the total volume of water to be released in a given year still does not exceed 24,280 acre-feet (plus any banked water that might be available), and 3) the ramping rates conform to fisheries ramping rate requirements.

The Committee may also request modifications to the magnitude, duration, frequency, or shape of scheduled peak flow releases, as long as 1) the requested flows do not exceed the operational limitations of the Project infrastructure, 2) the total volume of water to be released in a ten-year period does not exceed 2,913 acre-feet, and 3) the ramping rates conform to fisheries ramping rate requirements.

The Committee must submit any requests for modifications to the flow regime or scheduled peak flows to the Project Owners by May 1 of each year. If the requested flows exceed the operational limitations of the Project infrastructure, the established water budgets, or the approved ramping rates, then the Project Owners may reject the requested flow modifications with supporting rationale. If the Project Owners reject the requested flow modifications, then they must notify the Committee so that the Committee may request alternative flows if desired.

The Project Owners are not responsible for responding to natural processes that result in undesirable conditions in the river such as debris flow associated with precipitation or earthquakes, beaver activity, large wood build-up, etc.

### 3.5 Anticipated Costs

A Class 4 OPCC with an accuracy range of -30% to +50% was developed for the capital improvements proposed in this Draft Program (see Appendix E). Both the capital costs and the O&M costs for the proposed improvements increased from the Class 5 OPCC in part due to modifications to the design that were requested by AWWU. The total anticipated costs for the Project Owners to implement the proposed Draft Program are presented below in Table 3-6.

**Table 3-6. Cost Summary for the Proposed Fish and Wildlife Program.**

Cost Description	Value
Capital Cost (\$)¹	\$15,433,800
O&M Cost (\$/Yr)	\$315,900
Replacement Energy Cost (\$/Yr)	\$1,365,600
Monitoring Program Cost (\$)	\$270,000
Annualized Cost (\$/Yr)	\$3,485,000
Present Value of Annualized Costs (\$)	\$57,100,000
CEA Rate Impact (%)	+ 0.67%
MEA Rate Impact (%)	+ 0.87%
MOA Tax Impact (\$/100k)	\$0.54

¹ Capital costs at this level of design have an expected accuracy range of -30% to +50%.

## 4.0 Measures Not Selected for Fish and Wildlife Program

Section 4 presents alternative means of mitigating Project impacts that were identified by others and evaluated during the alternatives analysis process described in Section 2.0.

### 4.1 Higher Flow Releases from the AWWU Portal Release Facility

Of the 12 preferred alternatives, four proposals included construction of the AWWU portal release facility to deliver flow into the Eklutna River. Three of these comprehensive alternatives proposed flow regimes higher than that of the Project Owners’ Draft Program proposal. The increased flows are technically feasible to be released at the AWWU portal and provide increased habitat; however, the incremental gains in habitat are minor and result in significantly larger incremental unit costs, as presented in Figure 4-1.

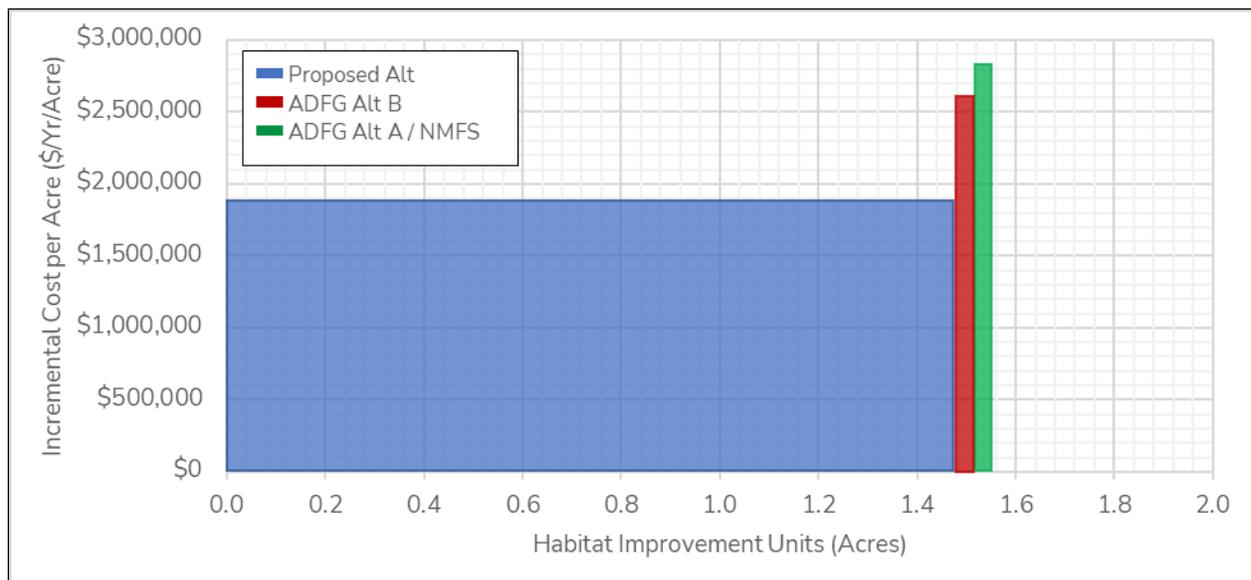


Figure 4-1. Incremental Cost Comparison – AWWU Portal Release Facility.

An additional means of analyzing the incremental gains of higher flow releases from the AWWU portal release facility is to quantify habitat improvements as a function of the maximum spawning habitat in the river. The Draft Program year-round flow release enhances 82% of maximum spawning habitat for Chinook and 84% of the maximum spawning habitat for coho. In comparison, the higher flow release alternatives from the AWWU portal release facility have minor gains of approximately 1% - 3% of Chinook spawning habitat and 0.2% - 0.3% of coho spawning habitat. A comparison of the habitat change as a percentage of maximum available riverine habitat is presented in Table 4-1.

**Table 4-1. Habitat Gains Comparison – AWWU Portal Release Facility.**

Comprehensive Alternative	Chinook		Coho	
	Flow Rate in July/Aug (cfs)	Habitat Gain (% of Max River Habitat)	Flow Rate in Sep/Oct (cfs)	Habitat Gain (% of Max River Habitat)
Selected Alternative	40	82%	40	84%
ADFG Alt B	60	83%	48	84%
ADFG Alt A	80	85%	57	84%

#### 4.2 Flow Releases from the Existing AWWU Pipeline (RM 5.5)

The AWWU pipeline segment P-4 runs along the Eklutna River from RM 5.5 to RM 11.0. Similar to the design of the AWWU portal release facility, an alternative was originally proposed to build a river release structure on the existing pipeline at or near RM 5.5, to take advantage of additional pipeline pressure resulting in a more compact facility. This location would have also eliminated the need to improve upstream AWWU road fords. This alternative was ultimately not selected as a preferred alternative due to the significant reduction in habitat that would benefit from releases. A summary of the gains in habitat if the preferred flow regime is released at the AWWU portal location rather than RM 5.5 is presented in Table 4-2.

**Table 4-2. Habitat Gains Comparison – AWWU Pipeline Release Facility.**

Description	Chinook Spawning	Coho Spawning	Chinook Rearing	Coho Rearing
Habitat Gains (Acres) with AWWU Portal Releases	1.5	1.6	6.3	9.9
Habitat Gains (Acres) with AWWU Pipeline Releases	0.3	0.8	3.3	4.7
Incremental Cost (\$/Yr/Acre) for AWWU Portal Releases	\$1,833,000	\$1,696,000	\$428,000	\$273,000
Incremental Cost (\$/Yr/Acre) for AWWU Pipeline Releases	\$8,486,000	\$3,594,000	\$860,000	\$601,000

### 4.3 Flow Releases from a New Bypass Tunnel (RM 11.5)

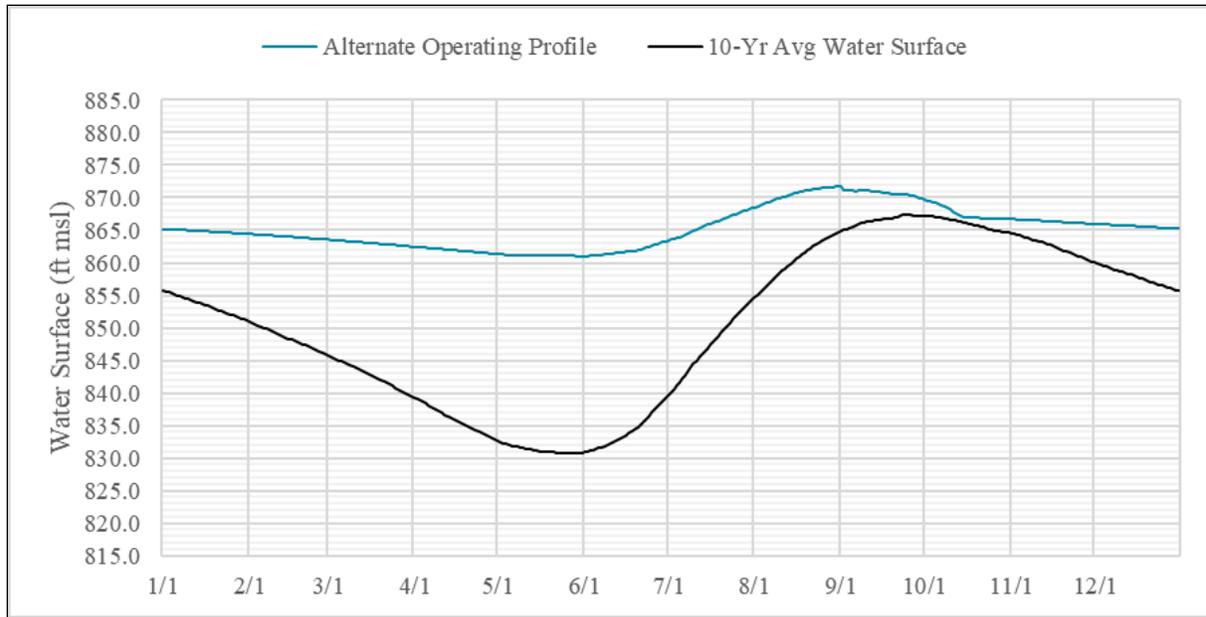
As an alternative to the AWWU portal release facility, which utilizes the existing lake AWWU diversion tunnel, an alternative was brought forth to construct a new tunnel in parallel to the existing AWWU tunnel complete with a river release facility at RM 11.5. This alternative was ultimately not selected due to the substantial capital costs to provide the same environmental benefits as the AWWU portal release facility. A comparison of the new bypass tunnel release approach with the AWWU portal release facility is presented in Table 4-3.

