Susitna-Watana Hydroelectric Project
(FERC No. 14241)

The Future Watana Reservoir Fish Community and Risk of Entrainment Study
Study Plan Section 9.10

Final Study Plan

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

July 2013

9.10. The Future Watana Reservoir Fish Community and Risk of Entrainment Study

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC or Commission) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Included within the RSP was The Future Watana Reservoir Fish Community and Risk of Entrainment Study, Section 9.10. RSP Section 9.10 focuses on understanding the relationship between Project design, operations, lacustrine habitat, and the potential fish community in the proposed Watana Reservoir is important for assessing potential Project impacts.

On February 1, 2013, FERC staff issued its study determination (February 1 SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 9.10 was one of the 13 approved with modifications. In its February 1 SPD, FERC recommended the following:

We recommend modifying AEA's proposed evaluation of the potential to establish viable populations of anadromous salmonids upstream of the project, specified in task 4 of section 9.10.4.2, to include evaluation of the production potential for Chinook, sockeye, chum, and coho salmon in reservoir and riverine habitats upstream of the dam.

In accordance to FERC's February 1 SPD, AEA has included this modification in the Final Study Plan.

9.10.1. General Description of the Proposed Study

The nature of the fish community inhabiting the proposed Watana Reservoir will depend on a suite of interrelated factors affecting fish populations and their habitat. These factors may be influenced by the design and operation of the Project. This study plan describes the efforts that will be implemented to predict the fish community that will develop in the Project's reservoir and identify the effects of the Project on the future reservoir fish community. Figure 9.10-2 shows the relationship between this study and other study programs.

Study Goals and Objectives

Construction and operation of the Project will result in inundation of the river upstream from the dam. Several operational scenarios will also be considered as part of the licensing studies. Some operating scenarios, such as load-following, could result in relatively large and frequent fluctuations of the reservoir water surface elevation. Operations would result in seasonal differences in pool elevation such as a winter or early-springtime drawdown in advance of the annual melt of accumulated snow during early summer.

Construction of the Project will fundamentally change the fish habitat characteristics in the area to be inundated. About 39 miles of mainstem river plus several miles of tributary stream will be converted to lacustrine habitat. Conversion from riverine habitat to lacustrine habitat will be beneficial for some fish species and detrimental to others, resulting in a modified fish community. Depending upon the fish protection measures included in the Project license and specific engineering design elements, the modified fish community may be subject to entrainment and mortality as a result of spill or passage through turbines. This study will provide information and tools needed for predicting the likely changes to the fish community due

to habitat conversion, potential mortality from entrainment, and for assessing the potential Project operational effects on lacustrine habitat following Project construction.

Understanding the relationship between Project design, operations, lacustrine habitat, and the potential fish community in the proposed Watana Reservoir is important for assessing potential Project impacts. The proposed Watana Reservoir has the potential to provide public benefits in the form of recreational fishing opportunities as well development of commercial or subsistence fisheries. Identifying the potential fish community and species with commercial, subsistence, and sportfish values is also important for identifying alternative fishery management strategies in advance of Project construction.

The overarching goal of this study is to predict the fish community that will develop in the Project reservoir based on the existing species and the habitat that will be created in the inundation zone, and to characterize the potential loss from entrainment.

Specific objectives include the following:

1. Develop scenarios for anticipated daily and seasonal changes in reservoir habitat characteristics based on predicted reservoir operations, size, temperatures, and water quality and depth profiles.
2. Develop scenarios for future reservoir fish communities based on current fish species composition upstream of the proposed dam site and enhancement potential for select salmon species incorporating anticipated daily and seasonal changes in reservoir habitat characteristics.
3. Characterize potential management options including recreational, commercial, and subsistence uses of the reservoir fishery.
4. Conduct a qualitative desktop analysis on the potential for entrainment of fish species inhabiting the proposed reservoir upstream of Watana Dam.

