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

March 11, 2022

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

RE: Interim Study Reports and Year 2 Study Plan for Eklutna

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

The 1991 Fish and Wildlife Agreement: Snettisham and Eklutna Projects (1991 Agreement) requires the Eklutna Hydroelectric Project owners ("Owners") to develop and a Fish and Wildlife Program to protect, mitigate damages to, and enhance fish and wildlife impacted by the continued operation of the Eklutna Hydroelectric Project ("Project"). As signatories to the 1991 Agreement, we are obligated to participate in the design and review of the studies to elucidate the best methods to protect, mitigate damages to, and enhance fish and wildlife impacted by the Project. We have commented on three drafts of the Eklutna Study Plan (11/25/20, 2/4/21, and 3/11/21). On February 11, 2022, you provided nine draft study reports, Year 2 Study Plans for the six ongoing studies, and four additional studies that will begin in 2022. Per your request, we review the documents and provide the attached comments.

We are impressed with the progress the utilities made in 2021 towards completing the studies. The study implementation closely followed the details in the respective study designs. We now know more about fish distribution in the river and the reservoir and the inaccessibility of the small east and west tributary streams for spawning. The three September flow releases from the upper dam designed to calibrate the lower end of the HEC-RAS and PHABSIMS models were a success.

The study plans state that some important study components will be completed in 2022, including:

- Understanding the potential salmon spawning habitat in the East and West forks of the Eklutna River and their tributaries.
- Exploring the various engineering solutions to delivering water year-around from the reservoir to the Eklutna River to create fish habitat below the upper dam.
- Releasing a flow large enough to understand if periodic large flow releases can create and then maintain salmon spawning gravel, rearing habitat, and help mitigate fish passage barriers in the Canyon Reach.

Our comments on these study reports and designs are intended to improve the overall understanding of the project features and support data to inform actions going forward.

We enjoyed working collaboratively with the utilities, tribes and other agencies to explore ways to balance the protection and mitigation of damages to fish habitat in 2021. We anticipate this amicable effort continuing as the studies and the implementation of the 1991 Agreement moves forward. Please contact Sean Eagan at sean.eagan@noaa.gov or by phone at 907-586-7345 if you have any questions.

Sincerely,

Gretchen Harrington

Gretchen Harrington
Assistant Regional Administrator
for Habitat Conservation

Enclosure: NMFS Comments on the Draft Interim and Final Study Reports and 2022 Draft Study Designs

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Author Agency/ Interested Party	Study and section/ page	Particular "text" Referenced	Comment
NMFS	Geomorphology	General	We recognize that this study represents a tremendous amount of fieldwork under challenging conditions and the results have greatly expanded our collective knowledge of fluvial processes in the Eklutna River channel.
NMFS	Geomorphology Page 1	"… accomplish habitat restoration and increase the anadromous fish assemblage of the river."	For a river that would naturally have July flows consistently over 1,000 cfs (Hydropower Operations Modeling Report), the largest 2021 flow release (150 - 180 cfs) was too small to expect habitat restoration. This report did not provide information to indicate whether larger flows could create additional side channels or pool habitat that are essential components of fish habitat.
NMFS	Geomorphology Throughout report	General	To support reader friendly figures, we recommend selecting a color for each year and use it consistently on all transects and pebble count graphics. Consider other distinct identifiers if two activities occur in the (e.g., dashed line or a speckled bar).
NMFS	Geomorphology Throughout report	General	We recommend making the "Relative Elevation" Y-axis scale the same on most transect graphs. This will support data comparison among graphs. This could be altered for the three transects in the old reservoir.
NMFS	Geomorphology Table 4.2-1, Page 4	Column 2	Clarify which river reaches and miles you are referring to. There are at least three different ways to divide the river in these studies.
NMFS	Geomorphology Table 4.2-1 Page 4	Transects	Credit transects XS 2-Up, XS 4-Up, XS 2 Down, and XS 4 Down to NMFS. We set them up in 2017 and led the resurvey efforts. There were many days when the agencies and NVE worked together on these and other cross sections.
NMFS	Geomorphology 5.3 Page 24 - 80	Field Data: Transects	Although four different groups collected this data, the year-to-year transect/cross–sections comparisons are valid and indicate the broad pattern of scour and fill. We appreciate your effort getting all the data in one place.
NMFS	Geomorphology 5.3 Page 24 - 80	Field Data: Pebble counts	Group-to-group and year-to-year pebble counts should be interpreted with caution. Some groups only did pebble counts in the wetted (submerged) channel. Other groups counted pebble in any area recently wetted (e.g., if it looked like it flowed in the previous 24 hours). NMFS started out counting pebbles in the bankfull flow channel. Bankfull flow is difficult to determine in the Eklutna channel, which is why ADFG did not use this method. From the removed lower dam to the Thunderbird confluence, the addition of significant material has drastically changed bankfull demarcation.

