FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, DC 20426
May 14, 2025

OFFICE OF ENERGY PROJECTS

Project No. 14873-001 – Alaska
Nuyakuk River Hydroelectric Project
Nushagak Electric and Telephone
Cooperative

VIA FERC SERVICE

Will Chaney
Electric Operations Manager
Nushagak Electric and Telephone Cooperative
P.O. Box 350
Dillingham, AK 99576

Reference: Determination on Requests for Study Modifications for the Nuyakuk River Hydroelectric Project

Dear Mr. Chaney:

Pursuant to 18 C.F.R. § 5.15 of the Commission's regulations, this letter contains the determination on requests for modifications to the approved study plan for Nushagak Electric and Telephone Cooperative's (Cooperative) proposed Nuyakuk River Hydroelectric Project No. 14873 (project), located on the Nuyakuk River in the Dillingham Census Area, Alaska. The determination is based on the study criteria set forth in sections 5.9(b), 5.15(d), and 5.15(e)) of the Commission's regulations, applicable law, Commission policy and practice, and the record of information.

Background

The Cooperative's study plan was approved on August 24, 2022, with modifications. The Cooperative filed its initial study report (ISR) on December 1, 2023, and on April 18, 2024, Commission staff issued a determination on requested study modifications and new studies.

The Cooperative filed its updated study report (USR) on December 2, 2024, held updated study report meetings in Dillingham, Alaska on January 15 and 16, 2025, and filed a meeting summary on January 30, 2025.

On January 22, 2025, the United Tribes of Bristol Bay (UTBB) requested a 90-day extension of time (May 20, 2025) to file comments on the USR. UTBB requested the extension to provide more time to review and prepare comments on several study reports

that were not included in the USR and were scheduled to be filed by February 15, 2025. On January 29, 2025, Commission staff extended the comment period by 30 days to March 21, 2025, reasoning that the extra time would provide UTBB a reasonable amount of time (i.e., a total of 30 days) to review and provide comments on the outstanding study reports without jeopardizing the Cooperative's ability to collect sufficient data during 2025 field season, if needed.

The Cooperative filed an addendum to the USR on February 14 and 21, 2025, containing the results of the four outstanding studies that it did not have time to include in the USR.

Comments on the USR and meeting summary were filed by Choggiung Limited, Bristol Bay Native Corporation (BBNC), Royal Coachman Lodge, Commission staff, National Marine Fisheries Service (NMFS), Bristol Bay Native Association (BBNA), Portage Creek Village Council, Alaska Department of Fish and Game (Alaska DFG), Trout Unlimited, Commercial Fishermen for Bristol Bay (Commercial Fishermen), U.S. Fish and Wildlife Service (FWS), Wood-Tikchik State Park Management Council (the Council), UTBB, Bristol Bay Science and Research Institute (BBSRI), New Koliganek Village Council, Ekwok Village Council, Aleknagik Traditional Council, Traditional Council of Togiak, and multiple members of Tribes and the public.

The Cooperative filed reply comments on April 22, 2025.

General Comments

This determination does not address requests for modifications to studies or portions of studies that were previously requested and not required by prior study determinations, or issues that were already addressed in prior study determinations.

Many of the comments filed do not specifically request additional studies or modifications to the approved studies, but rather they state opposition to the project. Others request changes in the presentation of data and results; request edits and changes to the format of the USR; recommend post-license monitoring studies or other protection, mitigation, and enhancement measures; request project effects analyses; disagree with the utility of the Cooperative's study results or models in predicting project effects; and repeat requests for additional time to file comments or to hold additional in-person meetings with the public and Tribes. This determination does not address these comments, but only addresses specific requests to modify the approved study plan or conduct new studies.

Study Plan Determination

Pursuant to section 5.15 (d) and (f) of the Commission's regulations, any proposal to modify a required study must be accompanied by a showing of good cause, and must include a demonstration that: (1) the approved study was not conducted as provided for

in the approved study plan, or (2) the study was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way. As specified in section 5.15 (e) and (f), requests for new information gathering or studies must include a statement explaining: (1) any material change in law or regulations applicable to the information request, (2) why the goals and objectives of the approved study could not be met with the approved study methodology, (3) why the request was not made earlier, (4) significant changes in the project proposal or that significant new information material to the study objectives has become available, and (5) why the new study request satisfies the study criteria in section 5.9(b). In addition, as specified by section 5.15(f), any requests for new information gathering or studies in response to a USR must demonstrate extraordinary circumstances warranting approval.

As indicated in Appendix A, requested modifications to two studies are approved with Commission staff's recommended modifications. The remaining requested modifications and the requests for two new studies are not approved. The basis for these findings is explained in Appendix B (Requested Modifications to Approved Studies) and Appendix C (Requested New Studies). Commission staff considered all study plan criteria in section 5.9 of the Commission's regulations; however, only the specific study criteria particularly relevant to the study in question are referenced in the appendices.

Nothing in this determination is intended, in any way, to limit any agency's proper exercise of its independent statutory authority to require additional studies.

If you have any questions, please contact Matt Cutlip at (503) 552-2762 or email at matt.cutlip@ferc.gov.

Sincerely,

JOHN WOOD

Digitally signed by JOHN WOOD
Date: 2025.05.14 09:16:39 -04'00'

for
Terry L. Turpin
Director
Office of Energy Projects

Enclosures: Appendix A – Summary of Determinations on Requested Modifications to Approved Studies and New Studies
Appendix B – Staff Recommendations on Requested Modifications to Approved Studies
Appendix C – Staff Recommendations on Requested New Studies

APPENDIX A

SUMMARY OF DETERMINATIONS ON REQUESTED MODIFICATIONS TO APPROVED STUDIES AND NEW STUDIES

Requested Modifications to Approved Studies (see Appendix B for discussion)

Study	Recommending Entity	Approved	Approved with modifications	Not Required
1. Additional Tribal and Public Engagement (*multiple approved studies*)	Multiple Tribal and Public Commenters			X
2. Additional Study Seasons (*multiple approved studies*)	Royal Coachman, UTBB, New Koliganek Village Council, Trout Unlimited, Multiple Tribal and Public Commenters			X
3. Characterization of Fish Community and Behavior near the Project Intake	Alaska DFG, BBSRI			X
4. Nuyakuk Falls Fish Passage Study	NMFS, Trout Unlimited, BBSRI			X
5. Fish Entrainment and Impingement Study	BBSRI, Trout Unlimited			X
6. Salmon Life Cycle Model	UTBB, Trout Unlimited, BBSRI			X
7. Integrated Risk Assessment of Fish Populations	UTBB, Trout Unlimited, NMFS, BBSRI			X
8. Subsistence Study	UTBB, Alaska DFG, FWS, BBNA, the Council		X	
9. Recreation	Royal Coachman,		X	

Study	Recommending Entity	Approved	Approved with modifications	Not Required
Inventory by Season	Trout Unlimited, UTBB, New Koliganek Village Council			
10. Section 106 Evaluation	UTBB			X
11. Economic Decision Support Tool	Commercial Fisherman			X
12. Aesthetics Study	Royal Coachman, the Council			X
13. Environmental Justice Study	UTBB			X

Requested New Studies (see Appendix C for discussion)

1. Construction Equipment Study	Royal Coachman			X
2. Moose Study	Bristol Bay Native Corporation			X

APPENDIX B

STAFF RECOMMENDATIONS ON REQUESTED MODIFICATIONS TO APPROVED STUDIES

I. Requests for Study Modifications

Additional Tribal and Public Engagement

Requested Study Modification

Multiple commenters state that additional opportunities for public engagement, education, and comments on all studies are needed to ensure that all the risks from constructing the project are meaningfully assessed before the project moves forward in the licensing process.

Reply Comments

The Cooperative states that it has encouraged and solicited regional participation at all levels throughout the licensing process, via a variety of means, including in-person meetings, phone calls, virtual meetings, updates to the project website, resource-specific technical working groups, and over 120 meetings and presentations related to the project. The Cooperative states that it has documented through its consultation record the level of consistent effort it has put forth to request objective input from stakeholders. The Cooperative disagrees with the assertion that there was a "lack of opportunity to participate" in the process, and states that it is confident that the comprehensive consultation record that it has maintained throughout the licensing process documents its attempts to bring all perspectives to the table.

Discussion and Staff Recommendation

The Integrated Licensing Process (ILP) provides multiple opportunities for stakeholders to request studies (section 5.9(a)), comment on the content of the Cooperative's study plan (section 5.12) and recommend modifications to the study plan after review of the Initial Study Report (ISR) and Updated Study Report (USR) (section 5.15(c) and 5.15(f)). Further, there will be additional opportunities for stakeholder engagement in the licensing process following the filing of the draft and final license applications, and during preparation of Commission staff's environmental analysis. Therefore, there is no need to require additional opportunities for public engagement, education, and comments on the project or the Cooperative's studies beyond what is required by the ILP regulations.

Additional Study Seasons

Requested Study Modifications

Royal Coachman, UTBB, New Koliganek Village Council, Trout Unlimited, and multiple commenters state that the Cooperative's studies were conducted during two wet years with higher-than-average river flows; therefore, the study results are insufficient to assess how the project might affect fish passage in warmer seasons where river flows would be substantially lower. Royal Coachman states that the Cooperative's studies, particularly the Salmon Life Cycle Model study (discussed further below), should continue for a longer period to accurately represent some low water years, which may be the norm in the future with climate change. New Koliganek Village Council states that 2019 was an extremely low-flow year in the region, with many creeks and streams drying up and that the next study season (2025) would likely be a low water year due to low snowpack. Therefore, additional studies need to be conducted to capture the high and low flow trends to fully access the risks of the proposed project. Multiple commenters request that the studies continue for several more years to encompass the entire 4- to 5-year life cycle of a salmon.

Reply Comments

The Cooperative states that the Commission's licensing process stipulates a 2-year study period, and even if studies occurred for more than 2 years, it is rarely possible to capture the entire range of conditions that might be expected over the operational life of a hydropower project or the term of a license. The Cooperative states that its studies and models, including the life cycle model, integrated risk assessment, agent-based fish passage model, entrainment study, tailrace false attraction study, and 2-D hydraulic and fish habitat model, were able to consider a wide range of hydrologic conditions at the project site ranging from less than 1,000 cubic feet per second (cfs) to over 25,000 cfs. The Cooperative asserts that the model results provide significantly more insight and predictive ability than would have been possible if empirical data were collected for a longer period.

Discussion and Staff Recommendation

As discussed in detail in our analysis and recommendations for each of the aquatic studies below, the Cooperative conducted numerous studies and modeling analyses to describe baseline conditions and predict changes in aquatic habitat and fish use at the project site. Although, as the commenters point out, the studies and models were generally conducted during two high-water years, the data that were collected are sufficient to describe baseline conditions, and the models provide sufficient predictive ability to assess changes in aquatic habitat and fish use at the project site under a range of flows (section 5.9(b)(4), including low-flow conditions of concern to the commenters.

Therefore, we do not recommend requiring the Cooperative to continue its aquatic studies for additional years to attempt to capture low-flow conditions, or to encompass the entire life cycle of salmon.

Characterization of Fish Community and Behavior near the Project Intake Study

Background

The primary goal of this study was to determine the baseline seasonal timing, species composition, relative abundance, habitat use, and migratory patterns of the different fish species and life stages in the Nuyakuk River at the project site. The study was implemented across two sampling seasons using various netting, trapping, and observational methods. Fish sampling occurred throughout the ice-free period beginning with sampling of out-migrating salmon smolts in May followed by summer sampling of juvenile and adult resident fish and migrating anadromous salmon. Sampling continued in the fall to evaluate juvenile fish use at the project site.

Additional study methods included: (1) deploying a hydroacoustic array in the river near the intake to monitor downstream migrating juvenile fish distribution for two sampling seasons; (2) tagging and tracking adult salmon and resident piscivores (e.g., rainbow trout, grayling) using radio telemetry and a fixed receiver array at the falls to evaluate upstream passage behavior of salmon and to document habitat use by piscivores for two sampling seasons; and (3) using boat and fixed-wing aerial surveys during the winter of 2023-2024 and the 2024 study season to track movements of adult tagged salmon and resident piscivores at and in the vicinity of the project site.

The Cooperative states its view that the study is complete, and the results are included in the USR.