9.10.2. Existing Information and Need for Additional Information

Information regarding resident species, non-salmon anadromous species, and the freshwater rearing life stages 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 Pre-Application Document (PAD) (AEA 2011b) summarize this existing information and also identify 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 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. Longnose suckers were less abundant in the Upper Susitna River than downstream of Devils Canyon (river mile [RM] 150). Lake trout were documented in lakes near the proposed impoundment zone but the impoundment zone has not yet been sampled.

In the 1980s, the Alaska Department of Fish and Game (ADF&G) completed an investigation of feasibility of upstream salmon passage through Devils Canyon and the enhancement potential in the river basin upstream of Devils Canyon (Barrick et al. 1983). Information from this historic study will be used in combination with data collected in 2013 and workgroup meetings with ADF&G management biologists to characterize the potential future reservoir fish community.

This study is needed to provide information and tools needed for predicting the likely changes to the fish community due to habitat conversion, for determining potential mortality from entrainment, and for assessing the potential Project operational effects on lacustrine habitat following Project construction.

9.10.3. Study Area

The study area (Figure 9.10-1) encompasses all portions of the basin to be inundated by the proposed Watana Reservoir up to the maximum reservoir water surface elevation to be determined during finalization of design and operational scenarios. About 39 miles of mainstem river (beginning at the dam site at RM 184), plus an unknown amount of tributary stream, will be converted to lacustrine habitat. During normal operation, the reservoir level may fluctuate substantially on a daily and seasonal basis. Annual drawdowns are anticipated to exceed 100 feet with a maximum drawdown of 150 feet. The Project is currently planned to be operated in a load-following mode to maximize firm power generation during winter (November through April), but inflows into the reservoir during this period are anticipated to be relatively low.

9.10.4. Study Methods

The following sections describe the approach that will be used to address each of the four interrelated study objectives associated with the Future Watana Reservoir Fish Community and Risk of Entrainment Study. Each component incorporates significant agency recommendations regarding the general study approach and specific methods to be used. These were developed collaboratively during the drafting of the relevant study request. Where appropriate, each study component has been broken down into separate tasks.

9.10.4.1. Reservoir Habitat Scenarios

Based on the alternative Project operating scenarios identified by Project engineers, this study component will develop corresponding scenarios for anticipated daily and seasonal changes in reservoir habitat characteristics. This study component is composed of the three following tasks that will consider reservoir conditions related to the relative size of lacustrine zones, water temperature, and turbidity.

Task 1 – Lacustrine Zone Estimation

Project operations will influence the relative size of different lacustrine zones and, as a result, the amount of habitat for aquatic biota that inhabit each zone. This task will coordinate with the operations modeling study team to adapt an existing model, such as HEC-ResSim, or develop a

new unsteady flow hydraulic model of the proposed reservoir that can be used to evaluate daily and seasonal changes in reservoir depth and the amount of exposed shoreline. Based on Light Detection and Ranging (LiDAR) data and a series of transects across the proposed reservoir, model results will provide reservoir water surface elevations and depths that will be used to develop estimates of the size of each of the following lacustrine zones under the alternative operating scenarios identified in coordination with project engineers:

Varial Zone: Area alternately wetted and dewatered by water level fluctuations; can include some or all of the littoral zone.

Littoral Zone: Near-shore area extending to the deepest extent of light penetration sufficient for primary production.

Limnetic Zone: Open-water layer with sufficient light penetration for primary production to occur.

Profundal Zone: Open-water layer too deep for primary production to occur; below the limnetic zone.

Benthic Zone: Bottom layer of the reservoir associated with the substrate and underlying all other zones.

An important part of this task will be the development of assumptions related to reservoir operations to be incorporated into the hydraulic model. These model assumptions will be developed collaboratively with the Fish and Aquatic Technical Workgroup (TWG). Additional assumptions pertain to how the lacustrine zone is defined temporally and spatially. Temporal aspects of the defined lacustrine zone will consider minimum and maximum time intervals appropriate to the frequency and magnitude of water level fluctuations expected under the alternative operating scenarios, in particular those related to peaking operations. Spatial definitions will consider turbidity or other factors related to light penetration that also may vary at least seasonally.

