ALASKA ENERGY AUTHORITY

June 17, 2013

Ms. Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: Susitna-Watana Hydroelectric Project, FERC Project No. 14241-000; Study of Fish Passage Barriers Implementation Plan

Dear Secretary Bose:

On February 1, 2013, the Federal Energy Regulatory Commission (Commission or FERC) issued its Study Plan Determination (February 1 SPD) for 44 of the 58 proposed individual studies in the Alaska Energy Authority's (AEA) Revised Study Plan (RSP) for the Susitna-Watana Hydroelectric Project, FERC Project No. 14241 (Project).

When approving the Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (RSP 9.12), the Commission recommended that AEA file a detailed plan that provides additional information described below on implementation of the study within the Middle River study area:

1) *A specific schedule for completing the following Middle River study components proposed for future development in consultation with the TWG as set forth in section 9.12.4 of the RSP: (a) identifying fish species to be included in the passage barrier study; (b) defining the passage criteria for the identified fish species; (c) selecting the number and location of study sites for each element of study implementation; and (d) filing the results of items (a), (b), and (c).*

2) *A description of how the effects of load-following during the winter ice-cover period on salmonid juvenile and fry passage (e.g., depth, velocity, potential ice blockages) from mainstem into off-channel habitats would be evaluated.*

3) *A description of the specific methods as set forth in section 9.12.4.5 (e.g., 2-dimensional modeling, or other unspecified modeling approach) that would be applied at the off-channel and tributary delta locations selected for the depth barrier analysis. This would include an explanation of the proposed methods and study sites for the open-water period for adult and juvenile fish, and the ice-cover period for juvenile fish.*

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4) *A description of a subsample of tributary deltas and off-channel habitat entrances within Middle River focus areas where velocity measurements will be taken to determine if velocity barriers to juvenile salmonids (particularly salmonid fry) would be created at tributary deltas and off-channel habitat entrances by modifications to river stage and discharge through proposed project operations.*

5) *Documentation that a draft plan and schedule were provided to FWS, NMFS, and any other TWG participants at least 30 days prior to the due date of the plan and schedule (allowing at least 15 days for comment); a description of how FWS', NMFS', or other TWG participant's comments are incorporated into the final plan; and an explanation for why any of FWS', NMFS', or other TWG participant's comments are not incorporated into the final plan.*

Consistent with the Commission's recommendations within the February 1 SPD, AEA is filing the attached Study of Fish Passage Barriers Implementation Plan (attached as Attachment 1).

On May 15, 2013, AEA provided to U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and other Technical Work Group participants for comment a Draft Study of Fish Barriers Implementation Plan (Draft Implementation Plan) that was developed to provide responses to the February 1 SPD recommendations. The Draft Implementation Plan was also made available on the Project website (http://www.susitna-watanahydro.org). Consistent with the February 1 SPD, AEA initially allowed 15 days for comment by requesting that all comments be submitted, in writing, by Thursday, May 30, 2013. At the request of NMFS, AEA extended the deadline for comments to June 5, 2013. NMFS and USFWS jointly submitted comments on June 7, 2013. AEA received no other comments on the Draft Implementation Plan. Attached as Attachment 2 is a comment response table that includes a description of how the NMFS and USFWS joint comments are incorporated into the final plan; and an explanation for why certain comments were not incorporated into the final plan.

As always, AEA appreciates the participation and commitment to this licensing process demonstrated by Commission Staff, federal and state resource agencies, and other licensing participants. AEA looks forward to working with licensing participants and Commission Staff in implementing the approved studies, which AEA believes will comprehensively investigate and evaluate the full range of resource issues associated with the proposed Project and support AEA's license application, scheduled to be filed with the Commission in 2015.

If you have questions concerning this submission please contact me at wdyok@aidea.org or (907) 771-3955.

Sincerely,

Wayne Dyok
Project Manager
Alaska Energy Authority

Attachments

cc: Distribution List (w/o Attachments)

Attachment 1

Study of Fish Passage Barriers Implementation Plan (June 2013)

Susitna-Watana Hydroelectric Project (FERC No. 14241)

Study of Fish Passage Barriers Implementation Plan

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

HDR, Inc.

June 2013

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LIST OF ACRONYMS AND SCIENTIFIC LABELS

Abbreviation	Definition
Active floodplain	The flat valley floor constructed by a river during lateral channel migration and deposition of sediment under current climate conditions.
ADF&G	Alaska Department of Fish and Game
AEA	Alaska Energy Authority
Age-0 juvenile	The description of an organism that, in its natal year, has developed the anatomical and physical traits characteristically similar to the mature life stage, but without the capability to reproduce.
Algae	Single-celled organisms (as individual or cells grouped together in colonies) that contain chlorophyll-a and are capable of the photosynthesis.
Anadromous	Fishes that migrate as juveniles from freshwater to saltwater and then return as adults to spawn in freshwater.
APA	Alaska Power Authority
APA Project	APA Susitna Hydroelectric Project
Backwater	Off-channel habitat characterization feature found along channel margins and generally within the influence of the active main channel with no independent source of inflow. Water is not clear.
Bank	The sloping land bordering a stream channel that forms the usual boundaries of a channel. The bank has a steeper slope than the bottom of the channel and is usually steeper than the land surrounding the channel.
Bankfull stage (flow)	The discharge at which water completely fills a channel; the flow rate at which the water surface is level with the floodplain.
Bankfull width	The width of a river or stream channel between the highest banks on either side of a stream.
Baseline	Baseline (or Environmental Baseline): the environmental conditions that are the starting point for analyzing the impacts of a proposed licensing action (such as approval of a license application) and any alternative.
Benthos (benthic)	Defining a habitat or organism found on the streambed or pertaining to the streambed (or bottom) of a water body.
Braided streams	Stream consisting of multiple small, shallow channels that divide and recombine numerous times. Associated with glaciers, the braiding is caused by excess sediment load.
Break-up	Disintegration of ice cover.
Cascade	The steepest of riffle habitats. Unlike rapids, which have an even gradient, cascades consist of a series of small steps of alternating small waterfalls and shallow pools.
Catch per unit effort	The quantity of fish caught (in number or in weight) with one standard unit of fishing effort.
Cfs	cubic feet per second
Channel	A natural or artificial watercourse that continuously or intermittently contains water, with definite bed and banks that confine all but overbank stream flows.
Cross-section	A plane across a river or stream channel perpendicular to the direction of water flow.
Depth	Water depth at the measuring point (station).
Devils Canyon	Located at approximately Susitna River Mile (RM) 150-161, Devils Canyon contains four sets of turbulent rapids rated collectively as Class VI. This feature is a partial fish barrier because of high water velocity.
Distribution (species)	The manner in which a biological taxon is spatially arranged.

Abbreviation	Definition
et al.	"*et alia*"; and the rest
FERC	Federal Energy Regulatory Commission
Fishwheel	A device for catching fish which operates much as a water-powered mill wheel. A wheel complete with baskets and paddles is attached to a floating dock. The wheel rotates due to the current of the stream it is placed into. The baskets on the wheel capture fish traveling upstream. The fish caught in the baskets fall into a holding tank.
Flood	Any flow that exceeds the bankfull capacity of a stream or channel and flows out on the floodplain.
Floodplain	1. The area along waterways that is subject to periodic inundation by out-of-bank flows. 2. The area adjoining a water body that becomes inundated during periods of over-bank flooding and that is given rigorous legal definition in regulatory programs. 3. Land beyond a stream channel that forms the perimeter for the maximum probability flood. 4. A relatively flat strip of land bordering a stream that is formed by sediment deposition. 5. A deposit of alluvium that covers a valley flat from lateral erosion of meandering streams and rivers.
Focus Area	Areas selected for intensive investigation by multiple disciplines as part of the AEA study program.
Fork length	A measurement used frequently for fish length when the tail has a fork shape. Projected straight distance between the tip of the snout and the fork of the tail.
Fry	A recently hatched fish. Sometimes defined as a young juvenile salmonid with absorbed egg sac, less than 60 mm in length.
Fyke net	Hoop nets are tubular shaped nets with a series of hoops or rings spaced along the length of the net to keep it open.
Geomorphic reach	Level two tier of the habitat classification system. Separates major hydraulic segments into unique reaches based on the channel's geomorphic characteristic.
Geomorphology	The scientific study of landforms and the processes that shape them.
Gillnet	With this type of gear, the fish are gilled, entangled or enmeshed in the netting. These nets may be used to fish on the surface, in midwater or on the bottom.
GIS	Geographic Information System. An integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes.
Glacier geometry changes	Changes in the size or shape of a glacier over time.
Glide	An area with generally uniform depth and flow with no surface turbulence. Low gradient; 0-1 % slope.
GPS	global positioning system. A system of radio-emitting and -receiving satellites used for determining positions on the earth.
Groundwater (GW)	In the broadest sense, all subsurface water; more commonly that part of the subsurface water in the saturated zone.
Habitat	The environment in which the fish live, including everything that surrounds and affects its life, e.g. water quality, bottom, vegetation, associated species (including food supplies). The locality, site and particular type of local environment occupied by an organism.
Hook and line	A type of fishing gear consisting of a hook tied to a line.
Hoop net	Hoop nets are tubular shaped nets with a series of hoops or rings spaced along the length of the net to keep it open.
Ice cover	A significant expanse of ice of any form on the surface of a body of water.
ILP	Integrated Licensing Process
Inclined plane trap	This trap consists of a revolving screen suspended between two pontoons. Downstream migrant fish reaching the back of the trap are dropped into a live box

Abbreviation	Definition
	where they can later be enumerated.
Instream flow	The rate of flow in a river or stream channel at any time of year.
Juvenile	A young fish or animal that has not reached sexual maturity.
licensing participants; Participants	Agencies, ANSCA corporations, Alaska Native entities and other licensing participants
Life stage	An arbitrary age classification of an organism into categories relate to body morphology and reproductive potential, such as spawning, egg incubation, larva or fry, juvenile, and adult.
Lower segment Susitna	The Susitna River from Cook Inlet (RM 0) to the confluence of the Chulitna River at RM 98.
M	meter(s)
m^2	square meter(s)
Macroinvertebrate	An invertebrate animal without a backbone that can be seen without magnification.
Main channel	For habitat classification system: a single dominant main channel. Also, the primary downstream segment of a river, as contrasted to its tributaries.
Main channel habitat	Level four tier of the habitat classification system. Separates main channel habitat types including: tributary mouth, main channel, split main channel, multiple split main channel and side channel into mesohabitat types. Mesohabitat types include pool, glide, run, riffle, and rapid.
Mainstem	Mainstem refers to the primary river corridor, as contrasted to its tributaries. Mainstem habitats include the main channel, split main channels, side channels, tributary mouths, and off-channel habitats.
Mainstem habitat	Level three tier of the habitat classification systems. Separates mainstem habitat into main channel, off-channel, and tributary habitat types. Main channel habitat types include: tributary mouth, main channel, split main channel, multiple split main channel and side channel. Off-channel habitat types include: side slough, upland slough, backwater, and beaver complex. Tributary habitat is not further categorized.
Major hydraulic segment	Level one tier of the habitat classification system. Separates the River into three segments: Lower River (RM 0-98), Middle River (RM 98-184), and Upper River (RM 184-233).
Mesh size	The size of holes in a fishing net.
Mesohabitat	A discrete area of stream exhibiting relatively similar characteristics of depth, velocity, slope, substrate, and cover, and variances thereof (e.g., pools with maximum depth <5 ft, high gradient rimes, side channel backwaters).
Middle segment Susitna	The Susitna River from the confluence of the Chulitna River at RM 98 to the proposed Watana Dam Site at RM 184.
Migrant (life history type)	Some species exhibit a migratory life history type and undergo a migration to from rivers/lakes/ocean.
Migration	Systematic (as opposed to random) movement of individuals of a stock from one place to another, often related to season.
Minnow trap	Normally composed of small steel mesh with 2-piece torpedo shape design, this trap is disconnected in the middle for easy baiting and fish removal.
N/A	not applicable *or* not available
Non-native	Not indigenous to or naturally occurring in a given area.
^oC	degrees Celsius
^oF	degrees Fahrenheit
Off-channel	Those bodies of water adjacent to the main channel that have surface water connections to the main river at some discharge levels.

Abbreviation	Definition
Off-channel habitat	Habitat within those bodies of water adjacent to the main channel that have surface water connections to the main river at some discharge levels.
Out-migrant trap	Several types of trapping equipment that can be used to estimate the abundance of downstream migrating anadromous salmonid smelts.
Overwintering	Freshwater habitat used by salmonids during the winter for incubation of eggs and eleven in the gravel and for rearing of juveniles overwintering in the stream system before migrating to saltwater the following spring.
pH	A measure of the acidity or basicity of a solution.
PIT	Passive Integrated Transponder tags used to individually identify animals and monitor their movements.
PM&E	protection, mitigation and enhancement
Pool	Slow water habitat with minimal turbulence and deeper due to a strong hydraulic control.
POW	Palustrian open water (ponds under 20 ac)
PRM	Project River Mile(s) based on the digitized wetted width centerline of the main channel from 2012 Matanuska-Susitna Borough digital orthophotos. PRM 0.0 is established as mean lower low water of the Susitna River confluence at Cook Inlet.
Project	Susitna-Watana Hydroelectric Project
Radiotelemetry	Involves the capture and placement of radio-tags in adult fish that allow for the remote tracking of movements of individual fish.
Rapid	Swift, turbulent flow including small chutes and some hydraulic jumps swirling around boulders. Exposed substrate composed of individual boulders, boulder clusters, and partial bars. Lower gradient and less dense concentration of boulders and white water than Cascade. Moderate gradient; usually 2.0-4.0% slope.
Rearing	Rearing is the term used by fish biologists that considers the period of time in which juvenile fish feed and grow.
Resident	Resident fish as opposed to anadromous remain in the freshwater environment year-round
Riffle	A fast water habitat with turbulent, shallow flow over submerged or partially submerged gravel and cobble substrates. Generally broad, uniform cross-section. Low gradient; usually 0.5-2.0% slope.
Riparian	Pertaining to anything connected with or adjacent to the bank of a stream or other body of water.
River	A large stream that serves as the natural drainage channel for a relatively large catchment or drainage basin.
River corridor	A perennial, intermittent, or ephemeral stream and adjacent vegetative fringe. The corridor is the area occupied during high water and the land immediately adjacent, including riparian vegetation that shades the stream, provides input of organic debris, and protects banks from excessive erosion.
River mile	The distance of a point on a river measured in miles from the river's mouth along the low-water channel.
RM	River Mile(s) referencing those of the APA Project.
RSP	Revised Study Plan
Run (habitat)	A habitat area with minimal surface turbulence over or around protruding boulders with generally uniform depth that is generally greater than the maximum substrate size. Velocities are on border of fast and slow water. Gradients are approximately 0.5 % to less than 2%. Generally deeper than riffles with few major flow obstructions and low habitat complexity.
Run (migration)	Seasonal migration undertaken by fish, usually as part of their life history; for example, spawning run of salmon, upstream migration of shad. Fishers may refer to

Abbreviation	Definition
	increased catches as a "run" of fish, a usage often independent of their migratory behavior.
Screw trap	A floating trap that relies on an Archimedes screw built into a screen covered cone that is suspended between two pontoons is used.
Seine (beach)	A fishing net that hangs vertically in the water with its bottom edge held down by weights and its top edge buoyed by floats. Seine nets can be deployed from the shore as a beach seine, or from a boat.
Side channel	Lateral channel with an axis of flow roughly parallel to the mainstem, which is fed by water from the mainstem; a braid of a river with flow appreciably lower than the main channel. Side channel habitat may exist either in well-defined secondary (overflow) channels, or in poorly-defined watercourses flowing through partially submerged gravel bars and islands along the margins of the mainstem.
Side slough	Off-channel habitat characterization of an Overflow channel contained in the floodplain, but disconnected from the main channel. Has clear water,
Slope	The inclination or gradient from the horizontal of a line or surface.
Slough	A widely used term for wetland environment in a channel or series of shallow lakes where water is stagnant or may flow slowly on a seasonal basis. Also known as a stream distributary or anabranch.
Smolt	An adolescent salmon which has metamorphosed and which is found on its way downstream toward the sea.
Smoltification	The physiological changes anadromous salmonids and trout undergo in freshwater while migrating toward saltwater that allow them to live in the ocean.
Spawning	The depositing and fertilizing of eggs by fish and other aquatic life.
Split main channel	Main channel habitat characterization where three of fewer distributed dominant channels.
Stratified sampling	A method of sampling from a population. In statistical surveys, when subpopulations within an overall population vary, it is advantageous to sample each subpopulation (stratum) independently. Stratification is the process of dividing members of the population into homogeneous subgroups before sampling.
Three Rivers Confluence	The confluence of the Susitna, Chulitna, and Talkeetna rivers at Susitna River Mile (RM) 98.5 represents the downstream end of the Middle River and the upstream end of the Upper River.
Tributary	A stream feeding, joining, or flowing into a larger stream (at any point along its course or into a lake). Synonyms: feeder stream, side stream.
Turbidity	The condition resulting from the presence of suspended particles in the water column which attenuate or reduce light penetration.
TWG	Technical Workgroup
Upland slough	Off-channel habitat characterization feature that is similar to a side slough, but contains a vegetated bar at the head that is rarely overtopped by mainstem flow. Has clear water.
Upper segment Susitna	The Susitna River upstream of the proposed Watana Dam Site at RM 184.
Watana Dam	The dam proposed by the Susitna-Watana Hydroelectric project. The approximately 750-foot-high Watana Dam (as measured from sound bedrock) would be located at river mile (RM) 184 on the Susitna River.

