



June 23, 2016

Hon. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Via online submission to: <http://www.ferc.gov>

**REQUEST FOR FURTHER STUDY OF THE IMPACTS OF CLIMATE CHANGE IN
THE SUSITNA RIVER BASIN FOR THE SUSITNA-WATANA HYDROPOWER
PROJECT (FERC PROJECT P-14241)**

On behalf of our more than 2 million members and online activists, the Natural Resources Defense Council (“NRDC”) submits the following comments regarding the proposed hydroelectric dam and power-generating facility on the Susitna River in Alaska (“Project,” FERC Project P-4241).¹ In the studies the Alaska Energy Authority (“AEA” or “Applicant”) submitted in its Initial Study Report (“ISR”) application filed June 3, 2014 (and supplemented through November 6, 2015 in ISR Parts A, B, C, and D) as part of its pre-license application before the Federal Energy Regulatory Commission (“FERC” or “Commission”), AEA failed to include a basin-wide study of climate change impacts as they affect the operation of the Project and surrounding natural resources.

¹ NRDC hereby incorporates by reference all of its past comment letters, and asks that these comments be placed in the record of the Initial Study Report (“ISR”) proceeding pursuant to 18 C.F.R. § 5.15(c)(4). NRDC, Mot. to Intervene (March 13, 2012); NRDC, Comments on Pre-Application Document and Scoping Document 1 for the Alaska Energy Authority Proposed Susitna-Watana Hydroelectric Project (FERC Project P-14241) (May 30, 2012). NRDC, Comments on Proposed Study Plan and Requested Modifications to the Proposed Study Plan of the Alaska Energy Authority for the Susitna-Watana Hydroelectric Project (FERC Project P-14241) (November 14, 2012) [hereinafter NRDC Comments on Proposed Study Plan]; NRDC, Comments on the Revised Study Plan for Studies 5.5, 5.6, 5.7, 6.5, 7.5, 7.6, 8.5, 8.6, 9.5, 9.9 and 11.6 of the Alaska Energy Authority for the Susitna-Watana Hydroelectric Project (FERC Project P-14241) (March 18, 2013) [hereinafter NRDC Comments on Revised Study Plan]. NRDC Submission of Report on Climate Impacts Associated with Dams for FERC Review of the Susitna-Watana Hydroelectric Project (FERC Project P-14241) (September 29, 2013); NRDC, Comments on Study Dispute of the National Marine Fisheries Service (“NMFS”) Before the Federal Energy Regulatory Commission (“FERC”) of FERC’s Study Plan Determination for the Susitna-Watana Hydroelectric Project (FERC Project P-14241) (April 1, 2013).

Licensing participants now have the opportunity to review the ISR and file comments and proposed “modifications to ongoing studies or new studies.”² NRDC requests that FERC require in the Study Plan an analysis of the cumulative impacts of climate change and the Project throughout the whole Susitna River basin, including the ecological impacts of predicted changes to surface water temperature and flow. Specifically, “NRDC’s Study Request” or “NRDC’s Requested Study” asks that the Applicant:

- a. Develop a climate model for the entire basin, using downscaled climate projections to simulate future non-stationary environmental conditions (including changes to evapotranspiration, glaciers, permafrost, hydrology, and surface water temperature) in accordance with the lifespan of the project (anticipated to last 100 years); and
- b. Apply this updated environmental baseline to analyses of Project impacts on the aquatic, riparian, and terrestrial habitat and species both upstream and downstream of the proposed dam.

It is only with this basin-wide climate study that the Commission can adequately discharge its statutory duty under Section 4(c) of the Federal Power Act (“FPA”), which requires FERC to give equal consideration to the “protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality” when making a decision to grant a hydropower licenses.³ Furthermore, this information is necessary for the National Marine Fisheries Service (“NMFS”) and the United States Fish Wildlife Service (“USFWS”) to develop recommendations to protect, mitigate damage to, and enhance affected fish and wildlife and habitat, as authorized in the FPA.⁴ Therefore, failure to require a basin-wide climate study will prevent FERC and the Services from understanding the potential impacts of the proposed Project, and consequently prevent them from making informed licensing decisions in accordance with their statutory obligations and authorities.

As noted in comments filed by other participants and agencies, the Applicant’s ISR contains inaccurate and incomplete environmental baseline data and analyses.⁵ NRDC agrees with the following requests for new studies, requests for modification of ongoing studies, and disagreements with the Applicant’s ISR meeting summary: Comments by The Nature Conservancy on the Initial Study Reports (June 17, 2016),⁶ NMFS Review of ISR (June 22,

² 18 C.F.R. §5.15(c)(4)

³ The Federal Power Act, 16 U.S.C. § 797(c).

⁴ *Id.* §§ 801(a), 803(j), 811.

⁵ NMFS preliminary comments on June 3, 2014 Initial Study Report for discussion at October ISR meeting NOAA Fisheries Service, Alaska Region under P-14241 (Sept. 22, 2014) [hereinafter NMFS ISR Comments]; USFWS comments on new study reports (2014) filed for P-14241 (October 10, 2014) [hereinafter USFWS ISR Comments]; Comments from Ctr. for Biological Diversity regarding the Revised Study Plans, Project P-142410 (Dec. 14, 2012) [hereinafter Ctr. for Biological Diversity Comments on the RSP].

⁶ Comments from Corinne Smith, The Nature Conservancy, to Kimberly Bose, Secretary, FERC, on the Initial Study Reports (Susitna-Watana Project, P-14241) (June 17, 2016).

2016),⁷ USFWS Review of ISR (June 22, 2016)⁸ and Wild Salmon Center Comments on the ISR and Proposed Modifications (June 23, 2016)⁹. While NRDC supports these comments, NRDC's comments below focus on the need for developing a predictive modeling framework to assess the cumulative impacts of climate change and the Project on the watershed's ecosystem.

The Susitna Project is particularly vulnerable to the impacts of climate change because of its location in subarctic Alaska, a region profoundly affected by global warming.¹⁰ The state is warming at twice the rate of the nation, with annual air temperature increasing by 3 degrees Fahrenheit and average winter temperature increasing by 6 degrees Fahrenheit over the past several years.¹¹ Such warming causes a cascade of hydrologic effects, including melting glaciers and permafrost and associated alterations in river temperature and flow regimes.¹² Wild salmon in this subarctic region depend on cold surface water temperatures, glacial sediment, riparian vegetation, and the seasonal flows tied to ice processes.¹³ Yet hydroelectric dam operations, like the proposed Susitna, release water according to electricity and demand, which dramatically alters natural flows and the temperature of the river.¹⁴ Thus, a study of the effects of both the operation of the dam *and* of a warming climate on river and ice processes and surface water temperature across the basin must be undertaken to fully understand the environmental impacts on sensitive fisheries habitats that occur above and below the dam.

⁷ NMFS, ISR review, Study Modifications, New Study Request, and Comprehensive Plan for the proposed Susitna Hydropower Project under P14241 (June 22, 2016).

⁸ USFWS, ILP Initial Study Report of USFWS Anchorage Field Office under P-14241 (June 21, 2016).

⁹ Wild Salmon Center, Comments on the Alaska Energy Authority's Initial Study Report, 2014 Technical Memorandum, and Supplemental Filings and Recommended Proposed Modifications, Susitna-Watana Hydrologic Project No. 14241-000 (June 23, 2016).

¹⁰ See F.S. Chapin, III et al., *Ch. 22: Alaska*, in CLIMATE CHANGE IMPACTS IN THE UNITED STATES: THE THIRD NATIONAL CLIMATE ASSESSMENT 514, 515 (J. M. Melillo, Terese Richmond, and G. W. Yohe eds., 2014), <http://nca2014.globalchange.gov/downloads> [hereinafter CLIMATE CHANGE IMPACTS IN ALASKA].

¹¹ See *id.* at 516.

¹² See *id.* ("Because of its cold-adapted features and rapid warming, climate change impacts on Alaska are already pronounced, including earlier spring snowmelt, reduced sea ice, widespread glacier retreat, warmer permafrost, drier landscapes, and more extensive insect outbreaks and wildfire.").

¹³ See generally M. D. Byrant, *Global Climate Change and The Potential Effects on Pacific Salmonids in Freshwater Ecosystems of Southeast Alaska*, 95 CLIMATIC CHANGE 169 (2009).

¹⁴ See generally ANCHOR QEA, PHASE 1 EXECUTIVE SUMMARY: PRELIMINARY FRAMEWORK FOR ECOLOGICAL RISK ASSESSMENT OF LARGE-SCALE HYDROPOWER ON BRAIDED RIVERS IN ALASKA, prepared for The Nature Conservancy, 8 (June 2015),

https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/alaska/scak/Documents/TNC_AKHydropower_ERA_Ph1ExecSum_June15.pdf [hereinafter TNC, ECOLOGICAL RISK ASSESSMENT].

FERC has yet to require an Applicant to undertake a comprehensive study of the impacts of climate change in a hydroelectric licensing proceeding.¹⁵ Three years ago, when the issue was before FERC, the Commission declined to require AEA to undertake a basin-wide study of climate change, and instead ordered the Applicant to conduct a literature review of the issue.¹⁶ However, FERC noted in its decisions that the science of climate change is rapidly changing and that it may in the future require climate change assessment as part of the licensing process.¹⁷ NRDC submits that it is time for FERC to require analysis of climate change in the Project's environmental review given recent advancements in climate science and the growing trend of other federal agencies undertaking climate impact assessments. A component crucial to informing FERC's decision-making is the assessment of potential effects of climate change on water resources, geomorphology, and terrestrial, riparian, and aquatic resources of the entire Susitna River basin, not just inflow to the upper basin as studied by AEA. The rationale that FERC has used in past hydroelectric relicensing proceedings—that climate science was too speculative and reliable data was minimal¹⁸—is not applicable this Project. As will be discussed, advances in climate science, and trends in law and policy, demonstrate that such arguments are no longer relevant.