Task 2 – Water Temperature Modeling

This task will involve the development of a water temperature model of the proposed reservoir that can be used to evaluate daily and seasonal changes in water temperatures and the potential for thermal stratification. The water temperature model will be developed in coordination with the water quality assessment team and as part of the proposed Water Quality Modeling Study. It is anticipated that the Environmental Fluid Dynamics Code (EFDC), will be used for this effort based on the review of available models described in Water Quality Monitoring Study (Section 5.6). Model results will be used to predict daily and seasonal variations in reservoir temperatures, including temperature profiles, and identify the potential for thermal stratification. This task will summarize the reservoir temperature model results including an assessment of how the results relate to the future reservoir fish community. Details regarding the implementation of the water quality model are described in Section 5.6 though specific outputs necessary for this study component will be developed through an iterative and collaborative process with the water quality study team. Completion of the initial study report for the Water Quality Modeling Study is expected in the first quarter of 2014. However, model outputs related to reservoir temperature will be obtained as they become available.

Task 3 – Reservoir Turbidity

Turbidity levels can influence the suitability of aquatic habitat for certain fish species. This task will involve reviewing available information to identify turbidity thresholds that can limit reservoir habitat utilization for species that may otherwise overwinter in the Watana Reservoir. The target species for this effort are lake trout, burbot, grayling, and whitefish. Historic information collected in the Susitna basin during the 1980s and synthesized as part of a 2012 study (Synthesis of Exiting Fish Population Data) will be reviewed to identify utilization relative to turbidity levels. Information collected in 2012 as part of the Upper Susitna River Fish Distribution and Habitat Study will also be reviewed as well as turbidity threshold information available for the target species from other out-of-basin literature sources. This information will be compared to turbidity levels expected to occur in the Watana Reservoir that are identified in coordination with the water quality assessment team. Species-specific turbidity exceedances in the Watana Reservoir during winter will be identified to predict the degree, if any, to which turbidity will limit the overwintering use of reservoir habitat by lake trout, burbot, grayling, and whitefish.

9.10.4.2. Reservoir Fish Community Scenarios

Creation of the reservoir and operation of the Project will drastically alter the habitat available to the existing fish community in the inundation zone. The future reservoir fish community will be determined by the altered habitat conditions, as well as the segment of the existing fish community expected to utilize the reservoir. This study component will develop scenarios for future reservoir fish communities based on the current fish species composition upstream of the proposed dam site, anticipated reservoir habitat characteristics, and management practices acceptable to ADF&G. This study component is composed of the following four tasks related to the existing fish community, potential use of the reservoir by these species, and the potential presences of invasive species.

Task 1 – Define Existing Fish Community

Species that comprise the existing fish community in the Susitna River and certain subbasins represent the source stocks from which the reservoir could be colonized. In this task, information from two studies conducted during 2012, the Synthesis of Existing Fish Population Data Study and the Upper Susitna River Fish Distribution and Habitat Study, will be reviewed to characterize the existing fish community in the mainstem river and any tributaries or lakes that could colonize the reservoir. Potential colonizing species will be identified based on their presence in the inundation zone, proximity/connectivity to the inundation zone, and the likelihood of potential movements to the inundation zone.

Task 2 – Identify Potential Use of Lacustrine Habitat

Although the reservoir could be colonized by fish species identified in Task 1, future reservoir habitat may not be suitable for all species. This task will involve a literature review to identify species in the existing fish community that may use lacustrine habitat for one or more life history stages. In the absence of such information, general utilization of lacustrine habitat in other systems will be reviewed. A white paper will be prepared that identifies the life history and habitat requirements for each species, with a focus on lacustrine elements. The white paper will be drafted during 2Q and 3Q, 2013 and findings will be incorporated into the Initial Study Report and the Updated Study Report. The discussion for each species will include an assessment of uncertainty in predicting their lacustrine habitat use. This assessment will be

written to aid in the development of a post-construction monitoring program by identifying such uncertainties as expected life histories or those related to future reservoir habitat conditions.