STUDY PLANS REFERRED TO IN THIS IMPLEMENTATION PLAN

RSP Section	Study Section
Geomorphology (RSP Section 6)	Fluvial Geomorphology Modeling below Watana Dam Study (Section 6.6)
Hydrology-Related Resources (RSP Section 7)	Groundwater Study (Study Section 7.5) Ice Processes in the Susitna River Study (Study Section 7.6)
Instream Flow (RSP Section 8)	Fish and Aquatics Instream Flow Study (Study Section 8.5)
Fish and Aquatic Resources (RSP Section 9)	Study of Fish Distribution and Abundance in the Upper Susitna River (Study Section 9.5) Study of Fish Distribution and Abundance in the Middle and Lower Susitna River (Study Section 9.6) Salmon Escapement Study (Study Section 9.7) Study of Fish Passage Feasibility at Watana Dam (Study Section 9.11) Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries (Study Section 9.12)

1. INTRODUCTION

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 Study of Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries, Section 9.12. RSP Section 9.12 focuses on the methods for locating, describing, and assessing potential fish passage barriers in the Middle and Upper Susitna River that could be created or eliminated as a result of Project construction and operation. RSP 9.12 provided goals, objectives, and proposed methods for identification, classification, measurement, and analysis of potential fish passage barriers.

On February 1, 2013, FERC staff issued its study determination (February 1SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications. RSP Section 9.12 was one of the 13 approved with modifications.

In accordance with the February 1 SPD, recommended modifications are addressed in detail in this implementation plan. Any area not discussed within this implementation plan will remain as detailed in the RSP.

2. FERC STAFF RECOMMENDATION

In its February 1 SPD, FERC recommended the following:

> *We recommend that AEA assess discharge conditions at the streamflow gages established by AEA closest to Devils Canyon and near the dam site during the time periods when salmon are documented to successfully pass upstream of the Devils Canyon passage impediment in 2013 and 2014 (via radio-tagging as set forth in study 9.7, salmon escapement), and document the results in the initial and updated study reports.*
>
> *We do not recommend use of any of AEA's criteria set forth in section 9.12.4.4 of the RSP for excluding study sites from the Middle River passage barrier evaluation. Instead, we recommend that AEA prepare and file a detailed plan by no later than June 15, 2013, that provides the additional information described below on implementation of the study within the Middle River study area.*
>
> 1) *A specific schedule for completing the following Middle River study components proposed for future development in consultation with the TWG as set forth in section 9.12.4 of the RSP: (a) identifying fish species to be included in the passage barrier study; (b) defining the passage criteria for the identified fish species; (c) selecting the number and location of study sites for each element of study implementation; and (d) filing the results of items (a), (b), and (c).*
>
> 2) *A description of how the effects of load-following during the winter ice-cover period on salmonid juvenile and fry passage (e.g., depth, velocity, potential ice blockages) from mainstem into off-channel habitats would be evaluated.*

3) A description of the specific methods as set forth in section 9.12.4.5 (e.g., 2-dimensional modeling, or other unspecified modeling approach) that would be applied at the off-channel and tributary delta locations selected for the depth barrier analysis. This would include an explanation of the proposed methods and study sites for the open-water period for adult and juvenile fish, and the ice-cover period for juvenile fish.

4) A description of a subsample of tributary deltas and off-channel habitat entrances within Middle River focus areas where velocity measurements will be taken to determine if velocity barriers to juvenile salmonids (particularly salmonid fry) would be created at tributary deltas and off-channel habitat entrances by modifications to river stage and discharge through proposed project operations.

5) *Documentation that a draft plan and schedule were provided to FWS, NMFS, and any other TWG participants at least 30 days prior to the due date of the plan and schedule (allowing at least 15 days for comment); a description of how FWS', NMFS', or other TWG participant's comments are incorporated into the final plan; and an explanation for why any of FWS', NMFS', or other TWG participant's comments are not incorporated into the final plan.*

3. GOALS AND OBJECTIVES

As described in RSP Section 9.12.1, the goal of this study is to evaluate the potential effects of Project-induced changes in flow and water surface elevation on free access of fish into, within, and out of suitable habitats in the Upper Susitna River (inundation zone above the Watana Dam site) and the Middle Susitna River (Watana Dam site to the confluence of Chulitna and Talkeetna rivers). This goal will be achieved by meeting the following objectives:

1. Locate and categorize all existing fish passage barriers (e.g., falls, cascade, beaver dam, road or railroad crossings) located in selected tributaries in the Middle and Upper Susitna River (Middle River tributaries to be determined during study refinement).
2. Identify and locate using global position satellite (GPS) the type (permanent, temporary, seasonal, partial) and characterize the physical nature of any existing fish barriers located within the Project's zone of hydrologic influence (ZHI).
3. Evaluate the potential changes to existing fish barriers (both natural and man-made) located within the Project's ZHI.
4. Evaluate the potential creation of fish passage barriers within existing habitats (tributaries, sloughs, side channels, off-channel habitats) related to future flow conditions, water surface elevations, and sediment transport.

These objectives will be met through the use of existing information, consulting with the Fish and Aquatic Technical Workgroup (TWG) and other licensing participants, and by using the methods described in the RSP.

4. STUDY AREA

The study area, as described in RSP Section 9.12.3 includes the mainstem and selected tributaries in the Upper and Middle segments of the Susitna River that would be affected by the construction and operation of the Project. For purposes of this study, the study area has been preliminarily divided into two segments:

- Upper River—Susitna River and selected tributaries within this segment up to the 3,000 foot elevation and extending upstream from Watana Dam site (RM 184) to the upper extent of river influenced by Watana Reservoir up to and including the Oshetna River (see Section 9.5, Figure 9.5-1).

- Middle River—Susitna River and selected tributaries within this segment, extending from Watana Dam site to the confluence of the Chulitna River (RM 98). Passage studies in the mainstem Middle Segment will include sloughs, upland sloughs, side channels, and tributary mouths and deltas.

Passage studies in tributaries to the Middle River will include select tributaries and will extend from the mouth to the upper extent of Project hydrologic influence. The upper limit of hydrologic influence will be determined from supporting studies including the Instream Flow Study (RSP Section 8.0) and the Geomorphology Study (RSP Section 6.0), among others.

5. BACKGROUND AND EXISTING INFORMATION

The background and existing information for this implementation plan is the same as described in RSP Section 9.12.2.

6. FISH PASSAGE THROUGH DEVILS CANYON

The first paragraph of the February 1 SPD recommends that AEA evaluate discharge conditions in the proximity of Devils Canyon and successful passage upstream of the canyon. AEA accomplished this objective by evaluating the relationship between river discharge and passage of radio-tagged salmon into and through Devils Canyon as part of the 2012 Salmon Escapement Study. Consistent with FERC's February 1 SPD, AEA will again accomplish this by evaluating the relationship between river discharge and passage of radio-tagged salmon into and through Devils Canyon from 2012-2014.

Mean daily discharge records will be obtained from one or more of the AEA stream gages located in the Devils Canyon Area (ESS55 or ESS60). The gage closest to the impediment will be used or discharge will be prorated between the two gages to obtain the most accurate discharge estimate at the impediment at the time of attempted passage. Data on timing of radio-tagged fish movements will be obtained from the salmon escapment study. Discharges during both successful and unsuccessful passage by radio-tagged fish will be evaluated to discern any possible relationship. If a relationship is found, these data can be used to model post-Project discharges and potential effects on passage of adult salmon through Devils Canyon.

All field data collection will be conducted as part of RSP Section 9.7 and RSP Section 8.5 - Hydraulic Routing and Operations Modeling.

7. DETAILED FISH BARRIER METHODS

The February 1 SPD states:

> *We do not recommend use of any of AEA's criteria set forth in section 9.12.4.4 of the RSP for excluding study sites from the Middle River passage barrier evaluation. Instead, we recommend that AEA prepare and file a detailed plan by no later than June 15, 2013, that provides the additional information described below on implementation of the study within the Middle River study area.*

AEA is fulfilling this recommendation by providing this implementation plan.

7.1. Implementation Plan Components

The February 1 SPD states:

> *A specific schedule for completing the following Middle River study components proposed for future development in consultation with the TWG as set forth in section 9.12.4 of the RSP: (a) identifying fish species to be included in the passage barrier study; (b) defining the passage criteria for the identified fish species; (c) selecting the number and location of study sites for each element of study implementation; and (d) filing the results of items (a), (b), and (c).*

The study components requested for future development are addressed below in the order presented.

7.1.1. (a) Identify Fish Species to be Included in Passage Barrier Study

Given the interdependencies between the barriers assessment and Instream Flow Study physical habitat data collection, AEA proposes that target species for the fish barrier studies be the same as, or a sub-set of, those selected for Instream Flow Habitat Modeling (RSP Section 8.5). For planning purposes, target species proposed in RSP Section 8.5 were assumed to include Chinook, coho, chum, and sockeye salmon, rainbow trout, Arctic grayling, Dolly Varden, burbot, longnose sucker, humpback whitefish, and round whitefish. These target species were selected because they are generally considered the most sensitive to habitat loss through manipulation of flows in the Susitna River. All of theses species also have been identified as target species for RSP Section 9.11 - Study of Fish Passage Feasibility at Watana Dam. RSP Section 9.11 target species selection was first based on presence of the species in the Upper River, secondly on the following three criteria, and thirdly in consultation with the Fish Passage Technical Team at their workshop on April 9 and 10, 2013. Aspects of these criteria used by the Fish Passage study team are also useful for selecting target species for passage barrier studies.

- ***The species exhibits migratory behavior*** – Fish passage has a greater importance to species that may exhibit migratory behavior as part of their natural life history compared to fish that exhibit only localized movement, especially when the migration is necessary to complete the life cycle of the species.

- ***The species has high relative abundance*** – Species that are relatively abundant in the Upper River and its tributaries would theoretically utilize fish passage facilities with greater frequency than less abundant species, disregarding other criteria (e.g., migratory behavior).
- ***The species is important to commercial, sport, or subsistence fisheries*** – Species that are harvested in commercial, sport, or subsistence fisheries have added importance with regard to the study of fish passage feasibility.

Since submittal of RSP Section 8.5, AEA and the TWG have engaged in meetings to initiate discussions of target species for Habitat Suitability Criteria (HSC) development and inclusion in instream flow habitat modeling. At the March 27, 2013 TWG meeting (AEA 2013a), AEA presented a proposed species priority list for HSC development (Figure 2). During 2013, AEA will seek the input of the Instream Flow Technical Work Group when finalizing target species and life stage for which HSC will be developed. AEA proposes that selection of target species for fish passage analysis occur toward the end of the HSC development process. Technical Team members, licensing participants, and AEA will have gained substantial knowledge of species and lifestage utilization of off-channel habitats, seasonal movement into and out of off-channel habitats, and microhabitat (depth and velocity) selection. This information will be informative to the refinement of target species selection and passage criteria.

7.1.2. (b) Define Passage Criteria for Identified Fish Species

Basic categories of fish passage criteria include water depth, water velocity, and fish leaping ability. The majority of passage criteria are based on the demonstrated swimming ability of a species/lifestage in a laboratory, or in some cases, under controlled natural conditions.

The onus for most research on adult swimming ability is related to upstream fish passage at manmade structures such as fishways, low head dams, weirs, and culverts. Most information on juvenile and fry swimming ability is related to entrainment (open diversions) and impingement (fish screens), of downstream migrating salmonids. Swim speed is the primary criterion developed from these studies. Although information exists, depth criterion for fry and juvenile salmonids is less researched. Although criteria are available for some of the proposed non-salmonids target species, swimming capabilities for non-salmonids is the least researched.

AEA is in the process of collating existing information on passage criteria for the Fish Passage Feasibility Study. Draft appendices summarizing these data have been developed for most of the target species listed above and data will be summarized for the remaining species in Q2 of 2013. These materials are being developed in collaboration with the Fish Passage Technical Team. AEA proposes to use this information to inform passage criteria for the barrier study. Any additional information necessary for the barriers assessment will be collated and summarized in Q3 and Q4 of 2013. AEA proposes that consultation with Licensing Participants regarding refinement of fish passage criteria occurs during TWG HSC development meetings scheduled for late 2013. This timing would benefit passage criteria discussions because of the knowledge gained from the HSC development process regarding species/lifestage use of different off-channel habitat types and from HSC field observations.

7.1.3. (c) Select Number and Location of Study Sites for each Element of Study Implementation

Study elements and respective schedules for study site selection are presented below. Detailed descriptions of these study elements and study sites are provided in this implementation plan.

Study Implementation Element	Schedule for Study Site Selection
Adult salmon passage in tributaries above Devils Canyon	79 tributaries (study sites) were selected and surveyed for barriers in 2012 (AEA 2013b). Follow-up surveys at a sub-set of these tributaries are schedule for July - August 2013.
Adult salmon passage through Devils Canyon	Impediment locations and radio-tracking stations were established in 2012 for studies of salmon passage at Devils Canyon (AEA 2013c).
Intensive study of passage at off-channel and tributary deltas for adult and juvenile/fry lifestages in Middle River Focus Areas during ice-free and ice-cover periods.	The number and location of all Focus Areas, within which all intensive study of fish passage will occur, will be determined as part of the implementation of RSP Section 8.5 - Fish and Aquatics Instream Flow Study. The selection of 2-D modeling sites is anticipated to occur in Q2-Q4, 2013.
Identification and location of physical barriers to fish passage in tributaries outside of Middle River Focus Areas.	In 2013, AEA proposes to ground survey 16 tributaries outside of Focus Areas for physical barriers within the zone of hydrologic influence (ZHI[1]) in the Middle River. These tributaries are listed below in Table 2.

7.1.4. (d) File Results of Items (a), (b), and (c)

The results of these implementation ideas will be included within the RSP Section 9.12 study reports filed with the Commission.

[1] The ZHI is defined as the approximated section of tributary extending from the Susitna River's modeled water's edge at a 1.5 year flow return interval downstream to the tributary's confluence with the Susitna River at a base flow.

7.1.5. Schedule Overview

Study Components, Implementation Element	Process/Field Effort	Proposed Schedule for Consultation or Field Surveys
(a) Identify Fish Species to be included	Defined as part of instream flow, HSC target species selection	Completed
(b) Define Passage Criteria for Fish Species	Define following initial results report for instream flow HSC sampling and Fish Distributin and Abundance sampling.	Q1 2014
(c) Select Number and Location of Study Sites	Locations of all study sites are proposed in this detailed implementation plan.	Q2-Q4 2013
(ci) Upper River Tributary	Passage studies in tributaries intended for survey but not completed in 2012 and confirmation of possible barriers identified in 2012	Q3 2013
(cii) Upper River Tribtaries within Reservoir Varial Zone	Selection of tributaries will be a subsample of the tributaries selected in 2012 and coordinated with the Geomorphology Study, RSP Section 6.5.4.8.2.2.	Q3 2013
(ciii) Tributaries, sloughs and side-channels in Focus Areas	Fish passage physical barrier field studies of tributaries and off-channel habitat types in Focus Areas will be conducted during habitat mapping surveys.	August and/or September 2013.
(civ) Tributaries outside of Focus Areas	Fish passage barrier field studies in selected tributaries outside of Focus Areas (Table 2)	August and/or September 2013.

7.2. Effects of Load-following on Passage during Ice-cover Periods

A description of how the effects of load-following during the winter ice-cover period on salmonid juvenile and fry passage (e.g., depth, velocity, potential ice blockages) from mainstem into off-channel habitats would be evaluated.