NRDC's Study Request for an expanded basin-wide study modeling climate change impacts on the Susitna watershed and its ecosystem is supported by and is consistent with FERC's Initial Study Review regulations, which allow a participant to propose a "study modification" or a "new study" after the applicant has filed the results of its first year studies.¹⁹ The arguments and facts set forth in detail below meet the requirements for a "study modification" and a "new study," thereby supporting FERC's approval of either.

The facts and arguments below establish that, consistent with FERC regulations, the following conditions exist in support of expanding the study of climate change impacts:

¹⁵ See, e.g., *Eagle Crest Energy Co.*, 147 FERC ¶ 61,220 (June 19, 2014) ("It would be too speculative to attempt to predict future scenarios that may occur due to climate change."); *Mahoning Hydropower*, 148 FERC ¶ 62,231 (September 26, 2014) (same); *Clean River Power MR-3*, 153 FERC ¶ 62,257 (December 30, 2015) and *Clean River Power MR-5*, 153 FERC ¶ 62,258 (December 30, 2015) (same); *Dominion Cove Point LNG*, 151 FERC ¶ 61,095 (May 4, 2015) (denying rehearing and stay, and contending that its initial order did not fail to analyze all of the impacts of climate change on the project, particularly from intense winds and storms).

¹⁶ *Alaska Energy Authority*, 144 FERC ¶ 61,040 (July 18, 2013).

¹⁷ See, e.g., 144 FERC ¶ 61,040 (Norris, concurring); *Eagle Crest Energy Co.*, 147 FERC ¶ 61,220 (June 19, 2014) ("If there is a need to modify project operations or facilities to accommodate changes because of climate change or related factors during the license term, and reliable data became available to justify such modifications, the Commission has retained the authority to reopen the license to determine whether additional environmental measures are necessary."); *Mahoning Hydropower*, 148 FERC ¶ 62,231 (September 26, 2014) (same); *Clean River Power MR-3*, 153 FERC ¶ 62,257 (December 30, 2015) and *Clean River Power MR-5*, 153 FERC ¶ 62,258 (December 30, 2015) (same).

¹⁸ See, e.g., 147 FERC ¶ 61,220; 144 FERC ¶ 61,040.

¹⁹ 18 C.F.R. § 5.15 (c)(4).

- a. Environmental conditions have changed in a material way since FERC determined a basin-wide climate change study was not required;²⁰
- b. There have been material changes in the law and policy governing how federal agencies incorporate climate-related considerations into their environmental assessments;²¹ and
- c. There is significant new information relating to the study of climate change, including advances in, and federal agency applications of, modeling techniques²² (see Appendix for detailed lists of recent advances in climate change science and related federal agency and White House actions).

1. FERC has the statutory authority to approve a modification or new study

FERC's role at this Initial Study Review phase of the license application is to make certain that studies presented by AEA provide accurate and adequate information regarding the environmental impacts of the proposed Project. Pursuant to its regulations, FERC has the broad discretion to require AEA to address deficiencies by ordering new studies or significantly modifying existing studies.²³

FERC has a duty under its regulations to independently assess the studies before the Commission and decide—based on the evidence presented in the study and by the agencies and the participants—whether it should order study modifications or request new studies. Study modification proposals must demonstrate that the study was not conducted as provided for in the approved Study Plan, that there were anomalous environmental conditions during the time the study was conducted, or that environmental conditions changed in a material way.²⁴ A proposal for a new study must demonstrate that new relevant information has become available or that relevant laws and regulations have changed.²⁵ If FERC determines that a proposal adequately provides a showing of “good cause” by meeting these criteria, then the Commission has the authority to order the modified or new studies.²⁶

The purpose of these “Conduct of Studies” regulations is to provide an opportunity early on for the participants, agencies, tribal entities, and FERC staff to scrutinize whether an Applicant is following the approved study plan and whether circumstances have changed such that there is cause to include any new studies.²⁷ It is during the Initial Study Review phase of the license pre-application that study results can elucidate the need or value of new studies or the need to modify

²⁰ *Id.* § 5.15 (d)(2).

²¹ *Id.* § 5.15 (e)(1).

²² *Id.* § 5.15 (e)(4).

²³ See *Georgia Power Co.*, 111 FERC ¶ 61433 (June 20, 2005). FERC has broad discretion in determining whether to require pre-licensing studies.

²⁴ 18 C.F.R. § 5.15 (d).

²⁵ *Id.* § 5.15 (e).

²⁶ NRDC's Study Request meets the criteria for both a study modification and a new study. FERC has the discretion to determine whether to grant a new study or study modification.

²⁷ 18 C.F.R. § 5.15.

ongoing studies. It is crucial to point out deficiencies in these early studies so that they can be corrected in follow-up studies. Second Year and Third Year follow-up studies should not commence until FERC and all parties are satisfied that First Year studies are accurate and complete.²⁸

AEA's First Year studies are poorly conducted and should not serve as the foundation for a second year of study. Instead, they must be redone as First Year studies, so that they can provide an accurate foundation for later Second and Third Year studies, and eventually form the basis of an updated study report.²⁹ Despite the quantity of data collected by AEA's numerous consultants, the federal agencies responsible for reviewing the data and the participants in the Initial Licensing Process ("ILP") proceeding have raised serious concerns.³⁰ Many of AEA's studies require modification or were not conducted pursuant to the FERC approved Study Plan and were conducted during anomalous environmental conditions that occurred during the first year of studies.³¹

In sum, FERC's role at this stage in the proceeding is to sift through the data and analyses and determine whether to modify any of the ongoing studies, or to grant any requests for new studies.³² FERC's failure to require AEA to study how climate change will affect the sections of

²⁸ AEA has essentially conducted its "First Year Studies" over a period of more than two years (2013-2015). *Documents*, SUSITNA-WATANA HYDRO, <http://www.susitna-watanahydro.org/type/documents/> (last visited June 17, 2016).

²⁹ 18 C.F.R. § 5.15(f).

³⁰ NMFS ISR Comments; USFWS ISR Comments.

³¹ *Id.*; Ctr. for Biological Diversity Comments on the RSP; NRDC Comments on Proposed Study Plan; NRDC Comments on Revised Study Plan; Water and Power Law Group, AEA's Update Regarding Study Plan Implementation During the 2014 Field Season for the Susitna-Watana Hydroelectric Project (P-14241).

³² See 18 C.F.R. § 5.15(c)(4) ("Any participant or the Commission staff may file a disagreement concerning the Applicant's meeting summary within 30 days, setting forth the basis for the disagreement. This filing must also include any *modifications to ongoing studies or new studies* proposed by the Commission staff or other participant." (emphasis added)); *id.* § 5.15(d) ("*Criteria for modification of approved study*. Any proposal to modify an ongoing study pursuant to paragraphs (c)(1)–(4) of this section must be accompanied by a *showing of good cause* why the proposal should be approved, and must include, as appropriate to the facts of the case, a demonstration that: (1) Approved studies *were not conducted as provided for in the study plan*; or (2) The study was conducted under *anomalous environmental conditions* or that environmental conditions have changed in any material way." (emphasis added)); *id.* § 5.15(e) ("*Criteria for new study*. Any proposal for new information gathering or studies pursuant to paragraphs (c)(1)–(4) of this section must be accompanied by a *showing of good cause* why the proposal should be approved, and must include, as appropriate to the facts of the case, a statement explaining: (1) Any material changes in the law or regulations . . . ; (2) Why the goals and objectives of any 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 5.9." (emphasis added)).

the Susitna River below the dam prevents full compliance with the FPA³³ to ensure adequate protection and enhancement of fish and wildlife, because it leaves unstudied an integral part of the river's ecosystem.

2 NRDC's Study Request meets the requirements of sections 5.15(d) and (e) for a showing of good cause why the proposal should be approved

NRDC makes its Study Request for a basin-wide climate study as either a modification or a new study and presents the following evidence to meet criteria for both. There is "good cause" to approve NRDC's Study Request given the overwhelming evidence in the record of this proceeding that hydropower dams vastly reduce salmon abundance and productivity by disrupting the natural river processes and habitats upon which salmon rely. The dam will block passage of salmon that spawn and rear upstream and alter the existing flow regime for approximately 180 miles downstream of the dam site.³⁴ According to a study of the Susitna Project conducted by the environmental consulting firm Anchor QEA, "Changes to flow regimes and sediment supplies will cause a cascade of habitat effects that may take decades to reach a state of dynamic equilibrium following construction."³⁵ Regional ecosystems are already under stress due to climate change;³⁶ the Project will only amplify these existing threats to fish, wildlife, and habitat.

While AEA has analyzed the potential impacts of glacial wastage and retreat on the Project (including changes to runoff and sediment delivery), it has not assessed the potential impacts of climate change on the Susitna watershed and ecosystems (on both the upper *and* lower river basin). These studies are needed to determine how anticipated seasonal, annual and long-term changes in temperature and precipitation will influence the efficiency, longevity and ecological

³³ The FPA guides FERC in how to assess the evidence submitted in the ISR and requires FERC to give equal consideration to environmental consequences of its actions when exercising its licensing authority for hydroelectric projects. FERC must review studies submitted in the pre-license phase of an application with the same standards applicable to a hydropower license, which provide in pertinent part: "In deciding whether to issue any license under this Part for any project, the Commission, in addition to the power and development purposes for which licenses are issued, shall give equal consideration to the purposes of energy conservation, the *protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.*" 16 U.S.C § 797(e) (emphasis added). FERC's role in review of the ISR studies is further prescribed in section 10(a)(1), which conditions all licenses on a requirement that: "the project adopted...shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the *adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes* referred to in section 797(e) of this title." *Id.* § 803(j) (emphasis added).