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			Generally this has created a wide level plane with the active stream moving back and forth. Between the Thunderbird confluence and the Old Eklutna Road bridge, the channel has been more consistent over the last five years and the pebble counts should be comparable.
NMFS	Geomorphology 4.2. Page 16	"Substrate at the majority of transect locations consisted of fines covering cobble/boulder material and was not suitable for sub-surface sampling."	It is not a good representation of the subsurface to say we only took sub-surface samples where the armor layer was loose. The second item in study objective 1 seems incomplete.
NMFS	Geomorphology 4.2.3 Page 16	Sliding bead scour monitors	We request that these remain in place and be monitored until a flow event occurs that we would be expected to create scour. The 2021 releases were too small to create conditions conducive to scour in many reaches.
NMFS	Geomorphology 4.2.3 Page 16	Sliding bead scour monitors	Consider whether the action of installing these bead strings, loosen the interlocking nature of the gavels/cobbles (many are not very rounded) and therefore tend to predict more scour than would occur if the bead string had not been installed.
NMFS	Geomorphology 4.3, Page 18	4.3 Timelapse Cameras	We commend this addition to the study plan.
NMFS	Geomorphology 5.1.1. Substrate Data 2019 Page 19	"Between Thunderbird Creek and the lower dam site, substrate is primarily gravel with some bedrock and silt/clay"	This section is more diverse than this description suggests and at least at this time, there is no bedrock on the channel bottom. It is primarily material from the old reservoir mixed with rock fall from the canyon walls. Is rock fall considered bedrock?
NMFS	Geomorphology 5.2 Page 23	Table 5.2-1, Gradient	State when these slopes were measured. Primarily in reaches 4 and 5, this gradient is changing.
NMFS	Geomorphology 5.3.1.1. Page 26	Figure 5.3-3	If there was only one point bar pebble count conducted in the whole river, it is misleading to put it on the same graph with full channel pebble counts.
NMFS	Geomorphology Page 28	Figure 5.3-4 and 5.3-5 Transect G	It is difficult to follow when the picture displayed is looking downstream but the cross section is displayed as if you are looking upstream. The orientation matches at transect ADFG 2 and it is much easier to follow.
NMFS	Geomorphology Page 31	Figure 5.3-8 Transect ADFG 8	This is not all the data. ADFG did surveys twice a year starting in the fall of 2017. Having all the data would make a stronger report.

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NMFS	Geomorphology Page 38	Figure 5.3-14 Accelerometer	State what the three colors on the graph represent. Same request for 5.3-26 and any other acceleration graphics. Alternatively, clarify what accelerometers measure.
NMFS	Geomorphology 5.3.1. Page 39	Transect 204	Thank you for establishing this important transect at the old dam site.
NMFS	Geomorphology Figure 5.3-19 Page 43	Figure 5.3-19	Explain how you calculated the horizontal distance from the very sloped tape. Even if you did not adjust that distance calculation, thank you for making an effort in this difficult terrain.
NMFS	Geomorphology Page 45	Figure 5.3-21 Transect 201	This juxtapose of two pictures from very different locations is confusing.
NMFS	Geomorphology Figure 5.3-35; 5.3-45 Page 57	Transect 103 & 105	This data suggests that in 18 - 30% of the channel, fines were moved downstream and the armored layer was exposed. Please clarify if those 45 mm -128 mm pebbles were new material deposited from upstream.
NMFS	Geomorphology Figure 5.3-39 Pages 60 - 63	Transect E & Transect D	Transect E - This appears like an unanticipated channel movement; however, the grain size distribution is largely similar. This is a good discussion. Transect D – Also a good discussion
NMFS	Geomorphology Figure 5.3-49 Page 73	Transect B	Excellent site selection and documentation. If the after picture represents the natural distribution of sediment sizes this was once a huge river. Water depth affects stream competence. From the slope and that distribution of grain sizes can the pre-dam bankfull flow be calculated?
NMFS	Geomorphology Figure 5.3-52 Page 76	Painted Rocks Movement Study	Can different conclusions be drawn based on whether the cobble moved a few inches or is totally missing? Were particular shapes targeted, since some shapes move downstream much easier than others?
NMFS	Geomorphology Figure 5.3-5 Page 78	Transect A	The size of these cobbles combined with an unconfined channel seems to indicate very large flows. Do you think these cobbles and boulders represent flows in the decade prior to dam construction, or perhaps these cobbles were deposited when the Eklutna glacier extended across the lake thus the lake did not exist?
NMFS	Geomorphology Page approx. 81	General	We recommend expanding the hypothesis that it is a different type of rainfall event that moves the clay particles off the fans than channel forming flows. Clarifying this statement could support the sediment source evaluation planned for 2022.

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NMFS	Geomorphology 6.3 Need for a High Calibration Flow Page 83	"Monitoring during and after the 2021 study flow release of approximately 150 cfs showed that this flow was sufficient to accomplish three levels of flushing flows in the existing channel"	We disagree that the armor layer was disrupted at most locations. We do not agree that the sediment transport model calibrated with this data will be applicable for flows over twice the released volume.
NMFS	Geomorphology 6.3 Need for a High Calibration Flow Page 84	"… but data on substrate movement that did occur will be sufficient to extrapolate and calibrate the sediment transport computations."	We disagree. The forces and flows that initiate the unraveling of an armor layer or even initiate movement in large cobbles and boulders are extremely complex. You cannot simply extend a curve formed by what particle moved at three lower flows.
NMFS	Geomorphology 7 Variances Page 84	"One variance proposed for the 2022 study is to not include a high calibration flow in 2022 …"	A study to understand geomorphologic processes with flow release of 15% of the natural Eklutna Lake July inflow will not lead to a complete understanding of fluvial processes in the Eklutna River. Greater flow volumes will be necessary.
NMFS	Geomorphology 7 Variances Page 84	General	If the utilities manage for maximum energy production over the decade, these large flows will happen occasionally in the fall by accident. We should understand their effect on the channel and fish habitat. If channel flushing flows in the Eklutna River are not considered, then the river will never produce quality salmon habitat.
NMFS	Lake Aquatic Habitat and Fish Utilization Aka (Lake Aquatic Habitat) Page 1	"… that significant number of Sockeye Salmon ever spawned in the Eklutna River drainage due to limitations of suitable spawning area in tributaries upstream and in the littoral zone of the lake (USACE 2011)."	We appreciate that the quality of spawning habitat in the East and West Eklutna Forks and their tributaries will be evaluated in the 2022 summer.
NMFS	Lake Aquatic Habitat Page 8 & 20	"None of these smaller tributaries (WB A-H, and EB A-H) had suitable spawning habitat."	We agree the effort to investigate these tiny tributaries in 2021 was sufficient and appreciate the clear documentation in Appendix B. We look forward the work at the larger south end tributaries (Tributary 4 and East and West forks).
NMFS	Lake Aquatic Habitat Page 13	"Within the 14 areas surveyed, 68,512 square ft. of potential	Please indicate whether these are appropriate spawning sites for sea-run sockeye? If salmon were to spawn within the varial zone of the reservoir, it

