UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

November 25, 2020

Municipality of Anchorage
Matanuska Electric Association, Inc.
Chugach Electric Association, Inc.
P.O. Box 196300
Anchorage, Alaska 99519

RE: Comments on the Eklutna Hydroelectric Project Draft Study Plan

Dear Ms. Henderson, Mr. Zellers, and Mr. Brodie:

The 1991 Fish and Wildlife Agreement (1991 Agreement) requires the Eklutna Hydroelectric Project ("Project") Owners to develop and propose a Fish and Wildlife Program ("Program") to protect, mitigate damages to, and enhance fish and wildlife impacted by the development of the Project, to be reviewed by the resource management agencies, the public, and the Governor of Alaska. To facilitate the development of the Program, the Project Owners are required to fund studies to examine impacts to fish and wildlife from the Project. The study plan must be developed by the Project Owners in consultation with the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and three state agencies. In accordance with the 1991 Agreement, the Project Owners presented a Draft Study Plan to the resource agencies on October 26, 2020. We appreciate the Owners' early action on developing the study plan and their willingness to consider all the interrelated elements of this plan. We provide the attached comments based on our review of the ten studies proposed in the plan for the first study year.

The Owners, the Native Village of Eklutna, and the resource agencies would like to return salmon to the entire 11 miles of the Eklutna River while maintaining low-cost electricity generation for Alaskan communities connected to the railbelt electrical grid as stated in the 1991 Agreement. These ten studies aim to inform a balanced decision between these competing goals. The studies investigate available habitat under current river conditions and attempt to define how various management actions might improve fish habitat.

We also strongly suggest the addition of two further studies: 1) Fish Passage Alternative Assessment, and, 2) Increase the Available Water. The additional studies would evaluate future infrastructure projects that could potentially increase salmon habitat and increase energy production simultaneously.

Although this is not a Federal Energy Regulatory Commission (FERC) relicensing process, this study plan timetable appears to track the FERC process. In FERC's Integrated License Process there are approximately six months of feedback between the project proponents, FERC, Tribes, and the resource agencies to define the studies. This longer process allows time for consensus building.

While we are close to agreement on some studies, there are significant differences of opinion on others. We urge the Project Owners to take the time to build consensus between themselves and the Native Village of Eklutna, stakeholders, and resource agencies on all studies before finalizing these study plans. This will support a more efficient consultation process once the study results are available for review.

Please contact Sean Eagan at sean.eagan@noaa.gov or by phone at 907-586-7345 if you have any questions.

Sincerely,

for Robert D Mecum

James W. Balsiger, Ph.D.
Administrator, Alaska Region

Attachment 1: National Marine Fisheries Service Comments on the Eklutna Hydroelectric Draft Study Plan

CC:

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National Marine Fisheries Service Comments on the

Eklutna Hydroelectric Draft Study Plan

November 25, 2020

Based on our review of the Eklutna Hydroelectric Draft Study Plan (DSP) provided by the Utilities, we offer the following DSP comments, and two new study requests.

List of Study Comments

3.1 Instream Flow Study (IF)

We agree with the approach of using Hydrologic Engineering Center's River Analysis System (HEC-RAS) or a similar model to understand inundation extent, depths and velocities at a range of flows. There are two aspects of the proposed Instream Flow Study plan which will weaken the final product, detailed below.

IF-1 **Creating a digital channel model:** The HEC-RAS model relies on creating a digital replica of the channel within a computer model. This is done with a combination of physical on-the-ground cross section surveys and cross sections derived from LiDAR data. Both of these techniques are usually applied to the channel geometry that is expected to exist during the management horizon.

The Eklutna River channel has significantly atrophied since the Upper Eklutna Dam was constructed 66 years ago. A small and accidental channel-maintenance flow (1,013 cfs) was released in 1995. Since then the alluvial fans and bridges have narrowed and constricted the channel, willow and alder have overgrown the side channels and sloughs, and the main channel's cobbles have been embedded by fines.

We acknowledge that the river will not return to the pre-dam hydrograph, where the Eklutna River routinely flowed at 800 cfs throughout July and August (Fig. 3-7, Draft Study Plan (DSP)) and the 2-year reoccurrence channel forming flow was between 1,500 and 2,000 cfs (Fig. 3-6, DSP). If utilities hope to provide the range of necessary habitats needed to support spawning, winter rearing habitat, spring rearing habitat, and passage for Chinook or sockeye salmon, then you cannot continue with the current narrow, fine-inundated channel above the Thunderbird confluence. It makes more sense to first put a channel flushing flow down the channel and then to survey the cross sections and/or fly LiDAR.