For the assessment of fish barriers within Focus Areas, AEA will rely on data collected by the intensive, multidisciplinary studies in Focus Areas to evaluate the effects of load-following on juvenile and fry passage at off-channel habitats during the ice cover period. These studies include:

- RSP Section 7.6 - Ice Processes in the Susitna River Study
- RSP Section 7.5 - Groundwater Study
- RSP Section 8.5 - Fish and Aquatics Instream Flow Study
  - Hydraulic Routing and Operations Modeling;

  - Winter Habitat Use Sampling;
  - Periodicity;
  - Habitat-Specific Model Development
- RSP Section 9.6 - Study of Fish Distribution and Abundance in the Middle and Lower Susitna River
  - Winter Fish Study;
  - Early Life History Study

An example of co-location of winter studies in Focus Areas is illustrated in Figure 3.

To study the effects of load-following on fish passage in the Middle River, AEA will use the River1D predictive ice, hydrodynamic, and thermal model to simulate time-variable flow routing, heat-flux processes, seasonal water temperature variation, frazil ice development, ice transport processes, and ice-cover growth and decay.

The River1D model will be used to simulate conditions in the Middle River due to various project operating scenarios and predict changes in water temperature, frazil ice production, ice cover formation, elevation and extent of ice cover, and flow hydrograph. The model will also be used to predict ice cover stability, including potential for jamming, under load-following fluctuations. For the spring melt period, the model will be used to predict ice-cover decay, including the potential for break-up jams. Proposed operating scenarios will include, at a minimum, the load-following scenario described in the Pre-Application Document (PAD) and a base-load scenario.

For Focus Areas, AEA will model and characterize ice processes using either River1D or River2D models. The appropriate model will be selected on the basis of which model better simulates the characteristics at the particular study location. The objective of this modeling will be to evaluate project effects on smaller scale habitat in the focus areas to provide physical data on winter habitat for RSP Section 8.5 (fish and aquatics instream flow) and RSP Section 9.12 (fish passage barriers).

As discussed by FERC (2013a), accuracy of hydrodynamic modeling during the ice-cover periods may or may not be sufficient to predict passage conditions at the small, local scale. FERC states:

> *…it's not clear if the winter model can accurately predict stage-discharge relationships and streamflow velocities at a scale that is fine enough to evaluate the effects of daily flow fluctuations during proposed winter load-following operations on fish passage conditions from the mainstem into off-channel habitats…While AEA's proposed fish passage barrier study plan does not appear to specifically address this issue, we assume the intensive, multidisciplinary study elements that would be implemented within the focus areas would provide some information to evaluate fish passage conditions between the mainstem and off-channel habitats under ice cover and load-following operations.*

The following is a discussion of multidisciplinary methods proposed by AEA to address FERC's comment.

The hydraulic data to be derived from the Focus Area ice models will be determined on a case-by-case basis by the needs of instream flow, geomorphology, fish passage, and other studies, but

will include at a minimum: extent of inundation; flow stages; and, velocities for post-Project winter conditions under load-following and base-load scenarios.

Initial modeling results of load-following effects on stage indicate that in an *ice-free* channel Project load-following (maximum load following OS-1 scenario) in January would result in a daily stage cycle (fall and rise) of 1.0 to 1.5 feet at the Susitna stream gage near Gold Creek (AEA 2013d). These initial modeling results also indicate that during the winter months, the average stage during *ice-free* periods, in the vicinity of Gold Creek, will be approximately 3.5 feet higher with the Project than under existing ice-free periods. Figure 4 illustrates these initial results.

The rise in stage described above is applicable to the ice-free period. Effects of load-following on river stage during ice-cover periods will likely be much different than under ice-free periods. One key finding of the 1980s modeling effort (Watana Dam only scenario) was that winter water surface elevations under ice would generally be 2-7 feet higher under project conditions (RSP Section 7.6). The combination of a predicted rise in stage due to winter Project flow releases and a predicted rise in stage due to ice-cover would be a 5-10 feet.

Obvious from these initial studies, but important to note is the dramatic difference in scale between predicted increases in river stage (depth) of several feet under Project operations, and the minimum depth criteria for juvenile and fry salmonid passage of 2-3 inches. At least for depth predictions, initial results indicate that model error can be large and still have sufficient accuracy to predict that depth would exceed 3 inches.

As highlighted by FERC above and discussed in more detail in Section 7.3.1 below, ice-process modeling may not provide detailed and accurate information at the micro scale. The study does, however, exhaust scientific methodologies and resources to provide data within the current bounds of research. Further, in combination with other multidisciplinary studies in Focus Areas, the models will be useful for predicting and evaluating effects of ice process on fish passage at the macro scale.

As discussed by FERC (2013a), for the purposes of the passage studies, stage and velocity model predictions for post-Project winter conditions under load-following and base-load scenarios will be augmented with other winter-period multidisciplinary study elements.

AEA does not propose any field data collection in RSP Section 9.12 for this study element. All field data collection will be conducted as proposed in other RSPs, as described above.

7.3. Description of Study Sites and Modeling Methods

> *A description of the specific methods as set forth in section 9.12.4.5 (e.g., 2-dimensional modeling, or other unspecified modeling approach) that would be applied at the off-channel and tributary delta locations selected for the depth barrier analysis. This would include an explanation of the proposed methods and study sites for the open-water period for adult and juvenile fish, and the ice-cover period for juvenile fish.*

AEA's fish barrier assessment in Focus Area will rely heavily of models develop as part ongoing Geomorphology, Instream Flow, and Ice Processes studies. Several environmental variables may affect adult and juvenile fish passage in sloughs, side channels, and tributary deltas and the

importance of these variables maybe different during ice-cover and ice-free periods. In general, at a given passage reach the water conditions (depth and velocity) interact with conditions of the channel (length and uniformity and substrate size) to characterize the passage conditions that a particular fish encounters when attempting to migrate into, within, and out of a slough, side channel, or tributary delta. The likelihood of a particular fish successfully navigating through a reach will depend on these environmental conditions as well as the individual capabilities and condition of the fish. These fish passage variables will be studied in Focus Areas using 1-D and 2-D models.

7.3.1. Proposed Study Sites for Modeling

As recommended by FERC (2013a), AEA will locate fish passage barrier intensive sampling sites for both the ice-free and ice-cover periods within the selected Focus Areas. Ice-free data collection includes a larger number and diversity of sample locations at off-channel and tributary deltas. Both ice-cover and ice-free passage data collection sites will be located to overlap with fine mesh 2-D modeling domains at the outlets and inlets of side channels, side sloughs, and upland sloughs. Figure 5 illustrates the conceptual distribution of fine mesh modeling domains in one Focus Area. Fine mesh 2-D modeling domains will be similarly distributed at tributary mouths and at inlets and outlets of off-channel habitat units in all Focus Areas. The exact locations of fine mesh sampling domains will be determined pursuant the Geomorphology Study, RSP Section 6.6. Ice-cover sample sites within Focus Areas will be fewer in number due to the inherent difficulties of measuring and modeling ice process and associated hydrodynamic conditions that control fish passage.

With input from the RSP Section 9.12 study lead, Focus Area study sites for modeling juvenile passage during the ice-cover period will be selected as part of RSP Section 7.6 - Ice Processes in the Susitna River Study and RSP Section 8.5 - Fish and Aquatics Instream Flow Study. One objective of the Ice Processes study is to develop detailed models and characterizations of ice processes at instream flow Focus Areas in order to provide physical data on winter habitat for the instream flow study. This study objective directly supports study site and modeling needs for juvenile fish passage during ice-cover periods.

The February 1, 2013 Study Plan determinate included specific recommendations regarding study sites for velocity measurements as follows.

> *A description of a subsample of tributary deltas and off-channel habitat entrances within Middle River focus areas where velocity measurements will be taken to determine if velocity barriers to juvenile salmonids (particularly salmonid fry) would be created at tributary deltas and off-channel habitat entrances by modifications to river stage and discharge through proposed project operations.*

Consistent with AEA's approach to co-locate intensive fish passage study sites with the Instream Flow Study sites in Focus Areas, velocity measurements and modeling will be completed at these locations. As described in RSP Section 6.6, Section 6.6.1.2.4, the use of Focus Areas is to conduct concentrated interdisciplinary studies at selected areas within the study area. Such areas represent specific sections of the river that will be investigated across resource disciplines and will provide for an overall understanding of interrelationships of river flow dynamics on the physical, chemical, and biological factors that influence fish habitat. Focus Areas will involve

portions of the Susitna River and its floodplain where detailed study efforts will be jointly conducted by the Fish and Aquatics Instream Flow (RSP Section 8.5), Riparian Instream Flow (RSP Section 8.6), Geomorphology (RSP Section 6.5), Ice Processes (RSP Section 7.6), Groundwater (RSP Section 7.5), Characterization and Mapping of Aquatic Habitats (RSP Section 9.9) studies, and Fish Passage Barriers (RSP Section 9.12). The Focus Areas will allow for a highly integrated, multidisciplinary effort to be conducted for evaluating potential Project effects on key resource areas across a range of representative sites.

As required by FERC, final selection of ten Focus Areas was completed by May 31, 2013 (2013b). The ten Focus Areas include a large number and diversity of side channels, side sloughs, upland sloughs, and tributary deltas that in sum would be representative of passage conditions at off-channel and tributary deltas in the Middle River. The ten Focus Areas being considered include a total of 34 side channels, 8 side sloughs (one with a beaver pond), 13 upland sloughs (one with a beaver pond), 2 macrohabitat backwaters, and 10 tributary mouths/deltas. The inlets to these off-channel habitats will be modeled using 2-D or 1-D hydraulic models as described in Section 6.3, above. Table 1 is a tally of off-channel and tributary deltas by Focus Area. The domain for 2-D modeling for each off-channel will extend from the mouth up to and including the inlet or head of each off-channel as illustrated in Figure 5. This domain will cover the fish entrance to the off-channel and breaching zone of the off channel, as well as the entire length of the channel. The 2-D modeling domain for tributary deltas will include the entire delta within the zone of hydrologic influence.

Final hydrodynamic model selection in Focus Areas will occur as part of the RSP Sections 6.6 and 8.5 study plan determination and modification process.

FERC (2013b) states:

> *Both one-dimensional and two-dimensional modeling approaches are consistent with accepted practices for implementing an instream flow study using PHABSIM (section 5.9(b)(6)). We note, however, that AEA does not identify in the RSP the specific locations where one-dimensional versus two-dimensional modeling would be applied, except for noting that two-dimensional modeling would be applied within some focus areas. NMFS is concerned that there may be disagreements about the selection of the appropriate habitat-specific models and the specific locations where one-dimensional and two-dimensional modeling would be applied. In our analysis and recommendations for Study 6.6 (geomorphology modeling), we are recommending that AEA file by the end of the second quarter of 2013, its proposed technical memorandum that summarizes the specific models and locations where one-dimensional and two-dimensional modeling would be applied pursuant to Study 8.5 and Study 6.6.*

AEA does not propose any data collection or hydrodynamic modeling under RSP 9.12 for this study element. All data collection and hydrodynamic modeling will be conducted as proposed in other RSPs, as described above.

7.3.2. Modeling Methods for Ice-free Periods

Depth and velocity passage for adults and juveniles in sloughs, upland sloughs, side channels, and at tributary delta mouths in Focus Areas will be assessed following concepts similar to ADF&G (1984b) in which depth, velocity, substrate, and length of the passage reach were

considered together to determine successful or unsuccessful passage into and within these habitats. Data collection and modeling methods, including two-dimensional modeling, not available in the 1980s, will be applied in the current studies.

As discussed by FERC (2013a), for fish passage during ice-free periods, AEA will rely on 2-D modeling already being conducted in Focus Areas under Section 6.6 - Fluvial Geomorphology Modeling below Watana Dam Study and 8.5 - Fish and Aquatics Instream Flow Study. The specific 2-D models will be selected from a list of candidate models in coordination with other studies and the licensing participants. As specified by FERC (2013b), AEA's schedule for selecting the 2-D model will be described in a technical memorandum prepared in the second quarter of 2013. The 2-D model selected will be applied over the full extent of all Focus Areas.

As described in RSP Section 8.5, the 2-D model will utilize a variable mesh (also referred to as flexible mesh). A variable mesh allows a finer mesh to be used in areas where either the information desired or the condition being modeled requires higher spatial resolution (RSP Section 6.6.4). For off-channels and tributary deltas, velocities, bathymetry, and substrate will be modeled at a fine mesh grid size of 2m x 2m. Figure 5 is an example of fine mesh 2-D modeling at off-channel passage sites and coarse mesh modeling in the open water areas.

As in the ADF&G 1980s studies, passage in off-channel reaches requires evaluation under three types of hydraulic conditions: breaching, backwater, and local discharge. The two-dimensional model, coupled with the flow routing model and the groundwater model will be used to evaluate passage conditions over the full range of pre- and post-Project flow conditions. To the extent possible, passage criteria will be input to the 2-D habitat model, yielding an integrated analysis tool.

Additional data will be collected in support of modeling effort, include stream flow data and data on beaver dams as fish barriers. Tributaries within Focus Areas (Table 2) will be either gaged with continuous stage recording instruments or they will be periodically measured at multiple flow levels to establish a rating curve with the intent of establishing drainage-area-based accretion estimates.

AEA will survey beaver dams encountered within the zone of hydrologic influence in select tributaries and Focus Areas as shown in Table 2 of the Implementation Plan and as part of the aquatic furbearers study RSP Section 10.11. Beaver dam ground surveys will follow those methods described in RSP Section 9.9, Section 9.12.4.4. Dimensions of the dam including height, length, and breadth, and depth of the leaping pool will be measured and observations of possible passage ways through or around the dam will be described. Photographs will be taken. Beaver dams, not ground surveyed, will be identified from high resolution aerial imagery. AEA will use this information to map the distribution of beaver dams in GIS and, as applicable, for extrapolation to beaver dams beyond Focus Areas. Data on stream flow and beaver dams will be used in conjunction with modeling to evaluate potential barriers for fish in Focus Areas.

7.3.3. Modeling Methods for Ice-cover Periods

As described above in Section 7.2, ice-cover passage barrier modeling will rely on the river ice-process model developed as part of RSP Section 7.6 - Ice Processes in the Susitna River Study. The river ice-process model will rely on the River 1-D hydrodynamic flow routing/thermal model to determine large-scale changes to ice-cover timing and structure, and under-ice discharges including stage fluctuations.

Ice-process studies will include 2-D modeling at the Focus Area below Devils Canyon (where there will likely be an ice-cover post-project to model), 1-D modeling at Focus Areas upstream of Devils Canyon for existing conditions, and using the open-water results for proposed conditions.

One objective of the ice processes study is to develop detailed models and characterizations of ice processes at instream flow Focus Areas in order to provide more detailed physical data on winter habitat for the instream flow study. RSP Section 7.6 Ice Processes study objective directly supports study site and modeling needs for juvenile fish passage during ice-cover periods. In its study plan determination, FERC (2013b) concluded that:

> *AEA's proposed modeling approach should provide the information necessary to describe project effects with respect to ice processes to a degree which is consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and, if effectively implemented, is expected to be able to satisfy the study objectives.*
>
> *If the initial results of the 2013 or 2014 study seasons (as documented in the initial study report) indicate that the model does not adequately evaluate project effects, and it becomes clear on the basis of the results that other procedures should be followed in order to meet the study objectives, then alternative methods and/or procedures could be added in 2014 or in subsequent study years (sections 5.15(d) and 5.15(e)).*

In addition to the ice-process modeling, AEA will rely on multidisciplinary data collection in Focus Areas to assess potential effects of the Project on salmonid juvenile and fry passage during the ice-cover period. Other multidisciplinary studies include: RSP Section 6.6 - Fluvial Geomorphology Modeling below Watana Dam Study and RSP Section 7.5 - Groundwater Study. Subsections from RSP Section 8.5 - Fish and Aquatics Instream Flow Study include: Hydraulic Routing and Operations Modeling, Winter Habitat Use Sampling, Periodicity, and Habitat-Specific Model Development.

The ice processes study in 2013/2014 is planning repeat aerial observations at each focus area, about 10 transects will be measured for ice thickness, frazil thickness, and water depth, and time-lapse photography will be taken of a small portion of the area, including open-leads. For all of the Focus Areas, ice thickness and elevation will be measured and inlets to side channels and sloughs will be observed to qualitatively document any throughflow. Throughflow discharges will be taken but only at the major side channels. The feasibility and application of ground penetrating radar (GPR) will be investigated to determine if it will provide sufficient resolution to determine frazil ice accumulations. This would provide broader and more continuous measure of bed-fast ice thickness and floating solid ice thickness, than relying on auger holes.