**Table 4-3. Habitat Gains Comparison – New Bypass Tunnel Release Facility.**

Description	Chinook Spawning	Coho Spawning	Chinook Rearing	Coho Rearing
Habitat Gains (Acres) with Portal Releases	1.5	1.6	6.3	9.9
Habitat Gains (Acres) with New Bypass Tunnel	1.5	1.6	6.3	9.9
Incremental Cost (\$/Yr/Acre) for Portal Releases	\$1,833,000	\$1,696,000	\$428,000	\$273,000
Incremental Cost (\$/Yr/Acre) for New Bypass Tunnel	\$5,373,000	\$5,037,000	\$1,279,000	\$814,000

### 4.4 Flow Releases from the Existing Dam (RM 12)

A measure that was included in three of the 12 comprehensive alternatives proposed by stakeholder groups was to modify the existing dam to release water into the river continuously. In doing so, operations of the reservoir would need to change substantially from current operations. In an average year the water surface elevation fluctuates from El. 830.0 ft (local datum) to El. 867.0 ft with the ability to draw down to El. 814 ft if necessary. Releases year-round at the existing dam would require the reservoir to remain above El. 861 ft to maintain connectivity with the dam outlet gate. A representation of the proposed reservoir operation if flow releases were made at the existing dam compared to current operations is presented in Figure 4-2.



**Figure 4-2. Water Surface Elevation Comparison – Existing Dam Releases.**

This alternative was ultimately not selected due to the elimination of over 80% of the reservoir storage from being utilized for power generation purposes. Due to the reduction of inflows throughout the winter and the need for maintaining the reservoir above El. 861 for river release purposes, the powerhouse is unable to operate for up to eight months of the year. This results in a substantial loss of power generation when grid demand is highest, violates power capacity reserve requirements throughout the winter for MEA, and presents an unacceptable risk to the Project Owners.

#### **4.5 Fish Passage**

The Traditional Ecological Knowledge (TEK) from the Native Village of Eklutna (NVE) indicates that there was a sockeye salmon run in Eklutna Lake before the lower dam was constructed in 1929. However, in a 2011 report, the USACE stated “It is doubtful that significant numbers of sockeye salmon ever spawned in the Eklutna River drainage because suitable spawning area upstream of the lake is limited and water quality in the lake would likely have limited opportunities for spawning in the littoral zone of the lake. Fully 80 percent of the water entering Eklutna Lake comes from two glacial streams that would not be conducive to the consistent survival of sockeye salmon from egg to fry, and the remaining spawning area would not be sufficient to support large numbers of spawning anadromous salmon. In addition, the physical limnology studies of Eklutna Lake suggest that the turbidity in Eklutna Lake during much of the year is not conducive to significant primary production.”

A separate study was conducted by Loso et al. to try to determine “whether there was an anadromous salmon run into Eklutna Lake prior to 1929” by using marine derived nutrients (MDN) as a biochemical marker in lake sediment. The study found that there was no significant difference in the composition of sediment layers from before and after 1929. However, a sensitivity test was conducted to assess the possibility that a small salmon run may have gone undetected by the isotopic analysis. It was determined that “a salmon run of up to 1,000 per year, and potentially as many as 15,000 per year, would be possible without noticeably altering the measured isotopic composition of the sediments in Eklutna Lake.” Therefore, the results “provide no evidence that such runs occurred, but do not preclude the possible existence of a relatively small sockeye fishery in Eklutna Lake before 1929.”

To investigate further, the Project Owners conducted several surveys to quantify the potential spawning habitat around and above Eklutna Lake and evaluate the available nutrients, turbidity, and primary production in Eklutna Lake. The Project Owners also developed high level (5%) conceptual designs and cost estimates of four upstream fish passage measures and two downstream fish passage measures. In addition, the Project Owners evaluated the impact of these measures on reservoir operations. It should be noted that although several entities expressed interest in fish passage to Eklutna Lake during the study planning process, no requests were made for studies specific to the efficacy of introducing anadromous fish above the dam. It should also be noted that AWWU has raised concerns that the introduction of a large salmon run to Eklutna Lake could potentially impact the water quality of the public water supply and may necessitate additional water treatment. However, no studies were requested by AWWU to evaluate this potential impact.

The lake study results and justification for the exclusion of each measure from the Project Owners’ Draft Program are presented in the following subsections.

#### **4.5.1 Lake Studies**

Much of the Eklutna Lake shoreline is steep, bouldery, or characterized by fine silt and grasses. The remaining shorelines that could be accessed during the study program (above the waterline) contained ~1.5 acres of potential habitat for lakeshore-spawning ocean-run salmon such as sockeye.

Most tributaries to Eklutna Lake are too steep to provide significant spawning or rearing habitat for ocean-run salmon. The only lake tributaries with accessible low-gradient habitat suitable for the migration and spawning of ocean-run salmon are the East and West Forks of Eklutna Creek where an estimated 0.77 – 3.61 acres of potential spawning habitat was documented based on water depth and substrate size. A small tributary to the West Fork of Eklutna Creek adds between 0.02 – 0.24 acres of potential spawning habitat.

Low water transparency (caused by high turbidity) and low nutrients levels in Eklutna Lake correlate with low levels of chlorophyll a (an indirect indicator of primary production). The low algal biomass within Eklutna Lake likely corresponds to low zooplankton densities (secondary production) and appears to be a limiting factor (i.e., food resource) for fish production in the lake, especially for the resident Kokanee population.

Spawning Kokanee collected from Eklutna Lake were smaller (4.5-6.5 inches) than those reported in many other lake systems (10–12 inches). The Kokanee in Eklutna Lake also differ from other Kokanee in their low fecundity (only 20-30 eggs), lack of sexual dimorphism, and lack of spawning color that is typical of the species (Figure 4-3). As previously stated, these are likely an indication of low nutrient concentrations and limited food sources in the environment, and may indicate that Eklutna Lake, in its existing condition, may not provide productive potential rearing habitat for large populations of ocean-run salmon.



**Figure 4-3. Typical spawning Kokanee in Eklutna Lake (left) vs. other lake systems (right).**

It has been theorized, but not studied, that if fish passage was provided into Eklutna Lake, the spawning salmon would bring enough marine derived nutrients with them. However, high turbidity in Eklutna Lake would still limit light penetration. The high turbidity in the lake is caused by runoff from the retreating Eklutna Glacier. Like the Eklutna Glacier, the nearby Skilak Glacier is also retreating. Elevated runoff from the retreating Skilak Glacier produces more silt (i.e. turbidity), blocking sunlight, reducing the euphotic zone, and diminishing zooplankton densities. The result is fewer zooplankton (e.g. copepods) available as a food resource for juvenile sockeye. Research by ADFG in 2004 showed that the average weight of juvenile sockeye in Skilak Lake was almost half of what was typical. If a critical summer weight size isn't achieved, overwinter survival of juvenile sockeye will be poor and at some point, will have a substantial impact on sockeye returns. As the Eklutna Glacier retreats further, we can expect a similar trend of increasing turbidity in Eklutna Lake as well.

It also important to note that no adult sockeye were observed spawning in the lower river during the 2-year study program. Therefore, any attempt to establish a sockeye salmon run in

the Eklutna watershed would either rely on sockeye straying from other river systems or intentional stocking efforts.

## **4.5.2 Upstream Passage Measures**

### **4.5.2.1 Gravity Flow Fish Ladder**

The gravity flow fish ladder measure includes the construction of a new technical fishway at the existing Eklutna Dam. The fish ladder would be of the weir and orifice or vertical slot style with an entrance below the dam and exit at fixed elevation on the upstream side of the dam. For proper function, the water surface elevation of the lake must maintain relatively constant during spawning season, resulting in the inability to utilize any of the reservoir storage for power generation purposes. For this reason, this alternative was not included in any of the preferred comprehensive alternatives.

### **4.5.2.2 Variable Exit Fish Ladder**

The variable exit fish ladder measure is included in three of the 12 comprehensive alternatives proposed by stakeholders. The design and construction are similar to the gravity flow fish ladder measure; however, the exit includes a series of gates corresponding to varying water surface elevations which allow for approximately 15-feet of reservoir fluctuation. While allowing for some operational flexibility and continued hydropower generation, this alternative being combined with the existing dam structure for flow releases still requires the hydroelectric powerhouse to be offline throughout the winter, when power demand is the highest. For this reason, the variable exit fish ladder and release through the existing dam is not included as part of the Project Owners' Draft Program.

### **4.5.2.3 Fish Ladder with Pumped Water Supply and Slide**

The fish ladder with pumped supply and slide measure includes the construction of a new technical fishway at the existing Eklutna Dam with a chute or slide to return fish to a lower water surface elevation within the lake. The fish ladder would be of the weir and orifice or vertical slot style with an entrance below the dam and exit at a false weir located at the dam. Water from the lake would be pumped continuously over the weir during spawning season providing attraction flow for salmon. From the false weir, migrating adults would fall into a chute or slide and enter Eklutna Lake at a reduced water surface elevation. While this alternative allows for operations of the reservoir for power supply purposes, the reliance on pumps for providing flow to the ladder presents a significant risk. Additionally, this method of fish passage has little to no precedence at existing dams. For these reasons this measure was not included in any of the stakeholder comprehensive alternatives.

#### **4.5.2.4 Trap and Haul**

A trap and haul facility was proposed to be combined with either the AWWU Portal Release or AWWU Pipeline Release measures. The proposal included the addition of a false weir, holding pond with crowder, and lift to transport migrating adults to a truck for transport to Eklutna Lake. While this measure would allow the Project Owners to maintain current reservoir operations and operate the powerhouse year-round, it was ultimately not selected as part of the Project Owners' Draft Program due to the lake studies concluding that Eklutna Lake has little to no productivity potential and would likely not support a healthy fishery as evidenced by the condition of kokanee residing in the lake. In addition, this upstream fish passage option received no support from any of the stakeholders.

#### **4.5.3 Downstream Passage**

##### **4.5.3.1 Spill**

One measure proposed for allowing downstream passage of out-migrating juvenile salmonids is to release a significant flow from the dam via a new spillway gate, or by uncontrolled release over the existing spillway from April through June. While this approach is viable, due to the size, depth, and layout of Eklutna Lake, a spill event on the order of 300-500 cfs would provide very low attraction velocities within the lake itself, resulting in substantially reduced efficacy of downstream passage. Additionally, the volume of water released in a spill event of this magnitude for a duration of up to 3 months results in a significant portion of the reservoir annual inflow volume being utilized for downstream passage rather than for power generation purposes. For these reasons spill is not being proposed for downstream passage as part of the Project Owners' Draft Program.

##### **4.5.3.2 Floating Surface Collector**

To preserve water for power supply purposes, an alternate method for downstream passage was proposed, consisting of a floating surface collector located at or near the intake or the lake outlet. This floating barge structure would consist of guidance screens and attraction flow pumps moving approximately 500 cfs through the screens to attract and capture migrating juveniles. A primary concern with the usage of floating surface collector for downstream passage is that the barge must operate in ice-free conditions. At Eklutna Lake, ice breakups typically occur in May to June, which results in the floating surface collector being inoperable for 50%-70% of the outmigration window. Additionally, as presented in the cost estimate summary, these structures have substantial capital and operating expenses. For these reasons, the floating surface collector has not been included as part of the Project Owners' Draft Program.