Task 3 – Identify Potential Invasive Species

Northern pike are considered an invasive species in the Susitna drainage and have spread throughout the system from the Yenta drainage after being illegally introduced in the 1950s (AEA 2011b). Alaska blackfish are also considered an invasive species and, while not captured in the Susitna River, may have been introduced to the system. This task will identify the presence of invasive species in lakes and ponds that are currently disconnected from the mainstem but have the potential to be inundated. Information from the two 2012 studies identified above will be reviewed to identify water bodies in which invasive species have been found and that have the potential to be inundated.

Task 4 – Identify Potential for Anadromous versus Land-Locked Salmon-Based Community

This task summarizes the potential to establish viable populations of anadromous salmon upstream of the proposed Project and the potential to affect native fish communities. This task will also evaluate the production potential for Chinook, sockeye, chum, and coho salmon in reservoir and riverine habitats upstream of the dam. The evaluation of production potential upstream of the Project will be based on the 1983 study by ADF&G (Barrick et al 1983). Depending on fish passage considerations, an alternative land-locked salmonid community will also be assessed. Potential effects of these species on native fish communities will be addressed. A literature review will focus on habitat utilization by relevant species in newly created reservoirs where such information is available. This effort will be conducted during 2Q and 3Q 2013 and findings will be synthesized to comprise relevant sections of the Initial Study Report and Updated Study Report.

9.10.4.3. Reservoir Fishery Management Options

This study component will characterize potential management options for a future reservoir fishery. A future fishery in the Watana Reservoir will be dependent upon the habitat conditions and fish community expected to occur in the reservoir, as described by the previous study components. Management options related to a reservoir fishery will be dependent on public access and recreational goals established for the reservoir and consistency with ADF&G management actions, as well as fish passage As such, analyses associated with this study component will be conducted in 2014 when more information on public access and recreational goals for the reservoir are available. Implementation of this study component will involve collaborating with ADF&G in the development of alternative recreational, commercial, and subsistence fishery management strategies for the reservoir. This effort will also coordinate with the recreation team to determine the recreational basis and potential access in support of a potential fishery. The technical memorandum for the overall study will include a section in which the potential management options for a future reservoir fishery, developed in collaboration with ADF&G and in coordination with the recreation team, are described in detail.

9.10.4.4. Entrainment Analysis

Fish inhabiting the proposed reservoir could be susceptible to entrainment through the Project (turbines or spillways) or impingement on the intake trash racks. This study component will

involve conducting a desktop analysis of the potential for entrainment and impingement of fish species inhabiting the proposed Watana Reservoir. This study component is comprised of the following three tasks related to identifying Project design and operating scenarios, reviewing relevant literature related to entrainment at other projects and biological information for target species, and analyzing this information to assess entrainment and impingement risks at the Project. Fish passage provisions, and the presence of anadromous fish, have implications regarding the overall number of species and individuals to be considered in evaluating potential entrainment or impingement risks; thus, the selection of target species for entrainment will be drawn from the reservoir fish community scenerios and identified in collaboration with the Fish and Aquatic TWG. The work product for this study component will be a technical memorandum summarizing the entrainment analysis that will entail the following tasks.

Task 1 – Identify Project Design/Operating Scenarios

Potential entrainment risks are influenced by Project design and operations. This task will involve coordinating with Project engineers to understand alternative Project designs and operating scenarios. This task is anticipated to be conducted in 2014 when more dam design and operational details are available. Specific design and operational details to be considered that can directly influence entrainment risks include the following:

- Intake approach velocities
- Trash rack spacing
- Intake depths and design
- Outlet depths and design
- Operating head
- Turbine design
- Turbine speed
- Generation
- Spillway design
- Spill height
- Spill frequency