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		spawning habitat was identified around the lakeshore and pond with mean pebble size range from 0.4 – 1.2 in. and mean embeddedness ranging from 32 – 68%."	seems the timing of alevin emergence might occur when the spawning bed was out of the water.
NMFS	Lake Aquatic Habitat 3.1.2, Page 14	"and the substrate is heavily sedimented."	Please clarify whether the substrate is embedded.
NMFS	Lake Aquatic Habitat	General	Consider moving some returning sockeye from a nearby river into the north end of Eklutna Lake and see if they find their way to tributaries at the south end and spawn. The study would need to follow up with if the eggs hatched and the juveniles grew to outmigration size.
NMFS	Lake Aquatic Habitat Table 3.3-2 Page 22	"No redds or spawning fish were observed in Yuditnu Creek, Tributary 4, or Bold Creek"	Please label Yuditnu and Bold Creek on future maps.
NMFS	Lake Aquatic Habitat Page 36	"lots of seeps/ groundwater expression along shoreline, *best gravels are high up near full pool*, lower in varial zone lots of fines sand/silt, "	The utilities management of Eklutna as a reservoir with 55 feet of surface elevation change annually makes spawning on the lake margins extremely unlikely. Redds in appropriate gravels at 10 feet of depth in the fall could be 20 feet above the water line in the spring.
NMFS	Fish Species Composition and Distribution Study aka (River Fish) 2.2, Page 8	2.2 Adult Salmon Spawning	ADFG staff have observed coho adults above the old dam. Please continue foot survey slightly farther above the AWWU access road in 2022.
NMFS	River Fish Page 9	Reach habitat Characteristics Table 3.1-1	It is unclear what bankfull refers to in a river controlled by a dam. That R-7 had a 4.26 feet bankfull depth is questionable. R-6 and R-8 also seemed high. This suggests all three reaches flowed 3 feet + deep every two years.
NMFS	River Fish Page 9	Table 3.1-1	Water gradient is consistently higher than the channel gradient in Geomorphology report table 5.2-1. Individual reaches could vary but the whole river being higher gradient is incorrect. Please reevaluate this data.
NMFS	River Fish Page 12	Figure 3.1-2	The data are clearly displayed. Excellent coordination with the surveys completed by NVE. That makes all the data stronger.

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NMFS	River Fish Page 14	3.2 Adult spawning	Since Chinook often run at peak river discharge and that would naturally be in July (per Hydropower Operations Modeling Report) the spawning surveys should start earlier in 2022. The Oct 28 cutoff of the spawning survey is appropriate.
NMFS	Water Quality Page 7	Figure 5-1 River Water Quality Sites	WQ-1 at 1 mile below site WQ-2 is typically 2° Celsius warmer. There is not enough sunlight in that canyon to produce that warming without some groundwater input. Being isothermal during the released was expected. Please expand the discussion of this temperature difference.
NMFS	Water Quality Page 8	Figure 5-2	The agreed upon monitoring included a thermistor string, not just one deep and one shallow measurement. This change in methods resulted in a data gap.
NMFS	Water Quality Page 9	Figure 5-3	The pond became slightly too warm for salmon for a few days in July. This is not surprising in a small, isolated, artificially pond, exposed to 20 hours of sunlight. This does not support the idea that this is an important fish habitat pond that needs to be maintained.
NMFS	Water Quality Page 10	Figure 5.4	This temperature data is overly consistent. The 9/28/2021 temperature generally seems right but exactly 9.4° C for 48 vertical feet is unexpected. Also, the straight line from 48 feet to 30 feet on 8/25/2021 seems odd.
NMFS	Water Quality Page 11	Figure 5.5	Please add information to show when the pond was hydrologically connected to the lake. Also update Figure 5.3.
NMFS	Water Quality Page 11	5.2.1 River Dissolved Oxygen	We agree that the turbidity may have confused the DO sensors. This does not count as a study plan objective completed. We should discuss value of repeating this study during the AWG meeting.
NMFS	Water Quality Page 15	5.2.3 River and Lake pH	The river is very basic (high pH) which does not seem ideal, but the data create a baseline. The whole watershed must be basic based on lake pH. Please add some discussion on this topic or compare it to similar Alaska lakes.
NMFS	Water Quality Page 16	5.3 Lake TSI	Please provide a comparison to state standards or other lakes in the area for chlorophyll a, total phosphorous, and TSI.
NMFS	Water Quality Page17	5.4 Turbidity	Turbidity levels doubled as the stream water goes through the old reservoir. There is almost no turbidity at WQ-3 and WQ-4. While this was