Juvenile Salmon Enumeration and Apportionment

Requested Study Modification

Alaska DFG states that the Cooperative proposes to use relative abundance metrics such as Catch Per Unit Effort (CPUE) to describe fish abundance, but Alaska DFG does not believe that there has been enough juvenile salmon outmigration data collected at this point to accurately quantify CPUE. Alaska DFG asserts that the Cooperative's juvenile salmon sampling efforts were sporadically implemented throughout the outmigration and the efforts that were undertaken were largely unsuccessful. Alaska DFG asserts that juvenile salmon (both smolt and fry) are the most vulnerable species and life stages to be affected by the project, and it is difficult to

understand from the data that were collected what the spatial and temporal passage of the different species of juvenile salmon were as they migrated through the project reach.

Alaska DFG states that the Cooperative's adult salmon studies revealed that significant numbers of pink salmon spawn above the falls. Alaska DFG states that given this information, further studies need to be conducted to determine when juvenile pink salmon out-migrate, what side of the river they travel on, and how they will be affected by project operation (e.g., turbine entrainment). Alaska DFG states that because pink salmon in Bristol Bay have a dominant even-year cycle, the studies should be conducted in even years.

Alaska DFG points out that the Cooperative's sonar data shows pulses of outmigrants, but it is unknown, due to a lack of verification sampling, what different species are represented in the sonar data and whether there was overlap between returning adult salmon and out-migrating juvenile salmon that might have interfered with interpretation of the sonar data. Alaska DFG states that because of the large sockeye salmon population, it is difficult to identify other species during outmigration; however, without this information it is impossible to know how susceptible the different species and life stages of juvenile salmon will be to project effects. To provide additional information on the species and life stages of juvenile salmon at the project, Alaska DFG recommends a "full-scale juvenile salmon outmigrant enumeration and apportionment study that can provide information on what species are out-migrating during which date ranges and in what volumes."

BBSRI states that the hydroacoustic data collection demonstrated that the bulk of the downstream migrating juvenile sockeye are primarily located in the channel's zone of dominant flow near the thalweg. BBSRI states that longitudinal trawl surveys down the channel below the falls reach were attempted as a fish inventory technique in 2023; however, "this approach was deemed ineffective due to hydraulic conditions." BBSRI states that fish collection sampling in 2023 and 2024 were conducted adjacent to the shoreline using fyke nets because it was determined to be too dangerous to sample in the migration corridor above the falls. BBSRI states that it doesn't believe the fyke net sampling was sufficient to achieve the study objectives.

BBSRI recommends an alternative sampling approach of operating an Inclined Plane Trap (IPT) at one of the three main river channels at the downstream portion of the falls. BBSRI recommends that sampled fish be measured for length, age, and species (using genetics sampling and analysis methods). BBSRI notes that IPTs were originally proposed in the RSP, but this method was replaced with beach seining and fyke netting because IPT operation was costly and logistically complex to carry out. BBSRI states that it was therefore agreed in consultation with stakeholders that the Cooperative should first attempt sampling with beach seines and fyke nets and reserve the IPT as a future potential method should the other sampling techniques be ineffective.

In support of its recommended IPT sampling, BBSRI states that fish species and life stage identification using the Cooperative's methods was likely challenging because collected fish were small with most being on the small end of their expected size range (e.g., very few samples >80 millimeters); and (2) the size of collected smolts was lower than other Bristol Bay sockeye smolts, which typically average 80-95 millimeters for age 1 and 103-122 millimeters for age 2 (2016-2019 data for Kvichak and Ugashik Rivers), suggesting that the fyke nets may have biased sampling toward smaller fish sizes.

BBSRI contends that it is not possible to ascertain from the data in the USR "the needed statistics to accurately characterize sockeye smolts and other co-migrating species passing over the array." BBSRI states that it expects that fish may distribute differently vertically and horizontally in the river channel depending on their species and life stage, so larger and older fish may not have been in that part of the channel where fish were sampled near the shoreline. BBSRI points out that turbine survival is partly fish length dependent, so if larger fish were indeed missed in the sampling, mortality rates and project effects analyses could be underestimated because larger fish have a higher risk of turbine mortality.

BBSRI asserts that fish length distribution is needed to support acoustic analyses (relationship between length and acoustic target size) and survival analyses for the entrainment study. BBSRI states that it recommends a sampling protocol to measure the length of at least 100 sockeye smolts every four days for the period starting the last week of May and continuing through the first week of July to collect the appropriate data to characterize the population.

Reply Comments

The Cooperative acknowledges that during initial study plan development it considered using IPTs and rotary screw traps (RST) for juvenile fish sampling. However, it determined that it would be logistically infeasible, unsafe, and too costly to attempt to deploy and operate enough of these traps to cover the entirety of the thalweg, 24 hours/day, over three months, just upstream of a significant hazard (i.e., Nuyakuk Falls). The Cooperative states that operating IPT and RSTs farther upstream where conditions are safer and more suitable for operating these types of traps (and where previous smolt trapping efforts have been implemented) would eliminate the site-specific data on lateral distribution of fish at the intake site that is so important to the analysis of project effects. The Cooperative states that it discussed these issues with the Aquatic Resources Working Group (Aquatic RWG) following a site visit in 2022 when the consultant team and BBSRI considered possible locations for an IPT/RST at summer base flow. However, even under base-flow conditions it was determined that deploying/operating IPT/RSTs at the intake location was infeasible.

The Cooperative acknowledges that the sonar system cannot distinguish between species of small fish very well, but nonetheless provided a safe, and highly informative site-specific dataset that shows how migrating smolts were distributed vertically, horizontally, and temporally across the channel throughout the smolt outmigration seasons in two successful study years. The Cooperative states that while it does not know exactly what species of outmigrants were present during which time periods, the study results do show that most fish were sockeye salmon originating from a wide range of upstream habitats including the Nuyakuk River mainstem, tributaries, lakes, and tributaries to lakes. The Cooperative states that Chinook, coho, and pink salmon were sampled by the project team, but in very small numbers compared to sockeye. The Cooperative states that if it conducted additional physical sampling to attempt to determine the horizontal and vertical distribution of these less-common species at the intake location, it is likely that hundreds of thousands of fish, if not more, would need to be captured to overcome the dilution factor of the tens of millions of sockeye salmon juveniles that move through the system during the outmigration period.

Discussion and Staff Recommendation

The Cooperative implemented a variety of sampling methods to assess juvenile fish use at the site, but predominately relied on fyke and seine netting to verify species composition and size distribution of juvenile fish detected by the hydroacoustic array. Due to the logistical and safety issues associated with sampling in the fast, deep water in the intake vicinity immediately upstream of the falls, nets were mostly deployed in near-shore areas, with the fyke net being deployed immediately downstream of the hydroacoustic array near the intake location. According to USR figure 5-2, fish community sampling occurred during spring, summer, and fall 2023 and 2024, with additional targeted verification sampling of the hydroacoustic array occurring in early May and in the month of June in 2024.

The results show that 18 fish species and 34 different life stages were sampled over the 2-year study. For juvenile salmon, sockeye were the most abundant species encountered, but pink salmon fry were also sampled in large numbers.[1] Most juvenile sockeye and pink salmon used the falls reach as a downstream migration corridor rather than foraging and rearing habitat. The other three salmon species were substantially less abundant, but those collected used the falls reach for rearing and foraging in addition to migration habitat. For all sampled juvenile salmon, nearly all fish of all species were less than 100 millimeters in length.

Although the Cooperative's sampling efforts collected only small numbers of juvenile coho and Chinook salmon, no chum salmon, and all sampled fish across all

[1] The USR indicates that "thousands" of juvenile fish of both species were sampled.

species were generally less than 100 millimeters, the sampling occurred in the vicinity of the project intake and during the known migration period for rearing and migrating juvenile salmon using accepted sampling methods for the target fish species that could safely be implemented at the site (section 5.9(b)(6)). Further, the results showed generally that the relative abundance of juveniles sampled by species was proportional to the abundance of adults sampled by species,[2] suggesting that the juvenile fish that were sampled were representative of the fish species and their abundance at the site. Therefore, we don't believe that additional sampling to attempt to capture more juvenile salmon would provide a substantial amount of new information about their abundance, size, or habitat use that is not already known (section 5.9(b)(4)). Accordingly, we do not recommend requiring any additional juvenile salmon sampling.

Adult Chinook Salmon

Requested Study Modification

Alaska DFG states that the original goal was to tag 100+ adult Chinook salmon. Alaska DFG states that although a considerable amount of effort was expended to find and target Chinook salmon for tagging, less than 15 adult Chinook salmon were ultimately tagged and tracked. Alaska DFG asserts that this sample size is too small to develop any meaningful conclusions about passage effectiveness through the project reach under the range of flows expected during project operation. Alaska DFG states that conducting studies to calculate the approximate abundance of adult Chinook salmon migrating through the project reach is important because Chinook salmon were designated in 2022 a Stock of Concern (SOC). Alaska DFG states that this designation necessitated the creation of a SOC Action Plan to rebuild the stock, and it believes that any proposed project in the watershed that has the potential to harm the species should warrant additional effort to develop the needed information to analyze potential project effects.

Trout Unlimited states that the lack of consideration for Chinook salmon in the studies is concerning not only because of their subsistence value, but also their global population declines even in areas relatively unimpacted by human development. Trout Unlimited asserts that the Nuyakuk watershed produces a substantial proportion of the Nushagak River Chinook run, which are among the world's largest remaining populations (Brennan et al., 2019). Trout Unlimited states that despite a "solid effort on the part of Project consultants," only twelve adult Chinook were sampled during the entirety of the study process. Trout Unlimited asserts that this sample size is "wholly insufficient for characterizing risk to that population."

[2] For example, sockeye and pink salmon were the most abundant species encountered for both juvenile and adult life stages, while small numbers of both life stages of coho, Chinook, and chum salmon were encountered in the study area.

New Koliganek Village Council states that the surrounding communities are especially concerned about the lack of studies on Chinook salmon. New Koliganek Village Council states that in recent years, Chinook salmon returns have declined significantly, and Chinook is now considered an SOC by Alaska DFG. New Koliganek Village Council states that its people rely heavily on Chinook salmon to sustain their diet and the project should not move forward until thorough studies on Chinook salmon have been completed.

Reply Comments

The Cooperative acknowledges that it did not achieve its study goal of tagging 100+ Chinook salmon but believes that its efforts to collect Chinook were "more than reasonable." The Cooperative states that it asked the Aquatic RWG to provide any data, suggestions, or other recommendations to improve Chinook encounters. The Cooperative asserts that BBSRI also collected some data on adult Chinook abundance at the counting tower downstream of the project site and corroborated the Cooperative's observations that Chinook salmon are present in low numbers in the Nuyakuk River. The Cooperative adds that fishing guides in the region "have said that they take clients elsewhere to fish for Chinook Salmon." The Cooperative states that Alaska DFG staff have asserted that more than 20,000 Chinook salmon return to the Nuyakuk River, but it has provided no data or reports to support this assertion.

Discussion and Staff Recommendation

The Cooperative's goal was to monitor and track 100 adult Chinook salmon to assess behavior and migration through the falls. However, despite dedicated sampling for Chinook salmon in both years, very few were observed or sampled at the falls. In 2023, a single adult Chinook was observed below the falls with an underwater camera. In 2024, 11 adult Chinook salmon were collected, tagged, and tracked near the falls. Nevertheless, the data that were collected provide some empirical data on Chinook salmon passage route selection and passage success through the falls. Further, the mechanisms that might affect Chinook salmon passage at the project are the subject of the Cooperative's other studies (e.g., Nuyakuk Falls fish passage study, including a 2-D hydraulic model and fish passage assessment; water quality assessment study; assessment of false attraction at the tailrace fish barrier). Data collected from these studies should be sufficient to inform staff's analysis of project effects on adult Chinook salmon passage through the falls under the range of flow and environmental conditions at the site (section 5.9(b)(4)). Therefore, we do not recommend requiring the Cooperative to conduct any additional adult Chinook salmon studies.

Adult Coho and Pink Salmon

Requested Study Modification

Trout Unlimited states that coho and pink salmon were "largely overlooked" by the Cooperative's studies. Trout Unlimited states that Table 4-1 in the fish community and behavior study report combines data collected for the project along with information from a literature review and from members of the Aquatic RWG. Trout Unlimited states that the table shows that both coho and pink salmon spawn only through the month of October, but it fails to mention that October was the end of the Cooperative's sampling period or the possibility that it failed to adequately characterize salmon use at the project site. Trout Unlimited states that coho salmon are known to spawn into November in many places in Alaska (Alaska DFG, 2025a) and can spawn late into December in the right habitat conditions (Alaska DFG, 2005). Trout Unlimited states that this is important because of the critical roles coho play in both human and ecological food webs, but also because hydrologic conditions, power use, and other factors vary drastically between fall and winter. Trout Unlimited asserts that failing to consider coho salmon use and migration through the project area during their entire migration period may risk their population productivity and sustainability. Trout Unlimited adds that no coho salmon were captured or meaningfully observed for the entire 2024 study year, suggesting the study window failed to characterize their use at the project.