Not all cross-sections of the river will change following the flushing flow, however a significant number will. The utilities will need to resurvey the on the ground cross-sections and perhaps fly new LiDAR over key areas. Releasing the flushing flow **first** is not more expensive, but it will require patience and will produce a more realistic first version of the model.

IF-2 **Selection of Calibration Flows:** The study plan proposes to calibrate the model at 25, 75 and 150 cfs. We agree that calibration is a key step and that these are valuable calibration points. Most modelers agree that at 2 to 2.5 times above the highest calibration point, models become inaccurate; between 300 cfs and 375 cfs the proposed HEC-RAS model will become inaccurate. The most productive Chinook spawning streams in Alaska flow higher than this during spawning season (late summer). Side channel rearing habitat is often dry during flows below 300 cfs.

If returning Chinook to the system is a goal then we need a HEC-RAS and PHABSIM model that has been calibrated in the 500 to 1,000 cfs range. This does not mean we will release this much water in the future, but we do need to understand the habitat available during those flows. The sooner the utilities create a model with functionality from 10 cfs to 1,000 cfs the better, however, higher flow calibration could be done later.

These next points will improve Physical Habitat Simulation (PHABSIM) model's ability to predict where fish habitat will exist.

IF-3 **Physical Habitat Attributes:** The DSP states the physical habitat attributes which determine each habitat attribute's relative value to a species will most often be taken from the literature. While relying on the published literature can work, it is often applied indiscriminately. We prefer the attributes values come from studies carried out on glacier-fed, turbid rivers similar to the Eklutna River. Alaska's salmon populations may not respond to the same habitat attributes as the salmon populations that spawn in Washington and Oregon, and are genetically attuned to rain/snow dominated systems with little glacier water input. Poor visibility (elevated turbidity) is an important watershed attribute. Ideally HSC/HSI values would be taken from rivers with similarly poor visibility.

IF-4 **Spawning Habitat:** As evidenced in old pictures, the Eklutna River once hosted large Chinook that Alaskans almost never catch today. If we want those Chinook to return, the channel needs large cobbles and sufficient depth to submerge 50-pound, 5 or 6-year old females. Even if we have correctly sized cobbles we will need to insure that the fines are continually flushed away. Evaluate the potential to move large cobbles from the lower river gravel pits to where they are needed for spawning in the upper river.

IF-5 **Upwelling Areas:** The DSP mentions several habitat attributes which help delineate Habitat Suitability Curves (HSC) and Habitat Suitability Indexes (HSI) for each salmon species. The HSC must investigate and include upwelling as a habitat attribute that increases spawning habitat productivity for all salmon species. Especially in rivers inundated with fines, upwelling keeps spawning gravels clean and eggs aerated when the river is turbid.

IF-6 **Rearing Habitat:** Wetted perimeter is a habitat metric that indicates whether side channels and sloughs have sufficient water for juvenile rearing. At least three factors are needed to correctly model habitat in sloughs and side channels:

a. Spatially close cross sections with high levels of vertical precision in areas where one would expect to have side channel rearing habitat. The model can then better predict when water will enter and exit the side channels and sloughs. This costly level of detail is not needed for the whole 11 miles, but is important in areas with the potential become usable side channels.

b. An understanding of accretion and groundwater flows that might add water to the side channels and sloughs once the river drops.

c. An understanding of how fast the water level in a slough drops once the river water surface is lower than the lowest point in the slough. The slough bottom may be an aquitard formed by a fine clay layer which could hold water and juvenile salmon for many weeks.

IF-7 **One Dimensional versus Two Dimensional River models:** There are opportunity costs to every study plan decision, and either method poorly executed will yield poor results. Modeling the whole river using a 1-D model and calibrating it at a range of flows (possibly 800 and 400 cfs in addition to 25, 75 and 150 cfs) will provide better information than a 2-D model that is not calibrated above 150 cfs. We favor a simpler model calibrated at a wider range of flows.

Further, a 1-D model should suffice for much of the Eklutna River. Canyon wall and alluvial fans often pin the river in a fairly defined channel. During flows from 10 cfs to 400 cfs the primary flow paths will be mostly parallel to the thalweg.

Areas that are recognized as likely to provide side channel and slough rearing habitat would benefit from a 2-D approach. A ½ -1 mile reach of 2-D modeling could be nested in a larger one dimensional model. Many reaches of the river would likely demonstrate primarily 1-D attributes at higher flows. This is certainly true from the top of the canyon reach to the Thunderbird confluence. Areas that may benefit from 2-D modeling include: immediately above the large fans; just above the entrance to the narrow canyon; at the Thunderbird confluence; and on the delta entering Cook Inlet.