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			expected, it is good to have the data to confirm it. The amount of turbidity was substantially the same on all days with 75 cfs release.
NMFS	Water Quality Page 19	6 Interim Conclusions	If there is a second flow release season, we request turbidity measurements continue. Sites WQ- 1, 2 and 3 are important in that descending order. A lower cost single parameter turbidity meter could be deployed. With turbidity spiking to 250 NTU, likely higher during the 150 cfs release, precision of +/- 10 NTU would suffice.
NMFS	Water Quality Page 19	6 Interim Conclusions	The temperature and pH raise substantially as the streams goes through the canyon. A focused study to identify where additional warmer water is entering and the chemistry of that water would be informative. If the current very low flows are maintained, temperature and pH difference might affect egg viability or spawning. We recommend discussing this with the AWG.
NMFS	Water Quality Page 20	7- Variance	We confirm that Eagan was consulted and agreed with the decision to not put the water quality sondes in the water during the 150 cfs flow release. The moving of WQ-3 was perhaps necessitated by the formation of the beaver pond; however, the new placement made it redundant with WQ-4.
NMFS	Water Quality	NMFS request	There is additional WQ data collected in the Lake Habitat and Fish Distribution study. Please incorporate that data into this WQ study in the final report.
NMFS	Water Quality	NMFS Conclusion	The continuous temperature data (Objective 1) is not yet complete. The study appears to meet the Objectives 2 & 4. Objective 3 may meet the wording of the study request but more information during a second release would make the turbidity results more robust. In retrospect putting the WQ string directly above the intake may have been a poor location choice. NMFS is not concerned that the secchi measurements were not taken. NMFS appreciates the utilities continuing with the TSI work in Eklutna Lake in 2022.
NMFS	Stream Gaging	General	Gaging a river with low flows in a cold inaccessible canyon is challenging, especially to do it safely. We acknowledge the good effort put forth in 2021.
NMFS	Stream Gaging Page 1 Goals and also Results 5.1.1	Study Goals and Eklutna Gage below Thunderbird Confluence	We expect to see eight months of accurate discharge data from this accessible site in each of two consecutive years. The new location and rating curves look fine. We realize that ice will affect precision. Additional years of discharge data outside the study period would help meet the study

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		"were to gain a better understanding of the current flow regime in the Eklutna River".	goal "*were to gain a better understanding of the current flow regime in the Eklutna River*". Data collected during a 17 month window from May 2021 to October of 2022 is too short a sample period to support conclusions.
NMFS	Stream Gaging 5.2 Page 7	Eklutna Gage above Thunderbird	This gage location is more important to the Eklutna study than the below Thunderbird site; however, we acknowledge it is difficult to access. We are planning to receive 5 months of 15-min data in each of two consecutive years. Periodic checks and data in the other 7 winter months will be informative.
NMFS	Stream Gaging 5.3 Page 9	Lach Q'atnu Creek	The 5-month effort in 2021 was commendable. We hope a similar effort will continue in 2022.
NMFS	Stream Gaging 5.4 Page 11	Unnamed Tributary	We agree that gaging this stream is not possible. We would like to see an additional 3 to 4 spot measurements in 2022, to back up the "very little water" conclusions from 2021. Please take one measurement during peak snowmelt.
NMFS	Stream Gaging 6 Page 12	Accretion Study	While some water is leaving the river below the Old Glen Highway Bridge, it is a small percentage of the total flow. Further study of river losses in the lower three miles may be unnecessary.
NMFS	Stream Gaging Page 12	Accretion Study	The water quality study indicted groundwater inflows between the top of the canyon and the Thunderbird Creek confluence. Please evaluate this in 2022. At low flows, these canyon accretion flows appear to be important.
NMFS	Stream Gaging	NMFS Conclusion	This study was initiated as described in the study plan in May 2021 and we anticipate its completion in 2022 and possibly 2023.
NMFS	Instream Flow 2.2 Model Selection Page 4	"Both 1D and 2D modeling approaches are quantitative and provide a basis for incrementally evaluating changes in habitat with changes in flow."	HEC RAS models provide some predictions about future velocities and depths. Many more stream attributes determine whether a fish will use a particular habitat.
NMFS	Instream Flow 2.3 Page 5	"… channel morphology changes would likely continue to occur even after the 2021 target flow releases."	The channel did change substantially in the river mile 8 - 11 area; the models should not use pre-release transect data for HEC RAS modeling. The channel incised through the old reservoir sediments and aggraded above Thunderbird Confluence, however in neither area is it fundamentally different from a modeling viewpoint.