Trout Unlimited states that pink salmon may also spawn after the period specified in the Cooperative's studies, and warrant "more focused attention regardless." Trout Unlimited states that pink salmon are often overlooked because of their biennial spawning cycle and relatively low economic value, but they are often the second most abundant salmon species in the Bristol Bay region in even numbered years (Alaska DFG, 1989). Trout Unlimited states that this makes pink salmon an important potential stock for future food security, and a critical source of marine derived nutrients that support hundreds of aquatic and terrestrial species upon which sockeye and human subsistence, recreation, and economics already depend (Cederholm, 1999).

Reply Comments

The Cooperative states that the Aquatic RWG, including representatives from Alaska DFG, NMFS, FWS, BBSRI, UTBB, and Trout Unlimited, selected sockeye and Chinook salmon as the focal species for field studies at the project site. The Cooperative states that the aquatic studies were planned and implemented to reflect the prioritization of these species, and therefore, it did not fail to consider other species such as pink and coho salmon. The Cooperative states that the "relative abundance of coho salmon observed or known of in the project vicinity was considered justification for the species to be considered of lower priority by the [Aquatic RWG]." The Cooperative adds that passage conditions during coho salmon migrations and the swimming capability of those

fish could be inferred from the radio-telemetry data for sockeye and other tagged species and from the fish passage models. The Cooperative asserts that the timing of the field data collection for the fisheries studies was never intended to overlap with the upstream migration of coho salmon; therefore, the lack of adult coho captures was not a "failure" of the study program.

Discussion and Staff Recommendation

The USR provides a periodicity chart (USR table 4-1) that includes upstream migration and spawning timing for coho and pink salmon. The USR states that data to inform the periodicity chart were derived from a literature review, the 2023 and 2024 field studies, and consultation with the Aquatic RWG. There is no other specific information on what literature sources were used to inform the periodicity chart or how the Aquatic RWG input was incorporated into the chart. Nevertheless, for coho and pink salmon, the periodicity chart shows that the timing of upstream migration and spawning is August through October for both species. Alaska DFG's website for the Nushagak River sonar site indicates that coho and pink salmon arrive in the river in late summer, but provides no additional information on the timing of upstream migrations or spawning for either species (Alaska DFG, 2025c). There is no other site-specific information that we're aware of that describes the timing of coho and pink salmon upstream migrations in the Nuyakuk or Nushagak Rivers.

Although Trout Unlimited asserts that coho salmon are known to spawn in November or December and could be present in the Nushagak River during these months, the sources it cites as support are a general species profile for coho salmon in the State of Alaska (Alaska DFG, 2025a), and a 2005 article on coho salmon in the Delta Clearwater River in the Yukon River drainage (Alaska DFG, 2005). Neither of these sources are specific to the Nuyakuk or Nushagak Rivers. For pink salmon, Trout Unlimited provides no specific information to support its assertion that pink salmon may spawn later than the time shown in the periodicity table. Therefore, while site-specific information is relatively limited on adult coho and pink salmon periodicity at the project site, there is no information specific to these rivers suggesting that either species is present in large numbers after the month of October. We conclude that existing information is sufficient to describe adult coho and pink salmon use at the project site (section 5.9(b)(4)), and we do not recommend requiring the Cooperative to attempt to collect additional data on upstream migration or spawning timing for the adult life stage of either species.

Predator Collection and Monitoring

Requested Study Modification

Trout Unlimited states that it appreciates that the Cooperative attempted to characterize existing predation risks on juvenile salmonids in the study area; however, it

is concerned that the Cooperative's efforts failed to evaluate fish, and especially, avian and mammalian predators sufficiently (or at all). Trout Unlimited states that throughout the range of Pacific salmon, areas where juvenile and/or adult salmon concentrate (e.g., hydropower projects, hatcheries, natural migration hurdles) attract predators of all kinds (Carey et al., 2012). Trout Unlimited states that predation by other fishes, birds, and mammals are all well documented as continued threats to the recovery of endangered Pacific salmon species on the U.S. West Coast. Trout Unlimited states that the proposed project runs the risk of concentrating prey in the form of juvenile and adult salmon, yet the only two predators evaluated were Arctic grayling (96% of predators sampled) and rainbow trout. Trout Unlimited states that the project's own data clearly indicates that Arctic grayling are not a significant predator of juvenile (much less adult) salmon, and most rainbow trout gut contents consist of invertebrates as opposed to juvenile salmon.

Reply Comments

The Cooperative states that the piscivorous predation assessment (using stomach content analysis) was not initially requested by stakeholders during development of the study plan, but was raised by Alaska DFG and BBSRI after the filing of the ISR. The Cooperative states that the species of interest were rainbow trout, arctic grayling, and northern pike. The Cooperative states that it accommodated this request by collecting stomach content samples from suspected predators during 2024. The Cooperative states that, while most arctic grayling are likely limited in their consumption of smolts by their small mouth size, there are large individuals capable of consuming fry of any species.

The Cooperative states that assessment of mammalian predation on adult salmon (e.g., bears) was not a requirement of the approved study plan.

Discussion and Staff Recommendation

The Cooperative sampled stomach contents of 86 grayling, 7 rainbow trout, and 1 Arctic char during 2024. The results showed that juvenile fish of all types composed less than 1% of the stomach contents of grayling, 14% of the stomach contents of rainbow trout, and none of the contents of Artic char (stomach was empty). Other potential piscivorous predator species were collected during the Cooperative's sampling (e.g., northern pike); however, all were generally low in abundance. Therefore, there is no evidence that the suspected predators of salmon smolts (i.e., primarily rainbow trout and grayling) or any additional piscivorous predators (i.e., northern pike) are congregating in large numbers at the project site to prey on juvenile salmon.

For avian predators, the Cooperative opportunistically recorded visual observations of avian predators and their behavior at the project site during the 2024 field season. Avian species observed included osprey, eagles, terns, gulls, and fishing ducks

such as mergansers and loons. For the avian species that were observed, the USR describes their relative abundance and predation activity at the site.

Although the Cooperative did not conduct dedicated surveys for bear or other mammalian predators at the falls, it does report observations of bears at the project site. There is no indication that large numbers of bears or other mammalian predators are congregating or feeding on adult salmon at the falls.

Collectively, the Cooperative's studies are sufficient to characterize piscine, avian, and mammalian predation of juvenile and adult salmon at the site and inform staff's analysis of project effects on fish predation (section 5.9(b)(4)). Therefore, we do not recommend requiring any additional predator sampling at the project site.

Nuyakuk Falls Fish Passage Study

Background

The approved study plan requires the Cooperative to identify major (or primary) upstream (and downstream) fish passage corridors and hydraulic conditions within the cascade/falls reach and their potential flow sensitivities; estimate species-specific "flow windows" for successful upstream fish passage that include lower passage thresholds above or below which passage could be affected; and evaluate effects of proposed operations and minimum flow releases on upstream and downstream passage. To achieve these objectives, the approved study plan requires the Cooperative to define species migration periodicity, establish species swimming and leaping criteria using available literature, develop a 2-D hydraulic model of the terrain, and conduct fish habitat and upstream passage modeling for target fish species to evaluate the effects of project operations. Target species for upstream passage modeling include sockeye and Chinook salmon. Target species for fish habitat modeling include rainbow trout, Arctic grayling, and Chinook, coho, sockeye, and chum salmon

The Cooperative states that it completed the study, and the results are included in the USR.

Hydraulic Model Calibration

Requested Study Modification

NMFS states that the low-flow calibration for the 2-D hydraulic model should be lower as "it reflects the proposed condition (i.e., 30% diversion) at a river flow of roughly 9,722 cfs which is between the 75% and 90% exceedance value in June, the 50% and 75% exceedance value in July, and the 10% and 25% exceedance value in August and

September." NMFS states that these data show that "the model is outside the calibration range for large portions of the migratory season under the proposed condition."

Reply Comments

The Cooperative states that water surface elevation data used to calibrate the model were collected over as wide a range of conditions as possible during the study year (2023) when the hydraulic model was developed. The Cooperative asserts that the sensitivity analysis completed to test the model's ability to predict water surface elevations outside of the measured range indicates that, while there is likely some error in predicting water surface elevations both at high and low flows outside of the range of calibration data, the errors are within 0.6 foot (low flow) and 0.8 foot (high flow). The Cooperative asserts that the model is a reliable tool for understanding how the hydraulic conditions in the falls reach could change under different flow levels.

Discussion and Staff Recommendation

As discussed in the USR, the hydraulic model was calibrated by comparing measured water service elevations at 11 sites across the study area to the modeled results and adjusting the model parameters to minimize the errors across all flows and all sites. The model was calibrated to a high, medium, and low flow representing the typical range of summer flows at the falls (i.e., between 7,480 cfs and 18,120 cfs). Although the low-flow calibration was only 7,480 cfs (i.e., about 6,800 cfs higher than the lowest modeled flow of 700 cfs), the Cooperative's sensitivity analysis shows a low level of variability in water surface elevations (i.e., 0.6-foot) and velocities (i.e., 1-foot per second) when model parameters (e.g., roughness coefficient) are adjusted at flows less than the low-flow calibration data set. This sensitivity analysis suggests a low-level of error in the model's predictive ability at flows less than the low calibration flow. Therefore, the model is sufficiently reliable to inform our analysis of potential project effects on hydraulic conditions under a range of flows through the falls (section 5.9(b)(4)). Accordingly, we do not recommend requiring the Cooperative to measure water surface elevations and calibrate the model to an additional low-flow data set.

Radio Telemetry Detection Probabilities

Requested Study Modification

Trout Unlimited states that it has some major concerns about the Fish Passage Study data analysis and believes that the analysis lacks the scientific rigor necessary to draw conclusions. Trout Unlimited states that one of its main concerns is that the Cooperative did not estimate detection probabilities at the telemetry antennas as part of the analysis. Trout Unlimited asserts that this is a major flaw in the study because passage success can be significantly underestimated if the study does not account for

detection probability. Trout Unlimited states that the Cooperative's analysis assumed that if 50% of tagged fish are observed at a given antenna, then passage rates were 50%. Trout Unlimited states that if the detection probability at a given antenna was only 50%, then the correct conclusion is that passage rates could be up to 100% after accounting for detection probability. Trout Unlimited notes that the Cooperative used a test tag to measure "detection efficiency" but states that "this is not equivalent to estimating detection probability from the data and is not a scientifically defensible way to measure detection efficiency (Pollock 1982, White and Burnham 1999)." Trout Unlimited asserts that the reported passage success rates are meaningless, and the Cooperative must calculate and report detection probabilities and the associated confidence intervals around passage.

Reply Comments

The Cooperative states that detection efficiency was measured for the locations used to determine passage success (i.e., R01 paired with R02 for entrance into the study area, and R03 paired with R04 for exit from the study area following transit). The Cooperative states that it was not possible to measure detection efficiency for all receivers, such as those within the falls, because they were not intended as passage "gates." The Cooperative states that based on an analysis of the proportion of fish detected on one receiver of each pair relative to the other, it had high confidence that passage gate (i.e., enter study area, transition into falls, exit study area above falls) detection efficiency was near 100%. The Cooperative states that the detection history of every unsuccessful fish (i.e., arrived at study area and was either not detected in the falls or was detected in the falls but not at the exit array) was reviewed individually. The Cooperative states that the telemetry study was designed to be a behavior study based on presence/absence detection records in a highly complex, turbulent area with potential for changing conditions, tag collision, and blind spots. The Cooperative asserts that the study design was not a paired release-recapture model study for purposes of estimating survival which requires the input of detection efficiency data for each passage gate to correct/adjust ultimate survival estimates. The Cooperatives states that, nevertheless, the PyMast software takes into account gaps in detection records between gates and flags missing detection data or mis-ordered detection data for review. The Cooperative believes that the behavior data gathered during the study provides meaningful insight on passage rates of tagged salmon transiting the falls.

Discussion and Staff Recommendation

As the Cooperative points out, the design of the radio telemetry study was to assess passage behavior based on presence/absence detection records in a highly complex and turbulent environment. The study was not designed to use a paired release-recapture model for the purpose of estimating absolute survival/passage success through all portions of the falls reach. The Cooperative tested receiver detection efficiency at the

locations needed to quantify total passage success through the falls (e.g., entrance and exit to the falls), but did not do so at the other locations within the falls because of the logistical difficulties of testing in a complex and turbulent environment, and because doing so was not needed to meet the study objectives. Overall, the Cooperative's methods were sufficient to describe passage baseline conditions and provide information to inform our analysis of fish transit time, passage success, and passage route selection through the falls (section 5.9(b)(4)). Accordingly, we do not recommend requiring the Cooperative to calculate and report detection probabilities and the associated confidence intervals around passage.