Factors that affect fish passage are much more difficult to physically measure and much more difficult to model for ice-cover than for ice-free conditions. The controlling forces over depth, velocity, and the presence of potential obstructions are much different in ice-cover versus ice-free conditions. Ice formation, including surface ice, frazil ice, and anchor ice can all physically obstruct access into and out of off-channel habitats. Ice formations can reroute water flow, thereby dewatering an access passageway that would otherwise be present under ice-free conditions. An example of this is the blockage of water flow to an inlet of a side slough or side channel, such that slough outflow is then insufficient for fish to access the off-channel habitat.

Localized passage conditions, such as a shallow riffle at the entrance of a slough, are extremely dynamic and are virtually unpredictable during ice-cover periods. The presence of frazil and structure ice appears or disappears in a matter of hours or days; likely opening up or closing fish passageways at the same frequency. Passage opportunities might be improved at some locations during winter Project operation due to the projected increase in river stage while at other locations increase in stage might contribute to the degradation of passage conditions (ice thickening at the inlets and outlets of off-channels).

These difficulties and uncertainties are noted here to bring attention to the difference in scale between evaluations of fish passage in ice-cover versus ice-free conditions. Passage conditions during ice-free periods can be observed and measured directly and modeled to the micro scale (tenths of feet and velocity). Whereas, passage conditions during ice-cover periods are generally not visible, very difficult to measure (the areal extent of the sample site might be the diameter of an ice auger bit), and are modelable at a lesser resolution.

While ice-process modeling and winter Focus Area studies may provide some information at the micro scale, they will likely be more useful for predicting and evaluating potential structural, spatial, and temporal changes to fish passage at the macro scale. Some macro scale evaluations during the ice-cover period include:

- Potential change in the timing of ice formation and breakup in relation to migration periodicities of juvenile salmonids;
- Potential change in the thickness and elevation of ice at the inlets and outlets of off-channels and tributary deltas;
- Potential for blockages created by unstable or thickened ice from frequent flow fluctuations;
- Potential changes in the formation and longevity of ice-free leads at slough entrances;
- Potential changes in the depth of ice cover into and within off-channel habitats; i.e. changes in passageways beneath the ice; and
- Potential changes in ice-process in sloughs due to changes in the dominant source of through flow.

This research approach is a viable application of current, reasonably feasible scientific application to address the issue. AEA does not propose any hydrodynamic or ice modeling under RSP Section 9.12 for this study element. All hydrodynamic or ice modeling will be conducted as proposed in other RSPs, as described above.

7.4. Identification and Location of Existing Physical Barriers to Fish Passage

7.4.1. Middle and Upper River

Tributaries above Devils Canyon (inclusive and upstream of Cheechako Creek) were surveyed by helicopter in 2012, followed by ground surveys of some barriers that could not be positively classified as a barrier from the air. Methods and results of these surveys are reported in AEA (2013b) 2012 Upper Susitna River Fish Distribution and Habitat Study, Fish Passage Barriers Assessment.

Seventy-nine drainages were surveyed throughout the study area between Devils Canyon and Oshetna River. A total of 43 potential fish passage barriers were identified from the helicopter within 29 of the 79 drainages surveyed (more than one barrier was identified on some tributaries). Of these 43 barriers, a total of 35 definitive passage barriers were identified within 24 tributaries, the majority of which had falls with a vertical height greater than 10 feet and that could be visually estimated from the helicopter. Three of the 35 barriers were surveyed from the ground with a range finder to determine vertical and horizontal distances from the crest to the plunge pool and were confirmed as barriers to fish passage. An additional eight features, within seven tributaries, were identified as potential fish passage barriers having falls heights visually estimated to be near 10 feet or other apparent elements of passage barriers such as multiple chutes and/or cascades and warranted further investigation; however, their challenging locations in canyons precluded safely landing the helicopter for ground surveys.

During the 2013 and 2014 study seasons, subject to obtaining access authorization and necessary permits, AEA will attempt on-the-ground measurement of the eight features that could not be positively identified from the air in 2012. On-the-ground measurement will depend on reasonably safe access. Accessible features will be measured using the methods as described in Alaska Department of Natural Resources (ADNR 2007) and Powers and Orsborn (1984). The geometry of the obstacle will be surveyed including measurements of barrier height, leap distance, and depth of leaping pool at an estimated high and low flow. The barrier will be photographed and its location fixed with GPS. If the obstacle is clearly not a barrier, its location and basic dimensions will be noted with no further measurements.

AEA proposes to conduct foot surveys for physical barriers and intensive hydrodynamic modeling studies for velocity and depth barriers within the zone of hydrologic influence at 20 named and unnamed tributaries in the Middle River below Devils Canyon (Table 2). This will include intensive study of 10 tributary deltas in Focus Areas as described above in Sections 7.2, 7.3, and 7.4. In 2013, AEA proposes to conduct foot surveys for physical barriers within the ZHI of the remaining 10 primary Middle River tributaries below Devils Canyon (Table 2). Foot survey field methods will be those described in RSP Section 9.12, Section 9.12.4.4.4. In addition to methods described in RSP Section 9.12.4.4.4, data collection on deltas of these 10 tributaries will include: tributary thalweg length; thalweg depth and velocity profile (longitudinal); stream gradient; dominant and subdominant substrate; and photographs from several angles of the delta and tributary. Several of these tributaries will be gaged (Table 2).

7.5. Study of Fish Passage Barriers in the Lower River

Investigation and evaluation of fish passage barriers in the Lower River will follow a phased approach in which studies of barriers in the Middle River will be used to determine the need and design for 2014 barrier studies in the Lower River (FERC 2013a). Other studies to be conducted in 2013 that will contribute to determining the need for barrier studies in the Lower River are RSP Section 9.6 – Fish Distribution and Abundance in the Middle and Lower Rivers, RSP Section 8.5 – Fish and Aquatics Instream Flow Study, RSP Section 6.5 – Geomorphology Study, and the Open-water Flow Routing Model (RSP 8.5). If 2013 results, as presented in the Initial Study Report, indicate that the Project will cause significant adverse effects on fish passage into tributaries and off-channel habitats in the Middle River then additional study sites will be added in the Lower River in 2014 (FERC 2013a).

7.6. Documentation of Consultation

On May 15, 2013, AEA provided to U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and other Technical Work Group participants for comment a Draft Study of Fish Barriers Implementation Plan (Draft Implementation Plan) that was developed to provide responses to the February 1 SPD recommendations. The Draft Implementation Plan was also made available on the Project website (http://www.susitna-watanahydro.org). Consistent with the February 1 SPD, AEA initially allowed 15 days for comment by requesting that all comments be submitted, in writing, by Thursday, May 30, 2013. At the request of NMFS, AEA extended the deadline for comments to June 5, 2013. NMFS and USFWS jointly submitted comments on June 7, 2013. AEA received no other comments on the Draft Implementation Plan. Attached as Attachment 2 to the cover letter for this filing is a comment response table that includes a description of how the NMFS and USFWS joint comments are incorporated into the final plan; and an explanation for why certain comments were not incorporated into the final plan.

8. REFERENCES CITED

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— 2013e. Susitna-Watana Hydroelectric Project No 14241-000. Technical Memorandum. Selection of Focus Areas and Sites in the Middle and Lower Susitna River for Instream Flow and Joint Resources Studies – 2013 -2014. March 1, 2013.

FERC (Federal Energy Regulatory Commission). Office of Energy Projects. 2013a. February 01, 2013 Study Plan Determination for the Susitna-Watana Hydroelectric Project No 14241-000. Federal Energy Regulatory Commission.

— . 2013b. April 01, 2013 Study Plan Determination for the Susitna-Watana Hydroelectric Project No 14241-000. Federal Energy Regulatory Commission.

9. TABLES

Table 1. Tally of off-channel habitats and tributary deltas in Middle River Focus Areas.

Focus Area	Side Channel	Side Slough	Upland Slough	Backwater	Tributary Mouth	Total
104	7	2	1		1	11
113	2		1		2	5
115	1		3	1	1	6
128	8	1	1		1	11
138	3	1	2			6
141	1		1	1	1	4
144	6	1	2		1	10
151					1	1
173	4	3	2		2	11
184	2					2
Total	34	8	13	2	10	67

Table 2. Named and unnamed tributaries in the Middle River selected for fish passage barrier investigation.

Project Rivemile (PRM)	Tributary Name	Geomorphic Reach	Focus Area	Intensive Study in Focus Area	Identify and Locate Potential Barriers in ZHI[1]	Documented in Anadromous Waters Catalog	Historical Data Available	Proposed for FDA Fish Sampling in 2013	Approximate Length of ZHI[1] (mi)	Drainage Area (mi[2])
184.6	Tsusena Creek	MR-2			2012		X	Yes		145.3
179.3	Fog Creek	MR-2			2012	X	X	Yes		144.1
174.3	Unnamed	MR-2	FA173	X	2012			No		
173.8	Unnamed	MR-2	FA173	X	2012			Possible		
164.8	Devil Creek	MR-4			2012		X	Yes		74.8
160.5	Chinook Creek	MR-4			2012	X	X	Yes		24.7
155.9	Cheechako Creek	MR-4			2012	X	X	Yes		
152.3	Portage Creek	MR-5	FA151	X		X	X	Yes	0.19	178.6
148.3	Jack Long Creek	MR-6			X	X	X	Yes	0.03	
144.6	Unnamed	MR-6	FA144	X				Yes	0.01	
142.1	Indian River	MR-6	FA141	X		X	X	Yes	0.14	86.2
140.1	Gold Creek	MR-6			X	X	X	Yes	0.15	23.7
134.3	Fourth of July	MR-6			X	X	X	Yes	0.12	
134.1	Sherman Creek	MR-6			X	X	X	Yes	0.02	
128.1	Skull Creek	MR-6	FA128	X		X	X	Yes	0.04	
127.3	Fifth of July Creek	MR-6			X	X	X	Yes	0.01	
124.4	Deadhorse Creek	MR-6			X	X	X	Yes	0.18	6.5
121.4	Little Portage	MR-7			X	X	X	Yes	0.12	2.4
120.2	McKenzie Creek	MR-7			X	X	X	Yes	0.02	2.3
119.7	Lower McKenzie	MR-7			X		X	Yes	0.16	
117.2	Lane Creek	MR-7			X	X	X	Yes	0.11	10.4
115.4	Unnamed	MR-7	FA115	X				Yes	0.12	
115.0	Gash Creek	MR-7	FA 113	X		X	X	Yes	0.01	
114.9	Slash Creek	MR-7	FA 113	X		X	X	Yes	0.02	
113.7	Unnamed	MR7	FA 113	X						
110.5	Chase Creek	MR-7			X	X	X	Yes	0.17	
105.1	Whiskers Creek	MR-8	FA104	X		X	X	Yes	0.33	17.2

10. FIGURES

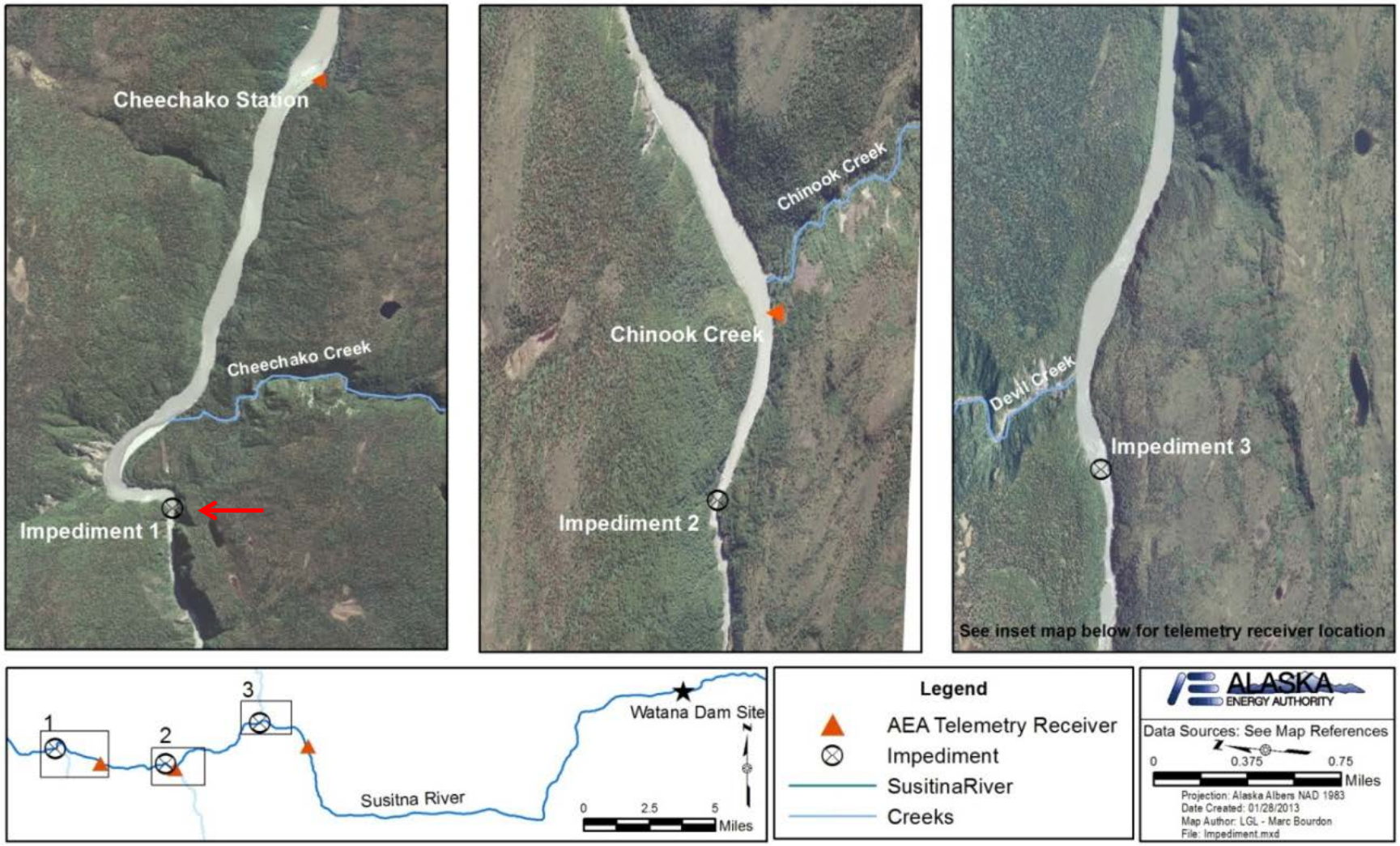

Figure 1a. Three potential impediment areas (Impediments 1, 2, and 3) to fish passage on the Susitna River located between Portage and Devil creeks at the top end of the Middle River Segment (AEA 2013c).

Figure 1b. Example of a location within Impediment area 1 where a velocity barrier could be created at a high river discharge. Photo at PRM 154.8, September 11, 2012, at 11,600cfs (provisional) at Gold Creek.

Proposed HSC Curve Development Priority[23]

Common Name	Low	Moderate	High
Arctic grayling			X
Dolly Varden		X	
Humpback whitefish		X	
Round whitefish	X		
Burbot		X	
Longnose sucker		X	
Sculpin	X		
Eulachon		X	
Bering cisco	X		
Threespine stickleback	X		
Arctic lamprey	X		
Chinook salmon			X
Coho salmon			X
Chum salmon			X
Pink salmon			X
Sockeye salmon			X
Rainbowtrout			X
Northern pike	X		
Lake trout	X		

Figure 2. Proposed HSC curve development priority (AEA 2013a).