³⁴ NMFS Request for Rehearing, at 2.

³⁵ TNC, ECOLOGICAL RISK ASSESSMENT, at 8.

³⁶ See CLIMATE CHANGE IMPACTS IN ALASKA, at 515, 533.

impacts of the Project. Without this information, studies assessing the environmental impacts of dam operations will be based on conditions that will not exist in the future and are therefore inaccurate.

NRDC requests that FERC modify the Study Plan or order a new study and reverse its prior decision not to study climate impacts throughout the entire basin.³⁷ The impact of the dam's operation together with the rapidly changing climate in the region will result in altered hydrology across the entire basin, with potentially devastating consequences to sensitive fisheries habitat that occur above and below the dam.

3. NRDC's Study Request meets FERC's requirement for a "study modification"

3.1 Section 5.15(d)(2) Environmental conditions have changed in a material way³⁸

Climate change has already altered environmental conditions in the region of the proposed Project since FERC issued its Study Plan Determination ("SPD") in 2013. The Third National Climate Assessment, released in 2014, summarizes how major shifts in Alaska's climate are occurring at a rate faster than previously projected.³⁹ From December of 2014 through February of 2015, average temperatures in Alaska were as much as 10 degrees Fahrenheit higher than average. As a result, the state experienced significantly diminished levels of snowpack, an important source of runoff and water supply.⁴⁰ These conditions raise concerns over the rate of climate change in the subarctic, given that recent increases exceeded the level of warming previously predicted to occur over the course of a century.⁴¹

In the SPD, FERC suggested that simply monitoring hydrologic conditions and operating the dam to accommodate any water supply oscillations could sufficiently ameliorate future potential adverse environmental effects.⁴² However, using a stationary environmental baseline around which minor fluctuations may occur is no longer accepted practice by the scientific community

³⁷ In its Study Plan Determination ("SPD"), FERC ruled: "[W]e do not recommend extending the geographic range of climate change assessment or adding an analysis of natural resources impacts as recommended by the National Marine Fisheries Service ("NMFS") and others." Letter from Jeff C. Wright, Dir., Office of Energy Projects, FERC, to Wayne Dyok, Susitna-Watana Project Mgr., AEA, Re: Study Plan Determination for the Susitna-Watana Hydroelectric Project, Project No. 14241-000, B-5 (Feb. 1, 2013), http://www.susitna-watanahydro.org/wp-content/uploads/2015/11/20130201_FERC_SPD.pdf [hereinafter "Study Plan Determination"].

³⁸ 18 C.F.R. § 5.15(d)(1) ("Approved studies were not conducted as provided for in the approved study plan") is not applicable.

³⁹ CLIMATE CHANGE IMPACTS IN ALASKA, at 515, 533.

⁴⁰ Tom DiLiberto, "Winter" in Alaska, CLIMATE.GOV (Mar. 18, 2015), <https://www.climate.gov/news-features/event-tracker/%E2%80%9Cwinter%E2%80%9D-alaska>.

⁴¹ See Gerd Wendler et al., *The Climate of Alaska for 2015*, ALASKA CLIMATE RESEARCH CTR, <http://akclimate.org/Summary/Annual/2015> (last visited May 16, 2016).

⁴² Study Plan Determination, at 18.

and many federal agencies.⁴³ The paradigm's core assumption of relatively static conditions is flawed, particularly in snow-dominated regions like Alaska where changes to precipitation and temperature will impact the magnitude, timing, and temperature of streamflow.⁴⁴ The Glacier and Runoff Changes Study and the Fluvial Geomorphology Study (Section 7.7 and Section 6.5 of the ISR, respectively) cannot establish an accurate baseline of environmental conditions, nor develop a realistic projection of future trends, without taking into account the recent impacts of climate change and modeling future changes on both the upper and lower Susitna River. Given that the proposed Project would be built in a location that is experiencing exceptionally rapid climatic change, the study should be modified to require a basin-wide climate model that will inform analysis of ecological impacts.

4. NRDC's Study Request meets FERC's requirements for a "new study"

4.1 Section 5.15(e)(1) Material changes in the law and regulations require a new study

Since FERC ruled in 2013 that a basin-wide climate change study was not warranted, federal law and policy has changed significantly. It is now well established that the potential impacts of climate change can have significant implications for the construction, maintenance, and operation of major infrastructure and building projects such as the proposed dam. Increasingly, other federal agencies are considering the impacts of climate change in the design of these projects, especially those projects located in climate-vulnerable areas.

President Obama has issued several executive orders since 2013 directing agencies to prepare for the impacts of climate change on federal facilities and their operation.⁴⁵ These orders seek to ensure that federal agencies are advancing climate change preparedness and resilience. For example, Executive Order 13653 specifically requires federal agencies to develop, implement, update, and regularly report on comprehensive adaptation plans that integrate considerations of

⁴³ U.S. ARMY CORPS OF ENG'RS, GUIDANCE FOR INCORPORATING CLIMATE CHANGE IMPACTS TO INLAND HYDROLOGY IN CIVIL WORKS STUDIES, DESIGNS, AND PROJECTS, NO. 2014-10, ENG'G & CONSTRUCTION BULLETIN 1 (2014) [hereinafter USACE GUIDANCE]; Sebastian Vicuna et al., *Basin-Scale Water System Operations with Uncertain Future Climate Conditions: Methodology and Case Studies*, 46 WATER RESOURCES RESEARCH 1, 1 (2010).

⁴⁴ Xuezhi Tan & Thian Yew Gan, *Nonstationary Analysis of Annual Maximum Streamflow of Canada*, 28 J. CLIMATE 1788, 1788 (2015); NMFS, Susitna River Project Effects Under Changing Climate Conditions Study Request, Project No. 14241-000, 11 (May 31, 2012) (citing P.C.D. Milly et al., *Stationarity is Dead: Whither Water Management?* 319 SCIENCE 573-74 (2008), <http://science.sciencemag.org/content/319/5863/573>) [hereinafter NMFS Study Request].

⁴⁵ See, e.g., Exec. Order No. 13693, *Planning for Federal Sustainability in the Next Decade*, 80 Fed. Reg. 15872 (Mar. 25, 2015); Exec. Order No. 13690, *Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input*, 80 Fed. Reg. 6425 (Feb. 4, 2014); Exec. Order No. 13677, *Climate-Resilient International Development*, 79 Fed. Reg. 58229 (Sept. 26, 2014); Exec. Order No. 13653, *Preparing the United States for the Impacts of Climate Change*, 78 Fed. Reg. 66817 (Nov. 6, 2013); EXEC. OFFICE OF THE PRESIDENT, THE PRESIDENT'S CLIMATE ACTION PLAN (June 2013), <https://www.whitehouse.gov/sites/default/files/image/president27climateactionplan.pdf>.

the challenges posed by climate change into their operations and mission objectives.⁴⁶ Executive Order 13693 builds upon this requirement by calling for agencies to, among other things, incorporate climate-resilient design and management elements into the operation, repair, and renovation of existing buildings as well as the design of new buildings.⁴⁷

In concert with the President's actions, the Council on Environmental Quality ("CEQ") released revised guidelines in 2014, calling for federal agencies to incorporate climate change projections into assessments of both the baseline environmental conditions and the impacts of proposed federal actions.⁴⁸ CEQ clarifies that considering how climate change affects the nexus between project operations and effects on the resource "falls squarely" within the realm of National Environmental Protection Act reviews.⁴⁹ Furthermore, such analysis is necessary in order to determine whether to proceed with the proposed action, to evaluate mitigation and adaptation strategies, and to weigh alternatives with "preferable overall environmental outcomes."⁵⁰ Environmental assessment must therefore address how the proposed action may exacerbate the impacts of climate change, as the latter "can increase the vulnerability of a resource . . . and result in a proposed action's effects being more environmentally damaging."⁵¹ This revised guidance has direct implications for the Project, as the dam's operation will indeed increase the vulnerability of the entire Susitna River Basin by disrupting natural river flows and temperature patterns. According to the guidelines, evaluating how climate change will influence the environment and the impacts of a project is particularly important in areas especially vulnerable to climate change, such as the subarctic.⁵² The document states: "For example, a proposed action may require water from a stream that has diminishing quantities of available water because of decreased snowpack in the mountains."⁵³ This example directly reflects the precarious future of the Susitna River's water supply and its ecosystem. In order to assist federal agencies in anticipating how climate change will influence the environmental consequences of a project facing this situation, the guidelines provide examples of existing climate science tools and information. More specifically, CEQ highlights modeling as an appropriate method for determining these reasonably foreseeable effects on the environment, affirming that resources are currently available to analyze climate change in environmental assessments.⁵⁴

Numerous government agencies have recently issued guidance outlining how the agencies and project applicants should assess the impacts of climate change on a project (see Section 4.5.5 for

⁴⁶ Exec. Order No. 13653, *Preparing the United States for the Impacts of Climate Change*, 78 Fed. Reg. 66817 (Nov. 6, 2013).

⁴⁷ Exec. Order No. 13693, *Planning for Federal Sustainability in the Next Decade*, 80 Fed. Reg. 15872, 15874-75 (Mar. 25, 2015).

⁴⁸ Council on Env'tl. Quality, *Revised Draft Guidance on the Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews*, 79 Fed. Reg. 77801 (proposed Dec. 24, 2014).

⁴⁹ *Id.* at 77823.

⁵⁰ *Id.* at 77823.

⁵¹ *Id.* at 77828.

⁵² *See id.* at 77830.