Statistical Analysis

Requested Study Modification

Trout Unlimited states that it has concerns about the "lack of exploration and statistical analysis" on what factors influenced holding time, transit time, and passage success. Trout Unlimited states that the USR concludes that flow level was the only significant predictor of holding time below the falls prior to upstream migration, but it's unclear how the Cooperative reached this conclusion because no other variable (e.g., fish density) was considered in the analysis. Trout Unlimited states that the effect of individual body size was considered, "but only in binned flow data and not part of a complete statistical model." Trout Unlimited states that the lack of testing various predictors leads to an incomplete picture of what controls passage and holding time, and the true effect that flows have on those metrics. Trout Unlimited adds that "there was increased variance in passage time at higher flows (USR Figure 5-25), which violates a key assumption of the statistical tool the Project used to analyze this data (i.e., linear regression)." Trout Unlimited recommends that "an alternative [statistical analysis] method should be used to accommodate the increased variance."

Reply Comments

The Cooperative responded by stating "comment noted."

Discussion and Staff Recommendation

The radio telemetry fish passage analysis provides information on passage success, transit time, and route selection for several hundred sockeye, Chinook, and pink salmon with a range of sizes and under a range of flow conditions. Additional information on environmental conditions and upstream passage for adult salmon through the falls is provided by the Cooperative's agent-based fish passage model, 2-D hydraulic model, and water quality assessment. Together these studies and models should provide sufficient information to inform our analysis of project effects on salmon upstream passage through the falls (section 5.9(b)(4)). Accordingly, we do not recommend

requiring the Cooperative to complete additional statistical analyses on the potential factors influencing holding time, transit time, and passage success.

Baseline Falls Mortality

Requested Study Modification

Trout Unlimited and BBSRI state that the USR did not provide estimates of baseline juvenile fish mortality through the falls, which was one of the study objectives. BBSRI states that it is important to understand total project mortality, including fish that pass via the turbines and via the falls reach. BBSRI states that total project mortality cannot be determined without knowing baseline mortality through the falls. BBSRI states that its recommended expanded fish sampling methods (previously discussed) using an IPT below the falls could be used to provide baseline information on catchability, species/life stage composition, and injury/mortality through the falls.

Reply Comments

The Cooperative states that there has been extensive and ongoing discussion among the Cooperative and Aquatic RWG over how to address and understand baseline mortality of smolts that pass the falls reach. The Cooperative states that the fish habitat modeling analysis assessed passage route connectivity for downstream migrating smolts under a range of flow conditions. The Cooperative states that additional information on potential juvenile fish mortality through the falls reach was provided by observations of avian and piscivorous predation. The Cooperative asserts that while these efforts do not provide an absolute survival rate, they do provide insight on passage risk in the falls reach. The Cooperative states that it considered methods for quantifying baseline survival using mark-recapture methods, but the Cooperative and "other stakeholders" determined that such as study would be infeasible due to the logistics of operating smolt traps above and below the falls, and due to the necessity of dye-marking or tagging hundreds-of-thousands (or more) fish to get a recapture rate that would yield any statistical rigor.

Discussion and Staff Recommendation

Based on available information in the project record, the primary concern as it relates to baseline juvenile fish survival through the falls is predation by fish, birds, and mammals. Although estimating baseline mortality rates for downstream migrating smolts was an objective of the approved study plan, the Cooperative did not employ sampling methods that enabled it to calculate baseline juvenile fish mortality. Nevertheless, the Cooperative's other studies collected information that can be used to indirectly assess the potential for predation through the falls. For example, the Cooperative's sampling of stomach contents of potential predatory fish (e.g. grayling, rainbow trout) show that fish

of all types compose a small portion of the diet of predatory fish that were sampled (i.e., range of less than 1% to 14% of all stomach contents, depending on predator species). Additionally, the Cooperative opportunistically conducted visual observations of birds and mammalian predators at the falls during both study seasons. No significant predation by either type of predator was observed. These data suggest that predation rates on smolts at the falls are likely low and passage survival is likely high. Therefore, based on this information, there is sufficient information to inform our analysis of baseline juvenile salmon survival through the falls (section 5.9(b)(4)). Because there is sufficient information to estimate baseline survival, additional IPT sampling is not needed. Accordingly, we do not recommend requiring the Cooperative to conduct additional fish sampling using IPTs or any other sampling methods to attempt to determine baseline juvenile salmon survival through the falls.

Sockeye Smolt Fish Habitat Model

Requested Study Modification

BBSRI states that the USR does not include fish habitat model results to assess the effects of different flows on migration habitat for sockeye smolts through the falls. BBSRI asserts that it is critically important to determine where sockeye smolts are likely to travel when passing downstream through the falls under project operation, but this species/life stage was not considered as part of passage route identification or HSC development for the falls reach. BBSRI states that it believes that velocity and depth criteria for sockeye smolt passage can be derived from the hydroacoustic data and used to conduct a fish habitat modeling analysis for smolt downstream passage. BBSRI states that such an analysis "is absolutely required to conduct an accurate assessment of comparing base[line] conditions over the range of observed and predicted discharge and those affected by operations of the Project so that inferences can be developed regarding how this population may be impacted."

Reply Comments

The Cooperative states that it believes the fish habitat model results for juvenile salmon conveyance habitat are applicable to fry and smolt life stages of all species because the depth criteria were based on "NMFS criteria for the minimum amount of depth required (1ft) for downstream migration protection of Pacific salmon smolts including Sockeye Salmon." The Cooperative states that using results of the 2-D model at different flow levels, the entire falls reach was divided into portions that met the criteria (>1 foot depth) and those that did not (<1 foot depth), and the analysis considered how the three major flow paths through the falls maintain or lose connectivity of water that was at least 1 foot deep.

Discussion and Staff Recommendation

Although the Cooperative asserts that it developed the depth criteria for sockeye fry and smolts based on the recommendations for juvenile salmonids from NMFS's 2011 Anadromous Salmonid Passage Facility Design, it is unclear where in the manual it specifies this criterion. Therefore, Commission staff contacted the Cooperative to seek clarification on its basis for the depth criterion.[3] The Cooperative clarified that it selected the 1-foot depth criterion based on section 7.5.2.7 of the NMFS manual, which describes the hydraulic design process for culverts. Section 7.5.2.7 recommends water depths of 1-foot and 0.5-foot for safe passage of adult and juvenile salmonids, respectively. Although culverts are a type of engineered structure that differs morphologically from a natural stream channel such as the Nuyakuk Falls reach, the recommendations in the NMFS manual are conservative and consider the biological needs for safe passage of salmonids. The Cooperative's approach of using a 1-foot depth criterion for salmon fry and smolts (i.e., twice as deep as the NMFS manual recommends) is a reasonable and conservative approach for assessing passage needs for juvenile fish. Therefore, we conclude that the modeling results are sufficient to inform our analysis of project effects on juvenile salmon migration habitat (section 5.9(b)(4)), and we do not recommend requiring the Cooperative to use the hydroacoustic data to develop depth and velocity criteria for use in the fish habitat modeling analysis.

Fish Entrainment and Impingement Study

Background

The approved study plan required the Cooperative to conduct a desktop evaluation to inform the preliminary design of the project intake and to evaluate the potential for fish impingement and entrainment into the intake and powerhouse. Specific study methods include using site-specific information from the fish community study and the 2-D hydraulic model, coupled with the results of field and desktop entrainment studies from other projects, to estimate entrainment rates of target fish species. The study would also evaluate impingement potential on the proposed trash racks using a fish body size and swim speed analysis and would develop an estimated mortality rate for fish that are entrained into the turbines based on mortality rates for turbines with similar characteristics as the proposed project turbines. The study plan states that entrainment mortality includes "both direct turbine mortality as well as shear and cavitation stress and pressure effects."

The Cooperative completed the study in the second study season and included the results in the USR.

[3] See summary of email communication between the Cooperative and Commission staff filed on May 7, 2025.

Turbine Survival Data

Requested Study Modification

BBSRI states that turbine survival data presented in the USR appear to have been compiled from at least six references, but most of these sources are not readily available (one reference does not even have a source) so it is difficult for stakeholders to understand how these survival rates were determined and how the studies relate to the Nuyakuk Project's turbines. BBSRI requests that the study reports be provided or that the Cooperative "include a summary description, an illustration of representative survival tests, and a discussion of what assumptions are inherent to the estimates so that readers can comprehend these super-critical values." BBSRI asserts that without the additional information, it is skeptical that such high survival rates are achievable.

Trout Unlimited disagrees with the study conclusions that project turbine survival would be 98% to 100%. Trout Unlimited asserts that the Cooperative's citations used to support this conclusion were not turbine survival studies. Trout Unlimited states that the Cooperative relied on two studies (Odeh, 1999 and Olbertz, 2021) to develop survival estimates but Odeh (1999) was a federally funded program that produced two design concepts for fish-friendly turbines, neither of which was ever built or tested for fish survival. Trout Unlimited states that Olbertz (2021) was a student project that was not published in a journal or formal (federal, state, industry) report, and many of the values cited by Olbertz (2021) need context or additional follow-up (i.e., some of the cited reports are not available). Trout Unlimited states that the remaining citations shown in Table 5-3 of the study report similarly need additional context or are not direct studies of turbine survival.

Reply Comments

The Cooperative states that it can provide the cited references to any interested stakeholder, and if the Cooperative prepares a draft license application it will provide the cited studies and include information in the document on where the studies were completed and what species and fish sizes were studied, among other things.

The Cooperative adds that the project engineering and turbine design were generally at a conceptual level at the time it completed the fish entrainment study report. The Cooperative states that turbine selection, operational considerations, and project design will be advanced in future design phases, which may include additional analyses to develop a project-specific survival estimate for the project. The Cooperative states that given the size, head, volume of water, and other factors including turbine survival studies published for other locations, it believes that a high level of turbine passage survival is possible at the project, and "future design phases will be implemented to ensure that the highest feasible survival level is achieved for migrating smolts of all sizes."

Discussion and Staff Recommendation

Fish friendly turbines are a type of turbine that is specifically designed to provide a high level of fish passage survival, generally exceeding 95%. There are several manufacturers of these turbine types and we are aware of several projects where they have been installed and preliminarily tested for fish survival (e.g., Monroe Drop Hydroelectric Project FERC No. 14430 in Oregon, Freedom Falls Project FERC No. 14421 in Maine). Testing results generally show a very high level of passage survival (e.g., 98% to 100%) for the species tested (rainbow trout, river herring, American eel) (NHA, 2024; LIHI, 2023). The Cooperative's fish entrainment study report estimated similar levels of turbine survival for the project's proposed fish friendly turbine design, ranging from 98% to 100%. However, the information the Cooperative used to derive its estimates were based on specific designs of fish friendly turbines (e.g., Alden Turbine, Natel Restoration Hydro Turbine, Bonneville Dam minimum gap runner turbine) and it is unknown at this point if the data are applicable to the proposed project because the project turbine design is preliminary and lacks the detail needed to make such comparisons. Nevertheless, the Cooperative will be required to include detailed design plans for its proposed turbines in the license application. Commission staff's analysis of turbine survival will be based on those design plans, estimates of turbine survival from fish friendly turbines, and the large body of existing information on turbine survival from conventional turbine designs (e.g., Winchell et al., 2000; Franke et al., 1997) (section 5.9(b)(4)). Therefore, we recommend that the Cooperative include all the cited references and studies in its draft license application as promised, but no other modifications to the study are warranted.

Delayed Mortality

Requested Study Modification

Trout Unlimited asserts that concern about delayed mortality after turbine passage was listed as one of the "four central potential impacts" in the approved study plan, but the Cooperative did not assess delayed mortality in the study report. Trout Unlimited states that delayed mortality can be significant for fish that pass-through turbines, as has been clearly demonstrated in the Columbia Basin hydrosystem (Comparative Survival Study annual reports https://www.fpc.org/documents/Q_fpc_cssreports.php) and should be studied and considered as a potential impact of the project.

Reply Comments

The Cooperative responded to this comment by stating "comment noted."

Discussion and Staff Recommendation

Although Commission staff's April 18, 2024 study determination stated that it expects the Cooperative to include information on delayed mortality in its fish entrainment analysis (to the extent that such information exists), there is no information in the USR on the potential for the project to cause delayed mortality and no basis for why they did not address delayed mortality.