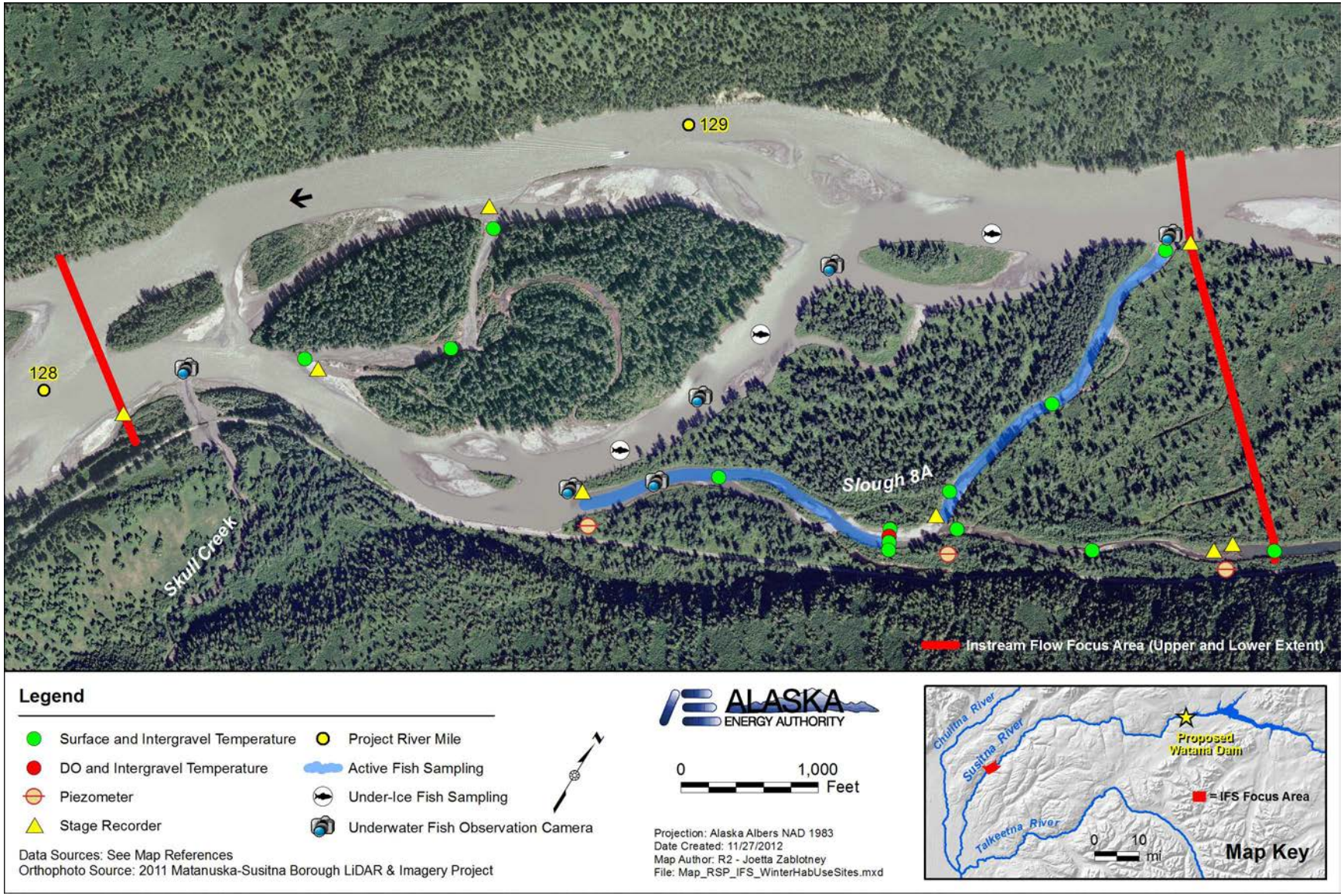

Figure 3. Example of proposed winter fish habitat use sampling sites at the Skull Creek Complex in the Middle Susitna River Segment (AEA 2013e).

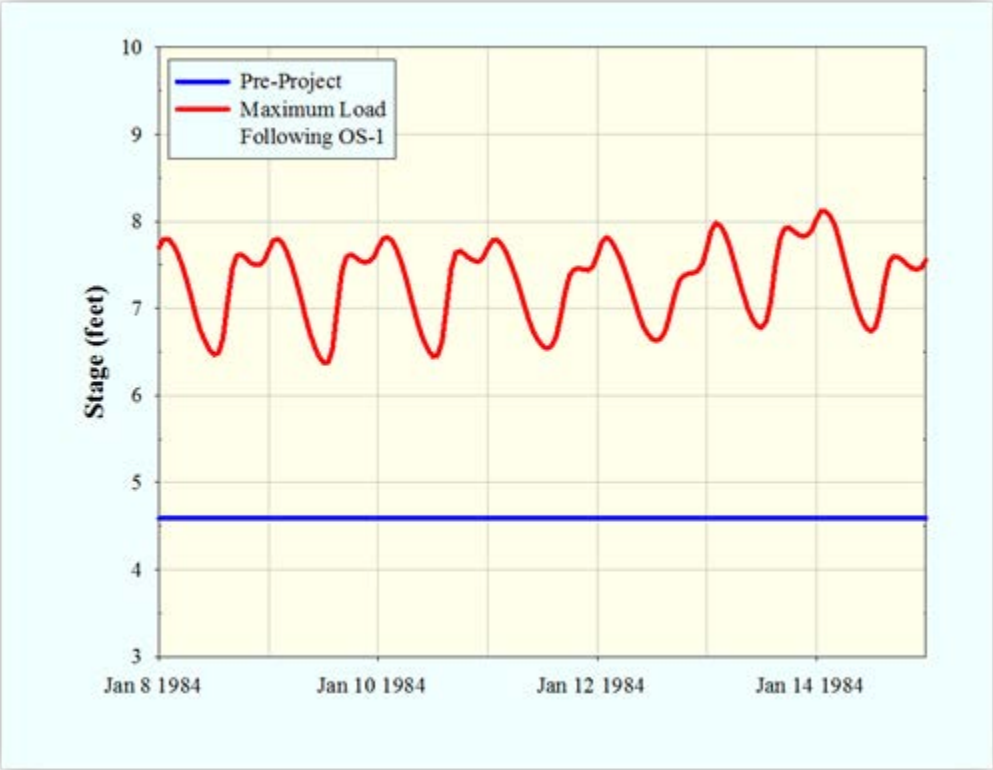

Figure 4. Predicted stage hydrographs in the Susitna River at Gold Creek (USGS 15292000) under Pre-Project and Maximum Load Following OS-1 conditions during the week of January 8 to 14, 1984. Actual results may differ from those depicted as a result of ice formation in the river (AEA 2013d).

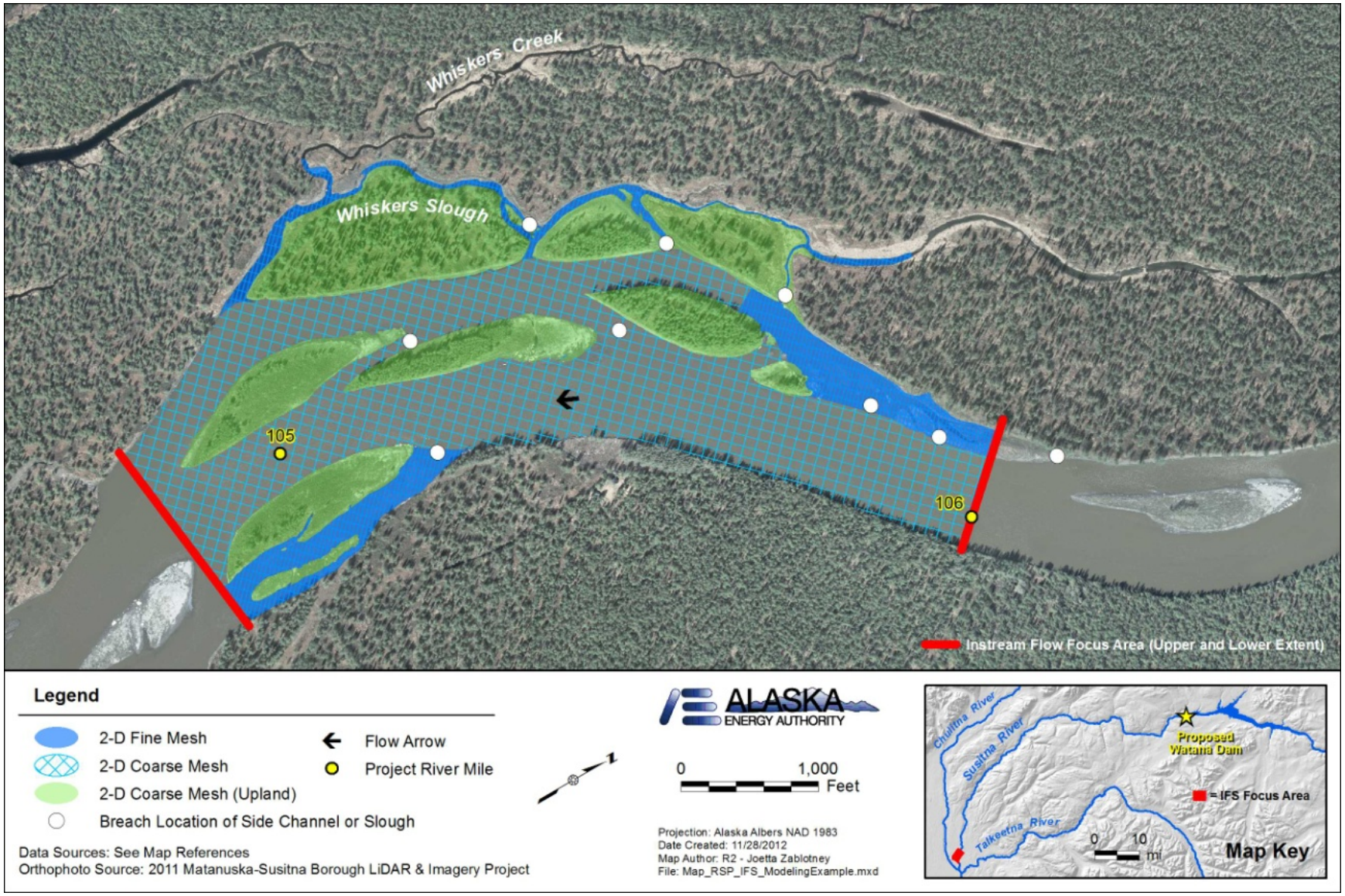

Figure 5. Conceptual layout of 2-D coarse and fine mesh modeling within the proposed Whiskers Slough Focus Area.

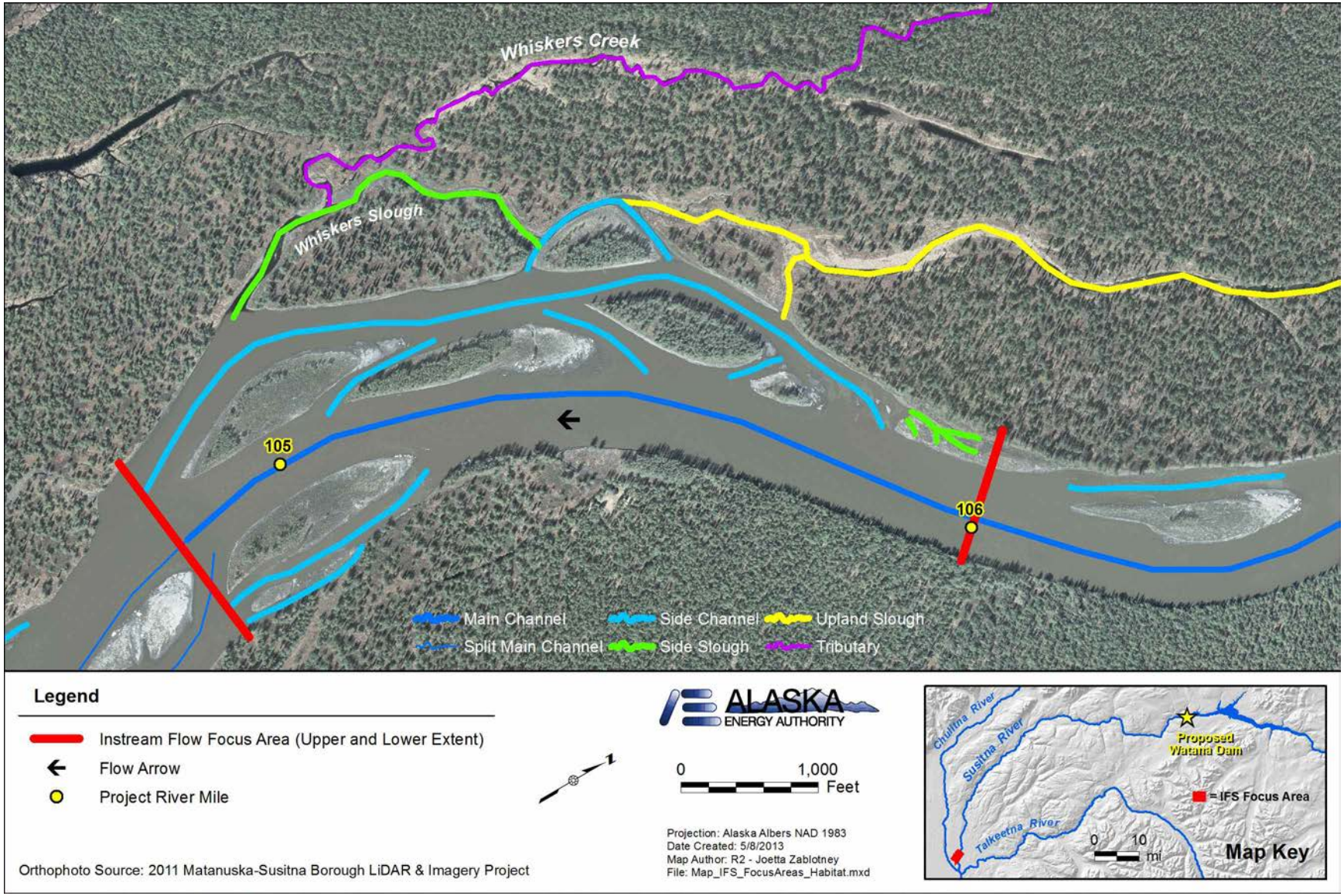

Figure 6. Instream Flow Focus Area 104.

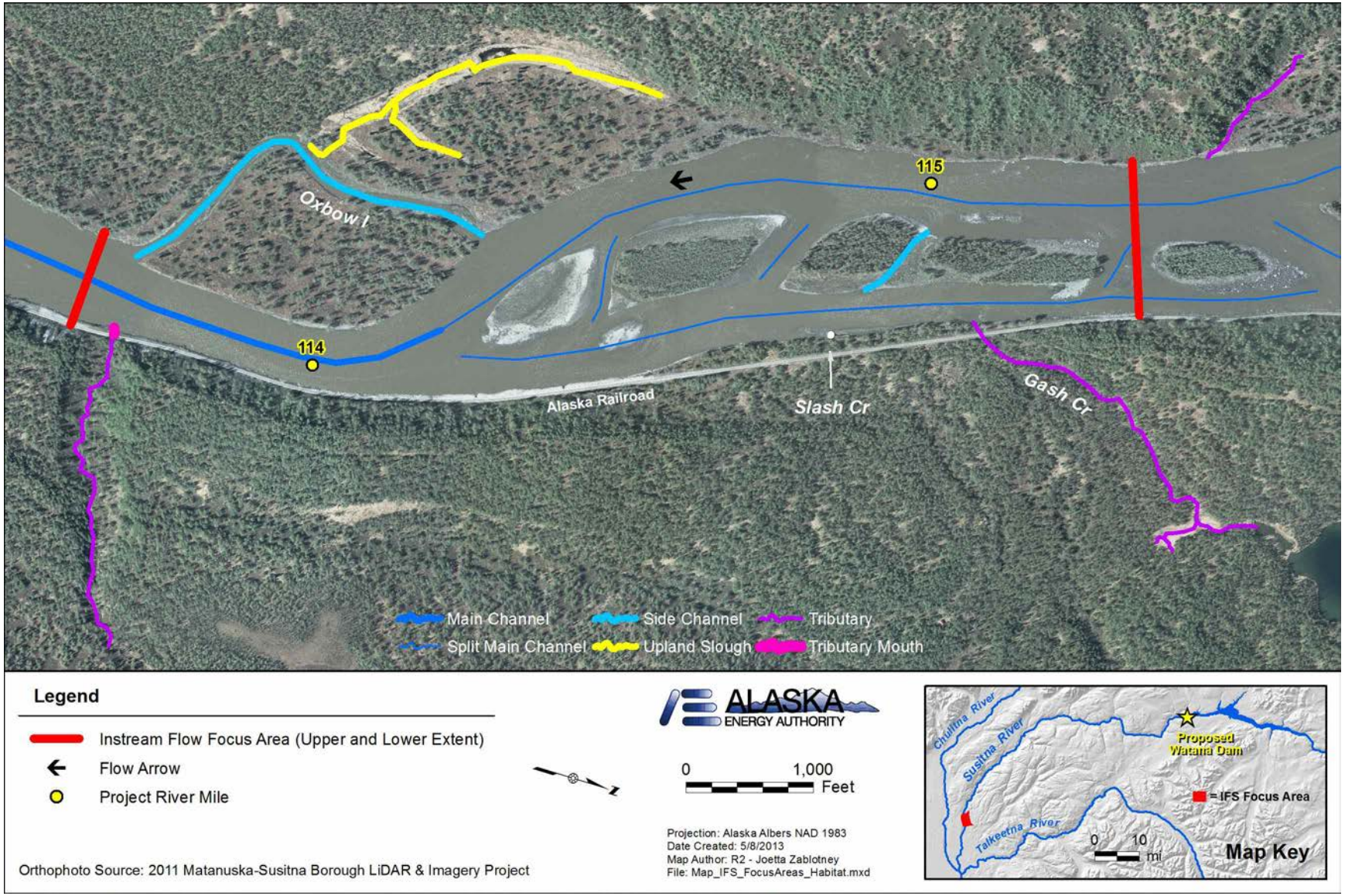

Figure 7. Instream Flow Focus Area 113.