IF-8 **Managing Expectations:** HEC-RAS has been used for 35 years because is based on widely agreed upon physical equations. Expectations for the model's performance in the Eklutna River will need to be carefully managed, given that the river has a reservoir's worth of extra sediment, is rapidly changing from a glacier runoff-dominated to a rain/snow-dominated regime, and is inundated with fines from alluvial fans. No matter how carefully the model is constructed, calibrated and validated, the HEC-RAS model outputs will not be highly accurate.

3.1.4.5 Data Collection: Transect Location Selection

IF-9 **Random versus Deliberate Cross Sections:** We agree that it makes sense for the Instream flow and Sediment Transport studies to share transects. Rather than assigning transect locations randomly, locations should be selected by reaching agreement between someone familiar with running the two models and someone familiar with the Eklutna River. These decisions should be explained to the Technical Work Group (TWG) so that they can provide input.

IF-10 **PHABSIM Transects:** We are less familiar with transect selection in Physical Habitat Simulation (PHABSIM). It is necessary to survey one or more transects in each meso habitat with the potential for complex channels in the future i.e., a main channel and distinct side channels. There may be river units with no habitat value beyond fish passage that do not need a transect. This topic needs more discussion.

IF-11 **Quantity of Cross Sections:** Is the DSP proposing 30 to 40 transects for both the Instream Flow and Sediment Transport study? In reaches likely to have rearing or spawning habitat in the future, three transects per mile will not provide sufficient detail. An approach which makes the number of transects per mile proportional to the river bank full width or square meters of potential habitat might be better. The DPS suggest many cross sections will derived from LiDAR, which makes it straightforward to select a few more. The model's computational time is not the big cost in this study.

IF-12 **Measurements at Each Cross Section:** Carefully consider the number of measurement needed at each transect during each calibration flow. Perhaps the initial model would be constructed from 50 transects, however, calibration velocities and wetted perimeters and depths would only be collected at 30 transects during the calibration flows.

IF-13 **Discharge Measurements:** When the USGS takes a discharge measurement, the standard practice is vertical bins each containing less than 10% of the total flow. However, this approach may not be necessary on every transect, as precise discharge measurement is not the goal. We encourage the TWG to divide the transects into primary and secondary categories, with a quicker set of measurements performed at the secondary transects.

IF-14 **Water Surface Elevation Precision:** Since the DSP is only measuring river bed elevation to the nearest 0.5 feet, wouldn't 0.05 feet of precision in the water surface elevation suffice. The 0.01 feet of precision suggested in the DSP is very difficult to consistently collect.

IF-15 **Water Depth:** A field technician can measure water depth to within 0.1 feet. In a shallow river like current Eklutna, 0.5 feet is not sufficient. There were no river reaches above the old dam site with average water deeper than 1-foot last summer (NVE 2000).

IF-16 **Lumping of Fine Sediments:** Please discuss lumping all fines less than 0.1 inch at the TWG meeting. Sand and fine gravel does not imbed spawning substrate as tightly as clays.

3.1.4.6 Habitat Suitability Criteria Development

IF-17 **Placing Species in Guilds:** The study should not use species guilding. Pick the two or three species we care most about and focus on them; ignore the others.

IF-18 **Review of HSC Criteria:** The TWG should get a chance to review the data and selection of HSC criteria/data.

IF-19 **Acknowledge HSC is qualitative:** While the HSC model provides a quantitative relationship between environmental variables and habitat, it is based on a suite of qualitative decisions. This should be acknowledged.

3.1.4.7 Data Analysis and Modeling

IF-20 **Running Model at 30 flows:** What is the value of running the model at 30 flows? The channel geometry will not be sufficiently precise to show meaningful differences between such similar flows.

IF-21 **Manning's Values:** Manning's channel roughness values and expansion/contraction coefficients are often used as fudge factors. Please be forthright about how much these need to be adjusted from the values measured in the field to make the model function. If the HEC-RAS model needs severely adjusted Manning's values to run, this may indicate that there are too few cross sections or some other issue with the model.

IF-22 **Flows used in Models:** Will an identical flow be used from the upper dam throughout the 8 miles to the Thunderbird confluence? This is generally assumed to be a gaining reach at lower flows. With larger reservoir releases it can be a losing or gaining reach, or the TWG might agree that accretion flows/loss to groundwater systems becomes inconsequential.