There is a large body of information in the literature that assesses delayed mortality from passage through hydroelectric projects (e.g., Haesaker et al., 2012; Rechiskey et al., 2013; Hilborn, 2013; NMFS, 2023); however, given the preliminary turbine designs at this stage in the process, there is no way to know the applicability of such studies to the project. Nevertheless, as previously discussed, the Cooperative must describe its turbine design in its license application and Commission staff's analysis can use the available information from the literature to assess the potential for delayed mortality, based on the description (section 5.9(b)(4)). Therefore, we do not recommend requiring the Cooperative to conduct any studies of delayed mortality.

Salmon Life Cycle Model

Background

The approved study plan required the Cooperative to develop life cycle models (LCM) for sockeye and Chinook salmon to assess population-level responses to a range of environmental conditions and potential project effects. The sockeye salmon model was completed in 2024 and the results were filed as an addendum to the USR. The Chinook salmon model was not completed because the Cooperative states that there were insufficient data on adult escapement, smolt-to adult returns, and site-specific behavior at different flow levels through the falls to develop a reliable model.

Sockeye Salmon

Requested Study Modification

UTBB and Trout Unlimited state that the study was inadequate for the following reasons: (1) the model assumed a turbine survival rate for juvenile fish of 95%, but model scenarios should have included a range of potential turbine survival rates; (2) the model evaluated an alternative whereby 30% of inflow would be diverted for hydropower generation, but it should have evaluated a range of minimum flow scenarios to assess whether they would protect juvenile salmon migration, specifically including a minimum flow regime that is consistent with the State of Alaska's instream flow reservation for the Nuyakuk River; and (3) the study failed to evaluate whether fish size affects upstream

passage through the falls and whether the project might have size-dependent effects on sockeye salmon over time.

Reply Comments

The Cooperative states that a 95% turbine survival rate input to the LCM is an estimate, and while the Cooperative hopes to provide all stakeholders the most robust estimate of smolt survival possible as the engineering design progresses, the consistent use of 95% survival in the LCM is reasonable and allows comparisons of project effects under a range of other variables that could affect the population (e.g., different future flow scenarios, escapement, and adult returns). The Cooperative adds that the LCM was intended primarily to identify risks to Nuyakuk fish populations from changes in flow over the falls ranging from 1,000 to 25,000 cfs because of project operation. The Cooperative states that it was not a study objective to extrapolate results of the LCM to the development of protection, mitigation, and enhancement measures related to minimum flow requirements. The Cooperative asserts that it is premature to evaluate alternative minimum flow scenarios with the LCM at this point in the licensing process.

Discussion and Staff Recommendation

The overarching goal of the LCM study was to develop a tool that estimates changes in salmon population dynamics under a range of project operational effects (e.g., turbine entrainment, flow-dependent juvenile predation) and environmental conditions (e.g., future climate scenarios). Although the model was not run for all possible scenarios such as a range of turbine survival values or minimum flow alternatives, the model results are sufficient to meet the study objective of helping to understand the sensitivity of the sockeye salmon population to the different potential project effects and environmental conditions (section 5.9(b)(1)). Further, the LCM is not the only source of information available to assess project effects on sockeye salmon. The Cooperative's other studies and models (e.g., fish entrainment study, fish community study, fish passage study and 2-D hydraulic and fish habitat model, water quality study) provide a substantial amount of additional information to assess project effects. Collectively, these studies and models coupled with information from the literature should be sufficient to inform staff's assessment of potential project effects on the sockeye population that are of concern to the commenters (e.g., turbine entrainment survival and the effects of different minimum flow alternatives on fish habitat and upstream passage through the falls bypassed reach) (section 5.9(b)(4)). Accordingly, we do not recommend requiring the Cooperative to modify the sockeye salmon LCM.

Chinook Salmon

Requested Study Modification

UTBB states that the Cooperative failed to adequately consider the potential project risks to Chinook salmon because of a lack of data for this species in the Nuyakuk River, which prevented it from completing an LCM for this species as required by the approved study plan. UTBB states that without a Chinook LCM, project risks to this species are based entirely on a qualitative assessment provided from the Integrated Risk Assessment Study, which is insufficient for assessing project effects.

Reply Comments

The Cooperative states that it is very difficult and inadvisable to develop a model without sufficient data. The Cooperative asserts that a Chinook LCM would require data that Alaska DFG and other regional managers or entities studying the populations and dynamics of Chinook salmon in the Nushagak system are not able to provide at this time.

Discussion and Staff Recommendation

Although there were insufficient data available to complete a Chinook salmon LCM, for similar reasons previously discussed above in our analysis of the *Characterization of Fish Community and Behavior near the Project Intake Study* for adult Chinook salmon, the results of the Cooperative's other studies and models should provide sufficient information to inform staff's analysis of project effects on adult Chinook salmon at the project.

For the juvenile life stage, the Cooperative's fish community study, fish entrainment and impingement study, and 2-D hydraulic and fish habitat model (completed as part of the fish passage study) should also provide sufficient information to assess project effects on juvenile Chinook salmon. For example, the fish community study provides information on juvenile Chinook relative abundance and periodicity at the project, the 2-D modeling analysis provides information on fish habitat availability for migrating and rearing juvenile Chinook at a range of flows, and the entrainment study provides information on turbine entrainment rates and survival.

Together, the Cooperative's study and model results coupled with information in the literature should be sufficient to inform our analysis of project effects on the Chinook salmon population (section 5.9(b)(4)). Therefore, we do not recommend requiring the Cooperative to develop an LCM for Chinook salmon.

Integrated Risk Assessment of Fish Populations

Background

The approved study plan required the Cooperative to conduct an Integrated Risk Assessment (IRA) to evaluate potential project effects on fisheries resources at the fish population level. The IRA integrates fish population responses to a range of environmental and project operation conditions or scenarios to assess likely benefits and costs associated with each operational alternative. The study plan states that the assessment will allow the Cooperative, agencies, and stakeholders to decide what impacts to the populations are acceptable or not.

Specific study methods include: (1) define management objectives or questions for each target species; (2) identify the elements that are measured as indicators of impact to a population; (3) identify the potential risks from the project and environment (e.g., climate) to achieving species population management objectives; (4) gather, collect, evaluate, and analyze available knowledge on the likelihood and magnitude of impact from each potential risk to each management objective; (5) develop and implement an appropriate method for summarizing identified risks into a semi-quantitative scale; and (6) evaluate the potential risk of the project and environmental factors affecting fish populations.

Although the approved study plan suggests that risk assessments would be completed for multiple populations of species, the USR states that the study focused on developing a risk assessment for the sockeye salmon population. Study steps 1-6 identified above were completed for sockeye salmon through a series of meetings and workshops that the Cooperative convened with a subcommittee of the Aquatic RWG (i.e., IRA Subcommittee). The Cooperative states its view that the study is complete and that the results were provided in an addendum to the USR.

Requested Study Modification

UTBB, Trout Unlimited, NMFS, and BBSRI state that the study was inadequate for the following reasons: (1) the Cooperative did not consult with the Aquatic RWG on ways to formally incorporate the life cycle model results into the IRA study; (2) the study relied on a Delphi approach to completing the risk assessment, but the USR provides no justification for using the Delphi method as the most appropriate approach for assessing risks to fish; (3) the tailrace outfall/predation risk study element needs to be expanded to include ecological effects such as altered predator/prey dynamics and other trophic interactions (effects on macroinvertebrate communities); (4) the approved study plan proposed to evaluate risks to numerous anadromous and resident fish species, but the Cooperative only completed a risk assessment for the sockeye salmon population; (5) the study did not assess the potential for river ice to complicate the proposed project's

operations and affect salmon survival through the project; and (6) the Cooperative failed to meaningfully engage with Tribes and Traditional Knowledge Holders to incorporate Traditional Knowledge into the risk assessment.

Reply Comments

The Cooperative states that it disclosed to the Aquatic RWG in 2024 that the IRA is a qualitative tool and the LCM is a quantitative model. The Cooperative states further that it informed the Aquatic RWG that the models were intended to provide independent evaluations of risk, rather than integrated assessments of risk.

The Cooperative states that risk elements for the study were selected and finalized by participating members of the Aquatic RWG in December of 2023 and January of 2024 "and cannot be revised at this point."

The Cooperative states that while it hoped to complete a risk assessment for all target species, it was unable to do so because the study relied on numerous entities, some of which were unable to effectively participate in the study for a variety of reasons. The Cooperative reported this situation as a variance in the USR, indicating that the participants: (1) did not have the time to effectively and timely synthesize all of the information to participate in the study; (2) were recent replacements for original members of the IRA Subcommittee; (3) lacked knowledge about the project or the Cooperative's studies; (4) were unable or unwilling to complete the study methodology of assigning scores to risk sources in light of uncertainty about potential project effects; and (5) had insufficient time to review the USR to complete the study on schedule.

The Cooperative states that two years of "studies" and seven years of satellite imagery for the intake location describe river icing conditions, but river ice is a complex process and will be accounted for in the detailed design of the project.

The Cooperative states that all interested participants (including Traditional Knowledge holders) were invited to participate in the IRA Subcommittee and share information, provide feedback, contribute data, and engage with the other members of the subcommittee.

Discussion and Staff Recommendation

The overarching goal of the study was to convene an IRA Subcommittee composed of regional fisheries experts and other interested stakeholders to review available data on the distribution and behavior of various life history stages of fish populations in the Nuyakuk River, and to identify the potential attributes of the project or its operation that could affect critical life stages and pose risks to the sustainability of the fish populations. As a qualitative assessment, the risk assessment was designed to

compile and compare opinions about the magnitude and likelihood of identified sources of risk to fish populations. The approved study plan states that the IRA would include target fish species "including Pacific Salmon, other migratory fishes and resident fish species that utilized the Project Area." However, ultimately, only a sockeye salmon risk assessment was completed for the reasons stated by the Cooperative.

Although the Cooperative did not complete a risk assessment for any populations besides sockeye salmon, the study predominately relies on existing information and the Cooperative's other study results to inform the risk assessment by the IRA Subcommittee and the Cooperative. The underlying study results and existing information are sufficient for Commission staff to review and use to independently analyze project effects on anadromous and resident fish populations in the project affected area (section 5.9(b)(4)). For example, the Cooperative's fish community study describes resident and anadromous fish species' habitat use and periodicity, the 2-D hydraulic and fish habitat models quantify passage conditions (i.e., depth and velocity) and the amount of habitat for different life stages of resident and anadromous species at a range of potential flows under project operation, the water quality and icing studies characterize baseline water quality and icing conditions, and the fish entrainment and tailrace barrier studies summarize information on fish use and anticipated hydraulic conditions near the powerhouse intake and tailrace. Accordingly, we neither need related additional information nor do we recommend requiring the Cooperative to modify the sockeye salmon risk assessment or to conduct any additional risk assessments for the other fish species.

Subsistence Study

Background

To evaluate the potential effect of constructing and operating the project on subsistence harvest and use, the approved study plan required the Cooperative to conduct subsistence harvest surveys in the villages of Koliganek, New Stuyahok, Ekwok, Aleknagik, and Levelock and in the city of Dillingham. As proposed, the study would be conducted by Alaska DFG Division of Subsistence and funded by the Cooperative. The approved study methodology requires systematic household surveys conducted by community-based survey technicians in cooperation with Alaska DFG subsistence resource specialists. The study methods would follow the research principles outlined in the *Alaska Federation of Natives Guidelines for Research*[4] and by the National Science Foundation, Office of Polar Programs in its *Principles for the Conduct of Research in the*

[4] Alaska Federation of Natives. 2013. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. Accessed June 6, 2020. http://www.ankn.uaf.edu/IKS/afnguide.html.

Arctic,[5] as well as the Alaska confidentiality statute (AS 16.05.815). These principles include community approval of research designs, informed consent, anonymity of study participants, community review of draft study findings, and the provision of study findings to each study community upon completion of the research.

In the USR, the Cooperative explains that because of financial considerations, it modified its approach to the subsistence study from a regional approach completed in collaboration with Alaska DFG to a more site-specific survey effort that focused on those areas "with a proximal connection to the project site (Nuyakuk Falls) and utilize desktop information for those villages further away from the project area but, under the current proposal, would still be provided power, if the Project were constructed." In addition, the Cooperative states that instead of surveying residents in each village, it held workshops in three centralized locations (i.e., Koliganek, New Stuyahok, and Dillingham) because it would be more efficient and effective. The Cooperative reasoned that because Ekwok and Levelock were over 70 river and air miles, respectively, from the project site at the falls, it would be more appropriate to rely on existing data.