#### 4.5.4 Other Downstream Passage Measures

During the Aquatics TWG meeting on November 9, 2022, two other downstream fish passage measures were discussed: 1) volitional downstream fish passage through the existing intake, and 2) trap and haul downstream fish passage utilizing a rotary screw trap and guide net. However, after preliminary evaluation, it was determined that neither of these measures would have a high success rate; therefore, neither measure was selected by the Aquatics TWG for further evaluation.

#### 4.6 Replacement Dam

The base of the existing Eklutna Dam is located on a depositional shelf approximately 200-ft higher in elevation than the deepest portion of Eklutna Lake and approximately 60-ft higher in elevation than the intake elevation for the power tunnel. As described in Section 4.4, providing continuous releases to the Eklutna River from the existing dam significantly curtails power generation and reduces the active storage volume of the reservoir by over 80%. An alternative proposed to reduce restrictions on reservoir operations while providing year-round hydroelectric generation involves the excavation of the depositional shelf at the existing dam and construction of a replacement dam in its place. The excavation would require construction of a channel approximately 20-ft deep, 50- to 350-ft in width, and 1-mile in length resulting in removal of approximately 550,000 cubic yards of material. The replacement dam would have an overall height of approximately 56-feet and incorporate a spillway and fish passage structures.

This alternative would restrict the minimum reservoir operating elevation to El. 840, removing approximately 40% of the storage capacity of the reservoir. While this allows operation of the Eklutna Power plant year-round in an average water year, it requires some operational restrictions and reduces flexibility in hydropower generation seasonally.

The replacement dam is included in four of 12 comprehensive alternatives proposed by stakeholder groups. While the replacement dam concept continues to allow hydroelectric generation year-round, the cost of this measure and loss of reservoir capacity are the primary reasons it is not included within the Project Owners' proposed Draft Program. Dependent on the measure chosen for downstream fish passage, the replacement dam alternatives range from a capital cost of approximately \$120M to \$180M<sup>18</sup> which results in a significant additional burden on ratepayers and taxpayers. A summary of the costs of the replacement

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<sup>18</sup> The cost estimate for the replacement dam measure was developed in close coordination with Eklutna Inc. and has a median construction cost of \$113M with a class 5 estimate range of \$57M to \$220M. Following development of the original estimate, Eklutna Inc. had recommended a few revisions to the costs including providing a new location for material disposal which resulted in a potential cost savings of approximately \$25M. The revision falls within the price range of the original estimate and will be considered if the design of this measure is advanced.

dam comprehensive alternatives compared to the Project Owners' proposed fish and wildlife alternative is presented in Table 4-4.

**Table 4-4. Cost Comparison Summary – Replacement Dam.**

Comprehensive Alternative	Alternative Measure	Capital Cost (\$)	Annualized Cost (\$/Yr)	CEA Rate Impact (%)	MEA Rate Impact (%)	MOA Tax Impact (\$/100k)
Selected Alternative	Portal Release Facility	\$8,862,000	\$2,743,000	0.53%	0.84%	\$0.51
TCF Alt A	Replacement Dam	\$118,129,000	\$19,776,000	3.81%	5.31%	\$4.46
NVE	Replacement Dam	\$122,853,000	\$22,006,000	4.24%	6.10%	\$4.62
USFWS Alt A	Replacement Dam	\$158,719,000	\$23,483,000	4.61%	5.50%	\$7.48
NMFS	Replacement Dam	\$177,833,000	\$25,465,000	4.91%	5.89%	\$8.32

#### 4.7 Lach Q'atnu Creek Reroute

A proposal to provide year-round natural flows into the Eklutna River included the re-route of Lach Q'atnu Creek from its current path into Eklutna Lake to a location approximately 1,000 feet downstream of Eklutna Dam. Stream gauging records of the creek as part of the study program revealed negligible inflows in the winter (<1 cfs) with daily mean flow rates >10 cfs for about 30 days in the summer. Engineering challenges with the proposed reroute of the creek involve the risk of channel migration through the alluvial fan over time and the encroachment onto private property in the vicinity of the proposed alignment. For these reasons the cost associated with the re-routing combined with the risk of impacting private property deemed this alternative unsuitable for further analysis and was excluded from all preferred alternatives.

#### 4.8 Physical Habitat Manipulation

As part of adapting the river to a new flow regime, physical habitat manipulations were proposed including measures such as re-routing, widening, or deepening main and side channels, construction of beaver dam analogs, engineered log jams, or post assisted log

structures, and placement of boulders or other improvements to encourage scour or deposition to improve fish habitat in the river. Federal funding is currently being pursued separately by NVE, USFWS, and other entities, thus any additional work regarding physical habitat manipulation in the river is excluded from the Project Owners' Draft Program.

#### **4.9 Lakeside Trail Repairs**

A recreational related measure evaluated as part of the study program involved repairing portions of the Eklutna Lakeside Trail that have historically been damaged by erosion, some of which was related to high lake water elevations. Repairs of the lakeside trail are currently underway by organizations funded by the State of Alaska, thus any additional work on the trail system is excluded from the Project Owners' Draft Program.

#### **4.10 Trapping Facility with Hatchery Spawning, Rearing, and Release**

During the Aquatics TWG meeting on November 9, 2022, the concept of a trapping adult salmon at the flow release point, spawning the adult salmon and rearing the juvenile salmon at a hatchery, and then releasing the juvenile salmon back into the Eklutna River. This method would likely result in a higher survival rate which would accelerate the salmon population growth in the river. However, the Aquatics TWG strongly opposed the idea of a hatchery; therefore, this measure was not selected by the Aquatics TWG for further evaluation.

## 5.0 Summary of Draft Fish and Wildlife Program and Rationale

The Project Owner's Draft Program includes the following elements:

- The Project Owners will release year-round instream flow from Eklutna Lake into Eklutna River from the new Eklutna River Release Facility located adjacent to the AWWU portal valve approximately one mile downstream from the dam. This will water 11 of 12 miles of the Eklutna River.
- The year-round flow will vary seasonally between 27 cfs in the winter and 40 cfs in the summer as shown in Figure 3-2.
- The Project Owners will conduct channel maintenance flows 3 out of every 10 years by releasing water concurrently from the existing dam outlet gate and the Eklutna River Release Facility. The Project Owners will automate the dam outlet gate, including providing power for the automation, to facilitate flow release.
- Channel maintenance flows will be ramped up to 220 cfs over the first 6 hours, be held at 220 cfs for 24 hours, and then be ramped back down over 52 hours as shown in Table 3-3.
- The Eklutna River Release Facility will not reduce the water supply or restrict the ability of AWWU to withdraw water from Eklutna Lake. Hydraulic restrictions will be in place limiting the maximum flow able to be diverted to the Eklutna River Release Facility while still maintaining the maximum flow able to be withdrawn for treatment at the Eklutna Water Treatment Facility. The River Release Valve actuator stroke timing will be set to minimize transient pressure surges within the AWWU diversion tunnel and pipelines during operation. Redundant flow meters and pressure transducers will be implemented to minimize the risk of a fault causing emergency closure of the existing AWWU intake valve. The facilities will be designed to provide flows into the river in the event of a power failure or loss of communication to the facility.
- The Project Owners will construct eight bridges over the Eklutna River on the AWWU access road to replace the existing ford crossings, so AWWU has reliable access to maintain their pipeline.
- A Monitoring and Adaptive Management Program will be implemented as described in Section 3.4, which includes the following:

- Use of water budgets for year-round and channel maintenance flows.
- Monitoring flow release at the Eklutna River Release Facility through use of a flow meter installed on the river release pipeline within the facility.
- Monitoring flow release at the Eklutna Dam outlet gate utilizing a gate rating curve, position feedback on the actuator, and a new level monitoring transducer within the lake.
- Monitoring the distribution and timing of adult salmon by conducting surveys for 5 years at weekly intervals between June and October.
- Monitoring winter incubation and rearing habitat by implementing a 3-year temperature monitoring study using continuous temperature loggers (thermistors) deployed at 3-5 locations that represent potential overwintering habitats for juvenile rearing and egg incubation.
- Monitoring sediment grain size in spawning reaches at selected monitoring transects annually for 5 years.
- Monitoring hatchery fish straying from Eklutna Tailrace into Eklutna River by collecting Chinook and coho carcasses (heads) observed in the Eklutna River during the annual salmon distribution and periodicity monitoring and delivering them to ADFG for stock origin analysis.

The Project Owners selected the Draft Program elements for the following reasons:

- The year-round and channel maintenance flows are the most cost-effective options in terms of fish habitat gains, creation and maintenance of channel dimensions, and substrate characteristics that support physical fish habitat in the Eklutna River over the long term.
- The Draft Program has the least impact on Chugach and MEA's ratepayers and MOA's property taxpayers of all the evaluated comprehensive alternatives while meeting the Project Owners' obligation to mitigate Project impacts to fish and wildlife.
- The Draft Program allows continued year-round operation of the Project and the benefits it provides including generation of cost-effective, carbon-free, flexible hydroelectric power for the electric customers in Anchorage and the surrounding area and contribution to Alaska's renewable energy goals.

- The monitoring and adaptive management plan helps to manage the inherent uncertainty associated with modeling of complex natural systems by allowing for continued knowledge to be gained and adjustments to the proposed measures to be considered.

## 6.0 Next Steps

The schedule for the remainder of the consultation process is outlined in Table 6-1 below.

**Table 6-1. Next Steps.**

Responsible Party	Milestone	Timeframe
Project Owners	Distribute the Draft Fish and Wildlife Program to the Parties and NVE.	October 27, 2023
Parties and NVE	Review and provide comments to the Project Owners.	November 2023
Project Owners	Meet with the Parties and NVE to attempt to resolve any differences.	December 2023
Project Owners	Conduct public meetings in Anchorage and the Mat-Su Valley.	Week of January 15, 2024
Project Owners	Submit the Proposed Final Fish and Wildlife Program to the Governor.	April 2024
Parties and NVE	Review and provide comments to the Governor.	May/June 2024
Project Owners	Provide responses to the Governor.	July 2024
Governor	Issues the Final Fish and Wildlife Program.	October 2024
Project Owners	Design and Permitting.	2024-2027
Project Owners	Contracting, Requisitioning, and Construction.	2027-2032
Project Owners and Committee	Monitoring and Adaptive Management	2033-2059

### 6.1 Review and Comment Period

Per the 1991 Agreement, the Project Owners have distributed this Draft Program and Draft Summary of Study Results to the Parties; it has also been provided to NVE for an initial opportunity to review. The Parties and NVE will have 30 days to review and provide comments to the Project Owners.

### 6.2 Attempt to Resolve Differences

Per the 1991 Agreement, if any of the Parties' or NVE's comments or recommendations differ from the Project Owners, the Project Owners will attempt to resolve such differences giving due weight to the recommendations, expertise, and statutory responsibilities of the Parties. The Project Owners will hold individual meetings to discuss differences and attempt to come to a resolution.