IF-23 **Less Accurate Channel Geometry:** "This analysis will be **representative of channel characteristics under current conditions**. Results of sediment transport analysis will be used to project channel changes that can be incorporated into a revised PHABSIM analysis reflective of future conditions resulting from a variety of flow scenarios" (pg. 48 DSP). A more logical approach would be to run a flushing flow down the channel first and then construct the HEC-RAS model (comment #1). The geomorphology model predictions of a future channel will be no match for simply supplying the flow.

IF-24 **PHABSIM Based on Current Geometry**: If the utilities model the wrong geometry, the fish habitat results from PHABSIM derived from current channel geometry will change as a result of changes to channel morphology.

IF-25 **Hypothesize Direction of Change**: The TWG, or a smaller subgroup, could hypothesize on the size and direction of the change in each reach with no flushing flow, with a small flushing flow, and with a 10 - 20 recurrence year event. Then the TWG and utilities could discuss where to spend additional effort on more precise modeling (more cross sections). For example, we could all agree that deposition below the old dam will continue.

IF-26 **Duration of Calibration flows:** What is the reasoning behind holding the calibration flows for seven days?

IF-27 **More Water versus More Precise Models:** We are uncertain how the cost of lost generation should be accounted for, however, it makes sense to spend money on larger volume flushing flows and calibration flows than on more complicated models. The larger flows will slightly improve fish habitat immediately.

IF-28 **Flow Definitions:** Please define these three terms with definitions from the published literature, and use them consistently in the text: 1. Flushing flow; 2. Channel maintenance flow; 3. Model calibration flow.

IF-29 **Terminology:** The use of "unit", "area", "reach", "meso habitat", and "major habitat" is confusing. Please define these terms.

IF-30 **Habitat Suitability Index:** HSI is only mentioned once in the Proposed Study Plan. Please provide more information on how HIS will be used.

IF-31 **Meso-habitat:** Fine scale habitat mapping is important and has been a point of contention in past Alaskan hydropower study plans. We need to agree on methods and all accept the results; no method is perfect.

IF-32 **USFWS Site Below Upper Dam:** We agree with reestablishing the 2019 channel morphology site surveyed by USFWS (Hanson, 2019) that is not influenced by the alluvial fans.

IF-33 **Page 38:** Please do not refer to the Eklutna River as a stream nor say the channel is currently 100 feet wide. The Native Village of Eklutna measured wetted widths from 15 to 79 feet during a wet week in 2020 (NVE 2020).

IF-34 **HABTAV:** This is not commonly used in Alaska; please describe it.

3.2 Geomorphology/Sediment Transport Study (ST)

The Sediment Transport Study is the most important study and the most difficult to implement. Four primary points:

ST-1 **Two-Year Recurrence Flow**: River morphology papers (Mathias 2020) agree that the highest volume of sediment moves at the bank full or 2-year recurrence flow. To clean and resort the imbedded cobbles that large Chinook prefer for spawning, a higher flow may be required.

ST-2 **Proposed Calibration Flows**: Based on the proposal, it is not clear whether a sediment transport model will be constructed and if so what flows will be analyzed. The calibration flows discussed (25, 75 and 150 cfs) are not large enough to transport much sediment or to recreate quality salmon spawning or rearing habitat, for the following reasons:

a. The proposed flows will move fines, however, the fines moved will represent only a small fraction of the total volume of fines that have accumulated over the last 25 years. The remaining surplus fines will continue to degrade salmon habitat by imbedding spawning gravels, decreasing macro-invertebrate diversity, and increasing turbidity.

b. The proposed flows will not significantly carve back the encroaching alluvial fans.

c. The proposed flows will not loosen the imbedded cobbles and boulders (armor layer) that have been cemented in place by 66 years of accumulating fines.

d. If these lower flows are supplied annually they will be unlikely to clean or resort the cobbles that Chinook prefer, even if additional gravels/cobbles are added to the channel. The competence of the flow (combination of depth and velocity) will be insufficient. A discharge of 150 cfs might be sufficient if Eklutna's bankfull widths were consistently 20 feet, but they are much wider, such that sufficient velocity and depth combination to move cobbles will not be created by 150 cfs.

e. To understand sediment movement in the Eklutna River, larger flows must be considered. Historically, the Eklutna River flowed at 800+ cfs for 60 days continuously in mid-summer (Fig. 3.7).

ST-3 **Logistics, Economics and Calculated Risk:** The size of the channel flushing flow has significant logistical (how to release it from the reservoir), economic (what value of power are the utilities willing to forgo) and calculated risk (how much risk to their bridges can AKDOT&PF and ARRC be asked to accept) challenges. If the utilities and agencies cannot work through these three challenges, then the TWG cannot implement a scientifically defensible study of sediment movement. Limiting the flushing flow to flows which can pass through the 3-foot by 3 foot gate will severely compromise the usefulness of this sediment transport study.