Task 2 – Literature Review

An abundance of information is available in the literature regarding fish entrainment at hydropower projects (i.e., EPRI 1997; Franke et al. 1997; FERC 1995). This task will entail reviewing such information as well as other analyses of entrainment risks with a focus on deep water intakes and cold water reservoirs. Biological information related to the future Watana Reservoir fish community identified as part of this study will also be considered to identify species and life stages expected to inhabit the reservoir that may be at risk of entrainment or impingement. Additional biological information related to entrainment and impingement risks will be obtained from the literature. Such information includes the swimming ability of target species, which will influence their ability to avoid entrainment as they approach the intakes, as well as fish size (i.e., body length and width), which will influence impingement risks. General behavioral information related to movements in the water column and reservoir habitat use will also be reviewed.

Task 3 – Desktop Analysis

This task will involve synthesizing the information collected in the previous tasks to conduct a desktop analysis identifying the potential vulnerability of target species in the anticipated reservoir community to entrainment and impingement mortality at the proposed dam under alternative design and operating scenarios. Because the size and composition of fish populations comprising the future reservoir community is theoretical under pre-Project conditions, rates of entrainment or impingement will not be predicted as part of this task. Rather, this analysis will focus on identifying species and life stages at risk of entrainment or impingement based on their size, swimming ability, periodicity, and/or behavior. The analysis will also identify the relative risks associated with different potential sources of indirect or direct mortality, including impingement, strike, shear, grinding, turbulence, cavitation, pressure changes, and dissolved gas levels.

9.10.4.5. Work Products

Deliverable work products include the following:

White Paper on Potential Use of Lacustrine Habitat

As described above, a white paper will be prepared that identifies the potential use of lacustrine habitat. This work product will rely on existing information developed in 2012 as well as a review of relevant literature. Because the contents of this work product do not require input from water quality modeling or operational scenarios, it will be completed in 3Q, 2013.

Technical Memorandum on Entrainment Analysis

A technical memorandum will be prepared that summarizes the results of the entrainment analysis, including a summary of relevant Project design/operational scenarios, a review of available literature pertinent to entrainment/impingement risks of target species, and the methods and results of the desktop entrainment analysis. Because this work product is dependent on input regarding Project design and operating scenarios, it will be completed in 2Q, 2014.

Study Reports

Initial and Updated Study Reports that summarize study progress and results gathered to date will be prepared and presented to resource agency personnel and other licensing participants, along with spatial data products. These Study Reports will represent the primary work products for this study and will provide detailed methods and findings associated with all of the aforementioned tasks related to Reservoir Habitat Scenarios, Reservoir Fish Community Scenarios, Reservoir Fishery Management Options, and the Entrainment Analysis. When available, the Initial and /or Updated Study Reports will incorporate results provided in the white paper on potential use of lacustrine habitat, and the technical memorandum related to the entrainment analysis. Along with the study reports, spatial data products will be provided that include shape files of the various lacustrine zones for each alternative operating scenario. 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 Alaska Department of Natural Resources (ADNR) standards. Naming conventions of files and data fields, spatial resolution, and metadata descriptions must meet the ADNR standards established for the Project.

9.10.5. Consistency with Generally Accepted Scientific Practice

The study methods have been developed in consultation with licensing participants. The methods chosen to accomplish this effort are consistent with standard techniques used throughout the fisheries scientific community. The use of models is a common technique used for assessing potential effects of a proposed project. The proposed modeling frameworks described below were developed by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency specifically for predicting the behavior of reservoirs and simulating physical water resource processes.

9.10.6. Schedule

This is largely a desktop analysis that will be completed in late 2013 and 2014 as information from other studies becomes available. The schedule for this study is shown in Table 9.10-1. Results from the Reservoir Habitat Study component will inform the Reservoir Fish Community Study component. In turn, results from the Reservoir Fish Community Study component will inform both the Reservoir Fishery and Entrainment Study components. As such, the schedule reflects the appropriate ordering of implementation for each study component. Initial and Updated Study reports documenting actions taken to date will be issued within 1 and 2 years, respectively, of FERC's Study Plan Determination (i.e., February 1, 2013).