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NMFS	Instream Flow 2.4 Page 6	HSC/HSI	The year 1 work is not complete. Some of this was provided on 2/25/2022 but we have not had time to review it.
NMFS	Instream Flow 2.5.1 Page 6	Step 4 –selecting reaches	About half of the river miles were selected for modeling. What conclusions are we supposed to make about the habitat under the new flow regime in the other half of the 11 river miles?
NMFS	Instream Flow Page 9	Table 2.4-3	The described approach for the six modeled reaches is reasonable.
NMFS	Instream Flow Page 11	Reach 6- Dam to Thunderbird Confluence	While the reach from the old dam to the Thunderbird confluence is changing, it is also an important passage reach for fish. It could provide some habitat. This reach should be modeled.
NMFS	Instream Flow NVE Reaches 2 and 3 Page 10	"would be difficult to model with the 1D PHABSIM models. "	The logic for not working in this reach is flawed; just because it does not fit the tool selected, is not a reason to ignore a reach.
NMFS	Instream Flow NVE Reach 7 (Geomorphology 4,5,6) Page 11	"The channel is single thread and comprised predominantly of silt/clay."	This is not an accurate description of this channel. It braids in certain areas and there is more gravel and cobbles than described. With 1.5 to 2 percent slope the finer material is likely to move through once the old reservoir sediments are mostly gone.
NMFS	Instream Flow 3.1 Page 13	"HEC-RAS has been widely used to calculate water surface elevations and flood inundation areas at 100-year flood conditions."	We did not agree on the 100-event magnitude. It is unlikely that the utilities would release that much water. Also, the channel would change beyond recognition in the section from the upper dam to the Thunderbird confluence during a 100-year flood event. The model will not be very useful above 350 cfs because it was not calibrated for that flow.
NMFS	Instream Flow 3.1 Page 13	2021 Flow Releases	We appreciate the utilities replacing the release gate. We agree the 2021 flow releases were well executed and provide solid information about flows in this range of magnitudes.
NMFS	Instream Flow 3.2.1 Page 16	Temporary surveying benchmarks	Please confirm whether these benchmarks are still in place.
NMFS	Instream Flow Table 2.6-1 Page 18	30 PHABSIM Transects	For reaches 7-11 a known amount of water was released through a 30-inch square gate. How are the discharge measurements in this section useful? Were they considered more precise than the gate calculation? The 10 measurements in reach 11 vary by 20 cfs for a flow that was supposed to be 75 cfs.

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NMFS	Instream Flow Page 19	"Mean Column Water Velocity"	While a Sontek Flowtracker2 reads to 0.01 feet/sec. The velocities measured are not valid beyond 0.1 feet/sec. For the purposes of this action, precision beyond 0.1 feet/sec is not needed.
NMFS	Instream Flow Page 19	"Substrate was classified, according to the dominant subdominant, .."	Was this done at every place velocity reading was recorded, once per transect, or some hybrid approach? Did you do it at all flows or just at the 25 cfs release?
NMFS	Instream Flow 6. Variances Page 20	6. Variances	While the execution of three release was done exactly according to the study plan, the model will only be applicable for smaller flows unless a larger discharge is released and similar measurement are taken. At higher flows, methods would need to be adapted for safety. Not all transects could be measured.
NMFS	Instream Flow Appendix A	Instream Flow Transect Data – Eklutna River, Alaska	Appendix A is nicely compiled and easy to follow.
NMFS	Hydropower Operations 4.2 Page 5	"9-foot diameter concrete-lined tunnel spanning 23,550 feet to a surge tank and gate control house"	Please indicate whether the water in this 4.5-mile, 9-ft diameter tunnel is under pressure?
NMFS	Hydropower Operations 4.2 Power Conduit Page 5	Tunnel and Penstock	Please indicate whether there are any discussion of changing aspects of the 4.5 mile tunnel or 1,088-foot penstock in the next 20 years or if extensive maintenance or serviceable life issue that will arise. This could provide opportunities to alter the plumbing to get water back into the Eklutna River.
NMFS	Hydropower Operations 4.4.1 Page 9	Table 4.3-2	How much of the time in recent years has just one turbine been spinning? Is there a rule as to the discharge that cause the utility to activate the second unit?
NMFS	Hydropower Operations Figure 4.4-2 Page 10	Figure 4.4-2 Monthly Energy Production	The data should extend back another decade or two so we can see how much energy is produced in dry years.

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NMFS	Existing Infrastructure Assessment Pages 18 - 30	Discussion of the five bridges and their capacity to pass large flows	The five bridges should not have any issues passing flows up to 1,000 cfs per this study. Bridge capacity is not a valid reason to object to mid-sized channel maintenance flow releases.
NMFS	Existing Infrastructure Assessment 5.6, Page 23	AWWU pipe	The AWWU pipe has been in place at a depth of 6 feet or more for 40+ years. In that time, there have been six uncontrolled flows up to 1,029 cfs. The lower dam removal has no effect on this upstream pipe.
NMFS	Existing Infrastructure Assessment 5.6, Page 23	AWWU pipe	Is there expected maintenance needs on this pipe in the next 20 years? If this pipe is near its life expectancy, alternative siting should be considered so that large flows down the canyon could not affect Anchorage water supply.
NMFS	Existing Infrastructure Assessment 5.6, Page 23	AWWU pipe capacity	This pipe has a capacity of 154 cfs and yet the water treatment plant can only treat 49.5 cfs. This would seem to leave spare capacity to move water to the river channel through a pipe tap.
NMFS	Existing Infrastructure Assessment	General Request	Compare the Eklutna Lake energy storage at full pool (868 feet) to the largest storage battery in the state (Homer Electric?). This would help clarify the environmental tradeoffs of more fish friendly reservoir operating scenario.
NMFS	Macro-Invertebrates	General	NMFS agrees this met the objective of describing the invertebrate community.
NMFS	Macro-Invertebrates	General	These sites were depauperate of invertebrates. How does it compare to other sites in Alaska?
Year Two Study Plan Comments			
NMFS	Y2-Geomorphology and Sediment Transport Study Page 12	"It was concluded that there are no major structural concerns with the spillway;"	A larger flow release through the spillway in 2022 is possible.
NMFS	Y2-Geomophology 1.2.9 Page 13	"TWG generally agreed on an approach for the Instream Flow Study that includes conducting controlled flow releases in 2021,	This clearly states it will be a joint TWG decision on if a larger spillway flow is warranted in 2022.