ST-4 **Calibrated Sediment Transport Model**: A sediment transport model cannot be calibrated without enacting a single flushing flow and measuring the resulting changes to the channel (Cui 2019). The first possible time for a flushing flow is September of 2021 when the reservoir level reaches the spillway height. In order to answer the study questions, therefore, we recognize two years is likely needed.

The following points will clarify and/or strengthen the study but failing to do them will not drastically undermine the study.

ST-5 **Goals 1 and 2:** Identifying current channel substrate and estimating sediment input from major sources are good, achievable goals.

ST-6 **Goal 3**: **Provide tools for estimating future sediment transport**. The utilities need estimates of future incision rates, aggradation rates, and sediment loads under various future flow regimes. Simply providing tools will not help decision makers. **Alluvial Fan Comparison**: The comparison between the 1950 photos and the 2016 and 2020 LiDAR data will be interesting. I am especially interested in how the fans are or aren't changing. Will the consultant calculate volumes of growth on those fans for the 2016 to 2020 period?

ST-7 **Three Sediment Sources:** There are **three** types of sediment of concern: 1) the old lake bed fines already on the valley floor and being delivered by the alluvial fans; 2) the sediment stored behind the old reservoir; 3) collapsible valley and gorge walls.

3.2.4.1 Map Channel Position Changes through Time

ST-8 **Additional Early Aerial photos**: With the Birchwood Airport 6 miles away, there are likely personal photos from airplanes of the river. Could these aid in the old channel evaluation?

3.2.4.2 Evaluate Sediment Transport Analysis/Modeling Options & Develop Initial Model

ST-9 **Sediment Transport Complexity:** Sediment transport varies between rivers because different rivers react differently to similar inputs and the mathematical computations do not fully model physical processes. The northern hemisphere has other rivers that often flow supersaturated with glacial fines. How does this enhance or detract from their ability to move sand, gravel and cobbles? Please find models that have been proven to work on rivers with similar sediment loads.

ST-10 **Three Distinct Sediment Layers.** Many reaches have three distinct layers of bottom substrate: 1) a veneer (<1 cm thick) of fine clay material; 2) an armored layer of various sizes of gravel, cobbles and boulders which are imbedded in fines; 3) a subsurface layer which we don't know much about. Please explain how the HEC-RAS model will be adjusted to new Manning's roughness values when a flushing flow changes the substrate.

3.2.4.2 Field Inventory and Scour/Sediment Monitoring

ST-11 **Substrate Data:** This plan implies pebble counts will only happen in the wetted channel which is often only 10-15 feet wide. The flows the study plans to model should fill the bankfull width. Will the study count pebbles on the strips within the bankfull width, but outside the wetted perimeter? This question has vexed the resource agencies during the last four summers.

ST-12 **Veneers of Clay:** When a field technician's finger touches a veneer of clay will you record that as the substrate, or record the larger gravel or cobble just underneath?

ST-13 **Hobo Accelerometer:** Is the HOBO accelerometer inside the 1.5 inch diameter pipe measuring impacts to the driven steel pipe? If it is tethered outside the pipe, the cable will absorb some of the impact, and you will not necessarily know the direction of the impact (per HOBO technician 10/30/2020).

ST-14 **Sediment Source Evaluation:** In both the old dam sediments and in the alluvial fans, it is likely there are lenses of coarser or finer material. How will visual estimates of the surface inform us about the lower layers?

ST-15 **Rows of Painted Rocks:** Provide more detail on how this technique works

3.3 River Fish Species Composition and Distribution Study (FD)

FD-1 **Complex Habitat:** The DSP explains that "both juvenile Chinook and Coho Salmon require complex habitats for rearing, such as main channel habitats with instream structure, cover, and pool sub-units as well as off-channel and/or side channel habitats with structure, cover, and reduced velocities" (p. 63). Little complex habitat as described here currently exists (NVE 2020), and will not be created by releasing flows of 100 or 150 cfs into the existing channel. What is the plan to evaluate the best methods for creating off channel/side channel habitat above the Thunderbird confluence?

FD-2 **Which Species are Present:** This detailed study of what species are there now "sampling 40x wetted channel width in each reach" is answering the wrong question. Especially in the eight miles above the Thunderbird confluence (Reaches 5 - 8, Figure 3 – 14, DSP), there are presently very few fish. The goal is to predict what species could be there in the future, and in what quantities, under different flow regimes and different actions to recreate complex channels.