The subsistence study was implemented beginning in 2024. As documented in the USR addendum filed on February 18, 2025, the study consisted of a literature review of existing subsistence information for six communities potentially affected by the project: Koliganek, New Stuyahok, Ekwok, Dillingham, Aleknagik, and Levelock. The literature review includes subsistence use area maps, harvest tables, and figures showing the timing of subsistence activities; subsistence data are available for all study communities dating from the 1970s through the 2000s. Based on the literature review, the Cooperative's study team developed a workshop protocol to guide subsistence workshops in the three centralized study communities. The study team coordinated with the three communities to gain permission to conduct and schedule the workshops. Each of the communities provided written permission (including resolutions in Koliganek and New Stuyahok) to conduct the workshops, which were held in October 2024. The workshops collected information on contemporary subsistence uses of the project area, including the Nuyakuk Falls area and the transmission corridors, identified key subsistence concerns, and documented ideas for potential mitigation measures. Specifically, participants at the workshops were asked about which resources they harvest in each portion of the project area (Nuyakuk Falls, above Nuyakuk Falls, below Nuyakuk Falls, and along the transmission corridors), when they harvest, why they harvest each resource at that area, how they travel to the area, how often they go to the area, and why the area is important for each subsistence resource harvested there. Four workshops were conducted: one in Dillingham which was attended by four participants from both Dillingham and

[5] National Science Foundation Interagency Social Science Task Force. 2018. "Principles for the Conduct of Research in the Arctic." Accessed June 6, 2020. https://www.nsf.gov/geo/opp/arctic/conduct.jsp.

Aleknagik; one in New Stuyahok which was attended by 7 participants; and two in Koliganek which were attended by 34 participants total.

The Cooperative states its view that the study is complete and the results are provided in the USR.

Requested Study Modifications

BBNA, Alaska DFG, the Council, FWS, and UTBB all express concerns with how the Cooperative modified the study without input from interested stakeholders. Each entity asserts that the Cooperative's subsistence study is inadequate because: (1) the study does not follow acceptable and standardized protocols and procedures that would have produced results that would be comparable to past and future data on subsistence use patterns, potentially revealing changes that could be attributable to project impacts; (2) the use of workshops that had limited attendance did not afford sufficient opportunity to gather Traditional Knowledge that would be useful for the analysis of project effects on subsistence activities, and may have missed important input from members that were not in attendance that would have been gathered through a representative sample of in-person household surveys; and (3) the data from the literature review are outdated and do not reflect many changes to caribou and Chinook salmon populations that likely have changed subsistence practices in these communities. UTBB, Alaska DFG, and the Council state that the principles on which original study plans were designed stress community approval of research designs, informed consent, anonymity of study participants, community review of draft study findings, and the provision of study findings to each study community upon completion of the research, all of which did not happen through the Cooperative's efforts. UTBB, BBNA and FWS assert that the decision to delay the study until 2024 compressed the timeline, and the diminished study efforts resulted in less community involvement.

Alaska DFG and FWS recommend an additional year of data collection to complete the study as it was approved so that subsequent decisions can be informed by robust and representative data on current subsistence use. Alaska DFG and FWS recommend conducting household studies with the assistance of community liaisons and hosting follow-up workshops in the communities to share and discuss study results. UTBB states that the Cooperative should have followed the approved study plan and conducted subsistence harvest surveys in all the communities that may experience impacts to subsistence, and returned to the communities to review the data and conclusions from the workshops. UTBB asserts that cost alone is not an adequate justification for deviating from the approved study plan and using outdated subsistence data. UTBB states that relying on historical subsistence data (i.e., subsistence data 10 years old or more) to identify impacts to current subsistence practices does not meet the needs for evaluating the project and raises scientific accuracy concerns.

Reply Comments

The Cooperative's reply comments reiterate the reasons explained in the USR for deviating from the approved study plan. The Cooperative again explains it intended to utilize Alaska DFG to provide mutually beneficial updated regional subsistence information. However, "when discussions related to the scope and associated cost of [Alaska DFG's] efforts occurred, it became clear that the overall financial obligation to the Cooperative related to the holistic study was cost prohibitive." The Cooperative states that as a result, it elected to focus the study on the much smaller potential area of impact associated with the proposed project as opposed to the more regional effort needed for Alaska DFG. The Cooperative asserts that "while it is important to have updated baseline data prior to a development project so that future changes in harvest amounts and use areas can be measured, updated data are not always necessary to analyze the types and nature of impacts that may arise from a proposed project, particularly if targeted workshops identify potential changes in subsistence baseline information since previous surveys." The Cooperative states that its workshops provided "an alternative to more comprehensive surveys by focusing on project-specific information (which would not be documented in a household survey) and by asking participants to identify whether existing subsistence information accurately captures current uses." The Cooperative adds that the subsistence workshops did document traditional knowledge and concerns regarding potential project impacts to fish survival and passage and incorporated the traditional knowledge into the analysis of subsistence impacts. Regarding protocols for community involvement, the Cooperative states that "the study team worked with the tribal councils to gain community approval of the workshops (including obtaining resolutions); sent draft protocols for the councils to review; had participants review and sign an informed consent form which guaranteed participants' anonymity, and sent the draft subsistence report to the councils for review." As for the reasons for delaying the study, the Cooperative states financial considerations, selection of appropriate technical specialists to conduct the study, and the amount of other technical studies necessitated that it delay the study until 2024.

Discussion and Staff Recommendation

The approved study deviated from required methods. However, the information in the USR describes historical subsistence use areas, methods of transportation, harvest data, and timing of subsistence activities for each village and the city of Dillingham. While the data are dated, the information obtained during the workshops indicates that the general characteristics, patterns, and importance of the subsistence activities are likely similar to historical uses and that project facilities (intake, powerhouse, transmission line) would be constructed in areas that overlap with subsistence activities.

However, because there was a relatively low turnout in Dillingham and New Stuyahok and the Cooperative made no effort to survey residents of Ekwok, Aleknagik,

and Levelock as required by the study plan to obtain subsistence information along the proposed transmission line, we do not have sufficient information to describe existing subsistence resources and uses and inform our analysis of project effects (section 5.9(b)(4)). More specifically, there is limited information available to describe changes in relative resource availability, traditional uses, competition, and access that have occurred over time, as these communities adapt their subsistence patterns in response to changes (e.g., recent declines in abundance of Chinook salmon and caribou). Therefore, we recommend that the Cooperative conduct another workshop in Koliganek, New Stuyahok, and Dillingham to review the study results, verify mapped subsistence sites, and determine if there is additional available data. We also recommend that the Cooperative hold a workshop in Ekwok, Aleknagik, and Levelock to obtain subsistence data and then conduct an additional workshop in each of the three villages to review the results and verify mapped subsistence sites. The Cooperative should include the revised subsistence data in the draft license application.

Although the methodology is different from that originally proposed and initially approved in the study plan, the data that are collected using the alternative methods described above should be sufficient to assess the potential effects of constructing the project on subsistence activities (section 5.9(b)(4)) and would be worth the effort that it will take to acquire the information needed for our analysis (section 5.9(b)(7)).

Recreation Inventory by Season

Background

The approved recreation study required the Cooperative to inventory and quantify the type and volume of recreational use occurring during each season in the vicinity surrounding the proposed project facilities on the Nuyakuk River, from approximately 0.5 mile upstream of the project intake to 1 mile downstream of the project tailrace, and along conceptual electrical transmission corridors between the falls and nearby communities. The approved study plan required the Cooperative to distribute a seasonal resident recreation survey (4 times per year) to people living in the villages of Koliganek, New Stuyahok, Ekwok, Aleknagik, and Levelock, and in the city of Dillingham and via an on-line portal. To encourage participation in the survey, the Cooperative was to conduct seasonal visits to the villages, mail surveys to individuals living in the targeted communities with instructions for returning the surveys, and distribute the surveys at local meeting places. The survey was to collect information on the number of participants involved in a recreation activity (i.e., hunting, fishing, trapping, gathering, flight seeing, hiking and other), the species being sought, and number and length of trips.

Although not required by the approved study plan, the Cooperative also conducted on-site field observations and intercept field surveys from July 14 through 19, 2023, to

document summer use of the study area. Of the 38 people observed visiting the falls, intercept surveys were distributed to 8 people.

Rather than conducting four seasonal visits to each village, the Cooperative proposed in the ISR to conduct two trips over a two-year study period, which was approved in the April 18, 2024 study determination. The first trip would be to introduce the study and conduct the surveys, and the second would be to present draft results to residents, ask for verification of information collected, and to collect additional data as needed.

The Cooperative distributed the recreation survey to Tribal Council members and local contacts recommended by the Tribal Councils in July and September 2023, held a community meeting in each of the required villages during April 2024, and made the recreation survey available online. Those who attended each meeting were asked to fill out the survey and record their recreation patterns and concerns about the project. To encourage participation at the meetings, the Cooperative offered a prize drawing at the end of the study period, advertised the meetings on some community and organization social media pages, and provided prepaid mailed envelopes for returning completed surveys to recreation study staff if the respondents preferred to provide their input later.

The Cooperative also developed a commercial operator questionnaire to solicit information about historic, recent, and upcoming commercial recreational visitation to the project area. Questions asked for details about season of visits, modes of travel, trip purpose, and where and what recreational activities that clients participated in, particularly at the falls. A total of 29 different operators were sent an email introducing the study and a request to complete the attached survey. The first email was sent on July 8, 2024, and a follow up on July 18th. Follow-up phone calls were to be made with nonrespondents.

Because there was no information on recreation activities along the transmission line corridor, the April 18, 2024 study determination required the Cooperative to expand its efforts to collect information regarding recreation use around the transmission line corridor rights-of-way. Questions related to recreation use around the transmission line corridor were added to the village surveys and discussions and the commercial operator questionnaire.

The Cooperative states its view in the USR that data collection and analysis is complete, and a second round of community visits to present results will not take place. Instead, follow-up efforts to share findings with stakeholders will take place during the remainder of 2024. The USR states that the study team "will prepare and provide a report summary and share local data with participating communities, per their requests. Summary reports will be delivered [via email] to the intended recipients (village, Tribal or Traditional Councils or Cities."

Commercial Operator and Village Resident Surveys

Requested Study Modifications

Royal Coachman states that the recreation study "seems incomplete" because there were only two weeks of in-person surveys at the site and little involvement by villagers at the meetings. Royal Coachman states that it attended all of the Recreation Technical Work Group (Recreation TWG) meetings and the commercial operator data form did not contain many of the questions the group discussed, the form/process seemed to be hurried into completion, and the form was only completed by two operators. Lastly, Royal Coachman states that it had inquired at the Recreation TWG meetings on two occasions about developing a questionnaire to be completed by lodge guests to gain valuable insight from guests that have been coming to fish the Nuyakuk Falls area for many years, but this was not done. Trout Unlimited states that it considered the 6-day field collection effort wholly insufficient to characterize recreational use, much less evaluate potential impacts. Trout Unlimited asserts that the "recreation inventory in general overlooks local (recreational and other) interests."

Reply Comments

The Cooperative noted the comment and states that there is a distinction between responses received and those solicited by the Cooperative.

Discussion and Staff Recommendation

As discussed in Commission staff's April 18, 2024 study determination, additional efforts to survey participants engaged in recreation in the field was not required because the remoteness of the area and expanse of the study area makes it difficult to intercept recreationists; and conducting interviews and distributing surveys to lodge owners, guides, commercial businesses, and village residents would garner similar or more information in a more efficient and economical way. The Cooperative made a reasonable effort to encourage village residents to complete the recreation surveys. Its efforts resulted in 99 residents of the region responding to the recreation survey; 36 respondents completed the survey online and 63 completed the surveys in person during visits to Koliganek (16 surveys), Levelock (9), Ekwok (11), New Stuyahok (5), Aleknagik (16), and Dillingham (6). The information gathered from the surveys is sufficient to characterize visitation characteristics and use of the project site by village residents, including the transmission line corridor alternatives (section 5.9(b)(4)).

Of the 29 commercial operators that were contacted by email to complete the commercial operator questionnaire, only Tikchik Narrows Lodge and Royal Coachman Lodge responded. Both operations are full-service, fly-out, guided sportfishing lodges

located near the project site. Both are active participants in the Recreation TWG and have a well-defined and historical interest in the project site. Based on their proximity to the site, the information obtained from these two lodges likely characterizes most of the recreation activities and is a good indicator of the level of commercial use occurring at the Nuyakuk Falls project site. However, there is no information in the USR that indicates that the Cooperative followed up its emails with a phone call to the nonresponding commercial operators as proposed in the approved study plan. Emails could have been sent to the respondent's spam folders and uncovered only after the requested due date of the survey responses. Therefore, we recommend that the Cooperative call each of the nonresponding commercial operators to determine if they received the request to complete the survey, and if interested in doing so, encourage them to complete the survey and return it to the study team. We further recommend that any new information obtained from this effort be incorporated in the draft license application, and to include a revised consultation record documenting its efforts.