⁵³ *Id.* at 77828.

⁵⁴ *See id.*

examples). These guidelines demonstrate the agencies' understanding that assessing climate change impacts is critical to a meaningful environmental review and falls within the scope of their missions and existing mandates.⁵⁵ The Environmental Protection Agency ("EPA"), National Oceanic and Atmospheric Administration ("NOAA"), Bureau of Land Management, Bureau of Reclamation ("Reclamation"), Department of the Interior, National Aeronautics and Space Administration, Army Corps of Engineers ("USACE"), and the Federal Emergency Management Agency have all developed guidance plans, technical guides, assessment tools, datasets, or models to aid the agencies in incorporating climate change science and modeling into environmental assessments.⁵⁶ This trend has also gained approval from entities such as the Government Accountability Office that argue in favor of incorporating climate change analysis into project licensing in order to reduce the government's long-term fiscal exposure to associated environmental risks.⁵⁷

As a result, federal agencies are examining the effects of climate change on proposed projects and their affected environment with increasing sophistication. The Sabin Center for Climate Change Law at Columbia Law School ("Center") documented this trend in its review of how federal Environmental Impact Statements ("EIS") prepared between 2009 and 2014 address climate-related considerations.⁵⁸ The Center found that some EISs contained a robust discussion

⁵⁵ See JESSICA WENTZ, ASSESSING THE IMPACTS OF CLIMATE CHANGE ON THE BUILT ENVIRONMENT UNDER NEPA AND STATE EIA LAWS: A SURVEY OF CURRENT PRACTICES AND RECOMMENDATIONS FOR MODEL PROTOCOLS 1, 16 (Sabin Ctr. for Climate Change Law, Aug. 2015) [hereinafter ASSESSING THE IMPACTS OF CLIMATE CHANGE UNDER NEPA].

⁵⁶ For example, in March of 2015, the Federal Emergency Management Agency began requiring states to incorporate climate change considerations, such as changes to precipitation and flooding patterns, in their project scoping and development. FED. EMERGENCY MGMT AGENCY, STATE MITIGATION PLAN REVIEW GUIDE, FP 302-094-2 (revised March 2015), <https://www.fema.gov/media-library/assets/documents/101659>. According to the revised guide, State Hazard Mitigation Plans must now consider "changing future conditions, including the effects of long-term changes in weather patterns and climate on the identified hazards" in their risk assessments.

⁵⁷ See Jessica Wentz, *Assessing the Impacts of Climate Change on the Built Environment: A Framework for Environmental Reviews*, 45 ENVTL. L. REP. 11015, 11017 (2015). .

⁵⁸ See ASSESSING THE IMPACTS OF CLIMATE CHANGE UNDER NEPA, at 27-30. The report concluded that it is technically feasible and necessary to consider climate change when conducting reviews under NEPA or state equivalents and offered a set of model protocols for assessing the impact of climate change on infrastructure projects and selecting appropriate risk mitigation measures. The report explained that agencies should assess the impacts of climate change in particular circumstances, including evaluating future baseline conditions, the potential for climate change to increase the vulnerability of the affected environment and any resources impacted by the project, and whether the impacts of climate change may exacerbate the environmental consequences of the project or generate new consequences which would not have otherwise occurred. The scope and depth of this analysis should be proportional to the magnitude of the risk posed by climate change and the correlated vulnerability of the action and its affected environment to the impacts of climate change. Finally, the analysis of climate change impacts

of climate change impacts and that this analysis ultimately influenced final design decisions in some cases. Environmental assessments for water management projects in particular contained the most comprehensive and analytical assessments of climate change impacts and their implications on project operation. The majority of USACE projects that examined climate-related impacts, for example, discussed the effects of climate change on *the project itself* in addition to the impacts of climate change on the surrounding environment.⁵⁹ Reclamation and the U.S. Forest Service have also served as lead agencies on major infrastructure projects for which the EISs prominently illustrate an understanding of the impacts of climate change on the project and its affected environment.⁶⁰

In addition to assessments conducted at the federal level, climate change analyses are also being incorporated into state and local planning efforts, and several jurisdictions have promulgated laws, policies, or agency guidance that explicitly require the consideration of climate change effects on actions subject to environmental review.⁶¹ California's environmental impact assessment statute, for example, requires consideration of climate change impacts. Accordingly, many California state agencies now consider climate impacts when conducting environmental reviews.⁶² Similarly, Massachusetts has expressly amended its environmental review statute to require decision-makers to consider the effects of climate change on public projects.⁶³ These trends in agency decision-making at all government levels demonstrate that it is possible for agencies to account for and draw meaningful conclusions about, climate change impacts on public infrastructure.

The courts have also recognized the feasibility and importance of examining climate change impacts on major projects undergoing environmental review. In *Massachusetts v. EPA*, the Supreme Court explained that the "harms associated with climate change are serious and well recognized[,]"⁶⁴ and suggested that agencies bear the responsibility of taking action to minimize

should inform the selection of design features, alternatives, site location, mitigation measures, and other aspects of the final decision undertaken by the agency. *Id.* at 59.

⁵⁹ See *id.* at 35.

⁶⁰ See, e.g., CAL. DEPT. OF WATER RES. & U.S. BUREAU OF RECLAMATION, BAY DELTA CONSERVATION PLAN/CALIFORNIA WATER FIX PARTIALLY RECIRCULATED DRAFT ENVIRONMENTAL IMPACT REPORT/SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT ES1–ES3 (2015); U.S. BUREAU OF RECLAMATION & STATE OF WASHINGTON DEPT. OF ECOLOGY, CLE ELUM POOL RAISE PROJECT: A COMPONENT OF THE YAKIMA RIVER BASIN INTEGRATED WATER RESOURCE MANAGEMENT PLAN: FINAL ENVIRONMENTAL IMPACT STATEMENT ES-i , ES-ii (2015); U.S. DEPT. OF THE INTERIOR & U.S. BUREAU OF RECLAMATION, SHASTA LAKE WATER RESOURCE INVESTIGATION: ENVIRONMENTAL IMPACT STATEMENT S-9 (2014); U.S. DEPT. OF AGRICULTURE, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE FLAGSTAFF WATERSHED PROTECTION PROJECT ii (2015).

⁶¹ See ASSESSING THE IMPACTS OF CLIMATE CHANGE UNDER NEPA, at 44-49.

⁶² See *id.* at 14.

⁶³ See *id.* at 44.

⁶⁴ *Massachusetts v. EPA*, 549 U.S. 497, 499 (2007).

the effects of climate change.⁶⁵ Other state and federal courts have repeatedly found that environmental analyses and decisions that failed to consider climate change and its potential impacts were inadequate.⁶⁶

Overall, the consideration of climate-related impacts on infrastructure projects falls squarely within the scope of agencies' environmental reviews, and many federal, state, and local agencies have incorporated such considerations into their environmental assessment processes. Thus, FERC should take action consistent with other federal agencies in thoroughly considering the impacts of climate change on projects proposed in vulnerable areas, which would improve the climate-resiliency of both the Project and the affected resources.⁶⁷

4.2 Section 5.15(e)(2) The goals, objectives, and methodology of prior studies are inadequate

The climate change studies approved by FERC as part of the Applicant's Study Plan (Sections 6.5 and 7.7) incorrectly assumed a mere literature review of glacial changes would provide an adequate understanding of how "climate change can affect Project operations and environmental resources."⁶⁸ The studies fail to properly assess all relevant future hydrologic changes and their effects downstream of the dam. AEA's studies narrowly focus on reviewing future glacial wastage and surges in the upper basin and how these changes will impact sedimentation and flow into the dam's reservoir. The entire basin, not just glaciers and not just the upstream reaches of

⁶⁵ See *id.* at 525 (2007) ("While it may be true that regulating motor-vehicle emissions will not by itself *reverse* global warming, it by no means follows that we lack jurisdiction to decide whether EPA has a duty to take steps to *slow* or *reduce* it.").

⁶⁶ See, e.g., *Ctr. for Biological Diversity v. Salazar*, 804 F. Supp. 2d 987, 1008 (D. Ariz. 2011) ("The BiOp does not analyze or even mention climate change."); *South Yuba River Citizens League v. Nat'l Marine Fisheries Serv.*, 723 F. Supp. 2d 1247, 1274 (E.D. Cal. 2010) ("The court cannot conclude that global warming's potential impacts are so slight that NMFS could ignore them without discussion."); *Pac. Coast Fed'n of Fishermen's Ass'ns v. Gutierrez*, 606 F. Supp. 2d 1122, 1184 (E.D. Cal. 2008) ("Plaintiff's motion for summary adjudication is GRANTED as to the climate change claim issue based on NMFS's total failure to address, adequately explain, and analyze the effects of global climate change on the species."); *NRDC v. Kempthorne*, 506 F. Supp. 2d 322, 370 (E.D. Cal. 2007) ("FWS acted arbitrarily and capriciously by failing to address the issue of climate change in the BiOp. This absence of *any* discussion in the BiOp of how to deal with any climate change is a failure to analyze a potentially 'important aspect of the problem.'"); *Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008) ("The impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct.").

⁶⁷ NRDC requests FERC to reverse the precedent of its prior decision on climate change study in the context of NEPA because of the rapidly changing science and policy of climate change. See *supra* note 8.

⁶⁸ See DIV. OF GEOL. & GEOPHYSICAL SURVEYS, ALASKA DEP'T OF NAT. RES. & UNIV. OF ALASKA FAIRBANKS, SUSITNA-WATANA HYDROELECTRIC PROJECT (FERC NO. 14241) GLACIAL AND RUNOFF CHANGES STUDY, STUDY PLAN SECTION 7.7: INITIAL STUDY REPORT – LITERATURE REVIEW A-1 (June 2014), http://www.susitna-watanahydro.org/wp-content/uploads/2014/05/07.7_GLAC_ISR_PartA.pdf.

the river, will be influenced by climate change. The narrow geographic scope of the studies therefore neglects to address the impacts to sensitive fish and wildlife habitats downstream.

