

# Susitna-Watana Hydroelectric Project Document

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## 1.1. Fish Distribution and Abundance in the Upper Susitna River, 2013-14

### 1.2. Requester of Proposed Study

AEA anticipates resource agencies will request this study.

### 1.3. Responses to Study Request Criteria (18 CFR 5.9(b))

The following sections provide the necessary context and justification for the proposed study.

#### 1.3.1. Describe the goals and objectives of each study proposal and the information to be obtained.

Construction and operation of the Project as described in the Pre-application Document (PAD, AEA 2011) will affect flow, water depth and surface water elevation in the mainstem channel as well as at tributary confluences, side channels, and sloughs, both in the area of the inundation upstream from the Watana Dam site and downstream in the potential zone of project hydrologic influence. Additionally, there are potential effects on the connectivity of aquatic habitats upstream of dam, including the potential effect of the reservoir on fish overwintering, spawning, dispersal, and habitat. The operations of hydroelectric dams often alter the flow, temperature, and sediment regimes in the rivers immediately downstream. Such modifications can have [an beneficial or](#) adverse effects upon the aquatic communities and fish populations residing in the river. To assess the effects of river regulation on these fish populations, an understanding of existing conditions will be needed, providing baseline information for predicting the likely extent and nature of potential changes that will occur due to Project operations.

The proposed study area encompasses the mainstem Susitna River from Devils Canyon up to the Oshetna River confluence (RM 233.4). Within tributaries the study area is further defined by the 3,000 foot elevation contour (based on the known extent of juvenile Chinook). Some study components, such as resident fish life-history studies and juvenile Chinook distribution sampling, may extend beyond the core area. The goals and objectives within this study area are described below.

The overarching goal of this study is to characterize the current distribution, relative abundance, run timing, and life history of resident and non-salmon anadromous species (e.g., Bering cisco, Dolly Varden, humpback whitefish, northern pike, and Pacific lamprey), and freshwater rearing life stages of anadromous fish (fry and juveniles). Specific objectives include:

1. Describe the seasonal distribution, relative abundance (as determined by CPUE, fish density, and counts), and fish-habitat associations of resident fishes, juvenile salmonids, and the freshwater life stages of non-salmon anadromous species.
2. Determine whether Dolly Varden and humpback whitefish residing in the upper river exhibit anadromous or resident life histories.
3. Collect tissue samples to support the Genetic Analysis Study.
4. Determine baseline levels of metal contaminants for resident fish species in the mainstem Susitna River.
5. Use biotelemetry (PIT and radio-tags) to describe seasonal movements of selected fish species (including rainbow trout, Dolly Varden, whitefish, northern pike, burbot, and Pacific lamprey if present) with emphasis on identifying spawning and overwintering habitats within the hydrologic zone of influence upstream of the project.

6. Document the timing of downstream movement and catch for all fish species via smolt traps.
7. Document the presence/absence of northern pike in all samples.

**1.3.2. If applicable, explain the relevant resource management goals of the agencies and/or Alaska Native entities with jurisdiction over the resource to be studied. [Please include any regulatory citations and references that will assist in understanding the management goals.]**

Alaska Department of Fish and Game (ADF&G), through the Commissioner, is responsible for the management, protection, maintenance, and improvement of Alaska's fish and game resources in the interest of the economy and general well-being of the state (AS 16.05.020). ADF&G monitors fish populations and manages commercial, sport, personal use, and subsistence fisheries through regulations set by the Board of Fisheries (AS 16.05.251). The Federal Subsistence Board, which comprises representatives of the U.S. Fish and Wildlife Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, and U.S. Forest Service, oversees the Federal Subsistence Management Program (57 FR 22940; 36 CFR Parts 242.1–28; 50 CFR Parts 100.1–28), with responsibility for managing subsistence resources on Federal public lands for rural residents.

According to the Alaska constitution, the legislature shall provide for the use, development, and conservation of all natural resources belonging to the state, including land and waters, for the maximum benefit of the people and, wherever occurring in their natural state, fish, wildlife, and waters are reserved to the people for common use. The Alaska National Interest Lands Conservation Act (ANILCA) passed in 1980 mandated that the state maintain a subsistence hunting and fishing preference for rural residents on federal public lands. The State of Alaska has established a priority for subsistence use of fish and game by Alaskan residents (AS 16.05.258) on all lands, but this rural resident preference was found to contradict the state constitution's "common use" provision; subsequent attempts to amend the state constitution were unsuccessful. Consequently, Federal management agencies exerted authority over subsistence harvests on Federal lands in 1990.