### 6.3 Public Meetings

Per the 1991 Agreement, once comments and recommendations have been received from the Parties and NVE, the Project Owners will hold four public meetings, two in Anchorage and two in the Matanuska Valley. For each location, one meeting will be held in the afternoon and one in the evening. All four meetings will be held the week of January 15, 2024 in an open house style with a brief presentation followed by an opportunity for participants to meet with the Project Owners and their technical team, ask questions, and submit comments. Members of the public will also have an opportunity to submit comments via email to [info@eklutnahydro.com](mailto:info@eklutnahydro.com).

### 6.4 Proposed Final Fish and Wildlife Program

The Project Owners are planning to submit their Proposed Final Program with all supporting information to the Governor in April 2024. An agreement with AWWU regarding interconnection and transportation services will be needed before then. After the Final Proposed Program is submitted to the Governor, the Parties will have a 60-day period in which they can provide comments directly to the Governor on the Project Owners' Proposed Final Program. The Project Owners will then have a 30-day comment period in which they can provide any final information to the Governor for consideration.

### 6.5 Governor's Issuance of a Final Fish and Wildlife Program

The Governor is required by the 1991 Agreement to review the Proposed Final Program as well as any comments or recommendations for alternative PME measures while giving equal consideration to:

1. Efficient and economical power production
2. Energy conservation
3. The protection, mitigation of damages to, and enhancement of fish and wildlife (including related spawning grounds and habitat)
4. The protection of recreational opportunities
5. Municipal water supplies
6. The preservation of other aspects of environmental quality
7. Other beneficial public uses
8. Other requirements of State law

The Project Owners anticipate the Governor's issuance of a final approved Fish and Wildlife Program no later than October 2, 2024.

## 6.6 Additional Requirements to Implementing the Fish and Wildlife Program

Upon the Governor's approval of the Fish and Wildlife Program, the Project Owners then have three years to achieve the following additional requirements that are preconditions to the Project Owners' ability to implement the Fish and Wildlife Program. Should any of these requirements fail to be achieved, the Project Owners will not be able to execute on the Fish and Wildlife Program.

- **Permits:** Various state and local permits may be required in relation to construction activities, environmental matters, and more.
- **Land Rights and Easements:** Various land rights (rights of way, easements, etc.) will be required for both temporary and permanent infrastructure related to constructing the Eklutna River Release Facility.
- **Amendment of ADL 44944:** The Project Owners' current Certificate of Appropriation must be amended by ADNR in order to allow the Project Owners to convey water to the Eklutna River for the purposes of complying with the Fish and Wildlife Program and to protect such in-stream flows in order to maintain appropriate fish and wildlife habitat thereto.

## **Appendix A. Consultation Record**

# Eklutna Hydroelectric Project Consultation Record

## Initial Consultation Meetings

Item No.	Stakeholders	Date	Meeting Type	Description
1	AWWU	3/18/2019	In-person Meeting	Initial Consultation
2	Eklutna Inc.	3/19/2019	In-person Meeting	Initial Consultation
3	ADFG	3/19/2019	In-person Meeting	Initial Consultation
4	ADNR – Water	3/20/2019	In-person Meeting	Initial Consultation
5	TCF	3/20/2019	In-person Meeting	Initial Consultation
6	NVE	3/26/2019	In-person Meeting	Initial Consultation
7	NMFS	3/26/2019	In-person Meeting	Initial Consultation
8	ADEC	3/26/2019	In-person Meeting	Initial Consultation
9	USFWS	3/27/2019	In-person Meeting	Initial Consultation
10	ADOT&PF	4/8/2019	In-person Meeting	Initial Consultation
11	USACE	4/10/2029	In-person Meeting	Initial Consultation
12	ADNR – State Parks	4/10/2019	In-person Meeting	Initial Consultation
13	ADNR – OHA	4/11/2019	In-person Meeting	Initial Consultation
14	ARRC	4/11/2019	In-person Meeting	Initial Consultation

## Group Stakeholder Meetings

Item No.	Stakeholders	Date	Meeting Type	Description
1	All Interested Stakeholders	7/16/2019	In-person Meeting	Follow-up Technical Discussion
2	All Interested Stakeholders	11/15/2019	Video Conference	Quarterly Project Update
3	All Interested Stakeholders	2/13/2020	Video Conference	Quarterly Project Update
4	All Interested Stakeholders	4/16/2020	Video Conference	Review Comments on the Draft IIP, Review the Information Matrix, and Establish the Aquatics TWG
5	All Interested Stakeholders	6/2/2020	Video Conference	Quarterly Project Update
6	All Interested Stakeholders	9/10/2020	Video Conference	Quarterly Project Update
7	All Interested Stakeholders	1/28/2021	Video Conference	Quarterly Project Update
8	All Interested Stakeholders	5/4/2021	Video Conference	Quarterly Project Update
9	All Interested Stakeholders	1/28/2021	Video Conference	Quarterly Project Update
10	All Interested Stakeholders	8/23/2021	Video Conference	Quarterly Project Update
11	All Interested Stakeholders	10/20/2021	Video Conference	Quarterly Project Update
12	All Interested Stakeholders	2/9/2022	Video Conference	Quarterly Project Update
13	All Interested Stakeholders	6/2/2022	Video Conference	Quarterly Project Update
14	All Interested Stakeholders	11/16/2022	Video Conference	Quarterly Project Update
15	All Interested Stakeholders	6/9/2023	Video Conference	Quarterly Project Update

## Anchorage Assembly Meetings

Item No.	Stakeholders	Date	Meeting Type	Description
1	Anchorage Assembly	2/12/2020	Worksession	Project Overview, 1991 Agreement, Schedule, Consultation to Date, and Next Steps
2	Enterprise and Utility Oversight Committee	10/15/2020	Video Conference	Quarterly Project Update
3	Watershed and Natural Resources Advisory Commission	1/27/2021	Video Conference	Project Overview and Efforts to Date
4	Enterprise and Utility Oversight Committee	3/18/2021	Video Conference	Quarterly Project Update
5	Enterprise and Utility Oversight Committee	6/17/2021	Video Conference	Quarterly Project Update
6	Enterprise and Utility Oversight Committee	10/21/2021	Video Conference	Quarterly Project Update
7	Enterprise and Utility Oversight Committee	2/17/2022	Video Conference	Quarterly Project Update
8	Enterprise and Utility Oversight Committee	7/21/2022	In-person w/ Video Conference Option	Quarterly Project Update
9	Enterprise and Utility Oversight Committee	11/17/2022	In-person w/ Video Conference Option	Quarterly Project Update
10	Enterprise and Utility Oversight Committee	3/16/2023	In-person w/ Video Conference Option	Quarterly Project Update
11	Anchorage Assembly	7/14/2023	Worksession	Study Results, Alternatives Analysis, and Next Steps

## Additional Meetings with Native Village of Eklutna (NVE) Tribal Council and Administration

Item No.	Stakeholders	Date	Meeting Type	Description
1	NVE, CEA, MEA, MOA	9/30/2020	In-person Meeting	Share the History of the Eklutna People and Surrounding Area
2	NVE, CEA, MEA, MOA	6/3/2023	Video Conference	Project Update
3	NVE, CEA, MEA, AWWU	9/14/2023	Site Visit	Study Flow Releases
4	NVE, CEA, MEA, MOA	10/19/2022	In-person Meeting	Share the History of the Eklutna People and Surrounding Area, Project Update, and Opportunities to Collaborate
5	NVE, CEA	6/29/2023	In-person Meeting	Meeting with Board of Directors
6	NVE, MEA	8/7/2023	In-person Meeting	Meeting and Site Visit with Board of Directors

## Technical Working Group (TWG) Meetings

Item No.	Stakeholders	Date	Meeting Type	Description
1	Aquatics TWG	7/15/2020	Video Conference	Site Recon Prep, and Additional Data Collection Updates
2	Aquatics TWG	7/23/2020	Video Conference	Site Recon Debrief, Additional Data Collection Updates, and Kick-off Study Planning
3	Aquatics TWG	9/3/2020	Video Conference	Proposed Study Program Framework, Study Plan Outline, and Study Planning Schedule

4	Aquatics TWG	11/30/2020	Video Conference	Review and Discuss Draft Year 1 Study Plans
5	Aquatics TWG	12/21/2020	Video Conference	Review and Address Comments on Draft Instream Flow and Geomorphology Study Plans
6	Aquatics TWG	1/26/2021	Video Conference	Present Hydro Operations Model, and Review Revised Study Plans
7	Aquatics TWG	4/21/2021	Video Conference	Update on Proposed Final Study Plans, Permits / Authorizations, Consents / Waivers, Engineering for Study Flow Releases, and Other Stakeholder Engagement
8	Aquatics TWG	6/9/2021 – 6/10/2021	Site Visit	Establish Transect Locations for the Instream Flow and Geomorphology Studies
9	Aquatics TWG	8/23/2021	Video Conference	Update on Concurrence Letters, Permits and Authorizations, MOAs and Consents, Gate Replacement, and Other Field Work
10	Recreation TWG	11/8/2021	Video Conference	Review Results from Lakeside Trail Erosion Study, Recreation Study Goals, Methods, and Planning Schedule
11	Cultural TWG	11/8/2021	Video Conference	Discuss Confidentiality, Area of Potential Effect, Cultural Study Goals, Methods, and Planning Schedule

12	Terrestrial TWG	11/9/2023	Video Conference	Discuss Terrestrial Study Goals, Methods, and Planning Schedule
13	Aquatics TWG	11/9/2023	Video Conference	Discuss Results from Year 1 Aquatics Studies, and Proposed Year 2 Aquatics Studies
14	Terrestrial TWG	3/21/2022	Video Conference	Discuss Comments on Draft Terrestrial Study Plans, Review Field Work Schedule, and Permitting Needs
15	Recreation TWG	3/21/2022	Video Conference	Discuss Comments on Draft Recreation Study Plan, Review Field Work Schedule, and Permitting Needs
16	Cultural TWG	3/22/2022	Video Conference	Discuss Comments on Draft Cultural Study Plan, TEK Assessment Update, Review Permitting Needs
17	Aquatics TWG	3/24/2022	Video Conference	Discuss Comments on Draft Year 2 Study Plans (Water Resources and Engineering Studies), Review Field Work Schedule, and Permitting Needs
18	Aquatics TWG	3/25/2022	Video Conference	Discuss Comments on Draft Year 2 Study Plans (Geomorphology, Fish, and Instream Flow Studies), Review Field Work Schedule, and Permitting Needs
19	Cultural TWG	4/8/2022	Video Conference	Discuss Area of Potential Effect, Confidentiality Protocol, and TEK Assessment Update