Furthermore, the studies fail to assess how climate change could exacerbate the effects of the Project on natural resources. Again, a literature review cannot inform FERC of how climatic changes will interact with Project operations to impact fish and wildlife behavior and habitat. In order to obtain this information critical to licensing decisions, FERC should require AEA to develop a modeling framework using downscaled climate projections to predict and simulate hydrologic changes throughout the basin, or modify the studies to include this methodology.

4.3 Section 5.15(e)(3) A climate modeling study has been requested previously, and now is the time to grant the request

Due to the pressing need to better understand the cumulative impacts of climate change and Project operations, the request for a basin-wide climate modeling study has been made several times already during the licensing process. In its final SPD, FERC left the door open to reconsidering the request if new information became available.⁶⁹ Recent advancements in climate science, and the ability to effectively incorporate this science into federal and state environmental reviews now warrants such reconsideration (see Appendix).

The Services first made the study request for a basin-wide climate change study on May 31, 2012, and this request has been repeated by the Services and echoed by participants multiple times throughout the process due to the value of the information to be obtained.⁷⁰ In its proposed study plan, AEA planned to develop a “hydrologic modeling framework . . . to predict the impacts of climate change.”⁷¹ Yet the SPD did not approve this study, maintaining that conventional hydrologic studies were sufficient and that operational flexibility could address any changes in future hydrologic conditions.⁷² In response, NMFS filed a notice of study dispute, requesting that AEA’s originally proposed climate modeling “study be required and that the study consider the effects of climate change on aquatic, riparian, and terrestrial habitat and species to determine an appropriate baseline for assessing the project’s effects on these resources.”⁷³ NMFS disagreed with FERC that operational flexibility and standard reopener articles would provide sufficient protection for important fisheries habitat, particularly given the

⁶⁹ See 144 FERC ¶ 61,040 (Norris, concurring).

⁷⁰ NMFS Study Request; USFWS, Study Request; Ctr. for Biological Diversity Comments on the RSP.

⁷¹ See Alaska Energy Auth., Susitna-Watana Hydroelectric Project Alaska Energy Authority (FERC Project No. 14241) Proposed Study Plan (July 2012), <http://www.susitna-watanahydro.org/type/documents/>; Alaska Energy Auth., Susitna-Watana Hydroelectric Project Alaska Energy Authority (FERC Project No. 14241) Revised Study Plan, 7-56 to -57 (Dec. 2012), http://www.susitna-watanahydro.org/wp-content/uploads/2012/12/03-RSP-Dec2012_3of8-Sec-7-8-HydrologythroughInstreamFlowStudies-v2.pdf.

⁷² FERC, Study Plan Determination.

⁷³ NMFS, Notice of Study Dispute and Request to combine portions of the proceedings for Project No. 14241-000 Susitna Hydropower Project; Applicant: Alaska Energy Authority 1 (February 20, 2013) [hereinafter NMFS Study Dispute].

irreversible consequences of increased fish mortality.⁷⁴ Furthermore, they maintained that such measures did not supplant the need to determine an accurate baseline for assessing the Project's environmental effects.⁷⁵ Consequently, the Commission convened a Study Dispute Resolution Panel ("Panel"). The Panel agreed with NMFS that a climate model was necessary and also recommended including an additional analysis of water temperature.⁷⁶ The Commission Director's SPD finally agreed that the literature review ought to be required but maintained that developing a modeling framework was unnecessary. Subsequent requests for rehearing of the determination were denied in the Director's final order issued on July 18, 2013.⁷⁷

While the final order determined a climate change study unnecessary, Commissioner Norris foresaw the potential need for future reconsideration in his concurring opinion. The Commissioner wrote: "[A]s climate change modeling continues to advance, it may eventually yield data and knowledge that can and should be used to formulate license requirements that respond to environmental effects caused by climate change."⁷⁸ Since then, climate science, and especially downscaling techniques, has indeed advanced and is relied upon in the environmental review process for federal and state actions, as mandated by recent policy and law. This additional information now prompts a reconsideration of the scope of studies necessary to understand the nexus between project impacts and effects.

4.4 Section 5.15(e)(4) Significant new information material to the study objectives has become available

Climate modeling reliability and accuracy has advanced significantly since FERC issued its SPD in 2013, and has become a valuable tool in guiding planning and design of federal projects. In 2014, updated versions of the most widely relied upon international and national climate science reports were released, and the new data and analyses have subsequently been incorporated into federal interagency resources. Information from any or all of these resources could be reliably used to assess the impacts of climate change with respect to NRDC's Study Request.

In November of 2014, the Intergovernmental Panel on Climate Change ("IPCC")⁷⁹ released its Fifth Assessment Report on climate change science.⁸⁰ Scientists found that the models of surface

⁷⁴ See NMFS Request for Rehearing of Director's Formal Study Dispute Determination, Project No. 14241-000 (May 28, 2013) [hereinafter NMFS Request for Rehearing].

⁷⁵ See *id.*

⁷⁶ Findings and Recommendations of Study Dispute Panel for the Susitna-Wantana Hydroelectric Projects (April 12, 2013) [hereinafter Recommendations of Study Panel].

⁷⁷ NMFS Request for Rehearing; Center for Water Advocacy, Request for Reconsideration of the Center for Water Advocacy to April 1, 2013 Study Plan Determination, Project No. 14241-000 (May 28, 2013).

⁷⁸ 144 FERC ¶ 61,040 (Norris, concurring).

⁷⁹ The IPCC, established by the United Nations and World Meteorological Organization, is the leading international body for the assessment of climate change. WMO & UNEP, *IPCC Fact Sheet: What is IPCC?* (Aug. 30, 2013), http://www.ipcc.ch/news_and_events/docs/factsheets/FS_what_ipcc.pdf.

temperature and precipitation have improved in recent years, and there is now “very high confidence” in the temperature models in particular, as they have been proven to reliably reproduce observed conditions.⁸¹ This is particularly significant for hydropower projects and river ecosystems in Alaska, where rising temperatures are the primary driver of rapid ice loss and these glaciers supply approximately half of the total freshwater input to the Gulf of Alaska.⁸² The five best-ranked general circulation models (“GCMs”) were used to inform downscaled projections of regional climate change information in the Scenarios Network for Alaska and Arctic Planning (“SNAP”) dataset.⁸³ AEA utilized these simulations and projections in their voluntary climate modeling study, which demonstrates the reliability and utility of these updated tools and downscaling techniques.⁸⁴

In May of 2014 the United States Global Change Research Program⁸⁵ also released its own climate science report for the country: the Third National Climate Assessment. According to the report, “substantial new information” and “evidence from improved models and updated observational data” shows that Alaska’s environment is experiencing major shifts at a faster rate than previously projected.⁸⁶ The latest data suggest that the average annual temperatures are now projected to rise by an additional 8 degrees Fahrenheit in interior Alaska by the end of the century (or by 2050 if global emissions continue to increase).⁸⁷ The impacts are widespread: earlier spring snowmelt and shrinking glaciers will affect the productivity of both hydropower and the state’s fisheries, while thawing permafrost will degrade infrastructure and wildlife habitat.⁸⁸ The report highlights that the projections for glacier mass loss are particularly robust, leading scientists to assert with a high confidence level that there will be related impacts on hydropower production, such as a reduction in water input to reservoirs over the long-term.⁸⁹

⁸⁰ RAJENDRA K. PACHAURI ET AL., IPCC, CLIMATE CHANGE 2014: SYNTHESIS REPORT: CONTRIBUTION OF WORKING GROUPS I, II AND III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2015), <http://www.ipcc.ch/report/ar5/syr/>.

⁸¹ *Id.* at 56.

⁸² *See* CLIMATE CHANGE IMPACTS IN ALASKA, at 519.

⁸³ DIV. OF GEOL. & GEOPHYSICAL SURVEYS, ALASKA DEP’T OF NAT. RES. & UNIV. OF ALASKA FAIRBANKS, SUSITNA-WATANA HYDROELECTRIC PROJECT (FERC NO. 14241) GLACIER AND RUNOFF CHANGES STUDY FINAL STUDY REPORT, 42 (October 2015), http://www.susitna-watanahydro.org/wp-content/uploads/2015/10/GlacierRunoffChangesStudy_FSR_FINAL_20151028.pdf [hereinafter FINAL STUDY REPORT].

⁸⁴ *See id.*

⁸⁵ The U.S. Global Change Research Program was established by Congress to analyze climate science with the goal of predicting and responding to climate change. *See About USGCRP*, U.S. GLOBAL CHANGE RESEARCH PROGRAM, <http://www.globalchange.gov/about> (last visited May 17, 2016).

⁸⁶ CLIMATE CHANGE IMPACTS IN ALASKA, at 515, 533.

⁸⁷ *Id.* at 516.

⁸⁸ *See id.* at 515. Based on the evidence, the authors rate the confidence that glacier mass loss will result in impacts on hydropower production and fisheries as “high,” and that the evidence on the impacts of melting permafrost on infrastructure is “rapidly accumulating.” *Id.* at 535.

⁸⁹ *Id.* at 535.

Ultimately, the latest National Climate Assessment finds that climate modeling for Alaska has improved to the extent that it is reliable. AEA's required studies should be updated accordingly.