The ADF&G manages the Susitna River fisheries in accordance with the sustained yield principle. Fisheries are managed based on perceived abundance and Alaska Board of Fisheries approved management plans. ADF&G has emergency order authority (5 AAC 75.003) to modify time, Area, and bag/possession limits.

Resident and anadromous fish are important to commercial, sport, personal use, and subsistence fisheries in the Susitna River basin. Pacific salmon and eulachon in the Susitna River basin support commercial fisheries occurring in Upper Cook Inlet (Shields 2010). Sport fisheries occur in the Susitna River basin for the five species of Pacific salmon indigenous to Alaska, Arctic grayling, Dolly Varden, rainbow trout, burbot, and northern pike. Sport fisheries within the Susitna drainage are managed under the Eastside Susitna and Westside Susitna subunits. Pacific salmon, Dolly Varden, rainbow trout, lake trout, eulachon, whitefish, and burbot support subsistence and personal use fisheries (Oslund and Ivey 2010, Fall and Foster 1987).

**1.3.3. If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study.**

Fisheries resources are owned by the State of Alaska and the Project could potentially affect these public interest resources by affecting fish habitat.

**1.3.4. Describe existing information concerning the subject of the study proposal, and the need for additional information.**

Information regarding resident species, non-salmon anadromous species, and the freshwater rearing lifestages of anadromous salmon was collected as part of the studies conducted during the early 1980s. Existing information includes the spatial and temporal distribution of fish species and their relative abundance. The Aquatic Resources Data Gap Analysis (ARDGA; AEA 2011a) and PAD (AEA 2011b) summarized this existing information and also identified data gaps for resident and rearing anadromous fish.

At least eight species of fish are known to occur in the upper Susitna River (AEA 2011a). These species are Arctic grayling, Dolly Varden, humpback whitefish (*Coregonus* spp.), round whitefish, burbot, longnose sucker, Chinook salmon, and sculpin (all assumed to be slimy sculpin). Northern pike, Alaska blackfish, and lake trout may also be present. Chinook salmon are the only anadromous species that has been documented in the Upper Susitna River.

In the proposed impoundment zone, arctic grayling are believed to be the most abundant fish species (AEA 2011a) and were found to spawn in tributary pools. In tributaries, juvenile grayling were found in side channels, side sloughs, and pool margins and in the mainstem at tributary mouths and clear water sloughs during early summer (AEA 2011b). Dolly Varden populations in the upper Susitna River are apparently small but widely distributed (AEA 2011b). Burbot in the upper Susitna River were documented in mainstem habitats with backwater-eddies and gravel substrate (AEA 2011b). The abundance of longnose suckers in the Upper Susitna River was less than downstream of Devils Canyon. Lake trout have been documented in lakes near the proposed impoundment zone but those within the impoundment zone have not been sampled.

Specific information needs relative to fish distribution and abundance in the Upper Susitna River that were identified in the ARDGA (AEA 2011a) include:

- population estimates of adult arctic grayling and Dolly Varden in select tributaries within the proposed impoundment zone,
- the migration timing of arctic grayling spawning in the proposed impoundment zone, the relative abundance and distribution of Dolly Varden, lake trout, and juvenile Chinook in the impoundment zone, and
- physical habitat characteristics used by round whitefish, longnose sucker, and burbot within the impoundment zone.

Little is known about the density and distribution of juvenile salmon in the Susitna River drainage. Pacific salmon (all five species) were captured in the lower and middle Susitna River during the 1980s. Juvenile Chinook salmon are the only anadromous species known to rear in the upper Susitna River and tributaries (Fog Creek, Kosina Creek, and the Oshetna River). The extent of their presence in the upper river has been poorly studied. Coho, chum, sockeye, and pink salmon were found in the lower and middle Susitna River during the 1980s.

Existing fish and aquatic resource information appears insufficient to address the following issues that were identified in the PAD (AEA 2011b):

**F1:** Effect of change from riverine to reservoir lacustrine habitats resulting from Project development on aquatic habitats, fish distribution, composition, and abundance, including primary and secondary productivity.