20	Aquatics TWG	4/18/2022	Video Conference	Established Habitat Suitability Curves for the Instream Flow Study
21	Aquatics TWG	9/28/2022	In-person w/ Video Conference Option	Discuss Preliminary Instream Flow Modeling Results and Potential Engineering Solutions for Providing Year-Round Flows
22	Aquatics TWG	10/17/2022	In-person w/ Video Conference Option	Discuss Preliminary Geomorphology Modeling Results and Potential Engineering Solutions for Providing Peak Flows
23	Aquatics TWG	11/9/2022	In-person w/ Video Conference Option	Discuss Preliminary Lake Study Results and Potential Engineering Solutions for Providing Fish Passage
24	Aquatics TWG	2/13/2023	Video Conference	Review 2D Modeling
25	Aquatics TWG	3/28/2023	In-person w/ Video Conference Option	Review Draft Year 2 Study Reports, Present Winter Flow Analysis, Review Conceptual Designs and Cost Estimates
26	Terrestrial TWG	3/29/2023	In-person w/ Video Conference Option	Review Draft Terrestrial Study Reports
27	Recreation TWG	3/29/2023	In-person w/ Video Conference Option	Review Draft Recreation Study Report
28	Cultural TWG	3/30/2023	In-person w/ Video Conference Option	Review Draft Cultural Study Report

## Meetings to Discuss Potential Funding Opportunities

Item No.	Stakeholders	Date	Meeting Type	Description
1	Hosted by USFWS, NVE, ADFG, CEA, MOA	3/1/2023	In-person w/ Video Conference Option	Discuss Perceived Gaps in the Current Analysis and Upcoming Funding Opportunities
2	Hosted by USFWS, NVE, ADFG, CEA, MOA, MEA, NMFS, TU	3/24/2023	Video Conference	Discuss Upcoming Funding Opportunities, Who May Qualify, Restrictions, Due Dates, Objectives, and Next Steps

## Meetings to Discuss Additional Infrastructure Options

Item No.	Stakeholders	Date	Meeting Type	Description
1	USFWS, NVE	3/17/2023	Video Conference	Discuss Details for Additional Infrastructure Options: 1) Nature-like Fishway, and 2) Replacement Dam
2	Eklutna, Inc.	4/17/2023	Video Conference	Discuss Details for Replacement Dam, Including Excavation Cost Assumptions
3	Eklutna, Inc.	8/11/2023	Video Conference	Discuss Replacement Dam Concept
4	Eklutna, Inc.	9/6/2023	Video Conference	Discuss Replacement Dam Construction and Excavation Projections

## Alternatives Analysis Meetings

Item No.	Stakeholders	Date	Meeting Type	Description
1	CEA, MOA, MEA, AEA, ADFG, ADNR, State Parks, OHA, NMFS, USFWS, NVE, TU	4/6/2023	In-person w/ Video Conference Option	Present Potential Instream Flow Regimes, Introduce CE/ICA Model, Review Comprehensive Alternatives Request Form
2	CEA, MOA, MEA, AEA, ADFG, State Parks, USFWS, NVE, Eklutna Inc., TU, TCF	5/17/2023	In-person w/ Video Conference Option	Review Conceptual Design and Cost Estimate for the Replacement Dam, Review Comprehensive Alternatives and Modeling Results
3	CEA, MOA, MEA, AEA, ADFG, ADNR, State Parks, NMFS, NVE, Eklutna Inc., AWWU, TU, TCF	6/14/2023	In-person w/ Video Conference Option	Discuss Feasibility of Downstream Fish Passage, Lake/Tributary Habitat, Review the Revised Comprehensive Alternatives and Modeling Results
4	CEA, MOA, MEA, AEA, ADFG, ADNR, State Parks, OHA, NMFS, USFWS, NVE, Eklutna Inc., AWWU, TCF	7/12/2023	In-person w/ Video Conference Option	Review Preferred Alternatives and Modeling Results, Discuss Impacts to Wetlands, Wildlife, and Recreation
5	CEA, MOA, MEA, AEA, ADFG, ADNR, OHA, NMFS, USFWS, NVE, Eklutna Inc., AWWU, TU, TCF	8/9/2023	In-person w/ Video Conference Option	Discuss Cultural Resources, Feasibility of the Hybrid Flow Release Alternative, Potential Monitoring Studies and Adaptive Management

## **Appendix B. Comparison to Baseline Conditions**

# Eklutna Hydroelectric Project Comparison to Existing Conditions

Evaluation Parameter	Existing Conditions	Draft Fish and Wildlife Program
<b>Instream Flows</b>		
Year-Round Base Flows	There are currently no year-round flow releases from Eklutna Lake into the Eklutna River. There is some accretion (~4-6 cfs) between the Project Dam and the Thunderbird Creek (TBC) confluence. TBC mean daily flows peaked in June (81 cfs in 2021; 182 cfs in 2022) and ranged from 7 cfs to 27 cfs in the winter.	Provides year-round base flows from Eklutna Lake to the Eklutna River by utilizing the existing AWWU tunnel. This provides flow to 11 out of 12 miles of the river, varying from 40 cfs in the summer to 27 cfs in the winter.
Periodic Peak Flows	There have been 10 spill events since the current dam was constructed in 1965 (every 6 years on average). Spill events occurred between August and October, ranged in magnitude from 18 cfs to 1,022 cfs, and ranged in duration from 8 days to 74 days.	Provides peak flows in 3 out of 10 years utilizing a combination of flows from the AWWU portal valve and the drainage outlet gate at the base of the dam. Peak flows will occur in the fall, ramp up from 40 cfs to 220 cfs over 6 hours, hold at 220 cfs for 36 hours, then ramp back down to 40 cfs over 52 hours.
<b>Water Quality</b>		
Temperature	Winter water temperatures in the Eklutna River above the TBC confluence ranged from 0.9°C to 3.3°C on average. Peak water temperatures in the Eklutna River above the TBC confluence ranged from 6.2°C to 9.3°C in 2021 and from 7.6°C to 9.7°C in 2022. This meets ADEC water quality criteria ( $\leq 15^{\circ}\text{C}$ ).	Flow releases to the Eklutna River would come from the existing intake at Eklutna Lake. The water temperature in Eklutna Lake at the intake depth ranges from $\sim 3^{\circ}\text{C}$ in the winter to $\sim 10\text{-}12^{\circ}\text{C}$ in the summer, which meets ADEC water quality criteria ( $\leq 15^{\circ}\text{C}$ ).
Dissolved Oxygen (DO)	DO in the Eklutna River above the TBC confluence is $>10\text{mg/L}$ throughout the year. This meets ADEC water quality criteria ( $\geq 7\text{mg/L}$ ).	Flow releases to the Eklutna River would come from the existing intake at Eklutna Lake. DO in Eklutna Lake at the intake depth is $>10\text{mg/L}$

		throughout the year, which meets ADEC water quality criteria ( $\geq 7$ mg/L).
pH	pH in the Eklutna River above the TBC confluence ranged from 7.8 to a maximum of 8.6 in the summer, just above the ADEC criteria (8.5).	Flow releases to the Eklutna River would come from the existing intake at Eklutna Lake. pH in Eklutna Lake at the intake depth ranged from 7.9 to 8.1, which meets ADEC water quality criteria (8.5).
<b>Geomorphology</b>		
Substrate	<p>Salmon prefer a substrate size of 16-128 mm for spawning gravel.</p> <ul style="list-style-type: none"> <li>- Coho prefer 16-64 mm</li> <li>- Chinook prefer 64-128 mm</li> </ul> <p>The average substrate size where salmon are currently spawning (below the TBC confluence) is ~25-30 mm. The average substrate size above the canyon from:</p> <ul style="list-style-type: none"> <li>- RM 5 to 6.5 ranges from ~75-16 mm (good for spawning)</li> <li>- RM 6.5 to 10 is &lt;16 mm (bad for spawning)</li> <li>- RM 10 to 11 is ~16-64 mm (good for spawning)</li> </ul>	The sediment transport modeling results indicate that the proposed peak flows will maintain the preferred substrate size of 16-128 mm throughout the majority of the potential spawning reaches in the Eklutna River, with significant improvements from RM 6.5 to 10.
<b>Fish Passage</b>		
Canyon Reach	The minimum flow required for adult salmon to migrate up through the canyon is ~40 cfs. Flows in the canyon currently range from ~4-6 cfs. Therefore, adult salmon are currently unable to migrate through the canyon.	Modeling indicates that the proposed 40 cfs flow release from the AWWU portal valve in the summer, plus the ~4-6 cfs of accretion above TBC, should allow adult salmon to migrate through the canyon.
Beaver Dams	There are several beaver dams in the Eklutna River below the railroad bridge. However, adult salmon have been observed above those dams, which indicates that they are not a barrier to upstream fish passage. There are 6 additional beaver dams above the canyon, the largest of which is 6 feet tall. It is unknown if	It is likely that increased flows in the Eklutna River will encourage beavers to build their dams on side channels instead of in the main channel, which should allow unimpeded upstream fish passage.

	these are a barrier to fish passage since adult salmon currently cannot reach this section of the river.	
Project Dam	The dam does not currently have any volitional fish passage facilities; however, adult salmon are not currently able to reach the dam due to insufficient flows. Trap and haul of fish from the river into the lake is not currently being done.	The Draft Program does not propose any volitional or trap and haul fish passage into or out of Eklutna Lake.
<b>Spawning Habitat</b>		
Chinook	0.7 acres	2.2 acres (this is a 209% increase and represents 96.5% of the max available habitat below the AWWU portal valve and 81.7% of the max available habitat in the Eklutna River)
Coho	2.5 acres	4.1 acres (this is a 65% increase and represents 99.6% of the max available habitat below the AWWU portal valve and 83.7% of the max available habitat in the Eklutna River)
Pinks	Pink salmon are known to utilize the lower Eklutna River for spawning; however, spawning habitat for pink salmon was not quantified.	The Aquatics TWG agreed that flows benefiting Chinook and coho should also benefit pink salmon.
Chum	Chum salmon are known to utilize the lower Eklutna River for spawning; however, spawning habitat for chum salmon was not quantified.	The Aquatics TWG agreed that flows benefiting Chinook and coho should also benefit chum salmon.
Sockeye	No adult sockeye salmon were observed spawning in the Eklutna River by the Project Owners or NVE.	While the year-round flow releases may technically create spawning habitat for sockeye in the Eklutna River, sockeye generally rear in lakes and the Draft Program does not propose fish passage into Eklutna Lake. Therefore, any sockeye habitat that may technically be created in the Eklutna River is not shown here.
<b>Rearing Habitat</b>		
Chinook	11.8 acres	18.1 acres (this is a 53% increase)