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		then using that information to determine if a larger spillway flow is warranted and if so, then define that larger spillway flow so that the Project Owners can evaluate the feasibility of conducting such a flow in 2022 as part of the study."	
NMFS	Y2-Geomorphology Page 27	Figure 2-7 Eklutna Lake Levels	The colors are difficult to tell apart. Please clearly label the two years that had significant spill (fat green and red/orange)
NMFS	Y2-Geomorphology Page 28	"The average cost of power produced by the Project is $0.013 per kWh."	If the lake was never lowered below the new release gate (851 feet?) and 10% of the annual water was allocated to provide fish habitat in Eklutna River, what would be the average cost of power? Total generation would drop by less than 10% as there would be 10 - 30 feet more head at most times. How much less power would be produced in that scenario? Assume deliveries to AWWU remain constant and the annual hydrograph remained similar. Suggestion for Hydropower Evaluation Study.
NMFS	Y2-Geomorphology Page 28	The Probable Maximum Flood (PMF) for the Project was most recently updated by USBR in 1987.	Alaska climate has changed in the last 35 years and it would be wise to Recalculate the Probable Maximum Flood.
NMFS	Y2-Geomorphology 3.1.1.1 Page 33	Need for a High Calibration Flow in 2022 _ goal 2	Goal 2 (move substantial sediments) is not stated completely. Moving material from the sediment wedge was one goal, however, a "channel maintenance" flow should also remove several years of material from the alluvial fans, and trim back shrubs trying to encroach on the channel and create off channel rearing habitat. The 2021 release removed more material than expected from the sediment wedge, moved some material from the toe of the debris fans, and in most stretches left all the riparian vegetation intact. It was too small to create any new off-channel habitat. Because the previous maintenance flow was in 2013, a larger flow was likely required.
NMFS	Y2-Geomorphology 3.1.1.1 Page 33	3.1.1.1 Need for a High Calibration Flow in 2022 _ goal 2	Goal 3 (disrupt the armor layer). In most reaches, the armor layer was not disrupted. Gravel moved in a few areas that lacked an armor layer. Knowing that the flow was insufficient does little to tell you what flow is required to disrupt the armor layer. The 150 cfs release did nothing to turn

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			armored location into spawning habitat. In some reaches, like downstream of the Thunderbird confluence, the needed armor disruption flow may be a 50-year event, without the dam. In the 6 miles of valley it is likely considerably larger than 150 cfs but not un releasable.
NMFS	Y2-Geomorphology 3.1 Page 33	"flow release of approximately 150 cfs showed that this flow was sufficient to accomplish three levels of flushing flows in the existing channel configuration"	We disagree. Not all three levels flushing flow were accomplished.
NMFS	Y2-Geomorphology 3.1 Page 33	"but data on substrate movement that did occur will be sufficient to extrapolate and calibrate the sediment transport computations."	Please state which reaches have an armor layer, and the percentage of that layer that was disturbed by 150 cfs release.
NMFS	Y2-Geomorphology 3.1 Page 33		The veneer of fines was completely removed. Will year 2 studies tell us how long it takes that veneer of fines to re-accumulate? These fines are the Achilles' heel of establishing spawning habitat.
NMFS	Y2-Geomorphology 3.1 Page 34	"Channel migration cannot be directly modeled using HEC-RAS or other widely accepted models due to the often stochastic nature of channel migration"	We agree HEC-RAS is not an appropriate tool and look forward to the 2022 aerial photographic and LiDAR data analysis. We still believe large flows are the best tool to create off-channel habitat for rearing salmon. If the utilities are ruling this tool out, what tool do you plan to use to create off channel habitat?
NMFS	Y2-Geomorphology 3.1.1.1 Page 34	Based on the results of the 2021 study flow releases and monitoring data, a high calibration flow is not needed to calibrate the 1-D HEC-RAS sediment transport model.	Since river competence expands exponentially with water depth and velocity, sediment movement models are poor candidates for expanding outside the calibrated range. The flows that will unravel an armored channel bottom are extremely difficult to model.
NMFS	Y2-Geomorphology	General	Will the relative elevation of the transect pins be determined such that you could say between transect 2 down and 4 down, xxx cubic yards of material has accumulated.
NMFS	Y2-Geomorphology 3.1.4 Methodology Page 35	General	We look forward to the sediment source evaluation and the channel position through time analysis being completed in 2022.

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NMFS	Y2-Geomorphology 3.1.4.2 Map Channel Position Page 36	The 2015, 2020, and planned 2022 LiDAR data will also be compared within GIS to evaluate channel change between the three times to provide additional information on channel bed changes	Since there were no large flows in this period, it is doubtful we can learn about channel change in most river reaches. We do agree that this technique will clarify change in the sediment wedge.
NMFS	Y2-Geomorphology 3.1.4.4 Sediment Input/Transport Analysis and Modeling Page 36	BAGS (Bedload Assessment in Gravel-bedded Streams)	What is the definition of a gravel bed stream? The majority of the material moving is sand sized and smaller. Can your analysis put estimates on the percentage of moved material in each grain class?
NMFS	Y2-Geomorphology 3.1.4.4 Sediment Input/Transport Analysis and Modeling Page 37	"3) disrupt the armor layer and move interstitial fine sediment; and 4) result in bank erosion/channel migration."	We are skeptical your techniques can meet these goals with any degree of accuracy. How do you intend to back up the model's outputs?
NMFS	Y2- Instream Flows 3.2.4.1 Page 41	To make velocity calibration adjustments, the Manning's n may be varied for specific cells.	Clearly indicate the Manning's n for each cell. If the model needs to vary too much from observed Manning's n values – the model is not working.
NMFS	Y2- Instream Flows 3.2.4.1	HSC and HSI	HSC and HSI based purely on depth, velocity and substrate over simplify salmon habitat and can lead to incorrect projections.
NMFS	Y2- Instream Flows 3.2.4.1 Page 42	Cross-section vs transect	In the ISR for Y1 studies, you only use the word transect; now you are using cross-section. What do you consider the difference in meaning between transect and cross-section?
NMFS	Y2-Instream Flows 3.2.4.3 Page 43	"HSC/HSI models will be developed based first on existing data sets from other instream flow studies in Alaska with a preference to HSC/HSI data developed from glacial fed systems"	Do not cite the Susitna studies. Those were neither completed nor peer reviewed. We do not feel they are valid.