In addition to these reports, new academic research has improved methodologies for projecting the impacts of climate change on northern watersheds and regional hydropower. Since FERC issued its SPD in 2013, scientists have established techniques for incorporating dynamically downscaled climate projections into planning for hydropower operations in snow and ice-dominated hydrologic regimes.⁹⁰ Further research has established frameworks for evaluating the combined effects of climate change and development on subarctic freshwater ecosystems. For example, a 2015 peer-reviewed study describes an integrated hydrologic model for assessing climate induced ecological risks to salmon in an Alaskan watershed, as a backdrop for assessing project induced risks.⁹¹ The researchers evaluated how altered hydrologic regimes and stream temperatures would adversely affect suitability of spawning gravel, duration of incubation, and exposure of salmon to temperature stress.⁹² Their "quantitative approach to estimating climate-mediated changes in ecological conditions" provides a new tool for determining impacts in "any ecosystem where climate and other proposed development activities could interact to compound ecological risk to sensitive receptors,"⁹³ as is the case in the Susitna River basin. This study demonstrates that modeling the combined impacts of climate change and the Project on natural resources in this context is indeed possible and reliable, and the authors argue that such a framework is actually required in order to create a robust baseline condition against which project induced changes can be compared.

These reports and studies represent only a few of the many examples proving that climate science has advanced enough to successfully achieve the objective proposed in NRDC's Study Request of modeling the impacts of climate change across the basin. Additionally, recent legal and policy developments have clarified how federal agencies should use the latest science to inform their environmental review process, as described in Section 4.1. As will be discussed in Section 4.5.5, guidance from the White House and scientific community has prompted federal agencies to develop and adopt climate models for use in water resource management. In light of these recent and significant advancements in climate change science, policy, and law, there is sufficient "new information" to meet FERC's requirements and justify a new or modified study modeling the climate change impacts related to the Project.

⁹⁰ See, e.g., *Some Aspects of Ice-Hydropower Interaction in a Changing Climate*, 7 ENERGIES 1641 (2014), www.mdpi.com/1996-1073/7/3/1641/pdf [hereinafter *Some Aspects*]; Solomon Gebre et al., *Sensitivity to Climate Change of the Thermal Structure and Ice Cover Regime of Three Hydropower Reservoirs*, 510 J. HYDROL. 208 (2014), <http://www.sciencedirect.com/science/article/pii/S0022169413009207> [hereinafter *Some Aspects*].

⁹¹ See Cameron Wobus et al., *Hydrologic Alterations from Climate Change Inform Assessment of Ecological Risk to Pacific Salmon in Bristol Bay, Alaska*, 10 PLoS ONE 1, 19 (2015), <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0143905>.

⁹² *Id.* at 1.

⁹³ *Id.* at 18.

4.5 Section 5.15(e)(5) The new study request satisfies the study criteria in Section 5.9(b) outlined below

As outlined in the following section, the new study request satisfies all study criteria of Section 5.9(b), demonstrating good cause for approval by addressing public interest concerns, the need for additional information to understand Project impacts, how the study employs scientifically accepted practice, and how the relatively low cost is justified.

4.5.1 Section 5.9(b)(1) A basin-wide climate model is required to achieve the goals and objectives of NRDC's Study Request⁹⁴

The goal of the NRDC's Requested Study is to evaluate the cumulative impacts of climate change and the Project on the Susitna watershed ecosystem.

As previously mentioned, the objectives of NRDC's Requested Study are to:

- a. Develop a climate model for the entire Susitna basin, using downscaled climate projections to simulate non-stationary future environmental conditions (including changes to glaciers, permafrost, hydrology, evapotranspiration, and surface water temperature) in accordance with the lifespan of the project (anticipated to last 100 years); and
- b. Apply this updated environmental baseline to analyses of Project impacts on the aquatic, riparian, and terrestrial habitat and species both upstream and downstream of the proposed dam.

This study proposes to expand upon Section 7.7 and Section 6.5 to include modeling of climate change impacts to hydrology across the entire basin. This analysis is needed in order to project environmental changes in the basin over the next 100 years and evaluate the vulnerability of fish and wildlife, and their habitat, to this altered temperature and hydrology regime. The nexus of Project operations and effects on the natural resources cannot be understood absent information obtained through this study, given that these changes will be driven by the combination of the Project and climate change.

4.5.2 Section 5.9(b)(3) Protecting the public interest requires FERC to use the best available science in its determination

In determining whether the study is in the public interest, FERC must account for a wide range of considerations, including the "public interest in preserving reaches of wild rivers and wilderness areas, the preservation of anadromous fish for commercial and recreational purposes, and the protection of wildlife."⁹⁵ FERC must ensure sufficient protections for fish and wildlife based on recommendations of the Services and state fish and wildlife agencies, pursuant to the Fish and Wildlife Coordination Act, 16 U.S.C. 661 *et seq.* ("FWCA").⁹⁶ Maintaining the ecological integrity of the Susitna River basin is of the utmost importance to the public interest in the preservation of fish, wildlife, and wilderness habitat.

⁹⁴ 18 C.F.R. § 5.9(b)(2) ("Relevant resource agency management goals") is not applicable as NRDC is not an agency.

⁹⁵ *Udall v. Fed. Power Comm'n*, 387 U.S. 428, 450 (1967).

⁹⁶ 16 U.S.C. § 803(j).

The Susitna watershed, set in the high, rugged peaks of the Alaska Range, is Alaska's most popular destination for hunters and anglers.⁹⁷ More than 375,000 tourists spend approximately \$201 million annually in the Matanuska-Susitna area.⁹⁸ The diverse ecosystem of boreal forest, tundra, and undisturbed glacially-fed rivers hosts resources of unique value to the public, including NRDC's membership of outdoor recreationists.⁹⁹ This productive habitat is home to wildlife of national significance, including bear, caribou, and bald eagles, as well as the state's second largest recreational fishery for Chinook salmon, which migrate, spawn, and rear upriver of the proposed dam site.¹⁰⁰ In fact, resident and tourist anglers in the Matanuska-Susitna Borough spend \$63 to \$163 million on sport fishing, an industry which provides 900-1,900 local jobs.¹⁰¹ Commercially, the Susitna is one of the largest salmon producing rivers in the upper Cook Inlet fisheries, which harvest four million salmon annually, generating \$34.2 million for the state's economy.¹⁰²

This industry will suffer considerably if the naturally abundant fish populations decline as a result of negative impacts on downstream fisheries habitat caused by the combination of dam operations and climate change. Failing to use the best available science to predict those adverse effects, such as warming surface water temperatures and diminished flows, throughout the entire basin will prevent FERC from fulfilling its obligation to thoroughly address these public interest concerns.

4.5.3 Section 5.9 (b)(4) Additional information is needed to adequately evaluate the impacts of the Project

While AEA has submitted a study of climate change and how it will affect the Project, its analysis falls far short of providing an accurate assessment of how these changes, in conjunction with the operation of a mega-dam, will affect the Susitna river ecology. FERC limited the required analysis of climate change to: a) conducting a literature review of glacial retreat and associated predicted changes in runoff in south central Alaska and the upper Susitna River watershed (Section 7.7 submitted by AEA in June 2014), and b) analyzing the predicted changes to sediment delivery into the reservoir due to these glacial surges (Section 6.5 submitted by AEA in November 2014).¹⁰³ These studies alone are inadequate to assess the likely impacts associated with the proposed operations of the dam. Outside the ILP process, AEA commissioned the Alaska Department of Natural Resources to model the effects of future glacial wastage and

⁹⁷ *Susitna Economies*, SUSITNA RIVER COALITION, <http://susitnarivercoalition.org/wp/susitna-economies/> (last visited May 18, 2016) [hereinafter *Susitna Economies*].

⁹⁸ *Id.*

⁹⁹ *See id.*

¹⁰⁰ *Susitna Salmon*, SUSITNA RIVER COALITION, <http://susitnarivercoalition.org/wp/susitna-salmon/> (last visited May 18, 2016) [hereinafter SRC, *Susitna Salmon*].

¹⁰¹ Letter from Hilda Sexauer, W. Div., Am. Fisheries Soc'y, to Kimberly Bose, Secretary, FERC (Mar. 3, 2015), http://wdafrs.org/download/resolutions/WDAFS_SusitnaLetter_AKLegislature_Final_3Mar15.pdf [hereinafter Letter from Am. Fisheries Soc'y].

¹⁰² *Susitna Economies*.

¹⁰³ 144 FERC ¶ 61,040.

retreat on runoff in the upper Susitna basin. Given that this study is voluntary, it is not included formally as a FERC-approved study in the ISR, but proves that such a study is feasible and provides information of great value to the Applicant.

The following information is needed to adequately assess the project effects:

a. A predictive climate model for the Susitna basin

The literature reviews in Section 7.7 and 6.5 are insufficient because there is an absence of existing studies regarding climate change in the Susitna River watershed and available information at the regional level is too imprecise, given that patterns in glaciation, precipitation, transpiration and evaporation are unique to individual glacial basins.¹⁰⁴ AEA therefore voluntarily chose to develop a climate modeling framework to analyze how glacial wastage and retreat in the upper basin would affect reservoir inflow.¹⁰⁵ This demonstrates that the Applicant itself found that the literature review was inadequate and saw the need for a predictive model to provide additional information. In fact, FERC staff acknowledged this during the Study Dispute Resolution Technical Conference by stating that AEA had chosen to conduct modeling because it was “to their benefit” “to know that they’re going to have the water to run” the Project.¹⁰⁶ For this reason, the Panel recommended requiring the modeling study, stating it “would provide valuable information that would inform potential project operations, resulting from changes in the timing, magnitude and duration of inflows to the project across a range of potential future conditions.”¹⁰⁷ However, this voluntary study narrowly focuses on potential future changes in runoff into the proposed reservoir and therefore still ignores important environmental impacts throughout the basin, particularly to river ecology downstream of the dam.

b. Analysis of projected surface water temperature

The current study also neglects to include an analysis of future changes in stream temperature, a factor that greatly influences the health of aquatic ecosystems.¹⁰⁸ This is a glaring omission given the predicted decreased snowpack and increased air temperatures that are likely to modify the thermal regime of the Susitna River.¹⁰⁹ These changes are likely to result in adverse effects on fish behavior and habitat, which in turn will have direct consequences on Project operations needed to meet license conditions and NMFS mitigation measures.¹¹⁰ The Study Panel recognized the need for this additional information and recommended modifying AEA’s study to

¹⁰⁴ See USFWS, Scoping Comments, Recommendations and Study Requests Notice of Intent to File License Applications; Filing of Pre-Application Document; Commencement of Licensing Proceeding and Scoping; Request for Comments on the Pre-Application Document and Scoping Document 2, and Identification of Issues and Associated Study Requests for the Susitna-Watana Hydroelectric Project No. 14241-000, 3 (May 31, 2012) at 3 [hereinafter USFWS Study Request].