FD-3 **Electro Fishing:** Given that there are few pools above the Thunderbird confluence, is electro fishing needed? Either there are enough adults which field staff can find by walking, or the lower dam site is still an effective barrier. If less than ½ dozen adult salmon make it above old dam site, the study should not lower their chance of successful spawning by electroshocking them. In deep turbid pools some method other than the human eye may be needed … but there are not many pools.

FD-4 **Identifying Juvenile Coho versus Chinook:** On the Susitna Hydropower study field staff could not consistently differentiating between juvenile coho and juvenile Chinook. NMFS suggests field technicians take a genetic swab of a subsample of minnows be captured and do DNA analysis. This would ascertain the accuracy of field identification.

FD-5 **Secchi Disks:** A hand held turbidity meter is more consistent then visibility measured with a secchi disk by different observers.

FD-6 **Channel characteristics measurements:** "Channel morphology characteristics will be documented at the reach scale". Reaches average a mile long; please describe how often will these measurements be taken.

FD-7 **NVE 2020 Habitat Assessment:** Will this new study use NVE determination of Habitat or redo the same work?

3.3.4.2 Adult Salmon and Carcass Survey

FD-8 **Coho Run Timing:** To document the coho run field tecnicians need to do surveys through November 30, or at least until coho count number are both declining and below 25% of the highest count.

FD-9 **Spawning Surveys:** Spawning surveys should go all the way to the old dam site, as adults are starting to be seen here.

FD-10 **Table 3.3** – Please use a darker color to indicate Chinook salmon timing. There is too little contrast for my eyes to detect the months.

FD-11 **Agree on Reaches:** Native Village of Eklutna defined 11 reaches (NVE, 2020); The Eklutna River Workshop (Trout Unlimited, 2018) defined 6 reaches below the Lake Eklutna. The DSP is referring to 8 reaches. We need to agree to the reaches.

FD-12 **Meso-habitat Definitions:** We support the USFS definitions of distinct meso habitats.

FD-13 **Quality Control 3:** We concur with adding notes of clarification to data values, however, all original field data must be intact. We do not agree that a "Senior reviewer" should remove any data.

3.4 Macroinvertebrate Study (MI)

MI-1 **What is the Macroinvertebrate Potential:** Either through literature review or by sampling a proxy site, typical diversity and typical density of the macroinvertebrate fauna should be defined. Sampling in Thunderbird Creek or Eagle River could provide valuable proxy data.

MI-2 **Study Area:** Most studies seem to delineate the whole 11 miles, but these three sites are all in the middle four miles. Please state why you chose to focus on this middle section of the river.

MI-3 **Sample size:** Approximately how many square feet will be sampled in each reach? It seems like the choice of the 1-foot square sample areas might greatly influence results.

MI-4 **Methods and Metrics:** The methods described for collection, preservation and identification seem reasonable. The metrics appear exhaustive and excellent.

3.5 Water Quality (WQ)

WQ-1 **Goal and Objectives:** The Goal focuses on Eklutna Lake Water Quality, and yet two of the primary objectives deal with river water quality. Please clarify the Goal.

WQ-2 **Turbidity:** River turbidity is the most important water quality parameter to fish in the Eklutna River and changes considerably between days and along the river channel. Of the possible river water quality parameters, please focus on turbidity.

a. Placing three to six turbidity sensors along the river during high flow periods (both those produced by rain events and reservoir releases) will allow the TWG to understand which areas are producing the sediment.

b. Place at least one continuously recording (hourly) turbidity meter in the river. This will allow the TWG to understand how often the river flips back and forth between fine sediment saturated and decently clear.

WQ-4 **River Temperatures:** Temperature is also an important water quality parameter, but most turbidity sensors also record temperature. The temperature measurements need a 0.5 degrees Celsius level of precision.

WQ-3 **Lake Temperatures:** The text suggest lake temperature will be taken at two depths, however Figure 3-20 shows a thermistor string with temperature loggers at seven distinct depths. The thermistor string which will record temperatures at several depth will provide more useful information.

3.6 Stream Gaging Study (SG)

SG-1 **Short Gage Records:** Gaging a site for 18-months will tell us very little. We prefer fewer gages with a commitment to keep them running longer (perhaps 5 years).

SG-2 **Lach O’atnu Creek Gage:** We agree with the decision to put gages on Lach Q’atnu Creek and the tributary entering the pond area. The TWG should discuss the needed precision and if we need 12 months of data each year. December, January, and February are challenging months for gaging, however, perhaps those are the most important months.