		It should also be noted that beaver dams in the river above the canyon may create additional rearing habitat; however, this was not quantified.
Coho	14.7 acres	24.6 acres (67% increase) It should also be noted that beaver dams in the river above the canyon may create additional rearing habitat; however, this was not quantified.
Pinks	Pink salmon are known to utilize the lower Eklutna River for rearing; however, rearing habitat for pink salmon was not quantified.	The Aquatics TWG agreed that flows benefiting Chinook and coho should also benefit pink salmon.
Chum	Chum salmon are known to utilize the lower Eklutna River for rearing; however, rearing habitat for chum salmon was not quantified.	The Aquatics TWG agreed that flows benefiting Chinook and coho should also benefit chum salmon.
Sockeye	Sockeye generally rear in lakes. Ocean-run sockeye cannot currently access Eklutna Lake; however, the current water quality conditions in Eklutna Lake (high turbidity, low nutrients, low productivity) indicate that it would not support a large sockeye run. This is supported by the current condition of the kokanee (land-locked sockeye) population in Eklutna Lake, which is poor (undersized and low fecundity with no sexual dimorphism or coloration).	The Draft Program does not propose any volitional or trap and haul fish passage into Eklutna Lake; therefore, no change in sockeye rearing habitat is anticipated.
Winter Habitat	The current overwintering strategy for salmon in the Eklutna River is unknown. However, modeling indicates that low winter flows may be causing unfavorable ice conditions (frazil ice and anchor ice) in the river.	Modeling indicates that the proposed 27 cfs flow release from the AWWU portal valve in the winter, plus the ~4 cfs of accretion above the TBC and ~7-27 cfs from TBC itself, should promote good ice conditions (surface ice) in the river.
<b>Wetlands</b>		
Estuary	There are 487.0 acres of habitat in the Eklutna River estuary below the railroad bridge. The brackish habitat	Since the Eklutna River estuary already receives flows from TBC (mean daily flows peaked in June at

	types in this area have a high ranking for wetland function.	81 cfs in 2021 and 182 cfs in 2022) the proposed base flow releases from the AWWU portal valve (40 cfs in the summer months) are not likely to significantly impact the quantity or quality of estuary habitat.
Riparian Zone	There are 42.5 acres of habitat in the flooded forest (area between the railroad bridges and the highway bridges) with a low to moderate ranking for wetland function. There are 46.9 acres of seasonally flooded Alder-Willow shrub scrub located above the canyon in portions of the dewatered Eklutna River channel with a high ranking for wetland function.	Channel maintenance flows are expected to remove the small, linear strip of riparian shrub along the narrowed stream channel in the upper and middle river. Overbank flooding and sediment deposits could, over time, promote greater cover of streamside cottonwoods in mixed forests.
Littoral Zone	There are 114 acres of freshwater littoral habitat near the outlet of Eklutna Lake with a low to moderate ranking for wetland function.	Since there are no proposed changes to reservoir operations, the quantity and quality of littoral habitat near the outlet of Eklutna Lake is not likely to change significantly.
<b>Wildlife</b>		
Bears	Camera traps were deployed throughout the Eklutna River in 2022. A total of 32 black bear groups and 14 brown bear groups were recorded, some with 1-3 cubs. Both black and brown bears were seen throughout most of the river corridor. However, there were more brown bears seen below the canyon and more black bears seen above the canyon.	Increased salmon abundance will likely benefit and may attract more bears to the area. This could potentially increase competition between black and brown bears for prime fishing habitats.
Moose	Moose were the most abundant wildlife species observed along the Eklutna River. A total of 352 moose groups were recorded in 2022. A moose browse survey was also conducted in 2022. The results showed a 22% browse removal rate, which is indicative of a population that should be in good nutritional	Increased salmon abundance should indirectly benefit moose (increased plant nutrients for forage); however, increased salmon abundance may also attract more bears, which could lead to a heightened predation risk for moose.

	status with healthy twinning rates. However, few moose twins were observed, which may be due to moose calf predation.	
Beavers	There is one long-standing active beaver colony (with 4 active dams) in the Eklutna River below the railroad bridge. Since the lower dam was removed in 2018, evidence of beavers started to be seen above the lower dam site. In 2022, there were 2 active beaver colonies above the canyon, each with a colony size of $\geq 3$ beavers. The middle river colony has 6 active dams. The largest dam is over 6 ft tall and some of the dams have caused flooding along the AWWU access road. The upper river colony was removed by ADFG in late 2022 because the impoundment behind the beaver dam was flooding the AWWU access road.	The study flow releases in 2021 breached 2 beaver dams and completely removed a third. It is likely that increased flows in the Eklutna River will encourage beavers to build their dams on side channels instead of in the main channel.
Raptors	A raptor nest survey was conducted in 2022. Suitable nesting sites for bald eagles are limited to coastal areas. A total of 4 bald eagle nests were recorded near the coast, but only 1 nest was determined to be occupied. The eroding cliff substrate in the river above the canyon is very low quality for other nesting raptors. However, 2 raven (or possible goshawk) nests were recorded in the Eklutna River valley.	Increased salmon abundance will likely benefit and may attract more raptors to the area.
Marine Mammals	Beluga, harbor seals, and sea otters have been observed around the mouth of the Eklutna River.	Increased salmon abundance will likely benefit and may attract more marine mammals to the area.
<b>Cultural Resources</b>		
Natural Resources	Eklutna Village (Idlughet) is located near the mouth of the Eklutna River (Idluytnu). The Eklutna River drainage	Increased salmon abundance will indirectly benefit other wildlife species, all of which are important

	<p>is an important subsistence area for the Eklutna Dena'ina.</p> <ul style="list-style-type: none"> <li>- Fishing – salmon</li> <li>- Hunting – moose, bear, sheep and ground squirrel</li> <li>- Gathering – berries, plants, trees, and stones</li> </ul>	<p>subsistence resources for the Eklutna Dena'ina.</p>
Archaeological Resources	<p>There were no archaeological resources identified within the Area of Potential Effect (APE).</p>	<p>No impacts to archaeological resources are anticipated.</p>
Historic Resources	<p>The Eklutna Dam and Spillway and the Eklutna River Railroad Bridge are within the APE and are eligible for the National Register of Historic Places.</p>	<p>No substantial modifications to the dam or spillway are proposed. ARRC had previously raised concerns about the potential for increased flows to impact the railroad bridge. However, the study flow releases in 2021 had no impact on the railroad bridge, and the proposed flows are well within the hydraulic capacity of the bridge. Therefore, no impacts to the railroad bridge are anticipated.</p>
<b>Municipal Water Supply</b>		
Water Availability	<p>AWWU's water right allows them to divert up to 41 million gallons per day (MGD); however, on average AWWU only diverts ~31 MGD.</p>	<p>The Draft Program proposes to utilize the excess capacity in the AWWU tunnel for providing flows to the Eklutna River. This will not impact AWWU's ability to divert up to 41 MGD. In addition, several engineering measures are proposed to prevent any potential disruption to the public water supply.</p>
Water Treatment	<p>Four step process: coagulation / flocculation, sedimentation, filtration, and disinfection.</p>	<p>Because the Draft Program does not propose fish passage into Eklutna Lake, no impact to the water quality in Eklutna Lake is anticipated. Therefore, no change in water treatment is required.</p>
Water Supply Infrastructure	<p>AWWU's buried pipeline follows the Eklutna River for 6 miles, crossing it 8 times before exiting the valley to the water treatment facility. The pipeline</p>	<p>Year-round base flows will prevent AWWU from crossing the river at the 8 fords. Therefore, the Draft Program proposes to construct 8 new bridges</p>

	<p>is buried ~5 feet deep, and the crossings are armored; therefore, no impacts to the buried pipeline are anticipated. AWWU’s access road follows the buried pipeline and crosses the river 10 times. Of the 10 crossings, 2 of them are bridges and 8 of them are fords. The AWWU bridges have a hydraulic capacity of ~1,000-1,200 cfs.</p>	<p>at these crossing to allow continued access by AWWU once the instream flow regime is implemented.</p>
<p><b>Other Downstream Infrastructure</b></p>		
<p>Old Glenn Highway Bridge</p>	<p>The current bridge was constructed in 2015 and has a hydraulic capacity of &gt;1,800 cfs. Since 2015, the largest flow release from the dam was the study flow releases in 2021 which had a max flow release of 150 cfs and resulted in a peak mean daily flow of 215 cfs in the lower river. In 2022, the peak mean daily flow was 270 cfs. Neither of these flows in 2021 or 2022 impacted the bridge.</p>	<p>Increasing flows in the Eklutna River by 27 cfs in the winter, 40 cfs in the summer, and 220 cfs during peak flows is well within the hydraulic capacity of the Old Glenn Highway bridge.</p>
<p>New Glenn Highway Bridges</p>	<p>These bridges were constructed in 1975 and have a hydraulic capacity of &gt;4,700 cfs. Since 1975, the largest flow release from the dam was the spill event in 1995 which had a max flow of 1,022 cfs. This did not impact the highway bridges, but it did occur before the lower dam was removed in 2018. ADOT&amp;PF previously raised concerns about how all the accumulated sediment that was left in the river after the lower dam removal would be transported downstream and may impact the highway bridges. In 2021, the Project Owners conducted a series of study flow releases with a max flow release of 150 cfs. These flows did not impact the highway bridges.</p>	<p>Increasing flows in the Eklutna River by 27 cfs in the winter, 40 cfs in the summer, and 220 cfs during peak flows is well within the hydraulic capacity of the New Glenn Highway bridges.</p>

<p>Railroad Bridge</p>	<p>The current bridge pre-dates the existing hydro project and has a hydraulic capacity of &gt;8,000 cfs. Since 1965 when the existing dam was constructed, the largest flow release from the dam was a spill event in 1995 with a max flow of 1,022 cfs. This did not impact the railroad bridge, but it did occur before the lower dam was removed in 2018. ARRC previously raised concerns about how all the accumulated sediment that was left in the river after the lower dam removal would be transported downstream and may impact the railroad bridge. In 2021, the Project Owners conducted a series of study flow releases with a max flow release of 150 cfs. These flows did not impact the railroad bridge.</p>	<p>Increasing flows in the Eklutna River by 27 cfs in the winter, 40 cfs in the summer, and 220 cfs during peak flows is well within the hydraulic capacity of the railroad bridge.</p>
<p><b>Recreational Use and Facilities</b></p>		
<p>Lakeside Trail</p>	<p>A recreation survey was conducted in 2022. The Eklutna Lakeside Trail was the most frequently reported destination in the area, with &gt;400 pedestrians per day in the summer months. The trail is open to motorized use Sunday-Wednesday and non-motorized use Thursday-Saturday. There are areas where the trail splits, with the non-motorized trail closer to the lake shoreline. Current reservoir operations cause some erosion of the non-motorized trail at high lake levels.</p>	<p>Chugach State Park has received funding to repair the sections of the trail that are currently impacted by erosion at high lake levels. Since the Draft Program does not propose any changes to reservoir operation, no additional impacts are anticipated.</p>
<p>Campground and Cabins</p>	<p>The nearby Eklutna Lake Campground has 50 campsites and is a popular camping area. There are also 2 popular cabins near the dam.</p>	<p>No impacts to the campground or the cabins are anticipated.</p>
<p>Kayaking</p>	<p>Kayaking is a popular activity on Eklutna Lake.</p>	<p>No impacts to kayaking are anticipated.</p>