¹⁰⁵ See FINAL STUDY REPORT.

¹⁰⁶ Transcript of Technical Conference at 70, Study Dispute Resolution Panel, Susitna Hydroelectric Project (April 3, 2013).

¹⁰⁷ See Recommendations of Study Panel.

¹⁰⁸ USFWS Study Request, at 4.

¹⁰⁹ NMFS Study Request, at 9.

¹¹⁰ *Id.*

include a water temperature component in the hydrologic modeling.¹¹¹ If it is to provide meaningful information in the licensing process, analysis of changes in runoff requires assessment of not only volume and timing, but temperature as well.

c. Analysis of ecological impacts

Existing information is limited to the impacts of climate change on the dam itself (e.g. changes to incoming runoff and sedimentation). In order to give equal consideration to the “protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality” as required of FERC under the FPA, the Commission must require a study of climate change impacts to the affected resources, not just to the Project. Similarly, in order for the Services to fulfill their obligation to issue conservation recommendations under the FWCA, they need information from a study that considers the effects of climate change on aquatic, riparian, and terrestrial habitat and species.

d. Analysis of basin-wide impacts

The current study fails to include the impacts of climate change throughout the basin and overlooks critical climate-induced environmental changes beyond glacial retreat. The seasonal, annual, and long-term changes in volume, timing, and frequency of precipitation and flows, above *and* below the dam, will be influenced by both reservoir releases and climate-induced changes to tributary hydrology. These alterations are likely to affect fish habitat, as well as the efficiency and longevity of the Project. The Services need data from models predicting future hydrologic and temperature conditions in the middle and lower reaches as well, in order to understand potential changes to biologic responses, such as migration timing in response to temperature, flows, and ice processes.¹¹² Without modeling changes across the entire basin, there is no way to assess the real impacts of dam operations.

Overall, the approved study is limited to assessing potential changes to inflow of water and sediment to the proposed dam’s reservoir, thereby ignoring hydrologic and ecological changes throughout the basin induced by both climate change and Project operations. The current information is too imprecise and limited to understand the impacts to the basin’s resources and a climate model using downscaled regional projections is needed to resolve this data gap.

4.5.4 Section 5.9(b)(5) A climate modeling study is necessary because the nexus between Project operations and effects on the resource is mediated by climate change

The effect of the Project on water, fish, and wildlife resources cannot be understood absent a climate model as the Project is likely to magnify the negative impacts of climate change on habitat throughout the basin. While AEA is required to conduct other fish and wildlife studies, none of them address how these impacts will interact with climate change to exacerbate the ecological consequences. A study of climate change would therefore greatly inform a cumulative effects analysis. These combined effects will be complex and varied, and could include:

a. Altered thermal and flow regime

¹¹¹ Recommendations of Study Panel, at 5.

¹¹² See NMFS Request for Rehearing, at 24.

The operation of the dam, in conjunction with climate change, will change the timing, magnitude, and temperature of river flows, which will adversely impact the behavior and abundance of native fish species. The dam is designed to release lower flows in the summer and warmer water during the wintertime, disrupting the river's natural freeze-thaw cycle.¹¹³ Climate change will alter these temperature and flow regimes as well, as surface water temperatures rise and warming air temperatures melt the state's snowpack earlier in the year.¹¹⁴ The net result is reduced flows of critical cold water during the summer. These conditions restrict pool habitats and often strand juvenile salmon in warmer off-channel habitat,¹¹⁵ ultimately leading to higher mortality rates and lower growth rates.¹¹⁶ Furthermore, disrupting the natural riverine processes to which resident fish are suited, especially while also introducing new reservoir habitat upstream, creates hospitable conditions for invasive piscivorous fishes that prey on native salmon.¹¹⁷ NMFS summarizes how climate change and Project operations will jointly impact the aquatic community downstream of the proposed dam in the following way:

Reduced summer flows of cold water can compound the effects of rising water temperatures, especially in off-channel habitat that are likely to become more isolated from the main channel through project-induced channel incision. Thus, project operations will not be able to mitigate for climate caused temperature changes by altering temperature of water discharged from the dam since these habitats will have become physically isolated from main stem river flows. Also, the project will effectively bisect the Susitna River watershed with a very large dam, preventing fish from being able to expand their range into the upper watershed which could serve as refugia from warming conditions in the lower portions of the watershed.¹¹⁸

Taken together, these changes to river temperatures and flows will hinder the ability of an already vulnerable fish population to successfully migrate, spawn, incubate their eggs, and rear juveniles, processes that are dependent upon a seasonal hydrology of frozen rivers in the winter, the spring freshet, and fairly high and cool flows in the summer.¹¹⁹ AEA's current study of climate change on just the upper Susitna River cannot accurately predict the range and magnitude of impacts on documented fish populations both upstream and downstream of the dam.

b. Altered sedimentation rates

Climate-induced changes to sedimentation rates in the glaciers above the reservoir and in the downstream tributaries regulated by Project operations pose potential threats to fish habitat. Salmon are dependent on very particular river channel morphology and riverbed substrate

¹¹³ USFWS Study Request, at 7.

¹¹⁴ NMFS Study Dispute, at 19.

¹¹⁵ TNC, ECOLOGICAL RISK ASSESSMENT, at 21; M.D. Bryant, *Global Climate Change and the Potential Effects on Pacific Salmonids in Freshwater Ecosystems of Southeast Alaska*, 95 CLIMATE CHANGE 169, 181 (2009) [hereinafter *Climate Change Effects on Pacific Salmonids*].

¹¹⁶ *Id.*, at 181.

¹¹⁷ See Letter from Am. Fisheries Soc'y, at 3.

¹¹⁸ NMFS Request for Rehearing, at 19.

¹¹⁹ *Climate Change Effects on Pacific Salmonids*, at 181.

composition for successful spawning.¹²⁰ The effects of climate change will disrupt the natural sedimentation pattern and threaten physical habitat structure.¹²¹ Project operations are likely to exacerbate these adverse consequences as the dam captures sediment and organic matter, reducing transport of important habitat material to downstream aquatic communities while depleting their food webs of essential nutrients.¹²²

c. Reduced Project longevity

Climate change also presents direct structural threats to the proposed dam. The incidence of extreme weather events, such as floods and storms, which can compromise structural integrity, is predicted to increase in the future. Such climate-driven events are also associated with high rates of sediment transport, which could reduce the capacity of the reservoir while abrading turbines and other mechanical components.¹²³ Overall, recent modeling suggests that climate change will result in unstable winter conditions and increased frequency of freeze-thaw cycles and river breakup in the region, which leads to a more dynamic load on dam infrastructure.¹²⁴

NRDC's Requested Study is needed to determine how the Project will impact riverine processes and terrestrial, riparian, and aquatic ecosystems. Modeling climate-induced changes to the thermal, flow, and sedimentation regime throughout the entire basin is necessary to provide a realistic projection of the range of potential future climatic and hydrologic trends, and evaluate the vulnerabilities of fish, wildlife and habitat to altered conditions. Ultimately, this analysis will allow decision-makers to understand the nexus between Project operations and effects on the resource.

4.5.5 Section 5.9 (b)(6) NRDC's proposed study methodology is consistent with generally accepted scientific practice

GCMs, downscaled climate projections, and corresponding streamflow predictions are more accurate than ever, as discussed in Section 4.4. Climate modeling is now an accepted scientific practice that is increasingly relied upon to inform federal water management and (non-FERC) licensing decisions for hydropower projects. Since the SPD was issued in mid-2013, the following agencies responsible for managing the nation's water supplies have integrated climate modeling into their decision-making:

a. USACE

In May of 2014, USACE issued guidance for incorporating new science and information regarding climate change impacts into their hydrologic analysis studies, in accordance with Executive Order 13653.¹²⁵ The guidance suggests relying upon data from the Third National Climate Assessment (discussed in Section 3.4), NOAA's 2013 technical report *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment*, and Reclamation's climate risk

¹²⁰ Letter from Am. Fisheries Soc'y, at 3.

¹²¹ *Id.*

¹²² See Letter from Am. Fisheries Soc'y, at 3.

¹²³ See NMFS Request for Rehearing, at 19.

¹²⁴ See *Some Aspects*, at 1648.