9.10.7. Relationship with Other Studies

The Future Watana Reservoir Fish Community and Risk of Entrainment Study is interrelated to several AEA studies (Figure 9.10-2). The flow of information into and out of this study is anticipated to occur over the two-year study period through an iterative process. As relevant data (described above) is collected, it will be disseminated to other participants in the Fish Program and Recreational Resources. To maximize communication among the Fish Study Program, study leads will participate in regularly scheduled internal meetings where preliminary data will be presented and implications to other studies discussed.

In addition to Project design and operations, five Project studies will interrelate by providing input information useful to the Reservoir Fish Community and Entrainment Study. In the fourth quarter of 2013, the Fish Passage Feasibility Study (Section 9.11.4) will provide input information on concepts and alternatives as an iterative process that will inform the future fish community. The Upper River Fish Distribution and Abundance Study (Section 9.5.4.3.1) will provide information on the potential reservoir fish community in the 2013 and 2014 Study Reports. The Fish Passage Feasibility Study (Section 9.11.4) will also provide information on entrainment risk with preliminary engineering and design alternatives in the 2013 and 2014 Study Reports. The Water Quality Modeling Study (Section 5.6.4) will provide information in the third and fourth quarters of 2014 on temperature and turbidity that will be used to assess reservoir habitat. The Recreational Resources Study (Section 12.5) Initial Study Report will provide information on how recreational use and demand of the reservoir may impact the fishery.

The Future Watana Reservoir Fish Community and Risk of Entrainment Study will also interrelate with three other Project studies by providing useful output information (Figure 9.10-2). The desktop analysis of potential entrainment will provide information on entainment risk to the Fish Passage Feasibility Study (Section 9.11) in the second quarter of 2014 and output back to the Watana Reservoir Fish Community Study (Section 9.10). Evaluating scenarios for

reservoir habitat, fishery management options, and future reservoir fish communities in the first quarter 2014 will inform the Future Watana Reservoir Fish Community Study (Section 9.10). The reservoir fisheries component of the Reservoir Fish Community and Entrainment Study will used to evaluate fishery management options in the second quarter of 2014 and used and inform the Recreation Resources Study (Section 12.5).

9.10.8. Level of Effort and Cost

Several components of this study will rely on modeling or other efforts developed in coordination with other study programs. As such, the level of effort and expected cost associated with each study component is dependent upon the distribution of effort among the different study programs. The total estimated cost for this study is $205,000. The estimated costs associated with each study component are provided below and include assumptions related to the distribution of effort. The staffing and costs for this study will be further refined as other related portions of the 2013–2014 study program develop.

Reservoir Habitat Scenarios

The estimated cost to complete this study component is $60,000. This cost assumes that the operations modeling study team will perform the majority of the reservoir hydraulic modeling effort and water quality study team will perform the majority of the water temperature modeling effort.

Reservoir Fish Community Scenarios

The estimated cost for this study component is $65,000.

Reservoir Fishery Management Options

The estimated cost for this study component is $40,000. This cost assumes that the recreation study team will develop the recreational basis for a future reservoir fishery.

Entrainment Analysis

The estimated cost for this study component is $40,000.

9.10.9. Literature Cited

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

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9.10.10. Tables

Table 9.10-1. Schedule for implementation of the Future Watana Reservoir Fish Community and Risk of Entrainment Study.

Activity	2013				2014				2015
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q
Reservoir Habitat Scenarios		——	——			-------			
Initial Study Report				——	Δ				
Reservoir Fish Community Scenarios				——	——				
Reservoir Fishery Management Options					——	——			
Entrainment Analysis					——	——			
Updated Study Report								——	▲

Legend:

—— Planned Activity
----- Follow-up activity (as needed)
Δ Initial Study Report
▲ Updated Study Report