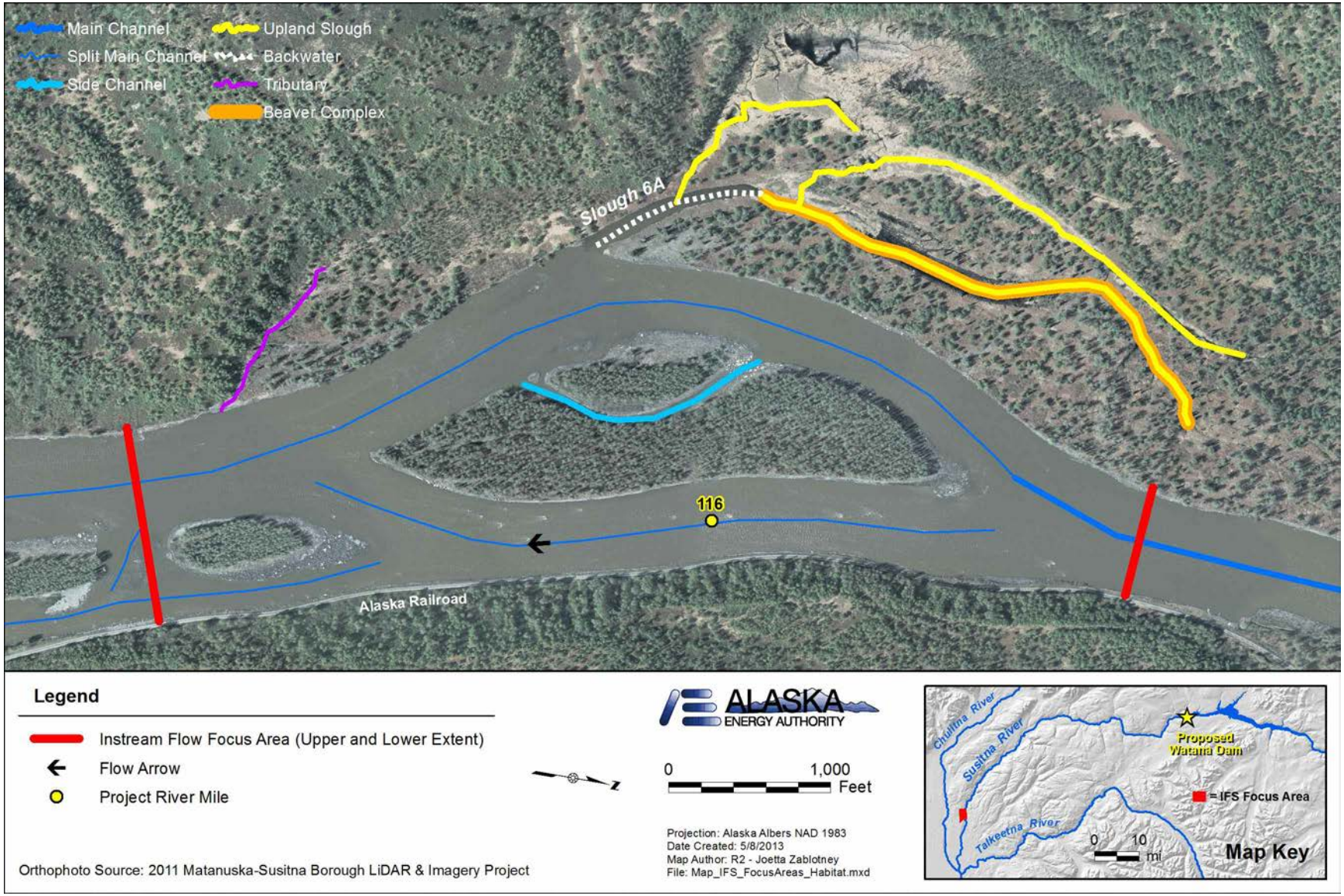

Figure 8. Instream Flow Focus Area 115.

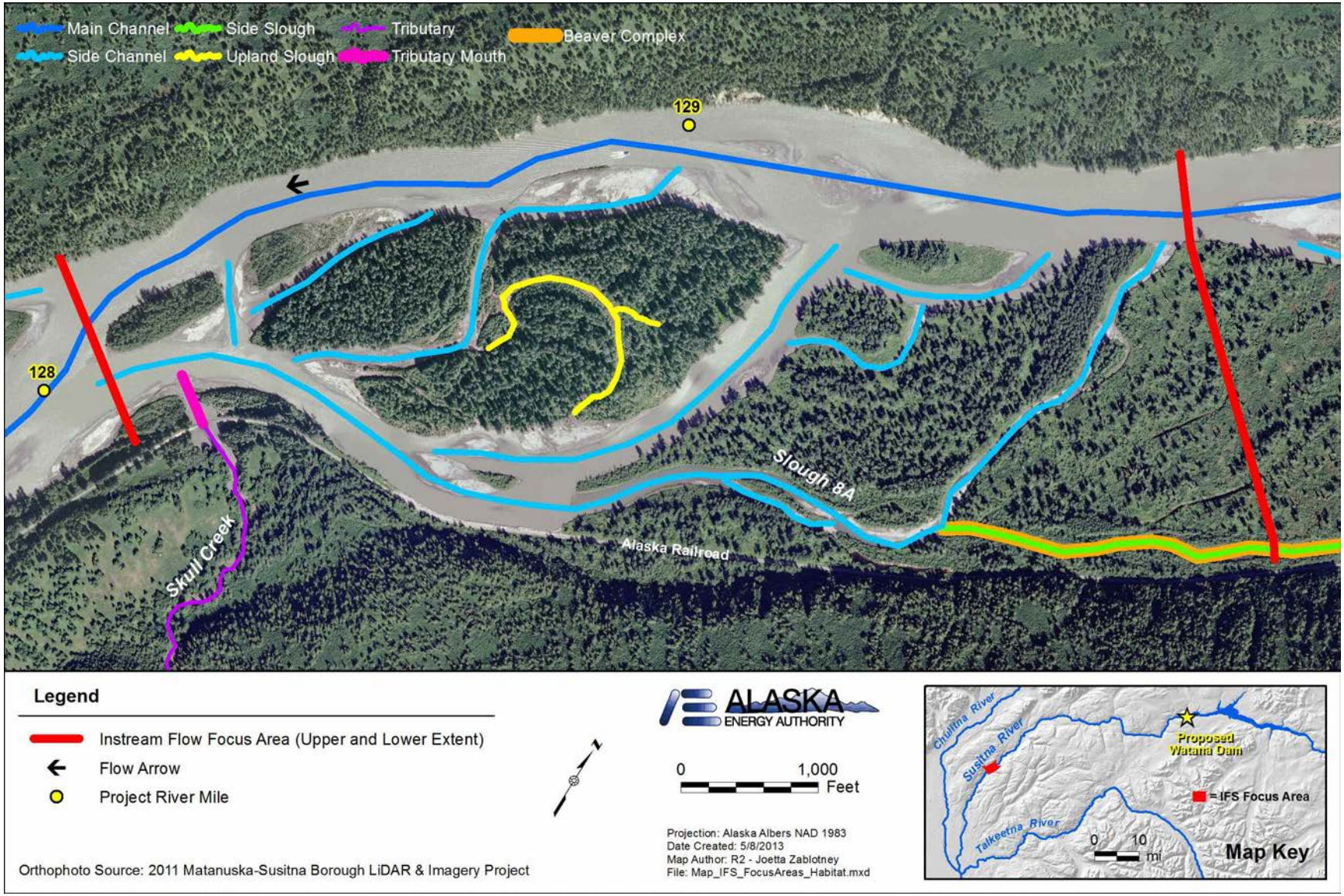

Figure 9. Instream Flow Focus Area 128.

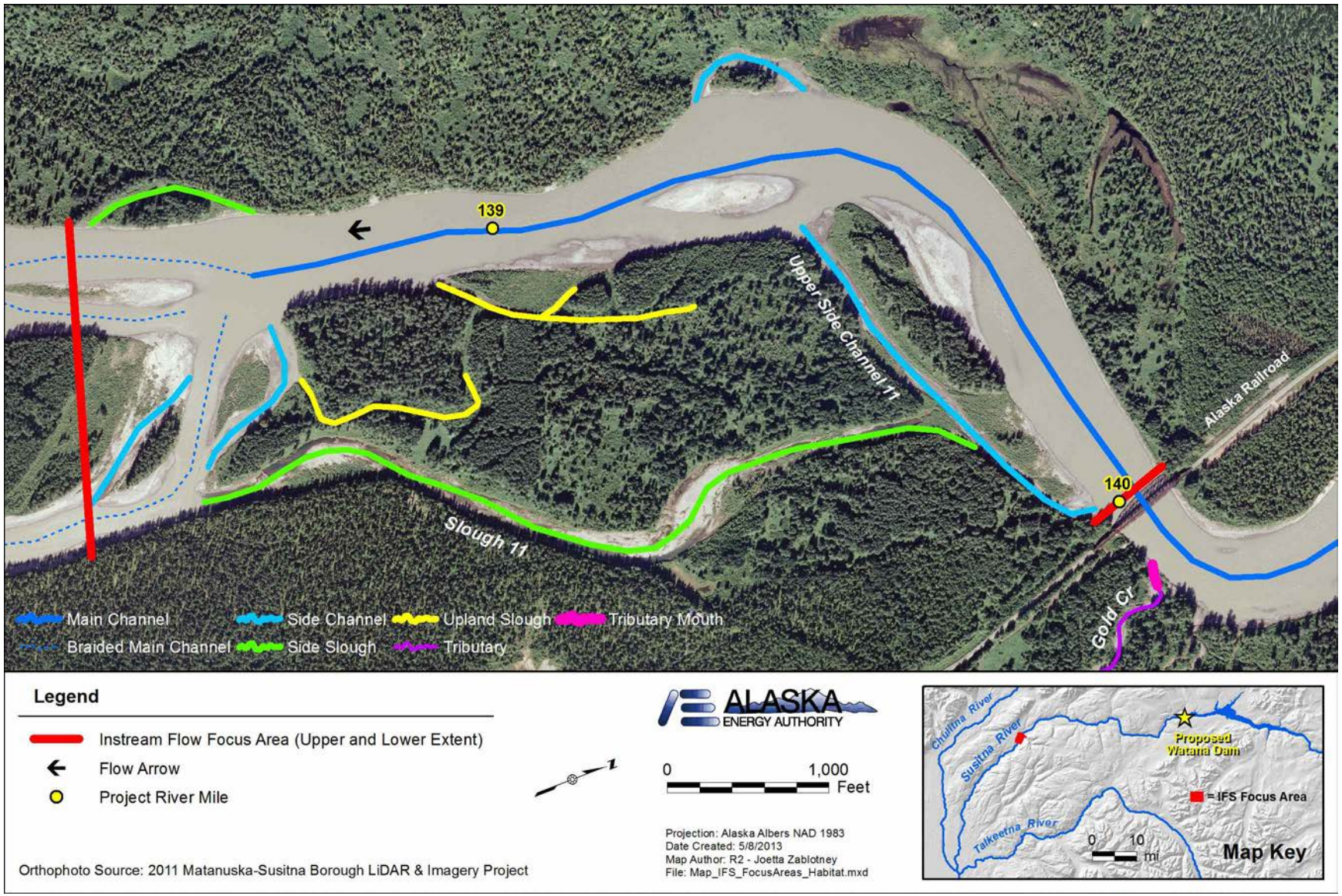

Figure 10. Instream Flow Focus Area 138.

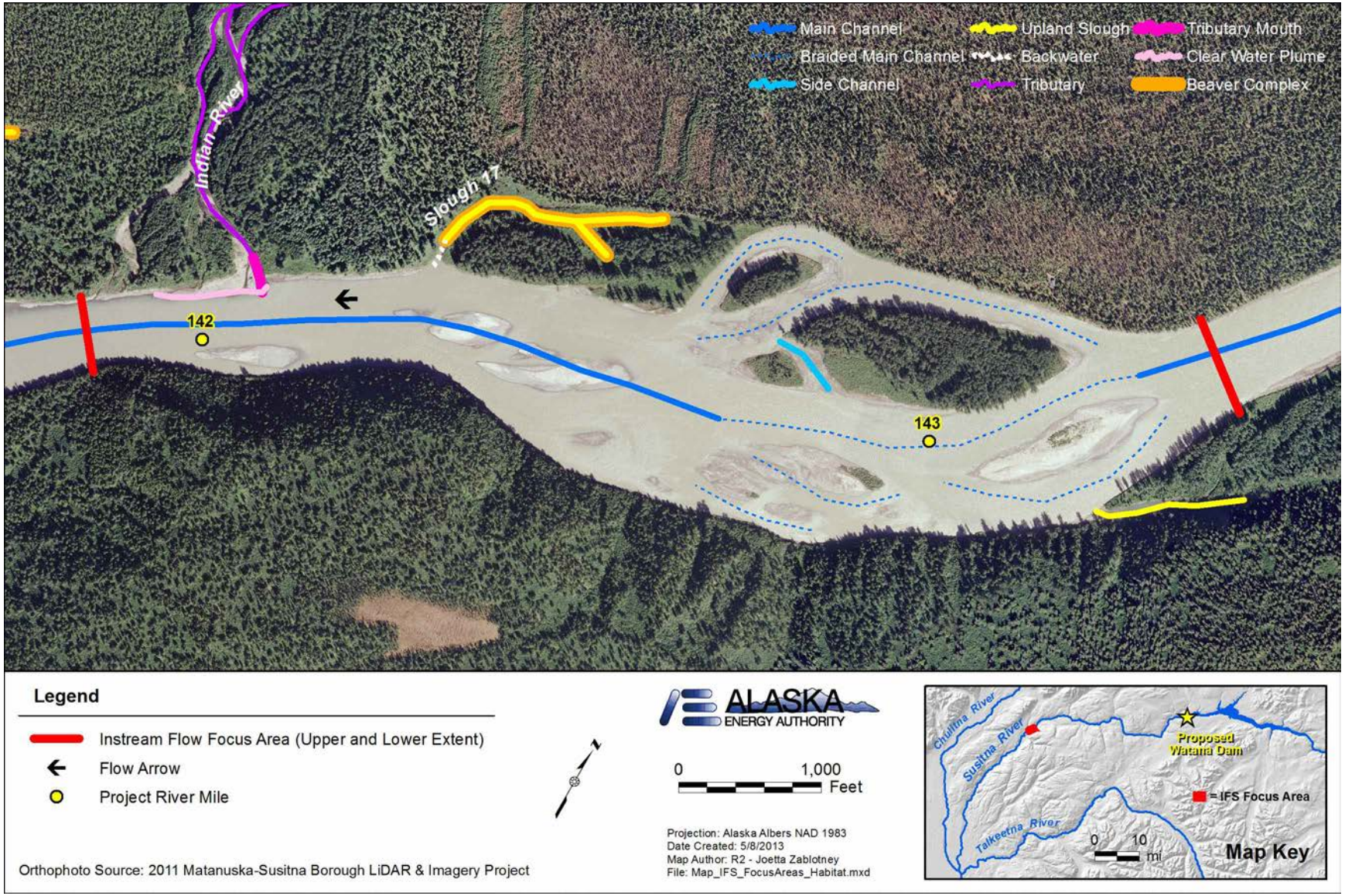

Figure 11. Instream Flow Focus Area 141.