<p>Tailrace Fishery</p>	<p>ADFG stocks Chinook and coho smolts at the Project tailrace to support a recreational fishery. In 2022, a minimum of 31,447 recreators partook in activities (mostly fishing) at the tailrace between June 8 and August 23.</p>	<p>With the proposed Draft Program, water from Eklutna Lake will now be released into both the Project tailrace and the Eklutna River. Salmon returning to the tailrace will first pass by the mouth of the Eklutna River and may stray into the river. This could decrease the number of adult salmon returning to the tailrace each year, which could impact the tailrace fishery. Therefore, a straying study has been proposed as part of the monitoring plan in the Draft Program. If significant straying is observed, the appropriate mitigation measures will be determined in coordination with ADFG.</p>
<p>Eklutna River Fishery</p>	<p>Most of the land around the river is owned by Eklutna, Inc. There is currently no public access to the Eklutna River.</p>	<p>The potential for allowing public access to the Eklutna River has been discussed with Eklutna, Inc. However, there are currently no plans to allow public access to the Eklutna River.</p>
<p>Hunting</p>	<p>ADFG regulates hunting and trapping activities in the Eklutna Lake Management Area, which is closed to all hunting except by bow and arrow. The taking of moose, brown bear, and sheep requires a permit, and the taking of black and brown bears requires completion of a hunter safety course.</p>	<p>Bears and potentially moose are likely to benefit from increased salmon abundance, which could improve hunting opportunities for these species in the area.</p>
<p>Wildlife Viewing</p>	<p>Some people reported wildlife viewing as one of their intended recreational activities in the Eklutna area.</p>	<p>Increased salmon abundance and the indirect benefits to other wildlife species will likely improving wildlife viewing opportunities in the area.</p>
<p><b>Safety</b></p>		
<p>Wildlife-Human Interactions</p>	<p>Negative wildlife-human interactions, while not common within Chugach State Park, are a public safety concern as visitors seek to view wildlife and use park resources for recreational pursuits. At least half of</p>	<p>Increased salmon abundance may attract more bears to the area, which could increase negative bear-human interactions near the campground. However, the year-round base flows will be releases at the AWWU portal</p>

	the 12 people injured or killed by bears in Chugach State Park since its establishment were within 100 yards of salmon spawning streams.	valve approximately 1 mile downstream of the dam and campground. Therefore, any increase in negative bear-human interactions should be low.
Flood Protection	The entire volume of the Probable Maximum Flood can be contained in the flood storage capacity of the reservoir with 3 feet of freeboard remaining even if the spillway was blocked.	Because there are no proposed changes to reservoir operations, there will be no change in the flood storage capacity.
<b>Power Production</b>		
Generation	Average annual generation at the Eklutna Power Plant is approximately 169,000 MWh per year.	The water released into the river will not go through the powerhouse and will result in a net reduction of 16,100 MWh per year. This is a 10% reduction on average.
Grid Reliability	The Project provides grid reliability through diversification of fuel for generation.	While the Project would continue to provide grid reliability through diversification of fuel for generation, its benefit would be slightly reduced.
Renewable Integration	The Project can be used to firm other intermittent renewables (wind and solar).	While the Project could still be used to firm other intermittent renewables, its benefit would be slightly reduced.
<b>Other Aspects of Environmental Quality</b>		
Carbon Offsets	The Project offsets approximately 72,500 metric tons of CO <sub>2</sub> equivalent per year.	Carbon offsets would decrease by 6,900 metric tons of CO <sub>2</sub> equivalent per year. This is a 10% reduction on average.
<b>Costs</b>		
Capital Improvements	-	\$15,433,800
Operations and Maintenance	-	\$315,900 (per year)
Replacement Energy	-	\$1,365,600 (per year)
Monitoring Program	-	\$270,000
Total Annualized Cost	-	\$3,485,000 (per year)

<b>Ratepayer and Taxpayer Impacts</b>		
Chugach Electric	-	+0.67%
Matanuska Electric	-	+0.87%
Municipality of Anchorage	-	+\$0.54 (per \$100k of property value)

## **Appendix C. Alternatives Request Form**

# Eklutna Hydroelectric Project

## Alternatives Analysis – Request Form

**Entity:**

**Flow Regime** (check one):

**Flow Level 1** (Jul/Aug = 40 cfs, Sep/Oct = 40 cfs, Winter = 27 cfs)

Channel Maintenance Flow:  200 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Flow Level 2** (Jul/Aug = 60 cfs, Sep/Oct = 48 cfs, Winter = 31 cfs)

Channel Maintenance Flow:  325 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Flow Level 3** (Jul/Aug = 80 cfs, Sep/Oct = 57 cfs, Winter = 35 cfs)

Channel Maintenance Flow:  400 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Flow Level 4** (Jul/Aug = 100 cfs, Sep/Oct = 65 cfs, Winter = 39 cfs)

Channel Maintenance Flow:  450 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Flow Level 5** (Jul/Aug = 120 cfs, Sep/Oct = 73 cfs, Winter = 42 cfs)

Channel Maintenance Flow:  500 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Flow Level 6** (Jul/Aug = 140 cfs, Sep/Oct = 82 cfs, Winter = 46 cfs)

Channel Maintenance Flow:  550 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Flow Level 7** (Jul/Aug = 160 cfs, Sep/Oct = 90 cfs, Winter = 50 cfs)

Channel Maintenance Flow:  600 cfs for 72 hours  Other:

Every:  Year  2 Years  3 Years  4 Years  5 Years  Other:

Time of year:

**Other:**

**Infrastructure for Year-Round Instream Flows** (check one):

- Existing Dam with Existing Gate at El. 852 feet (RM 12)<sup>1</sup>
- Existing Dam with Fixed Wheel Gate at El. 852 feet (RM 12)<sup>1</sup>
- Existing Dam with Siphon Bypass at El. 840 (RM 12)<sup>2</sup>
- Replacement Dam with Automated Gate at El. 835 feet (RM 12)<sup>3</sup>
- Releases through new Bypass Tunnel, existing intake at El. 793 (RM 11.5)<sup>3</sup>
- Releases at AWWU Portal Valve, existing intake at El. 793 (RM 11)<sup>3</sup>
- Releases from lower in the AWWU Pipeline, existing intake at El. 793 (RM 5.5)<sup>3</sup>

**Infrastructure for Channel Maintenance Flows** (check one):

- Uncontrolled Spill<sup>4</sup>
- Radial Gate<sup>5</sup>
- Fixed Wheel Gate<sup>6</sup>
- AWWU Portal Valve plus Existing Gate in the Dam (only for Flow Level 1)<sup>6</sup>

**Upstream Fish Passage** (check one):

- Existing Dam with Gravity Fish Ladder
- Existing Dam with Fish Ladder with Variable Exit Gates
- Existing Dam with Fish Ladder with Slide
- Replacement Dam with Fish Ladder
- Trap and Haul
- None

**Downstream Fish Passage** (check one):

- Spill during:  April  May  June  Other:
- Floating Surface Collector
- None

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<sup>1</sup> Eklutna Lake average WSEL will fluctuate from WSEL 863 to WSEL 876 (approx.)

<sup>2</sup> Eklutna Lake average WSEL will fluctuate from WSEL 854 to WSEL 870 (approx.)

<sup>3</sup> Eklutna Lake average WSEL will fluctuate from WSEL 830 to WSEL 865 (approx.)

<sup>4</sup> Requires WSEL 873 (@ 200 cfs spill) to El 876 (@ 600 cfs spill)

<sup>5</sup> Requires WSEL 875 (@ 200 cfs spill) to El 878 (@ 600 cfs spill)

<sup>6</sup> Requires WSEL 861

**Miscellaneous:**

- Divert Lach Q'atnu Creek into the Eklutna River
- Construct Bridges at AWWU Road Crossings (*recommended for any alternative that includes year-round instream flows from either the dam or the AWWU portal valve*)
- Lakeside Trail Repairs (check one):
  - Full (*recommended for any alternative that requires the lake level to be held higher*)
  - Partial (*recommended for any alternative that maintains current reservoir operations*)
  - Other:
- Physical Habitat Improvements (check one):  Current Concept  Other:

**Monitoring Program / Adaptive Management** (open answer):

## **Appendix D. Cost Effectiveness Modeling**

## Technical Memorandum

To:	Mike Brodie, P.E. Chugach Electric Association	Project:	Eklutna Fish & Wildlife Project
From:	Sean P. Ellenson, P.E. McMillen, Inc.	cc:	
Date:	August 30, 2023		
Subject:	Supporting Data for Cost Effectiveness Model		

## Revision Log

Revision No.	Date	Revision Description
0	08/30/2023	Draft

### 1.0 Introduction

A cost effectiveness model was utilized to compare various alternative protection, mitigation, and enhancement measures proposed by stakeholders as part of the Eklutna Fish & Wildlife Program. To capture the financial considerations of each proposed alternative, the capital costs, operations and maintenance (O&M) costs, and replacement energy costs must be annualized over the 35-year period of the agreement. This memorandum defines the methodology and components of the financial analysis that went into determining the annualized costs and ultimately the estimated ratepayer and taxpayer impacts for each proposed alternative.

### 2.0 Annualized Costs

To determine the annualized cost of each comprehensive alternative proposed as part of the alternatives analysis process, the components of capital costs, O&M costs, and replacement energy costs were evaluated. The details of this evaluation are presented in the following subsections.

## 2.1 Capital Expenditures

The estimated capital expenditures for each proposed alternative were based on the class 5 opinion of probable construction costs (OPCC) developed for each measure as part of the Phase 1 engineering design (McMillen, Eklutna Fish & Wildlife Project. Engineering Feasibility Study - Class 5 Opinion of Probable Construction Costs 2023). The estimated costs for each measure are defined in Table 2-1.

**Table 2-1. Class 5 OPCC - Cost Summary.**

PME Measure		Total Median Cost	Expected Estimate Cost Range Class 5 (-50% to +100%)		
A	Dam Release Modifications	\$6,680,000	\$3,340,000	to	\$13,360,000
B	Siphon Bypass Pipeline	\$22,371,500	\$11,186,000	to	\$44,743,000
C	AWWU Portal Release Facility	\$5,546,500	\$2,773,000	to	\$11,093,000
D	AWWU Pipeline Release Facility	\$2,248,300	\$1,124,000	to	\$4,497,000
E	Bypass Tunnel Release	\$76,747,200	\$38,374,000	to	\$153,494,000
F	Channel Excavation	\$569,000	\$285,000	to	\$1,138,000
G	Lach Q'atnu Creek Re-Route	\$1,523,000	\$762,000	to	\$3,046,000
H	Spillway Modifications - Tainter Gate	\$5,574,300	\$2,787,000	to	\$11,149,000
I	Spillway Modifications - Fixed Wheel Gate	\$6,573,500	\$3,287,000	to	\$13,147,000
J	Gravity Flow Fish Ladder	\$16,670,300	\$8,335,000	to	\$33,341,000
K	Variable Exit Fish Ladder	\$17,569,600	\$8,785,000	to	\$35,139,000
L	Pumped Supply and Slide Fish Ladder	\$15,240,200	\$7,620,000	to	\$30,480,000
M	Trap and Haul Facility	\$8,336,200	\$4,168,000	to	\$16,672,000
N	Floating Surface Collector	\$57,557,000	\$28,779,000	to	\$115,114,000
O	Fish Exclusion Barrier	\$3,125,600	\$1,563,000	to	\$6,251,000
P	Replacement Dam	\$113,344,500	\$56,672,000	to	\$226,689,000
Q	Lakeside Trail Improvements	\$373,600	\$187,000	to	\$747,000
R	AWWU Maintenance Road Crossings	\$2,941,500	\$1,471,000	to	\$5,883,000
S	Physical Habitat Manipulation	\$1,469,200	\$735,000	to	\$2,938,000

A comprehensive alternative proposed by a stakeholder, owner, or interested party combines the individual costs of each measure for a combined estimated capital cost. It shall be noted that at the level of design presented in phase 1 engineering these costs carry an accuracy range of -50% to +100%, which will be further refined as part of further phases of engineering design. A summation of capital costs for an example comprehensive alternative proposed as part of the Fish & Wildlife Program is presented in Table 2-2.