While surveying clients of the commercial outfitters could provide additional insights into their client's recreation experience, the information provided by Tikchik Narrows Lodge, Royal Coachman Lodge, intercept field surveys, and any additional information obtained from follow-up calls with nonresponding commercial operators, should be sufficient to characterize the types and amount of recreation that occurs in the vicinity of the project (section 5.9(b)(4)). Therefore, we do not recommend requiring the Cooperative to develop and implement a separate client-based survey of commercial use operators.

Recreation Study Meetings and Surveys

Requested Study Modifications

UTBB states that the Cooperative only conducted one survey in Tribal communities in 2024 and has not shared any results or a draft report of the survey results with Tribal councils and community members. UTBB states that "the Cooperative's failure to follow the approved study plan and communicate variances with communities affects the ability to collect accurate data and indicates that additional study seasons are necessary." New Koliganek Village Council states that the recreation survey [report] is an incomplete draft until the Tribe has reviewed it and approved the interview transcripts and maps. New Koliganek Village Council recommends that the Cooperative return to the villages to review the survey report before it is finalized and made public.

Reply Comments

The Cooperative states that "the intent to revisit the communities was genuine, however not ultimately necessary for the collection of recreation-related data or sharing the study report." The Cooperative asserts that the logistical difficulties encountered

trying to coordinate meetings and receiving responses in a timeframe consistent with the licensing process was difficult. Lastly, the Cooperative states that the recreation study report was made available to the public for review and comment on eLibrary and through the Updated Study Report meetings on January 15 and 16, 2025.

Discussion and Staff Recommendation

Scheduling another meeting in each of the villages to go over the study results could uncover additional information and clarify information provided in prior meetings. However, given the difficulties in scheduling such meetings, such efforts are likely to unduly extend the development of the license application and provide little additional information that could not be provided through ILP commenting procedures. As previously discussed above, the ILP provides multiple opportunities for stakeholders to comment on the content of studies, including a review of the ISR, USR, draft license application, and final license application. Therefore, we do not recommend that the Cooperative be required to schedule additional meetings to review the recreation study results with the Tribes.

Section 106 Evaluation

Background

The approved study plan required the Cooperative to identify historic properties and Traditional Cultural Properties (TCPs) that could be eligible for the National Register of Historic Places (National Register), determine their eligibility to be placed on the National Register, and assess the potential effects of the proposed project on such properties within an Area of Potential Effect (APE). The approved study plan identified the APE as "the lands enclosed by the proposed Project boundary, and lands or properties outside the project boundary where project operation or other project-related activities may cause changes in the character or use of historic properties, if any historic properties exist." However, the approved study plan also required that the Cooperative develop the APE in consultation with Commission staff, the Alaska State Historic Preservation Office (SHPO), and Tribes who have an interest in the project, recognizing that indirect effects and TCPs often require a much larger APE than archeological and historical sites directly affected by project construction.

The USR contains a cultural resources survey report that includes an extensive literature review of archaeological surveys conducted in the project area, including the villages that would be connected by the project transmission line. The report also includes the results of an archaeological survey (pedestrian survey and shovel testing) conducted by the Cooperative within the roughly 90-acre site where the proposed project intake structure, powerhouse, airstrip, access road, cabins, and other structures would be

located near Nuyakuk Falls. The survey identified four sites, two of which are likely significant enough to be eligible.

In the USR, the Cooperative states its view that the archaeological study of the project facilities at Nuyakuk Falls is complete but commits to "expanding its efforts in consultation with Tribes, the SHPO, and Commission staff to define and identify resources within an APE that includes a transmission line corridor and any TCPs therein that could be affected by the project. Upon confirmation of the feasibility of the project by the Cooperative's board, a final route for the transmission line corridor will be selected. Any necessary cultural resources studies to identify significant properties within the APE for the corridor will be completed in advance of the draft license application." Section 8.0 of the report states: "Consultation meetings will continue to discuss field findings and determinations of eligibility, and address additional concerns, through the winter of 2023/2024. Evaluation of the transmission lines will continue through the summer of 2024. A report will be prepared on that effort, recommendations of effect will be prepared, and a Historic Properties Management Plan will be drafted." In section 9.0, the Cooperative states: "To effectively consult with Tribal elders and other knowledge bearers, the Cooperative will schedule and conduct, as practicable, in-person meetings with Tribal elders in the villages of Koliganek, New Stuyahok, Ekwok, Aleknagik, Levelock, and in Dillingham."

Requested Study Modification

UTBB requests that the Cooperative clarify, reconsider, and expand the existing project APE because there has been a lack of consultation and description on potential effects to historic properties and a failure to account for indirect and cumulative effects, including around the project transmission line. UTBB states that the analysis of effects is limited to archaeological data and ground-disturbing activities and offers no consideration of other effects like sensory disturbances (e.g., visual, auditory, olfactory), changes in atmospheric conditions (e.g., increased equipment exhaust, dust), increases in access to communities' traditional use areas, and changes in land use. Many members of the public from the affected communities state that the study ignores TCPs and that the Cooperative should first be identifying historic and culturally significant places to inform the transmission line route.

UTBB states that the APE for the project transmission will need to be much larger than the 100-foot-wide transmission corridor described in the USR and should be selected using height and visibility criteria such as that deployed by Argonne Laboratory to evaluate cultural effects associated with proposed transmission lines. Based on data from

the Argonne Laboratory evaluation,[6] UTBB states that the project's transmission line corridor APE needs to extend out a minimum of 5.5 miles from the 100-foot right-of-way to ensure that direct, indirect, and cumulative effects to historic properties are taken into consideration.[7]

UTBB recommends that all field sampling, survey, excavation, analysis, and reporting efforts include Tribally appointed cultural advisors.

UTBB adds that the Cooperative has not conducted any research, in-person interviews, or Tribal consultation to document TCPs, including cultural landscapes in the project area. UTBB states that early identification of TCPs would allow for avoidance, minimization, and mitigation of impacts to cultural landscapes and TCPs before the project design has been finalized. UTBB states there is already one documented cultural landscape (the Nushagak River Traditional Cultural Landscape) in the project APE but the Cooperative failed to evaluate its National Register eligibility. UTBB discusses the widely recognized cultural importance of Nuyakuk Falls to the Tribes, but notes that the Cooperative has yet to document Nuyakuk Falls as a TCP.

Lastly, UTBB states that the Cooperative did not study places with Yup'ik names to the same level as the places with a state assigned Alaska Heritage Resources Survey (AHRS) number. UTBB identifies multiple places with Yup'ik names within five miles of the project site that should be evaluated for National Register eligibility, despite not having an AHRS number and therefore states the analysis is incomplete.

UTBB concludes that because of the lack of consultation with Tribes on the research design or APE, not providing an opportunity to comment before finalizing reports, and not providing an opportunity to consult on the National Register eligibility determinations, the efforts to date have not met the reasonable and good faith standard required by section 106.

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[6] Robert G. Sullivan, et. al, *Electric Transmission Visibility and Visual Contrast Threshold Distances in Western Landscapes* (Apr. 2014), https://shpo.nv.gov/uploads/documents/NAEP14_Sullivan_TransmissionVCTDFinal141029.pdf

[7] UTBB reasons that the Cooperative's proposed 100-foot-tall transmission towers would be half the height of the poles considered in the Argonne Laboratory guidance. Therefore, visible effects would be half that reported by Argonne Laboratory, resulting in the project's 100-foot towers being visible up to 5.5 miles, noticeable to casual observers at 2.5 miles, and a major attractant of visual attention at 1.25 miles.

Reply Comments

The Cooperative states that it is using a phased approach to section 106 identification and that the cultural resources study is not complete. The Cooperative acknowledges that the project APE has not been finalized due to changes in the project footprint and because the final route of the proposed transmission line has not been chosen. The Cooperative states there will be a full consideration of effects when the assessment of the APE, including the transmission line corridor(s), has been completed and that the effects discussion will benefit from Tribal involvement. However, the Cooperative states that because the selection of the transmission line corridor is still ongoing and that archaeological and TCPs are location-specific, they have decided not to conduct in-person interviews until the final route(s) have been determined.

The Cooperative asserts that it has been transparent about the phased approach (i.e., proposed facilities at Nuyakuk Falls being the first phase and the second phase concerning the proposed transmission lines) to the section 106 process and that the Commission, Tribes, and the SHPO will be consulted to determine an appropriate APE for the transmission line. The Cooperative adds that it appreciates UTBB's input on the APE for the transmission line using the Argonne Laboratory approach and the information regarding the recommendations of eligibility.

The Cooperative states that it appreciates UTBB's concerns regarding the lack of evaluation to sites with Yup'ik names, that there may or may not be material cultural remains associated with these places, and some could be TCPs. The Cooperative adds that it understands that the significance of an ancestral site would be best determined by the group whose history it represents and states that future consultation may alter eligibility recommendations. Also, the Cooperative states the Nushagak River Traditional Cultural Landscape will be considered as the section 106 process continues. Lastly, the Cooperative urges any person or Tribal entity, including UTBB, to contact the Cooperative if they have information on Nuyakuk Falls being considered a TCP and states that future consultation may result in information that would lead to recommending Nuyakuk Falls eligible for the National Register as a TCP.

Discussion and Staff Recommendation

The first step in evaluating the effects of project construction and operation on properties eligible for inclusion on the National Register is identifying the APE and the resources within the APE. Although the Cooperative's efforts have thus far focused on the resources surrounding the falls where most of the project facilities (intake structure, powerhouse, airstrip, access road, cabins, and other structures) would be located, it has committed to expanding its efforts in consultation with Tribes, SHPO, and Commission staff to include the transmission line corridors and any TCPs, which include traditional cultural landscapes, that could be affected by the project. Consideration of auditory and

visual effects of the transmission line on TCPs should be considered in selecting the transmission line corridor APE and any modifications necessary for the APE at Nuyakuk Falls to address TCPs. Using methods that consider the height and visibility of the transmission line would be an appropriate method to use to help select the APE and analyze effects, but the appropriate distance would depend on site topography and distance to identified TCPs. Therefore, based on available information, Commission staff cannot determine if a minimum of 5.5 miles around the transmission line would be appropriate as suggested by UTBB. Therefore, we recommend that the Cooperative consult with the Tribes and Alaska SHPO as required by the approved study plan to identify the appropriate APE for indirect project effects on TCPs and to justify the distance chosen for analysis in the draft license application.

Because the Cooperative has committed to finalizing the APE in consultation with the Tribes, Alaska SHPO, and Commission staff, and identifying and analyzing direct and indirect cultural resources affected by the project (including the transmission line once a final route is selected) as required by the approved study plan, it is premature to recommend any modifications to the study plan.

However, to be clear, the Cooperative's remaining efforts are not confined to investigating direct and indirect effects of the final transmission line corridor(s). The Cooperative has not sought the Tribe's and Alaska SHPO approval of the APE around Nuyakuk Falls, identified or undertaken efforts to determine if the falls constitute a TCP or historic district as suggested by UTBB, or evaluated places with Yup'ik names within five miles of the project site for National Register eligibility, as it has committed to do. In the April 18, 2024 study determination, Commission staff expressed its concern about the Cooperative's efforts to engage the Tribes and modified the study to require the Cooperative to file quarterly progress reports with the Commission documenting its consultation efforts with the Tribes. The Cooperative failed to file any reports until the last quarter following a reminder from Commission staff. Therefore, we remind the Cooperative that it must continue to file quarterly reports until the study is complete.

Economic Decision Support Tool

Background

The approved study plan required the Cooperative to develop a spreadsheet-based analytical tool (economic Decision Support Tool or eDST), to aid in assessing tradeoffs between the power generation and economic benefits of the project and potential effects on salmon abundance and commercial salmon fisheries. The eDST would consider both: (1) the economic impact of developing the run-of-river hydropower project as well as the impact on the sockeye and Chinook fisheries, and (2) an electricity-based rate model to explore cost differentials between current diesel generation and a run-of-river hydropower project with diesel backup. The tool would consider numerous factors such

as the cost of project power, the cost of existing diesel generation, and the amount of energy produced at the project over the term of any license issued for the project considering river flow conditions (such as the diversion limits per month, the baseline river flow values by month in cubic feet per second, and the potential changes in flow associated with climate change). It would also consider predicted changes in sockeye and Chinook salmon returns with and without the project. The eDST would incorporate information from the river flow/climate model in terms of the impact over the 50-year life of the run-of-river hydro generation system, the powerhouse model, and the aquatic fisheries lifecycle model to capture the economic impact from changes in sport and commercial fishing.