9.10.11. Figures

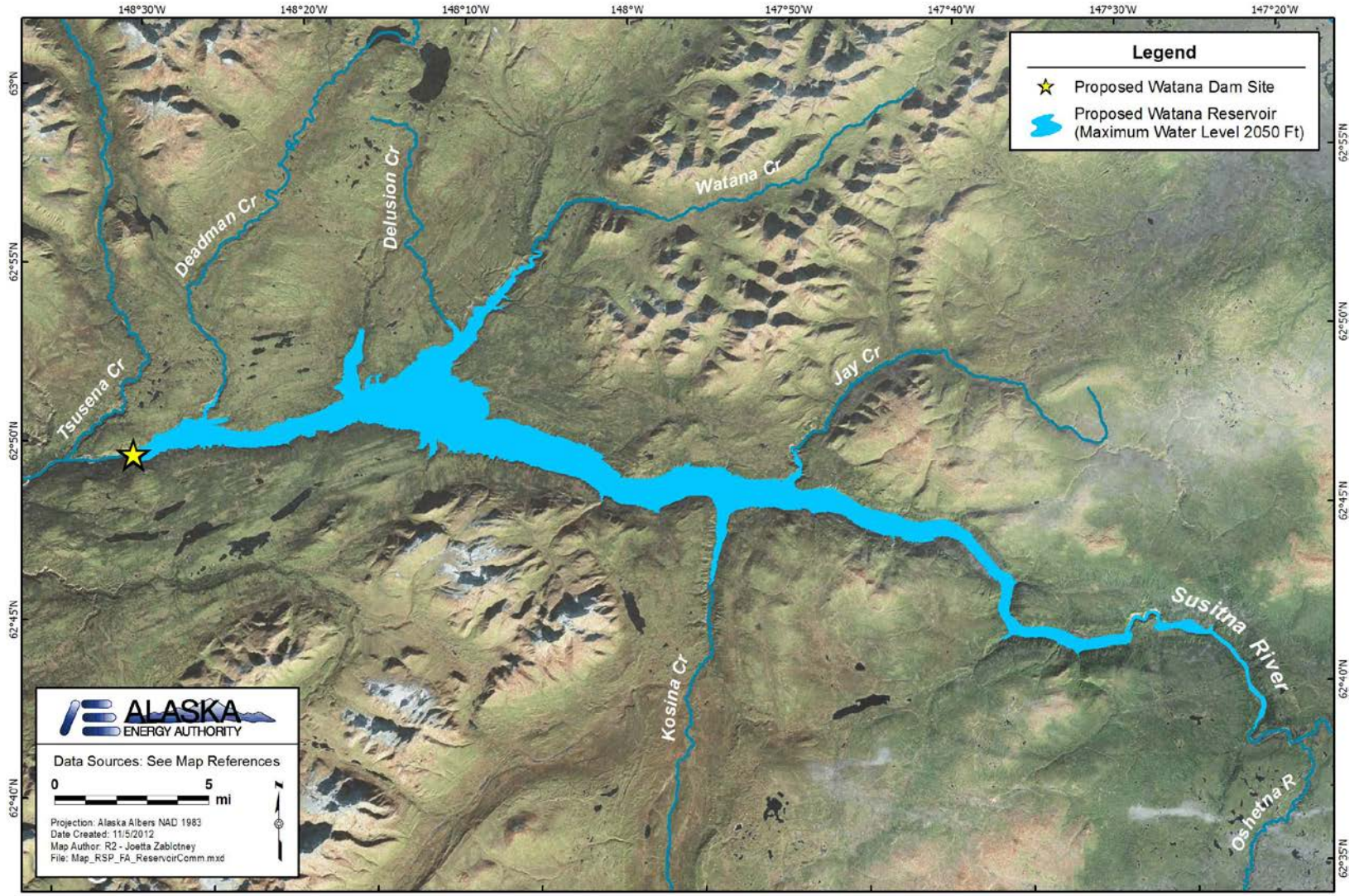

Figure 9.10-1. Map of study area for Future Watana Reservoir Fish Community and Risk of Entrainment Study.