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NMFS	Y2-Instream Flows Conclusion	2D model development versus higher flow release	A higher flow release in 2022, provided nature somewhat cooperates, would tell us more than these four 2D models. The AWG should think carefully about the best way to spend resources.
NMFS	Y2 Studies-River Fish Page 46	"specific locations within the canyon reaches may become fish passage barriers"	Rockfall will happen and may create passage barriers. It is very difficult to predict where rockfall will happen. We have doubts the cameras will give you the information mentioned.
NMFS	Y2 Studies-River Fish Page 46	"We propose to evaluate the four cascades (A-D)"	We fully support some evaluation of how these 4 semi-barriers evolve/devolve. Even if new rockfall happens elsewhere, the same lessons could be applied. Two big questions – 1) what flows over what duration cause the barrier height to decrease so fish can pass? 2) Could they be ameliorated with hand tools so fish could pass?
NMFS	Y2 Studies-River Fish 3.3.2 goals	Goals	These 4 goals are reasonable.
NMFS	Y2 Studies-River Fish 3.3.4.1 Page 51	Electro fishing	How is this second year of electrofishing and meso habitat delineation going to change the future management decisions? If the meso habitat changes from 2021 what will be learned from that?
NMFS	Y2 Studies-River Fish 3.3.4.2 Page 52	Adult salmon survey	Extend a little farther up the river. We agree with ADFG that a few coho may have made it up here.
NMFS	Y2 Studies-River Fish 3.3.4.3 Page 53	Passage Barrier Analysis	These barriers may become passable only at the highest flow of the year. It is unclear if that will be 50 cfs, or 150 cfs, or 400 cfs. We would encourage you to study them at a range of larger flows.
NMFS	Y2-Lake Habitat 3.4 Page 58	"small tributaries entering both forks of Eklutna Creek with low-gradient (<3%) access points and available rearing and spawning habitat including Serenity Creek and West Fork Sidewall Tributary."	Our interpretation of these preliminary reports and NVE reports is that there is more quality spawning habitat in these streams than previously thought. We agree with the Year 2 Goals.
NMFS	Y2-Water Quality 3.5.1	"Collect continuous water temperature data in Eklutna Lake	The temperature data from the river collected in 2021 was what we understood from the study plan. The lake temperature data was less

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	Page 61	and the Eklutna River" Objective 1 Water Quality Study plan. We are not sure when the words "two depths" were added to the methods.	informative than we expected so we are glad you are continuing this data series in 2022. We would like a thermistor string with FOUR hobo temperature logger in the Western end of the lake and not directly over the intake. (0.5, 4, 8 meters below the surface and 1 meter off the bottom or similar). The upper 55 feet is sufficient. The time period from early-May until the lake turns over in October is sufficient. The goal is better understanding or lake stratification mid-summer and spring and fall turnover. Please leave the string in until the lake turns over in the fall.
NMFS	Y2-Water Quality 3.5.1 Page 62	In situ DO and pH	The date presented in the ISR are acceptable. We are not concern the secchi depth measurement did not work out.
NMFS	Y2-Water Quality 3.5.3 Page 62	Thermistor String 1- located in Eklutna Lake near the Project intake structure	Please consult with the AWG about this location. If we want to understand lake stratification perhaps right above the intake is not the best location. A new pipe to move water from the lake into the river may be constructed at a different location.
NMFS	Y2-Water Quality 3.5.5 Page 65	Reporting	Some water quality data was collected during Lake Fish Habitat and River Fish studies. Please find a way to integrate that data into this report. It can also remain in those reports. Please do not pull out the thermistor strings until the lake turns over.
NMFS	Y2-Stream Gaging 3.6.6 Schedule Pages 66 and 69	Long Term Stream gaging	Consider keeping one of the Eklutna stream gages operating until the *program to protect and mitigate damages, and enhance fish and wildlife (*stated in 1991 Agreement) is implemented. The site above Thunderbird Creek confluence would be most valuable, but we realize the Bridge site is logistically easier. If you go with the bridge site consider installing heating elements so we can have 8 - 9 months of measured data as opposed to 5-6 months. We realize ice effect may still make December – early March measurement extremely difficult.
NMFS	Y2-Stream Gage Figure 3-12 Page 68	Schematic of stream gage	This sample picture is from another river. Include pictures of both Eklutna River gages and the Lach Q'atnu Creek gage. Include GPS coordinates.
NMFS	Y2-Engineering Feasibility	It is challenging to rank alternatives based on scoring criteria including costs if design is only at the 15 percent level of design. With less than 15% design drawings, the cost is an extremely lose estimate.	