**F2:** Potential effect of fluctuating reservoir surface elevations on fish access and movement between the reservoir and its tributaries and habitats.

**F3:** Potential effect of Watana Dam on fish movement.

**1.3.5. Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements.**

Non-salmon anadromous, resident and invasive fish species communities comprise key components of the aquatic ecosystem. Project facilities and operations will create a reservoir, modify the flow, thermal, and sediment regimes, and may alter connectivity of aquatic habitats upstream of the dam in the Susitna River basin. These potential ecosystem changes will alter the composition and distribution of fish habitat and may have effects on fish overwintering, spawning, dispersal, and habitat. The proposed hydropower operations for the Susitna-Watana Hydropower Project may influence the abundance and distribution of one or more of these fish populations. The degree of impact on the fish communities resulting from hydropower operations will necessarily vary depending on the magnitude, frequency, duration, and timing of flows as well as potential Project-related changes in temperature and turbidity. [The study results will inform FERC's decisions regarding the need for and content of any mitigation or enhancement requirements. By investigating the current populations in the upper Susitna River, and applying what is known regarding the impacts of river regulation and hydropower operations on fish communities, this study and its objectives may be able to offer important options for P&A and PM&E measures.](#)

**1.3.6. Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge.**

This study will employ a variety of field methods to build upon the existing information related to the distribution and abundance of resident, non-salmon anadromous fish, and juvenile salmon in the Upper Susitna River. The methods chosen to accomplish this effort are consistent with standard techniques used throughout the fisheries scientific community. However, logistical and safety constraints inherent in fish sampling in a large river in northern latitudes also play a role in selecting appropriate methodologies. The following sections provide brief descriptions of the suite of methods that will be used to accomplish each objective of this study. This study incorporates fish surveys in Upper river but does not include estimates of escapement. This study will occur over two years in order to cover as much habitat as possible. If dramatically different flow conditions occur between these two years, the re-sampling of 20-25% of habitats sampled in year one will be considered in year two. The proposed methods are outlined, by objective, below.

**Objective 1:** Describe the seasonal distribution, relative abundance, and habitat associations of resident fishes and the fresh water life stages of non-salmon anadromous species.

- Document fish distribution and abundance in the mainstem, tributaries, and lake habitats identified as accessible to fish during habitat characterization, including the year-round distribution and movement of fish, including whitefish, arctic grayling, Dolly Varden, rainbow trout, burbot, and lamprey if present.
- Use a systematic scheme for sampling across habitat types and randomize selection of habitat units to sample.
- Conduct systematic fish sampling (electrofishing, snorkeling, gillnetting, etc.) to document fish distribution and abundance. Tributary streams will be sampled up to 3,000-ft elevation. If Chinook salmon are observed, sampling efforts will continue upstream beyond the 3,000-ft elevation, including above potential barriers, to the upper extent of suitable habitat. Fish sampling will be coordinated with the Habitat Characterization Study team using methods similar to Hankin and Reeves (1988).
- Use summer fish-habitat association data, historic data, and ground water study results to identify select potential winter habitats. Based on these data, habitats will be randomly selected to sample for overwintering fish.

**Objective 2:** Determine whether Dolly Varden and humpback whitefish residing in the upper river exhibit anadromous or resident life histories.

- Collect otoliths for micro chemistry analysis from Dolly Varden and humpback whitefish building on results of the 2012 efforts to provide additional spatial coverage. Otoliths will be analyzed for the marine derived elements strontium (Sr), and potentially barium (Ba), to detect evidence of anadromy.

**Objective 3:** Collect tissue samples to support the Genetic Analysis Study.

- Collect genetic samples for juvenile Chinook salmon in the Susitna tributaries above Devils Canyon captured in conjunction with Objective 1. Sample collections will be coordinated with the Genetic Analysis Study team.
- Collect genetic samples opportunistically for resident and non-salmon anadromous fish captured in conjunction with Objective 1. Sample collections will be coordinated with the Genetic Analysis Study team.
- Results of genetic sampling will be used to develop a genetic baseline for resident fish species upstream of Three Rivers prior to dam construction.