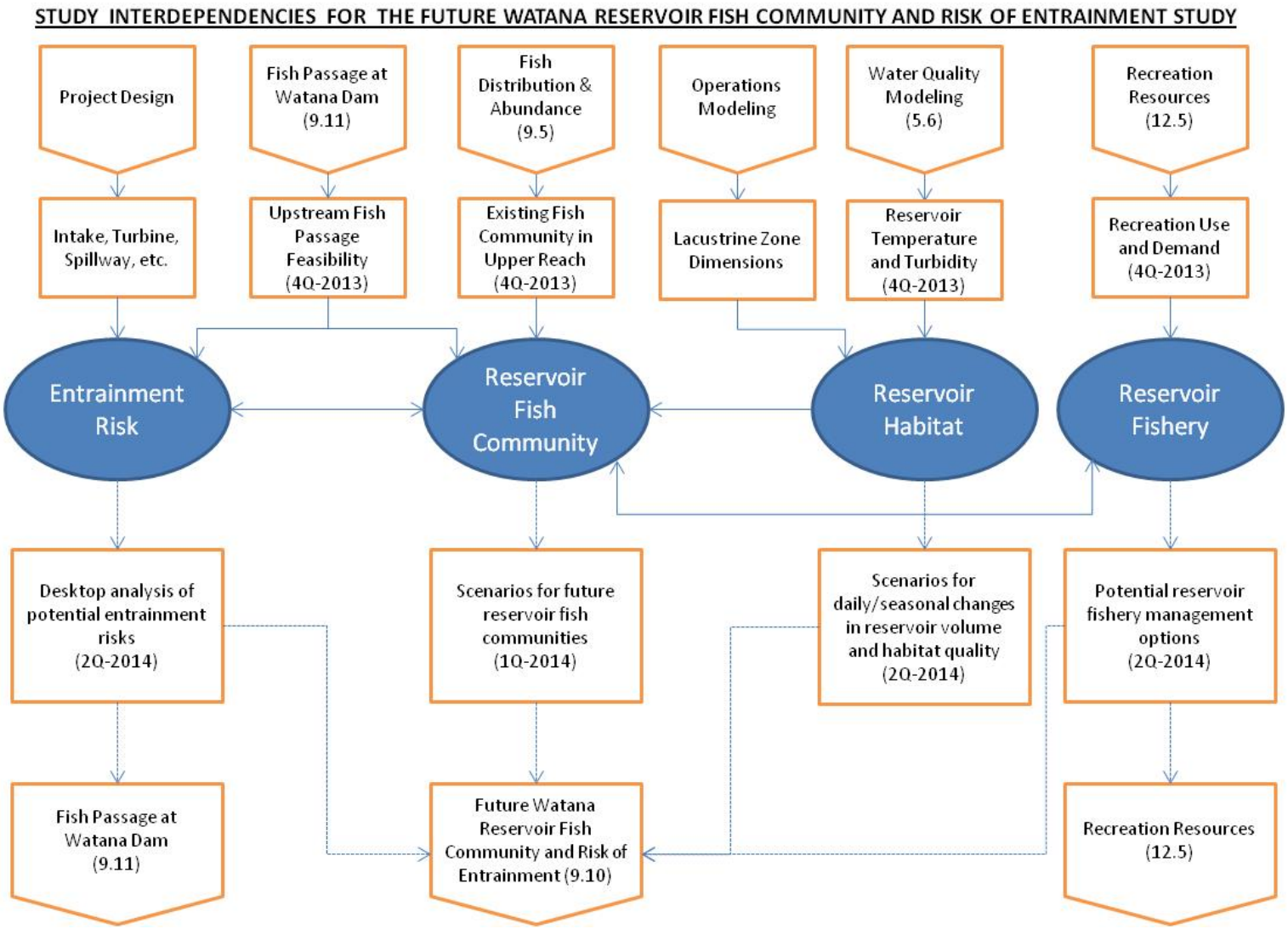

Figure 9.10-2. Flow chart showing relationships between components of the Future Watana Reservoir Fish Community and Risk of Entrainment Study (ovals), other study programs, and related information.