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NMFS	Y2-Engineering Feasibility	Please consider the following items 1-9. We plan to fully engage in the alternative discussions.	
NMFS	Y2-Engineering Feasibility	1) **Maintain the lake at or above the 30" X 30" new release gate elevation (852 feet):** This would allow water to be released to the channel at any time during the year. It would also be a means for smolt to swim downstream. While it would entail a completely new operating procedure, new infrastructure cost would be comparatively small. This could be paired the Trap and haul for adults (#7).	
NMFS	Y2-Engineering Feasibility	2) **Construct a new AWWU pipe along the road: Use the existing AWWU pipe to deliver water to the Eklutna River:** This would allow a similar operating scenario, depending on the amount of water for fish. This might support smolt outmigration. It would be desirable to return the water to the channel further upstream of the "portal" if possible. With a new AWWU pipe near the paved road, the dirt track and 7 crossing in the Eklutna River Valley would no longer need to be protected.	
NMFS	Y2-Engineering Feasibility	3**) Bore a new pipe through the old glacier moraine** and under the 1964 dam into the river channel for water releases.	
NMFS	Y2-Engineering Feasibility	4) **Dual use of the AWWU pipe:** The AWWU pipe currently has unused capacity. There may be engineering solutions where a pipe tap could release 10-90 cfs into the river.	
NMFS	Y2-Engineering Feasibility	5) **Channel Maintenance flows based on water year:** Due to the massive alluvial fans some method to move sediment down the river will always be needed. In wet years, based on some annual precipitation amount by Aug 1, the utilities would agree to a release through the spillway in late September to October. This would pair well with a new AWWU pipe adjacent to the paved road. Consensus-based protocols with the utilities could be developed to release and maintain flows.	
NMFS	Y2-Engineering Feasibility	7) **Trap and Haul:** For the first decade, we recommend trapping salmon that migrate to the dam and releasing them into the lake. While not a permanent solution this works as a temporary measure.	
NMFS	Y2-Engineering Feasibility	6) **Fish ladder:** The Eklutna dam is a height where a fish ladder is feasible. With minor operating changes the reservoir could be mostly full when the adult salmon return.	
NMFS	Y2-Engineering Feasibility	8) **Juvenile Fish Collector in Eklutna Lake:** Collecting juvenile fish for release below the dam would allow current drawdowns to continue.	
NMFS	Y2- Engineering Feasibility 3.7.5 and 3.7.6	9) **Schedule and Costs:** The proposed schedule and costs to develop alternative are optimistic. This 1991 Agreement goal of accommodating human and salmon needs can only be met with careful planning and compromise.	
NMFS	Y2-Hydropower Valuation 3.8.2	Goals and Objectives	We suggest a fourth objective to include 30% less storage in Eklutna Lake. This opens many more possible solutions. This loss of energy storage be replaced at this site or elsewhere on the railbelt grid.

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NMFS	Y2-Hydropower Valuation	Goals and Objectives	Quantifying lost revenue or increased greenhouse gas emissions is not practical without a better understanding of water needs for fish habitat.
NMFS	Y2-Hydropower Valuation	Goals and Objectives Increased Risk of Discharge	Every dam creates some risks. Many of the risks along the river channel are being suggested as more risky then the infrastructure report says. The risk "targets" in the 6-mile Eklutna Valley should be relocated. Six feet of scour in a sediment abundant valley is unlikely. The old and new Glenn highways bridges are not at risk. The railroad bridge is an unknown, but bridges have life expectancy of about 100 years – it was built in 1927.
NMFS	Y2-Hydropower Valuation	Methodology	The reservoir stage versus storage curve from 1964 looks oversimplified. Ensure the method used incorporates surface area increases with water surface elevation.
NMFS	Y2-Hydropower Valuation	Intricate Connection	Eklutna Lake has been a key component in the railbelt power mix for 60 years. It is oversimplifying the grid system to say every watt not generated at Eklutna will be more natural gas burned.
NMFS	Y2-Wetland and Wildlife Habitat 3.9.4.6 Page 78	"cast forward to potential future disturbances or improvements for use in evaluating habitat and wetland function change"	This cast forward should consider the continually warming climate. Even simple metrics, like increasing frost-free days, would provide a clearer picture.
NMFS	Y2-Terrestrial and Wildlife Studies 3.10.2 Page 81	General	Any increase in anadromous fish, be it a few coho in the Eklutna River Valley, or 500 sockeye spawning in the East and West forks, will enrich the trophic food chain. In a few decades anadromous fish in that lake would likely benefit all key species.
NMFS	Y2-Terrestrial and Wildlife Studies 3.10.4.3 Page 83	Beaver Pond Mapping and Beaver Survey	Beaver ponds create rearing habitat and occasionally create fish barriers. From our viewpoint, this is the most important component of the wildlife survey.
NMFS	Y2-Cultural Resources 3.13 Page 96	"NVE is a federally recognized tribe"	If any entity chooses to pursue federal funds, this is an important fact.

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NMFS	Y2-Cultural Resources 3.13.1.1 Page 96	"The rail bed at Eklutna was moved in 1968 due to shoreline erosion"	How does this information compare with the infrastructure study saying the railroad bridge was built in 1927?
NMFS	Y2-Cultural Resources 3.13.3 Page 98	"The study area for traditional cultural properties will be larger than that for archaeological and historical sites."	Traditional Cultural Properties are very different from the 36 archeological and historic sites listed in the AHRS. Traditional Cultural properties should at least have their own section and perhaps their own study.
NMFS	Y2-Cultural Resources 3.13.4.2 Page 99	Field Surveys	No evidence of pre-1900 human use in that Eklutna Valley does not mean the Eklutna people did not use that valley. Large flows combined with the continually expanding alluvial fans would have quickly erased evidence of past human use.