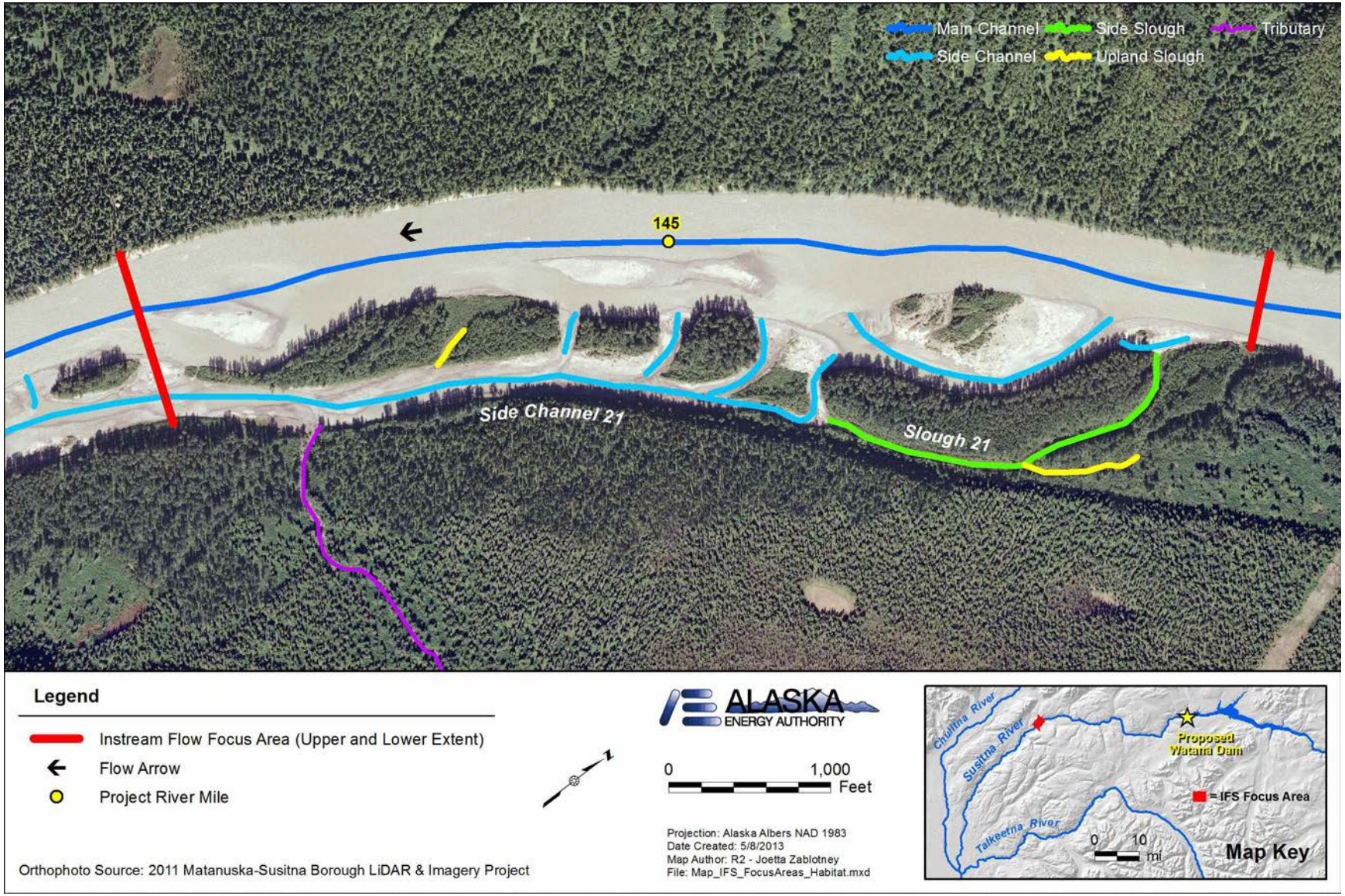

Figure 12. Instream Flow Focus Area 144.

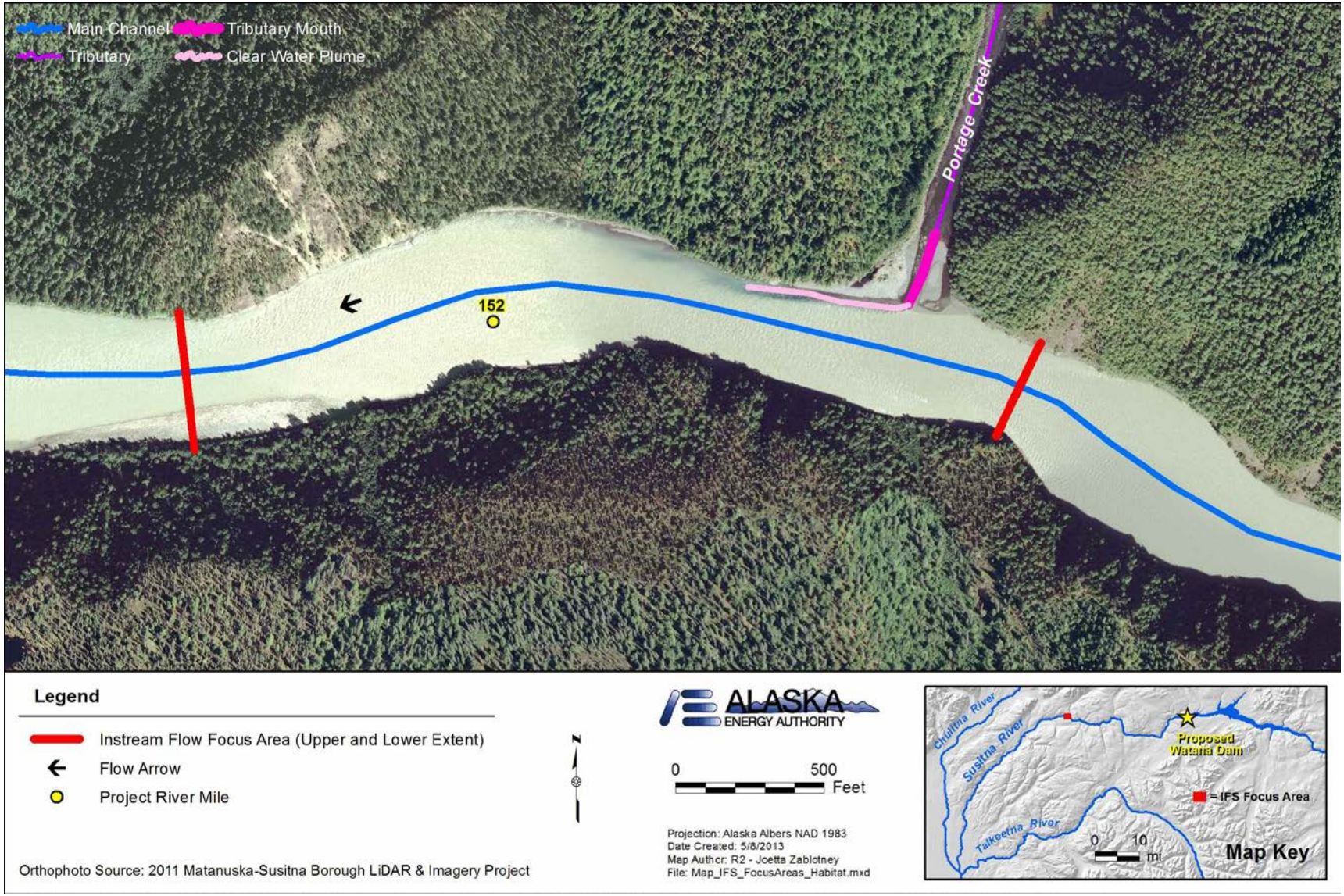

Figure 13. Instream Flow Focus Area 151.

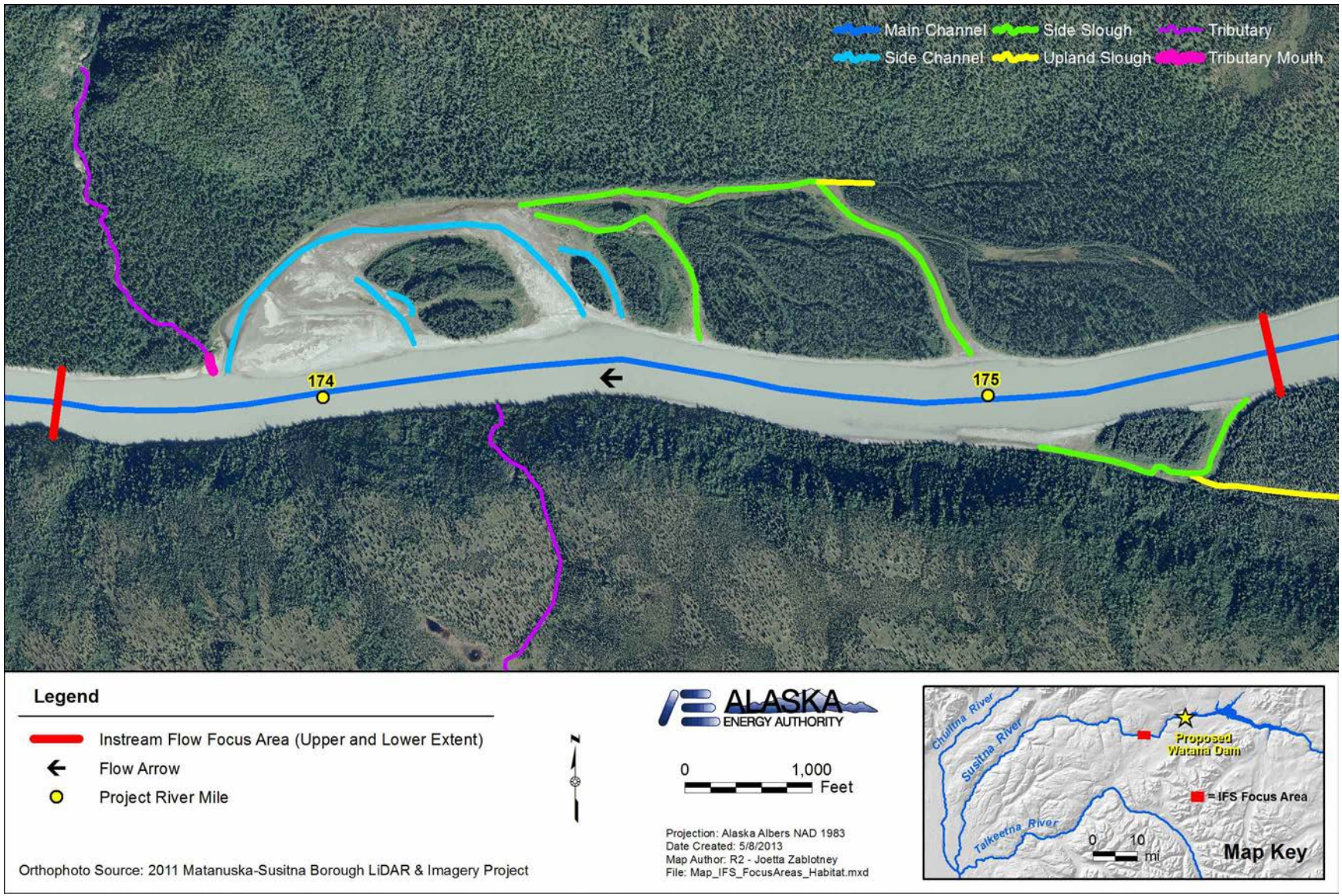

Figure 14. Instream Flow Focus Area 173.

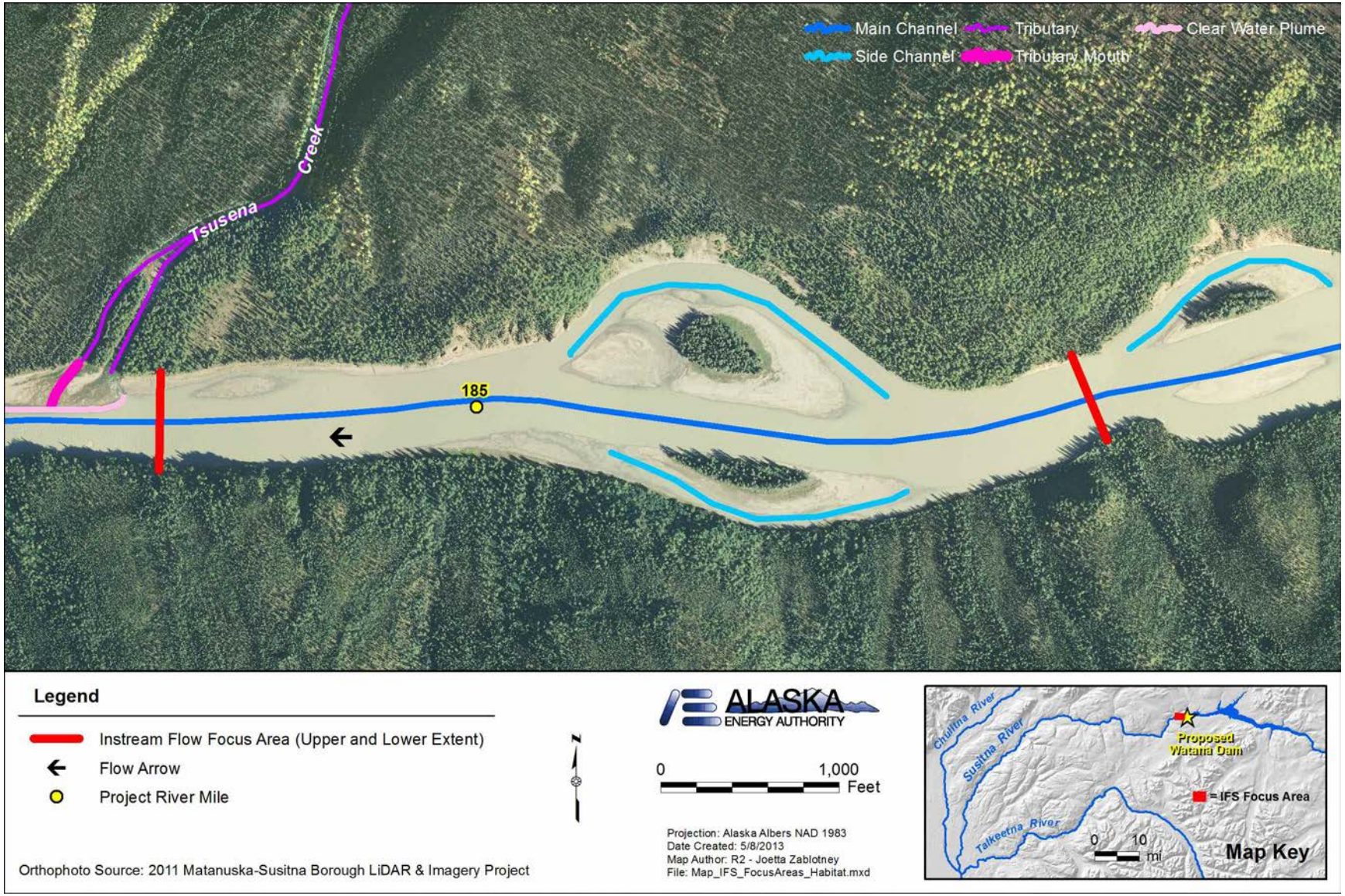

Figure 15. Instream Flow Focus Area 184.

Attachment 2

Alaska Energy Authority Response to the June 7, 2013 Joint Comments of National Marine Fisheries Service and U.S. Fish and Wildlife Service on the Study of the Fish Passage Barriers Implementation Plan

ATTACHMENT 2

Alaska Energy Authority Response to the June 7, 2013 Joint Comments of National Marine Fisheries Service and U.S. Fish and Wildlife Service on the Study of the Fish Passage Barriers Implementation Plan, the Susitna-Watana Hydroelectric Project, FERC Project No. 14241

Comment	AEA Response
Section 7.1.1 Identify Fish Species to be included in Fish Passage Study	
1. The Implementation Plan should clearly state which species are proposed for inclusion in the fish passage barrier study for each of the four study areas: above the dam, through Devils Canyon, in the Middle River, and in the Lower River. If only a subset of all species is proposed, the Implementation Plan should list and describe the criteria used to select these species and eliminate species from consideration and present these to the TWG for discussion and concurrence.	The candidate list of target species for passage studies in the Middle River is stated in Section 7.11 of the Fish Passage Barriers Implementation Plan. These species include Chinook, coho, chum, and sockeye salmon, rainbow trout, Arctic grayling, Dolly Varden, burbot, longnose sucker, humpback whitefish, and round whitefish. These target species were selected because they are generally considered the most sensitive to habitat loss through manipulation of flows in the Susitna River. Section 7.11 of the Fish Passage Barriers Implementation Plan also states the basis or criteria for their selection as candidate species. Consistent with the February 1, 2013 Study Plan Determination (February 1 SPD), the Fish Passage Barriers Implementation Plan does not include identification of fish species in the Upper River or Lower River, or for passage through Devils Canyon. This agency recommendation pertaining to identification of fish species in these locations is beyond the scope of the issues addressed in the Fish Passage Barriers Implementation Plan. Revised Study Plan (RSP) Section 9.12.4.3 addresses how Upper River 2013–2014 passage studies will proceed. AEA proposes that candidate target species for passage studies in the Upper River be the same as those for the Middle River as listed above. The Alaska Energy Authority (AEA) intends to seek the input of the Technical Workgroup (TWG) in finalizing the selection of target species. Identification of, and the selection of, salmon species for passage assessment through Devils Canyon is included in RSP Section 9.7 – Salmon Escapement Study. Objective 1 of RSP Section 9.7 states “Capture, radio-tag, and track adults of five species of Pacific salmon in the Middle and Upper Susitna River in proportion to their abundance,” and Objective 2 states “Determine the migration behavior and spawning locations of radio-tagged fish in the Lower,

	Middle, and Upper Susitna River." Identification of resident species to be radio-tagged and monitored is included in Section 5.8 of the Fish Distribution and Abundance Implementation Plan corresponding to RSPs 9.5 and 9.6. Arctic grayling, burbot, Dolly Varden, humpback whitefish, lake trout, longnose sucker, northern pike, rainbow trout, and round whitefish will be radio-tagged with the goal of 30 tags to each species in the Middle and Lower River. Tracking of tagged resident fish below, within, and above Devils Canyon is described in the Fish Distribution and Abundance Implementation Plan.