¹²⁵ USACE Guidance, at 1.

assessments and basin-wide studies, described below.¹²⁶ Furthermore, USACE describes how to formulate “projections of specific climate changes and associated impacts to local-scale project hydrology that may occur far in the future due to changing baselines and ranges of variability reported in the recent literature.”¹²⁷ The agency recommends using hydrologic simulations, models, and projections using spatially downscaled data from the CMIP5, available through the Downscaled Climate and Hydrology Projections website, which is maintained in partnership with USACE, U.S. Geological Survey (“USGS”), Reclamation, and several research institutions.¹²⁸

b. Reclamation

In March of 2016, Reclamation issued a report to Congress on implementing climate change science in order to develop climate risk assessments for western water supplies and demands under the SECURE Water Act.¹²⁹ As mandated by this legislation, “Reclamation coordinates with [the Department of Energy] to compare climate modeling analyses that project climate conditions and impacts to hydropower into the future.”¹³⁰ Reclamation maintains that “advances in modeling efforts” and “tools currently available to support incorporation of climate information into resource management decisions,” now enable federal agencies to evaluate the impacts of climate change on hydropower projects and natural resources.¹³¹ For example, Reclamation is currently conducting the Upper Deschutes River Basin Study in Oregon, in which applies climate change scenarios through integrated models to evaluate the viability of future water resource management alternatives.¹³²

c. USFWS & NOAA

The National Fish, Wildlife, and Climate Adaptation Strategy, an initiative led by USFWS and NOAA to share best practices for climate modeling, issued “A Report on Implementation” in

¹²⁶ *Id.* at C-2.

¹²⁷ *Id.* at 1.

¹²⁸ *Id.* at C-3. This site, run by the Program for Climate Model Diagnosis and Intercomparison, not only serves as a data archive, but also issues reports evaluating local and regional projection data and techniques to promote effective use of the most reliable models to inform water resource science and management. *Downscaled CMIP3 and CMIP5 Climate and Hydrology Projections*, PROGRAM FOR CLIMATE MODEL DIAGNOSIS AND INTERCOMPARISON, http://gdo-dcp.ucllnl.org/downscaled_cmip_projections/ (last visited May 17, 2016)

¹²⁹ Section 9505 of the SECURE (Science and Engineering to Comprehensively Understand and Responsibly Enhance) Water Act directs federal agencies, including DOI, DOE, NOAA, USGS, and the National Weather Service; the Federal Power Marketing Administrations; and state water resource agencies to collectively examine “the potential effects of climate change on water available for hydropower generation at federal facilities and on the marketing of that power.” Omnibus Public Land Management Act of 2009, Pub. L. No. 111-11, tit. IX, subtit. F, § 9503(c); BOR, SECURE WATER ACT SECTION 9503(C) – RECLAMATION CLIMATE CHANGE AND WATER 1-40 (Mar. 2016), <http://www.usbr.gov/climate/secure/docs/2016secure/2016SECUREReport.pdf>.

¹³⁰ *Id.*

¹³¹ *Id.* at 1-12.

¹³² *Id.* at 4-21.

2015.¹³³ The document provides strategies for incorporating climate change science into natural resource management and outlines recent commitments from federal, state, and local agencies to develop, improve, and increase use of climate modeling.¹³⁴

d. EPA

In September of 2013, the EPA released a report describing how watershed modeling can be used to assess the sensitivity of stream flow—as well as nutrient and sediment loads—to the cumulative impacts of climate change and development.¹³⁵ The study investigated “the influence of downscaling approaches on watershed model simulations.”¹³⁶ EPA found that, with appropriate calibration and validation, these models could be used to “provide a range of plausible future hydrologic and water quality change scenarios that can be applied in various planning and scoping frameworks.”¹³⁷

e. USGS

USGS now routinely uses downscaled temperature and precipitation data to inform its risk assessments. Beginning in October of 2013, the agency published multiple scientific studies modeling the potential impacts of climate change on salmon habitat in Pacific Northwest watersheds.¹³⁸ In their 2015 report, the USGS National Climate Change and Wildlife Center touted how their Alaska Climate Science Center in particular has helped “the scientific modeling community make refinements to improve the understanding of” how sensitive arctic resources, such as glaciers and permafrost, will continue to be impacted by climate change.¹³⁹

¹³³ USFWS ET AL., NATIONAL FISH, WILDLIFE, AND PLANTS CLIMATE ADAPTATION STRATEGY: NEXT STEPS: A REPORT ON IMPLEMENTATION (Sept. 2015), <http://www.wildlifeadaptationstrategy.gov/next-steps-implementation-report.php>.

¹³⁴ *Id.* at App. 1, 27-66.

¹³⁵ U.S. EPA, NAT’L CTR FOR ENVTL. ASSESSMENT, WATERSHED MODELING TO ASSESS THE SENSITIVITY OF STREAMFLOW, NUTRIENT, AND SEDIMENT LOADS TO POTENTIAL CLIMATE CHANGE AND URBAN DEVELOPMENT IN 20 U.S. WATERSHEDS (Sept. 2013), <https://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=256912>.

¹³⁶ *Id.* at 5-2.

¹³⁷ *Id.* at 8-2.

¹³⁸ See, e.g., D. Graves & A. Maule, *A Stakeholder Project to Model Water Temperature under Future Climate Scenarios in the Satus and Toppenish Watersheds of the Yakima River Basin in Washington, USA*, 124 CLIMATIC CHANGE 399-411 (2014), <http://dx.doi.org/10.1007/s10584-012-0643-x>; James R. Hatten et al., *Modeling Effects of Climate Change on Yakima River Salmonid Habitats*, 124 CLIMATIC CHANGE 427-39 (2014), <http://dx.doi.org/10.1007/s10584-013-0980-4>; FRANK VOSS & ALEC MAULE, DEVELOPMENT OF A DATABASE-DRIVEN SYSTEM FOR SIMULATING WATER TEMPERATURE IN THE LOWER YAKIMA RIVER MAIN STEM, WASHINGTON, FOR VARIOUS CLIMATE SCENARIOS, USGS OPEN-FILE REPORT 2013-1010 (2013), <https://pubs.usgs.gov/of/2013/1010/pdf/ofr20131010.pdf>.

¹³⁹ ELDA VARELA MINDER & HOLLY A. PADGETT, U.S. DEPARTMENT OF THE INTERIOR CLIMATE SCIENCE CENTERS AND U.S. GEOLOGICAL SURVEY CLIMATE CHANGE AND WILDLIFE SCIENCE CENTER ANNUAL REPORT FOR 2015, USGS OPEN-FILE REPORT 2016-1043 (Apr. 2016), <http://pubs.usgs.gov/of/2016/1043/ofr20161043.pdf>, at 2.

The implementation of climate change models across federal water agencies has clearly become standard practice over the past few years, replacing the outdated practice of assuming relatively stationary baseline conditions. According to the 2014 USACE guidance, “the assumptions of stationary climatic baselines and a fixed range of natural variability” have ceased to “be appropriate for long-term projections of the climatologic parameters, which are important in hydrologic assessments for inland watersheds.”¹⁴⁰ This assertion demonstrates that federal agencies have already recognized the prudence of utilizing predictive modeling, given the reliability of current models and the known unreliability of considering future conditions to be static. The hydrologic and glacier mass balance models recommended by NMFS and employed in the voluntary study by AEA, have been recognized by IPCC as particularly reliable models and should be incorporated as required components of the study plan. The Appendix provides additional examples of recent proven methodologies (developed and tested since mid-2013) for creating climate modeling frameworks to assess future hydrologic change in glacial basins.

4.5.6 Section 5.9(b)(7) NRDC’s Requested Study is cost-effective and feasible and alternative studies are inadequate

The project is anticipated to cost \$250,000 to \$350,000 in order to hire a primary investigator (with doctoral or preferably post-doctoral experience in applied climate projections) and research assistants to develop a modeling framework and analyze the data over the course of a year.¹⁴¹ This level of cost is reasonable given that the Project cost is currently estimated at \$5.19 billion.¹⁴² This relatively small expense is justified by the importance of understanding the hydrologic and climatic changes that will impact the resources and the Project. AEA’s decision to conduct climate modeling on the upper basin, despite such modeling not being a required component of the Study Plan, demonstrates that modeling is not only worthwhile, but can and should be performed for the entire basin. Furthermore, it demonstrates that the information gathered in the alternative literature reviews of Section 7.7 and 6.5 failed to provide information of satisfactory precision, quality, and value, as discussed in Section 4.5.3. NRDC’s Requested Study is evidently worth the reasonable costs.

5. Conclusion

The vulnerability of the Susitna basin ecosystem to the combined adverse impacts of the Project and climate change, and the vulnerability of the Project’s water supplies, requires a more thorough climate change study. Narrowly assessing potential changes to sedimentation and inflow to the proposed dam overlooks critical, basin-wide alterations to surface water temperature and flow that will impact terrestrial, aquatic, and riparian resources, particularly downstream of the proposed dam. Furthermore, the existing literature review falls far short of predicting these changes and their environmental consequences with sufficient precision. Fortunately, relevant and robust climate modeling data and downscaling techniques are now available to achieve this objective. Recent studies provide AEA with modeling frameworks developed for glacially-fed subarctic basins that can assess the effects of climate change on

¹⁴⁰ USACE Guidance, at 1.

¹⁴¹ NMFS, 7.7 Glacier and Runoff Changes, ISR Review and Study Modifications, (June 22, 2016), at 31.

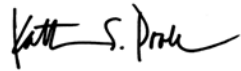
¹⁴² *Project Overview*, SUSITNA-WATANA HYDRO, <http://www.susitna-watanahydro.org/project/project-description/> (last visited May 17, 2016).

hydropower projects, as well as basin hydrology and ecology, with minimal uncertainty. Such improvements in climate modeling, as well as new federal law and policy clarifying how to incorporate climate science into environmental reviews, have allowed natural resource management agencies to more accurately characterize baseline conditions. We respectfully request that FERC approve NRDC's Study Request in order to accurately predict the impacts of climate change and the Project on the entire Susitna River watershed and ecosystem.

Respectfully submitted on this 23rd day of June, 2016,



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APPENDIX

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