**Table 2-2. Example Comprehensive Alternative Cost Summary.**

PME Measure	Capital Cost
AWWU Portal Release Facility:	\$5,547,000
AWWU Maintenance Road Crossings:	\$2,942,000
Lakeside Trail Improvements:	\$374,000
Comprehensive Capital Cost:	\$8,863,000

To annualize the cost of the capital expenditures over 35 years, a discount rate is applied to take into account the time value of capital costs spread over the 35-year program. The discount rate utilized by the Hydro Project owners for assessing future cash flows is equal to 5%. In addition to the discount rate applied for assessing future cash flow, the Regulatory Commission of Alaska (RCA) sets a Times Interest Earned Ratio (TIER) which must be applied on assessing future interest payments as part of the equation for setting utility rates. The TIER is only applied to assess capital cost cashflow for Chugach Electric Association (CEA) and Matanuska Electric Association (MEA) and is currently set at 1.75x and 1.60x, respectively.

To assess the responsibility of these costs per Project Owner, the annualized capital costs must vary based on the TIER and ownership of the project by entity. The breakdown of project ownership for capital costs associated with the Project is presented in Table 2-3 based on the comprehensive alternative discussed within this section. The 35-year annualized cost variation based on the required TIER is presented in Table 2-4. The annualized cost for the purposes of ratepayer impacts based on project ownership by utility is presented in Table 2-5.

**Table 2-3. Project Ownership - Capital Expenditures.**

Entity	Ownership
Chugach Electric Association	64.29%
Matanuska Electric Association	16.67%
Municipality of Anchorage	19.04%

**Table 2-4. 35-Year Annualized Capital Costs with Varied TIER.**

Description	35-Year Annualized Cost
Capital Cost	\$8,863,000
35-Yr Annualized Cost; 1.75x TIER	\$819,000
35-Yr Annualized Cost; 1.60x TIER	\$760,000
35-Yr Annualized Cost; No TIER	\$541,000

**Table 2-5. 35-Year Annualized Capital Costs by Owner.**

Entity	35-Year Annualized Cost
Chugach Electric Association	\$527,000
Matanuska Electric Association	\$127,000
Municipality of Anchorage	\$103,000

## 2.2 Operations and Maintenance Annualized Costs

The estimated O&M costs for each proposed alternative were based on estimates developed for each measure as part of the Phase 1 engineering design (McMillen, Eklutna Fish & Wildlife Project. Engineering Feasibility Study - Class 5 Opinion of Probable Construction Costs 2023). The estimated O&M costs for each measure are defined in Table 2-6.

**Table 2-6. O&M Cost Summary.**

PME Measure	O&M Cost
A Dam Release Modifications	\$565,500
B Siphon Bypass Pipeline	\$664,300
C AWWU Portal Release Facility	\$196,300
D AWWU Pipeline Release Facility	\$196,300
E Bypass Tunnel Release	\$210,600
F Channel Excavation	\$0
G Lach Q'atnu Creek Re-Route	\$19,500
H Spillway Modifications - Tainter Gate	\$32,500
I Spillway Modifications - Fixed Wheel Gate	\$32,500

PME Measure		O&M Cost
J	Gravity Flow Fish Ladder	\$604,500
K	Variable Exit Fish Ladder	\$657,800
L	Pumped Supply and Slide Fish Ladder	\$813,800
M	Trap and Haul Facility	\$200,200
N	Floating Surface Collector	\$1,773,200
O	Fish Exclusion Barrier	\$37,700
P	Replacement Dam	\$299,000
Q	Lakeside Trail Improvements	\$0
R	AWWU Maintenance Road Crossings	\$0
S	Physical Habitat Manipulation	\$0

A comprehensive alternative proposed by a stakeholder, owner, or interested party combines the individual costs of each measure for a combined estimated O&M cost. A summation of O&M costs for an example comprehensive alternative proposed as part of the Fish & Wildlife Program is presented in Table 2-7.

**Table 2-7. Example Comprehensive Alternative Cost Summary.**

PME Measure	Capital Cost (\$)
AWWU Portal Release Facility:	\$196,300
AWWU Maintenance Road Crossings:	\$0
Lakeside Trail Improvements:	\$0
Comprehensive O&M Cost:	\$163,800

To annualize the cost of the O&M expenditures over 35 years, an annual increase is applied to consider the increasing price of labor and materials over time. The escalation is based on historical trends for the utilities and is equal to an annual increase of 3% per year.

To assess the responsibility of these costs per Project Owner, the annualized O&M costs vary based on the ownership of the project by entity and is equal to the ownership breakdown of the capital costs of the project, as presented in Table 2-8. The 35-year annualized cost including annual escalation is equal to \$345,000/yr based on the comprehensive alternative proposed as part of the Fish & Wildlife Program. The annualized cost for the purposes of ratepayer impacts based on project ownership by utility is presented in Table 2-9.

**Table 2-8. Project Ownership – O&M Expenditures.**

Entity	Ownership
Chugach Electric Association	64.29%
Matanuska Electric Association	16.67%
Municipality of Anchorage	19.04%

**Table 2-9. 35-Year Annualized O&M Costs by Owner.**

Entity	35-Year Annualized Cost
Chugach Electric Association	\$221,800
Matanuska Electric Association	\$57,500
Municipality of Anchorage	\$65,688

### 2.3 Replacement Energy Annualized Costs

The estimated replacement energy costs for each comprehensive alternative are based on the hydropower operations model developed as part of the Year 1 study results (McMillen 2023). For the comprehensive alternative proposed as part of the Fish & Wildlife Program the replacement energy is based on reduced flow to the Eklutna Power Plant as a result of flow releases into the Eklutna River. The proposed release regime is presented in Table 2-10.

**Table 2-10. Eklutna River Flow Release by Month.**

Month	Flow Rate (cfs)
Jan	27
Feb	27
Mar	27
Apr	27
May	34
Jun	40
Jul	40
Aug	40
Sep	40
Oct	40
Nov	35
Dec	27

Modifying reservoir and powerhouse operations to release the proposed flow regime into Eklutna River results in an average annual decrease of generation of 15,725 MWh/yr. To determine the value of energy losses from the Eklutna Power Plant the value of the replacement energy within MEA and CEA's system was studied. In the case of both utilities, any energy lost from the facility would be replaced by one of the multiple natural gas generation facilities located in the local system.

The value of energy produced from a natural gas generation facility is directly tied to the price of natural gas. In June 2023 the local provider of natural gas, Enstar Natural Gas Company LLC, presented to the RCA a range of gas prices expected in 2026. The price of gas ranged from a low of \$12.20 per thousand cubic feet (MCF) to \$13.90/MCF with a median expected value of \$13.05/MCF. Using the median expected gas price, the Project Owners performed a production cost model run of energy generation on the Railbelt system utilizing GenTrader®, an energy portfolio modeling software, to determine a forecasted price of energy from natural gas generation sources of \$84.65/MWh. Based on the median price of replacement energy, an initial cost of replacement energy during Year 1 was determined to be \$1,330,000.

To annualize the cost of the replacement energy over 35 years, an annual increase is applied to consider the increasing price of gas over time. The escalation is based on historical trends for the utilities and is equal to an annual increase of 1% per year. Considering the annual increase in energy costs, the 35-year average annualized cost of replacement energy is equal to \$1,593,000/Yr.

To assess the responsibility of these costs per Project Owner, the annualized replacement energy costs vary based on the ownership of the project by entity as presented in Table 2-11. The annualized cost for the purposes of ratepayer impacts based on project ownership by utility is presented in Table 2-12.

**Table 2-11. Project Ownership – Replacement Energy Costs.**

Entity	Ownership
Chugach Electric Association	64.29%
Matanuska Electric Association	35.71%
Municipality of Anchorage	0%

**Table 2-12. 35-Year Annualized Replacement Energy Costs by Owner**

Entity	35-Year Annualized Cost
Chugach Electric Association	\$1,024,000
Matanuska Electric Association	\$569,000
Municipality of Anchorage	\$0

## 2.4 Comprehensive Cost Summary

After determining the individual annualized costs of each sub-component by utility ownership structure, the overall annualized cost per comprehensive alternative is combined to assess impacts to each Project Owner. The combined annual costs by utility are presented in Table 2-13.

**Table 2-13. 35-Year Annualized Cost Summary.**

Entity	35-Year Annualized Cost
Chugach Electric Association	\$1,772,800
Matanuska Electric Association	\$753,500
Municipality of Anchorage	\$168,700

## 3.0 Ratepayer & Taxpayer Impacts

Each of the utilities is a member-owned not-for-profit cooperative of which rate schedules are set by the RCA based on annual expenses for O&M, capital expenditures, labor, and debt service if applicable. The Municipality of Anchorage must fund expenses through the collection of property taxes on an annual basis. The annualized costs associated with ownership of this project will have direct impacts to member utility rates and property taxes for households residing in the Anchorage area. The energy rate increases based on annual expenditures are 0.3% and 1.12% per \$1,000,000 spent for CEA and MEA, respectively. On a property tax basis, the Municipality of Anchorage must increase property taxes by 0.03 mils per \$1,000,000 spent, with 0.03 mils being defined as a \$3 increase in property tax per year per \$100,000 in property value. A summary of the ratepayer and taxpayer impacts based on the example comprehensive alternative is presented in Table 3-1.

**Table 3-1. Summary of Ratepayer and Taxpayer Impacts.**

Entity	Ratepayer / Taxpayer Impacts
Chugach Electric Association	+0.53%
Matanuska Electric Association	+0.84%
Municipality of Anchorage	0.0051 mils \$0.51/\$100k

## 4.0 References

McMillen. 2023. *Eklutna Fish & Wildlife Project. Engineering Feasibility Study - Class 5 Opinion of Probable Construction Costs*. <https://eklutnahydro.com/documents/>.

—. 2023. *Hydropower Operations Modeling Study Report*. <https://eklutnahydro.com/documents/>.

## **Appendix E. 15% Design Drawings**