SG-3 **Gages above Thunderbird:** It would be informative to have two gages in the eight miles between the dam and the Thunderbird Confluence to understand where accretion contributions are entering the river. Perhaps both gages do not need USGS level precision (Rantz 1982) and a shorter record would suffice on one gage.

SG-4 **Accretion study**: While accretion at base flow is important, we would also like to understand accretion during a typical summer rainstorm (perhaps 1+ inches in 24 hours). This could help us understand if summer rainstorms will fill side channel or reconnect sloughs to the main channel. SG-3 and SG-4 are interrelated.

SG-5 **Below Thunderbird Gage:** The TWG/Utilities should clarify what we hope to gain from the gage below Thunderbird. Will dam release requirements be based on Thunderbird flows? Precise stream gages are costly, so the TWG should be sure they are providing equivalent benefit to the study.

SG-6 **Hourly data**: We request that at least hourly data from all gages be made publically available on the Utilities' Eklutna website. It would not need to be live data. A plan to archive the data is also crucial to support future assessments at the site.

SG-7 **USGS gage**: It would be valuable to have at least one gage site operated by USGS, as it will be displayed and archived on the USGS water data site (https://waterdata.usgs.gov/nwis). This is especially true if the Utilities gaging information is not live, or collected with lower precision. Any gage site likely to be a future compliance point should be operated by USGS.

SG-8 **Eklutna Glacier Inputs:** We would like a better understanding of the contributions of the East and West Forks of the Eklutna River. Once the Eklutna glacier is functionally gone how much water can we expect from the West Fork? At what size does the melting glacier ice contribution become noise in the hydrograph? When do we expect that to happen?

3.7 Lake Aquatic Habitat and Fish Utilization Study (AH)

AH-1 **Task 1: Identify Areas with the Greatest Potential to Support Fish:** Objective 3 of Task 1 looks at overall species composition in the littoral zone. How will quantifying the relative abundance of various resident fish species affect hydropower management decisions? Reservoir drawdown does reduce the surface area of shallow fish habitat.

AH-2 **Methods for Task 1:** NMFS suggests the study plan use fewer fish sampling methods so the results are more repeatable results. The more sampling methods employed, the harder it is to run valid statistical analysis of change. If fish distribution survey documents four resident species, and overlook one less common one, will that affect management decisions? If there is potential for a state or federal listed resident species the consultant should use methods that are most likely to record it.

AH-3 **Task 2**: **Habitat and Fish Use of the Clear Water Pond:** Clearly describe why this 3-acre artificial water body warrants study. Perhaps it does since many solutions to return water to the Eklutna River would connect it to the larger lake, or at least result in the ponds water level varying significantly.

AH-4 **Task 3**: **Spawning Habitat in Lower Tributary Reaches:** We support this task of looking for potential spawning habitat for Chinook, coho and possibly sockeye in the tributaries. We recommend this be the primary task/objective, because it is the Eklutna Lake's potential to be good habitat, or lack of potential, that will allow the users to evaluate the value of fish passage.

AH-5 **Methods for Task 3:** We support the idea of focusing sampling on a flexible subset of the 16 tributaries which might support spawning. Not all 16 identified tributaries require extensive documentation.

AH-6 **Fish Barriers on the Eklutna Forks:** Fish on my fork at dinner makes me happy. If fish barriers do not exist, how far up the East and West fork of Eklutna will you go to document potential spawning areas? This information could be provided as qualitative information about spawning area locations up to a clear barrier.

AH-7 **Methods for Eklutna Lake Tributaries studies:** Please clarify whether the study's objective is to evaluate the tributaries' future potential to support anadromous spawning or to evaluate whether spawning is currently happening.

Points of Clarification:

AH-8 **Terminology:** In the first five studies the goal is broken into several objectives, while in this study the goal is broken into tasks that each have objectives. Please use one of these two approaches throughout the entirety of the text for consistency.

AH-9 **Glacier Size Today:** Please identify the percentage of the west fork drainage occupied by the Eklutna Glacier in the fall of 2020. It is likely the glacier has experienced significant change in the decade since the cited work.

3.8 Lakeside Trail Erosion Study (TE)

NOAA Fisheries has no comments on the Lakeside Trail Erosion Study.

3.9 Hydro Operations Modeling Study (HO)

HO-1 **Implement in First Year:** We concur with the need for this study and encourage the utilities to start it in the first study year.

HO-2 **Scenarios Possible with Modest Changes:** The study should evaluate scenarios that are not possible now, such as releasing water in June, but could be made possible by connecting the natural lake with the clear water pond.