The USR states that the eDST was to be integrated into the LCM and "the data collected as part of the eDST will be referenced in the LCM Report which will be filed with FERC as part of an addendum in February 2025." The USR also states that the eDST model will be filed as an attachment to the USR addendum.

Requested Study Modification

Commercial Fisherman requests that study implementation for the eDST include participation from the fishing industry "throughout the process" to ensure that the tool accurately predicts potential impacts to the commercial fishing economy. Commercial Fisherman states that as the eDST is updated with input from the other studies, economic scenarios should be presented to Bristol Bay communities and members of the fishing industry for their input. Commercial Fisherman states that as the region's economic driver, any potential direct impacts to salmon populations as well as indirect impacts to the fishing economy must be accurately evaluated.

Reply Comments

The Cooperative states that the eDST was a voluntary study "implemented by the Cooperative outside of the FERC process" (i.e., not a requirement of the approved study plan). The Cooperative states that if the Cooperative elects to move forward with the licensing process, it is committed to working with all interested parties on any further refinements to the eDST.

Discussion and Staff Recommendation

The eDST was part of the Commission approved study plan[8] and the Cooperative committed to filing the eDST as an addendum to the USR. However, we are unable to

[8] See Appendix A of Commission staff's August 24, 2022, study plan determination.

locate the eDST within that document. Therefore, we recommend that the Cooperative file the eDST with the draft license application.

The primary purpose of the eDST as it relates to commercial fisheries is that it would be used to assign a potential economic value to the commercial fishery after taking into consideration the effects of the project on fish populations that support commercial fisheries (e.g., sockeye and Chinook salmon). However, as explained in detail elsewhere in this determination, there is sufficient information from the Cooperative's other fisheries studies and models to assess project effects on the sockeye and Chinook populations. This information can be used in turn to, as a broad socioeconomics matter, evaluate potential project effects on commercial fishing in the project-affected area (section 5.9(b)(4)). Therefore, we do not recommend requiring the Cooperative to conduct any additional efforts to further refine the eDST or its outputs.

Aesthetics Study

Background

The approved study plan required the Cooperative to identify Key Observation Points (KOPs) and develop visual values and classifications that describe the level of change from the existing conditions at the KOPs that would result from project construction. The KOPs were to be selected, and the evaluations made, using an interdisciplinary team composed of invited members from the Alaska Department of Natural Resources Division of Parks and Outdoor Recreation, local outfitters such as Royal Coachman Lodge, and Tribes that use the project area for subsistence, residence, or other traditional cultural practices. At a minimum, KOPs were to be established near Nuyakuk Falls and from representative public use sites along the transmission line and within the six communities served by the proposed project transmission line.

The Cooperative identified and assessed 7 KOPs[9] around the Nuyakuk Falls project area. Photographs from these locations, topobathymetric LiDAR data, and aerial imagery were used to create a digital elevation model of the Nuyakuk Falls project area. The digital elevation model file was exported in Global Mapper to develop a 3D physically based rendering of the 7 locations with the proposed project features. The rendering was synthesized into a short video that simulates both on the ground and aerial imagery with the proposed project features in place.

No KOPs were established along the proposed transmission line route or around the six communities served by the proposed project transmission line. The Cooperative states that it used the Nushagak and Mulchata Rivers Recreation Management Plan (Alaska DNR) and the current conceptual design elements for the project as the primary

[9] The Cooperative called these sites "Key Points of Interest."

drivers for assessing aesthetic impacts. The Cooperative did not use an interdisciplinary team to identify and evaluate KOPs and states that substantial collaboration with the Recreation and Aesthetics TWG would occur to define the elements of a Visual Resources Management plan if a license is issued for the project.

Requested Study Modification

Royal Coachman, Trout Unlimited, and the Council, state that the study did not evaluate the visual effects of constructing the project transmission line. The Council also expressed concern over not using an interdisciplinary team to evaluate the study design, methodology, or study results. The Council recommends repeating the study to include the transmission line, and when doing so, include the Council members as part of the interdisciplinary team for study implementation. The Council also states that "the discussion of study results contains value statements which do not align with the comments and discussions held at our Council meetings."

Reply Comments

The Cooperative states that a very detailed, high-quality video is available on the Cooperative's project website that provides a flyover and a ground-referenced rendering of all proposed project works as well as the transmission line near the falls. They state that the portion of the proposed transmission line shown in the video provides valuable context into the visual impact of the line and is accurate from an elevation perspective given the comprehensive topographical survey data collected. They state that the video includes imagery of the substation connection to the transmission line and the transmission line itself, as it transitions into its corridor. They state that the proposed project features were looked at globally, not just from a KOP perspective, which was necessary to evaluate the aesthetic effects on the area. Lastly, the Cooperative states that "the combination of KOPs and video are beyond commensurate with other aesthetic studies conducted in other recently licensed projects in Alaska."

Discussion and Staff Recommendation

Although the Cooperative did not select KOPs of the project features at Nuyakuk Falls in consultation with stakeholders, the video and renderings from the seven KOPs will be sufficient to analyze the aesthetic effects of constructing the project facilities from various points near Nuyakuk Falls if the Cooperative provides all the ground and aerial photography used to create the video simulation and photo renderings. Without the baseline data, it is difficult to contrast the existing condition with the developed condition. Therefore, we recommend that the Cooperative file all ground and aerial photographs for each KOP with its draft license application.

However, the video and renderings do not provide any information regarding how the proposed transmission line could affect the visual landscape or users from areas along the transmission line further from the falls. There is no evidence that the Cooperative tried to select KOPs for the proposed transmission line in consultation with the interdisciplinary team as required by the approved study plan.

Therefore, Commission staff recommends completing the approved study plan by identifying KOPs along the transmission line corridor in consultation with the interdisciplinary team and providing an evaluation of the level of change at the KOPs, including renderings of selected KOPs to illustrate the change. KOPs could include TCPs or areas used for subsistence and representative views of the transmission from the six communities being connected by the transmission line. Because the approved study plan already requires this analysis, no modifications are needed. However, the study is not complete as implied by the Cooperative, and therefore, we recommend that the Cooperative file the results of the completed study with the draft license application.

Contrary to the Cooperative's assertion, the study requirements are consistent with accepted practices and have been required in other licensing proceedings (section 5.11(d)(5)). For example, the Alaska Energy Authority was required to evaluate aesthetic conditions and potential project effects by conducting viewshed modeling and producing photo simulations for all project features, including the reservoir, roads, and transmission lines, for the proposed Susitna-Watana project (P-14241) on the Susitna River in the Matanuska-Susitna Borough, Alaska.

Environmental Justice Study

Background

The Cooperative proposed to determine if and how licensing the project, including construction, could disproportionately and adversely affect identified environmental justice communities. To achieve this goal, the Cooperative would: (1) identify potential environmental justice communities, (2) conduct outreach efforts to identified environmental justice communities, (3) evaluate the potential for disproportionate and adverse effects on environmental justice communities and if those effects would be disproportionately high and adverse, and (4) describe any mitigation measures proposed to avoid and/or minimize potential project effects on environmental justice communities.

The Cooperative conducted the analysis by applying the methods included in EPA's *Promising Practices for EJ Methodologies* in NEPA Reviews (2016). For analyses that require comparison to a reference population, the Cooperative used the Bristol Bay Native Regional Corporation as the reference population reasoning that it encompasses all block groups potentially impacted by the project and is appropriately representative of the region, significantly more so than applicable borough or state

comparisons. Regarding outreach efforts, the Cooperative states that it encouraged and solicited regional participation via in-person meetings, phone calls, virtual meetings, updates to the project website, resource-specific technical working groups, and over 120 meetings/presentations related to the project.

Based on the study results, the Cooperative concluded that all communities and villages in the study area are identified as environmental justice communities; therefore, "effects cannot be disproportionately higher than populations unaffected by the project."

Requested Study Modification

UTBB states that the Cooperative improperly conducted its environmental justice analysis because it failed to identify an appropriate "comparison group" to support its conclusion that no community would experience disproportionately high and adverse effects from the project and that this improperly minimizes any potential impacts.

Reply Comments

The Cooperative states that recent federal guidelines still require the Commission to consider environmental justice impacts associated with potential project development; however, environmental justice assessments are no longer required by applicants.

Discussion and Staff Recommendation

President Trump's Executive Order 14148, entitled "Initial Rescissions of Harmful Executive Orders and Actions" rescinds Executive Order 14096 (Revitalizing Our Nation's Commitment to Environmental Justice for All). For this reason, the study is not needed for staff's environmental analysis. Staff's analysis will examine impacts to all potentially affected communities and, where appropriate, will consider measures to mitigate those impacts.

APPENDIX C

STAFF'S RECOMMENDATIONS ON REQUESTED NEW STUDIES

New Study Request: Construction Equipment Study

Requested New Study

Royal Coachman requests a new study to assess how the equipment needed to build the project would be delivered to the site. Royal Coachman states that a project of this scope will require heavy machinery. Royal Coachman states that it has used helicopters to lift various loads into its lodge (located upstream of the project site) over the past 20 years and it's uncertain whether equipment that would be needed to build the project could be delivered by helicopter. Royal Coachman adds that a barge can only make it upriver as far Koliganek on the Nushagak River, leaving about 33 miles that the machinery would have to be driven over land to the site. Royal Coachman states that transporting equipment that far over land would likely affect environmental resources, which should be studied and evaluated as part of the environmental analysis.

Comments on Requested New Study

The Cooperative states that there are currently two well-developed lodges close to the project site within the Tikchik lake system, one with an airstrip on site, and there are several private property inholdings that have been developed as well, suggesting that it is possible to transport construction materials for a large-scale construction project to the area. The Cooperative adds that is has completed construction of a 135-mile buried fiber optic cable between Dillingham and Levelock. The Cooperative states that the fiber optic cable project supports the notion that equipment and materials for a large construction project can be transported overland to the site via the transmission line route during the winter when the ground is frozen.

Discussion and Staff Recommendation

The Cooperative's reply comments are the first mention in the project record of using the transmission line corridor as a road for transporting construction equipment and materials to the project site during the winter. Should the Cooperative include this proposal as part of its proposed action, the license application would need to describe under what conditions the road would be used to transport materials. As the Cooperative notes, it is not uncommon for materials to be transported under these conditions in northern climates. If the road is only used during the winter when the ground is frozen and covered in snow and ice, there would likely be minimal adverse effects on environmental resources, and we have sufficient information to analyze those effects. However, if the Cooperative proposes to use the road outside of the winter, additional

information may be required based on its specific proposal. We expect that the Cooperative will provide detailed information on its plans for use of the transmission line corridor for transporting construction materials in its draft license application. Therefore, we don't recommend requiring the Cooperative to conduct a study to assess how construction equipment will be delivered to the project site.

New Study Request: Moose Study

Requested New Study

BBNC requests a new study to assess project effects on moose. BBNC states that moose is "an important subsistence species in the region, and the USR does not appear to assess moose populations or potential impacts." BBNC states the Caribou Population Evaluation study provides useful insights into potential impacts on caribou populations and caribou-human interactions near the transmission corridor. Conducting a similar study for moose "would be beneficial and complement the studies completed to date."

Comments on Requested New Study

The Cooperative states that during study planning efforts with federal and state agencies, Tribal entities, and members of the public, caribou were identified as a primary focus species for the study program. The Cooperative did not directly respond to BBNC's request for a moose study.

Staff Discussion and Recommendation

The approved study plan required the Cooperative to conduct a desktop study that evaluated caribou population size, migration patterns, and habitat utilization data to determine the potential effects of project construction and operation on "caribou behavior and success." Data sources included existing literature, agency correspondence, and publicly available information from Alaska DFG on the Mulchatna caribou herd.

As part of the Botanical and Wetlands Survey Study, the Cooperative conducted an aerial survey of the transmission line corridor in June 2024 which documented habitat conditions, vegetation communities, megafauna distribution, game trails (including moose), potential migration corridors, and anthropogenic trails. These survey results provide information on moose habitats within the project area. Additional, information on moose and its habitat is accessible through the Alaska DFG website (Alaska DFG, 2025b). Scientific literature is available on the effect of linear features, including powerlines, on moose movement (e.g., Bartzke et. al., 2015; Ricard and Doucet, 1999).

The data collected from the Cooperative's studies and the additional information identified above should be sufficient to analyze the effects of proposed project

construction and operation on moose and its habitat (section 5.9(b)(4)). Therefore, we do not recommend the Cooperative conduct a new study on moose populations and potential impacts.

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