**Objective 4:** Determine baseline levels of metal contaminants for resident fish species in the main stem of the Susitna River.

- The sampling will be conducted in concert with Objective 1, with distribution and target species or species assemblages determined in coordination with the Fish and Aquatics technical working group for species used for human consumption and the wildlife technical working group for furbearers.
- Tissues or whole fish, depending on prescribed protocols, will be sampled and delivered to an approved laboratory in coordination with the water quality program.

**Objective 5:** Use biotelemetry (PIT and radio-tags) to describe seasonal movements of selected fish species (rainbow trout, Dolly Varden, whitefish, northern pike, burbot, Arctic grayling, and Pacific lamprey if present) with emphasis on identifying spawning and overwintering habitats within the hydrologic zone of influence upstream of the project.



- PIT tag large numbers (on the order of 10K) of adult resident and juvenile fishes collected to document movement and habitat connectivity throughout the river system.
- Radio tag select resident fish species to understand movement throughout the River.
- Repeat the Arctic grayling radiotelemetry study from the 1980s with an increased sample size and reduced the tag size to obtain results that are more representative of the population(s).

**Objective 6:** Document the timing of downstream movement and catch for all fish species via outmigrant traps.

- Operate inclined plane and/or rotary screw traps in the mainstem to determine the species, timing, and number of fish emigrating from the upper River.

**Objective 7:** Document the presence/absence of northern pike in all samples.

**Data:** All data collected in the field will be subjected to QA/QC and delivered to AEA. The data will be entered into the relational database described below, QC'd, and delivered to AEA.

**Geospatially-Referenced Relational Database:** All data generated during this study will be incorporated into the Susitna Fish Program geospatially-referenced relational database that will be created in 2012; this database will form the basis for additional data collection in 2013-2014. All new field data will be associated with location information collected using a Global Positioning System (GPS) receiver in unprojected geographic coordinates (latitude/longitude) and the WGS84 datum. Naming conventions of files and data fields, spatial resolution, and metadata descriptions will meet the ADNR standards established for the Susitna-Watana Hydroelectric Project.

**Spatial Products in ArcGIS Software:** The geospatial products will include geodatabases and maps indicating survey area, radio-tagged fish locations by survey, habitat types used by spawning fish, habitat data, and locations of significant features such as barriers and springs. Naming conventions of files, data fields and metadata descriptions will meet the ADNR standards established for the Susitna-Watana Hydroelectric Project. All map and spatial data products will be delivered in the two-dimensional Alaska Albers Conical Equal Area projection, and North American Datum of 1983 (NAD 83) horizontal datum consistent with ADNR standards.

**Summary of Interim Results:** A brief interim report will be prepared and presented to AEA and the licensing participants to document the progress of the study identify any issues that have occurred, and allow for further refinement of the 2014 studies.

**Annual Project Report:** A report will be prepared that documents the methods, field effort, results, conclusions, and recommendations from the 2012 study.

**Technical Memo:** A technical memo summarizing the 2012 results will be presented to resource agency personnel and other licensing participants, along with spatial data products.

## Schedule

This is a multi-year study and includes an ongoing study planning component. The schedule for the 2013-2014 components will be developed in coordination with the AEA during the ILP formal study planning process.

- Proposed Study Plan – July 16, 2012.
- Revised Proposed Study Plans – November 14, 2012.
- Summary of Interim Results – September 10, 2013 and 2014.
- Original QC'd 2012 Data - December 1, 2013 and 2014.
- QC'd geospatially-referenced relational database – December 1, 2013 and 2014.
- Final Technical Report on 2013 and 2014 Activity – December 31, 2013 and 2014.

**1.3.7. Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.**

To describe the seasonal distribution, relative abundance, and habitat associations of the various fish species in winter, alternate methods involving snorkel and dive surveys were considered. These alternate methods were dismissed based on safety concerns owing to potentially extreme cold temperatures, remoteness of the sampling locations, and that sampling would most appropriately be conducted at night.

The schedule, staffing, and costs will be detailed as the 2013–2014 Study Plan develops. Total study costs are estimated at \$2,000,000.

**1.3.8. Literature Cited**

- AEA (Alaska Energy Authority). 2011a. Aquatic Resources Gap Analysis. Prepared by HDR, Inc., Anchorage. 107 pp.
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