HO-3 **Hydro Data Years Selected:** We agree that using historical data will make the model accurate enough for the purposes described here. Rather than using the entire 66 year data set, we would encourage extrapolating from the most recent 15 to 20 years of data. We know the climate has changed, so reservoir levels, power production and rain fall amounts from 1980s and 1990s are less relevant. If you used the last 30 years of data, that would follow the convention of the National Weather Service. I would argue that a shorter comparative time period is appropriate for Alaska.

HO-4 **Baseline Energy Generation:** Does baseline refer to MWh produced per month with no effort to release water?

3.10 Infrastructure Assessment Study (IA)

We support this study and offers the follow additions.

IA-1. Is bullet #2 implying using the “pond” as a winter/spring source of water for the Eklutna River without hydrologically connecting it to Eklutna Lake?

IA-2. Please investigate the feasibility of tapping into the penstock or tunnel to be able to release a portion of that water into the Eklutna River.

IA-3. Please investigate the feasibility of tapping into the AWWU pipeline to be able to release a portion of that water into the Eklutna River.

Second Year Studies:

3.11.2 Hydropower Valuation Study (HV)

HV-1 This study seems to have many overlapping components with the Hydropower Operations Model. Please elaborate on the differences.

HV-2 Will the study attempt to predict future power demands and prices, or for the sake of the model simplicity work with current prices and demand loads? Predicting future loads, when changes in wind and solar generation, and demand for electricity consumption, will introduce new sources of uncertainty into the study.

3.11.3 Recreation Study

We recommend additional emphasis placed on the types of recreation most practiced by members of the Native Village of Eklutna and other Alaskan Natives.

3.11.5 Wetlands/Riparian Habitat Study

We suggest that the wetlands locations may change after a flushing flow is released; therefore it makes sense to delay surveying for wetlands until after the flushing flow, at least above the Thunderbird confluence.

New Studies

We recommend the following additional studied be adopted and conducted by the Project Owners to further our understanding of the options for mitigating impacts on fisheries habitat.

New Study 1. Fish Passage Alternatives Assessment (FPA)

In addition to focusing studies on ways to create spawning and rearing habitat for coho and Chinook in the eight miles between the dam and the Thunderbird Confluence, we suggest focusing this particular study on salmon passage into Lake Eklutna. Please include a tabletop exercise evaluating the costs that other hydropower projects have incurred to implement fish passage plans similar to the following:

FPA-1 **Trap and Haul**

Please identify the best locations to trap adults and haul them to the Eklutna Lake with trucks. Evaluate digging a channel so that juveniles can out-migrate each May through the existing 3-ft X 3-ft gate. Once they out-migrate, shut the gate and fill the reservoir similar to current operations. This is not an ideal ecological solution for fish passage, however, it might be an effective middle ground that satisfies stakeholders.

FPA-2 **Build a Fish Ladder**

a. This option would include releasing enough flow for adult salmon to swim to the upper dam in late July, August and September and lowering the gradient through the old dam site. If passage is the primary goal, an eight week release of 10 - 20 cfs might may prove sufficient.

b. Evaluate dams of similar height that have been retrofitted with fish ladders.

c. Investigate successful juvenile collection systems. The clear water pond might work well as a juvenile collection location if a spring connection to Lake Eklutna could be maintained. Whether the juvenile are released directly below the dam or in a lower location on the river will be a decision point.

FPA-3 **Build A New Impoundment Wall**

a. A new impoundment could be designed to let out the exact flow needed as required without wasting any acre feet. The existing intake, penstock and hydropower plant can remain as is.

b. Design the new impoundment with a state of the art fish ladder rather than adding a fish ladder as an afterthought.

c. The impoundment could be located and designed to allow juvenile outmigration with minimal disruption to power generation.

d. While the initial expense of building the impoundment will be large, it may allow the utilities to generate more electricity and forgo fewer acre feet of water each year than any other solution.

New Study 2. Increase the Available Water (IAW)

The following recommendation expands the volume of water available rather than limiting the volume to 400,000 acre feet to be divided between the competing societal needs listed in the 1991 Agreement.

IAW-1 **Pump Storage:** Constructing a pump storage system tied to solar or wind generation such that the same water could generate electricity twice. Eklutna Lake is an ideal lower basin. The topography of the Chugach Mountain provides numerous locations for smaller upper basins to be constructed.

IAW-2 **Divert Water from a Non-anadromous Stream:** Diverting water from a non-anadromous stream like Thunderbird Creek to re-water the eight miles of Eklutna River above the confluence could support returning salmon. This is what was accomplished by diverting Stetson Creek to Cooper Creek in 2015. To date the utility has gained less water than anticipated and the improvements to riverine habitat in Cooper Creek have fallen short of predictions.

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