Comment	**AEA Response**
Section 7.1.2 Define Passage Criteria for Identified Fish Species	
2. <u>Recommendations</u> The conflicting schedules for the proposed consultation process for defining passage criteria for identified fish species should be resolved.	The schedule outlined in the Fish Passage Barriers Implementation Plan has been revised to be more in line with the Habitat Suitability Criteria (HSC) and Habitat Suitability Index development schedule to be presented at the June 25, 2013 Fish and Aquatics TWG meeting. AEA proposes to seek input of licensing participants regarding refinement of fish passage criteria following the distribution of the Initial Study Report (ISR) in the first quarter of 2014 (Q1 2014). This timing will allow the TWG passage criteria discussions to be informed by the HSC development process regarding species/lifestage use of different off-channel habitat types and from HSC field observations.
3. The draft Implementation Plan should propose passage assessment criteria. The criteria should include: • Combined water depth and channel length criteria for adult and juvenile salmon and resident fish species that results in physical and behavior barriers. • Leap height and pool depth barrier criteria for all adult	AEA has revised the implementation plan to indicate that it will finalize the fish passage criteria during Q1 2014. This schedule will allow AEA to consider the results of other studies including habitat suitability sampling and fish distribution and abundance sampling. Prior to finalizing the fish passage criteria, AEA will seek the input of the Federal agencies and other licensing participants during Q1 2014. In developing the fish passage criteria, AEA will consider the categories of criteria included in the agencies' comments.

salmon species, resident fish species and lengths, and all species of juvenile salmon. • Combined channel slope and length criteria resulting in presumed migration barriers for all adult salmon species, resident fish species and fork lengths, and juvenile salmon species. • Burst and sustained swimming speeds with time to exhaustion for all adult salmon species by fork or total length, juvenile salmon by fork length or total length, and resident fish species. • Definition of permanent, temporary, seasonal, and partial barriers. • The Implementation Plan should provide a description of the proposed survey dates, methods, and criteria that will be used to accomplish the first two objectives of the study plan and proposed dates for consultation with the Services. • Consultation for development of passage criteria should occur prior to fish passage barrier surveys (Objectives 1 and 2).	

Comment	AEA Response
Section 7.1.3 Select Number and Location for Study Sites for each Element of Study Implementation	
4. Recommendations The Implementation Plan should provide a schedule of when field surveys of tributary streams and off-channel habitats would be conducted to identify and classify potential barriers and provide for TWG review.	In response to agency comments, Section 7.1.5 of the Fish Passage Barriers Implementation Plan has been modified to include a schedule of fish passage barrier field studies at tributary streams and off-channel habitats. Fish passage physical barrier field studies of tributaries and off-channel habitat types in Focus Areas will be conducted during habitat mapping surveys in August and/or September 2013. Surveys of physical barriers to fish passage in off-channel habitat types outside of Focus Areas will also be conducted in August and/or September 2013. Fish passage barrier field studies in tributaries outside of Focus Areas are currently scheduled for August and/or September 2014.
5. Field methods and passage criteria should be described and adequate time for consultation with the Services and TWG should be scheduled as proposed in RSP 9.12.	Fish passage field study methods are described in detail in RSP Section 9.12.4.4. Regarding Agencies' comments on passage criteria consultation, please see AEA's Response to Comment 3.
6. Initial surveys should be conducted at all tributary and side slough locations; however, if sites are excluded, the rationale for excluding those locations should be provided. The distribution of barriers by barrier type could then be evaluated to determine if they are adequately represented in Focus Areas where post project effects will be evaluated for extrapolation to the larger area of project influence on river functions.	RSP Section 9.7 and the accompanying Fish Barriers Implementation Plan proposes ground surveys in Focus Areas and in selected tributaries (27, or 34 percent of Middle River tributaries). Table 2 of the Fish Passage Barriers Implementation Plan lists the 27 tributaries in the Middle River AEA selected to be surveyed, and provides the criteria that were used in selecting these tributaries for sampling. The distribution of these barriers will be mapped in GIS. This data will then be available, as applicable, for extrapolation purposes. Within the Middle River, there are over 75 tributaries, including both perennial and ephemeral streams. Consistent with standard scientific practices, AEA is subsampling a larger population of habitats. To ensure a representative sample, AEA has selected tributaries that reflect a full range of stream sizes and species utilization in the Middle River.

7. All Middle River tributaries should be surveyed to identify those that currently have migration barriers or may have migration barriers under some flow conditions.	The agency recommendation that all Middle River tributaries be surveyed is inconsistent with RSP Section 9.12.3 – Study Area, which states: "Passage studies in tributaries to the Middle River will include select tributaries and will extend from the mouth to the upper extent of Project hydrologic influence. . . ." Table 2 of the Fish Passage Barriers Implementation Plan lists the 27 tributaries in the Middle River AEA selected to be surveyed for physical barriers to fish passage within the zone of hydrologic influence. This list represents the largest tributaries and numerous smaller perennial tributaries that are known to support target species in the Middle River. These 27 tributaries represent approximately 34 percent of over 75 perennial and ephemeral tributaries identifiable from high resolution imagery. Please see AEA's Response to Comment 6.
8. Surveys also should be conducted to identify those locations where project-induced changes in channel morphology or tributary deltas could form migration barriers.	Studies of the effects of the proposed Project on channel morphology at tributary deltas are addressed in RSP Section 6.6 – Geomorphology at Section 6.6.4.1.2.6.
9. Many small streams are important for juvenile salmon rearing and may not be accessible during low flows. These should be included in the survey of potential migration barriers and included in the list of potential study sites. Otherwise, important fish habitat that is likely to be affected by changes in accessibility due to project operations will not be assessed for effects or development of mitigation.	The 27 tributaries to be surveyed for fish passage barriers include the largest tributaries as well as smaller perennial tributaries that are known to support target species in the Middle River (see Table 2 of the Fish Passage Barriers Implementation Plan). Please see AEA's Response to Comments 6 and 7.

Comment	AEA Response
Section 6. Fish Passage through Devils Canyon	
10. Recommendations Target fish species and life stages for fish barrier assessment through Devils Canyon should be selected in consultation with the Services.	Consistent with the February 1 SPD, the Fish Passage Barriers Implementation Plan does not include identification of fish species and life stages for passage through Devils Canyon. This agency recommendation pertaining to identification of fish species in these locations is beyond the scope of the issues addressed in the Fish Passage Barriers Implementation Plan. *FERC recommends that AEA assess discharge conditions closest to Devils Canyon during the time that salmon are documented to successfully pass upstream of Devils Canyon passage impediments. Identification of and the selection of salmon species for passage assessment through Devils Canyon is included in RSP Section 9.7 - Salmon Escapement Study. Objective 1 of RSP Section 9.7 states "Capture, radio-tag, and track adults of five species of Pacific salmon in the Middle and Upper Susitna River in proportion to their abundance" and Objective 2 states "Determine the migration behavior and spawning locations of radio-tagged fish in the Lower, Middle, and Upper Susitna River."* Section 5.8 of the Fish Distribution and Abundance Implementation Plan states that Arctic grayling, burbot, Dolly Varden, humpback whitefish, lake trout, longnose sucker, northern pike, rainbow trout, and round whitefish will be radio-tagged with the goal of 30 tags to each species in the Middle and Lower River. Tracking of tagged resident fish below, within, and above Devils Canyon is described in the Fish Distribution and Abundance Implementation Plan.
11. The probability of a tagged resident or anadromous fish being detected should be calculated given the number of tags and frequency and duration of aerial surveys and time when stationary receivers are operating. The lengths of all tagged fish moving through Devils Canyon should be recorded and the lengths of all captured above Devils Canyon	This recommendation pertains to RSP Section 9.7 and is therefore outside the scope of RSP Section 9.12 – Fish Passage Implementation Plan. The study methods described in RSP Section 9.7.4 provides a detailed description of metrics to be collected on tagged fish and fish tracking methods.

should be recorded. The burst and sustained swimming speeds of fish passing through Devils Canyon should be observed and/or obtained from literature where other high-velocity salmon rivers have been assessed and compared to the burst and sustained swimming speeds of other fish species to estimate passage potential and to develop environmental flows that may condition the license for protection of migrating fish.	

Comment	**AEA Response**
Section 7.2 Effects of load following on passage during ice-cover periods.	
12. <u>Recommendations</u> Ice process models and winter flow-routing studies need to be linked to the elevations and cross-sectional area of tributary and off-channel habitats to predict the effect of ice formation on water velocities at different stage heights during pre-project conditions to assess post-project conditions. Within all Focus Areas, cross-sectional surveys should be conducted at multiple transects to measure ice thickness and open	As described in Section 7.2 of the Fish Passage Barriers Implementation Plan, the measuring and modeling micro-hydraulics (such as to a scale relevant to a 3-5 inch fry/juvenile salmonid) under ice, over a broad enough area to have any relevance, is physically infeasible and would not produce data or information that could be used to assess potential effects of the proposed Project. As discussed by FERC (2013a), accuracy of hydrodynamic modeling during the ice-cover periods may or may not be sufficient to predict passage conditions at the small, local scale. FERC states: *. . . it's not clear if the winter model can accurately predict stage-discharge relationships and streamflow velocities at a scale that is fine enough to evaluate the effects of daily flow fluctuations during proposed winter load-following operations on fish passage conditions from the mainstem into off-channel habitats…While AEA's proposed fish passage barrier study plan does not appear to specifically address this issue, we assume the intensive, multidisciplinary study elements that would be*

channel area on multiple dates through the winter at representative side sloughs, upland sloughs and tributary mouths. Ice thickness and the cross-sectional area of open channels could be used to test for relationships between mid-channel ice thickness and predicted ice cover. Flow routing during winter combined with measures of cross-sectional area at tributary and off-channel habitat mouths could be used to predict water velocity barriers due to load-following operations.	*implemented within the focus areas would provide some information to evaluate fish passage conditions between the mainstem and off-channel habitats under ice cover and load-following operations.* AEA's proposed winter studies in Focus Areas, as described in Section 7.2 of the Fish Passage Barriers Implementation Plan, are consistent with FERC's findings that assessment of passage under ice-cover conditions will likely be at a larger rather than a finer scale. The RSP Section 7.6 – Ice Processes study objective directly supports study site and modeling needs for juvenile fish passage during ice-cover periods. In the February 1 SPD, FERC (2013b) stated: *AEA's proposed modeling approach should provide the information necessary to describe project effects with respect to ice processes to a degree which is consistent with generally accepted practices in the scientific community (section 5.9(b)(6)) and, if effectively implemented, is expected to be able to satisfy the study objectives.* *If the initial results of the 2013 or 2014 study seasons (as documented in the initial study report) indicate that the model does not adequately evaluate project effects, and it becomes clear on the basis of the results that other procedures should be followed in order to meet the study objectives, then alternative methods and/or procedures could be added in 2014 or in subsequent study years (sections 5.15(d) and 5.15(e)).*

Comment	**AEA Response**
Section 7.3.1 Proposed Study Site for Modeling	
13. <u>Recommendations</u> The draft Implementation Plan should provide proposed study locations and a schedule for consultation with the Services prior to final study site selection. A sufficient number of ice-covered	Study sites for fish passage in Focus Areas will be located at the inlets and/or outlets of upland sloughs, side sloughs, and some side channels. Two-dimensional fine mesh hydraulics and substrate will be collected at most of these habitat types in all Focus Areas. The Implementation Plan has been revised to include maps of all Focus Areas showing the delineation of off-channel types that will be included for investigation of fish passage (Figures 6-15). The upland sloughs, side sloughs, or side channels that will <u>not</u> be investigated for fish passage must be determined during field reconnaissance by the fish passage barrier, the Fish

sites should be included in the study.	and Aquatic Instream Flow study, and Geomorphology study leads. AEA will report on the identification of these study sites during the scheduled quarterly TWG meetings and in the ISR.

Comment	AEA Response
Section 7.3.2 Modeling Methods for Ice-Free Periods	
14. Recommendations Beaver dams within Focus Areas should be surveyed so that fish passage into and out of these important habitats can be assessed.	Beaver dams are transient and dynamic in the Susitna River, as they are in most large rivers. They are removed by high river flows, by ice, or are abandoned and deteriorate over time. The beaver dam may be partially removed by flow or ice and rebuilt within a matter of days, or alternatively, the dam may be completely removed and rebuilt in the future or never rebuilt. Beaver are opportunistic dam builders. As described in Section 7.5 of the Fish Passage Barriers Implementation Plan, AEA will survey all beaver dams encountered within the zone of hydrologic influence in select tributaries and Focus Areas as shown in Tables 1 and 2 of the Fish Passage Barriers Implementation Plan. Survey methods of beaver dams will follow those described in RSP Section 9.9, Section 9.12.4.4. Dimensions of the dam including height, length, and breadth, and depth of the leaping pool will be measured and observations of possible passage ways through or around the dam will be described. Photographs will be taken. The Fish Passage Barriers Implementation Plan at Section 7.3.2 has been modified to specify these methods at all beaver dams in Focus Areas. Because beaver dams are transient and dynamic, it is unlikely that this assessment will be material in analyzing potential Project effects.
15. The mouths of all tributaries within all Focus Areas should be surveyed and discharge measured and gauged to evaluate fish passage conditions under multiple pre- and post-project flows. Velocities should not be reported as averages, the range of flow velocities should be collected and	As described in Section 7.5 of the Fish Passage Barriers Implementation Plan, barrier surveys will be conducted in all 11 tributary mouths found within Focus Areas. The 11 tributaries are listed in Table 2 of the Implementation Plan. Two-dimensional hydraulic models of all tributary mouths within the zone of hydrologic influence will be modeled using 2-D or 1-D models. Tributaries within Focus Areas (Table 2) will be either gaged with continuous stage recording instruments or they will be periodically measured at multiple flow levels to establish a rating curve with the intent of establishing drainage-area-based accretion estimates. Section 7.3.2 of the Implementation Plan has modified accordingly. AEA will record all point velocity measurements on data sheets when using manual meters, or

reported in order to characterize passage velocities applicable to small fish – juvenile salmonid resident fish species.	in the case of the acoustic Doppler current profiler (ADCP), point velocities in the water column will be recorded into the ADCP data file.

Comment	**AEA Response**
Section 7.3.3 Modeling Methods during Ice-cover Conditions	
16. Recommendations Ice thickness and water depth should be measured along multiple cross-section transects or grids at the upstream and downstream controls and within side channels and off-channel habitats of Focus Areas. Measurements should be taken at each transect at least twice during winter. Enough transects should be established to adequately evaluate flow and water depth related juvenile fish passage. Sites should include all of the major off-channel habitats within Middle River Focus Areas.	As described in Section 7.2 of the Fish Passage Barriers Implementation Plan, the measuring and modeling micro-hydraulics under ice, over a broad enough area to have any relevance, is physically infeasible and would not produce data or information that could be used to assess potential effects of the proposed Project. See AEA response to Comment 12.

Comment	AEA Response
Section 7.4. Description of Ice-Free Off-Channel and Tributary Delta Study Sites	
17. Recommendations The draft Implementation Plan still needs a description of the tributaries that will be evaluated for fish passage, passage criteria, and methods that will be used to evaluate project effects to juvenile and resident fish movement into Middle and Lower River tributaries.	Tributaries to be evaluated for fish passage in the Middle River are included in Table 2 of the Fish Passage Barriers Implementation Plan. This table also includes characteristics of these tributaries that were used in selecting them. Also please refer to Response to Comments 14 and 15. Regarding passage criteria, please see AEA Response to Comments 2 and 3. As recommended by FERC, AEA will locate fish passage [including juveniles and resident fish] study sites in Focus Areas. Section 7.3 of the Implementation Plan describes the models that will be used for evaluating potential project effects to fish depth and velocity barriers. Regarding fish passage studies in the Lower River, please AEA Response to Comment 1.

Comment	AEA Response
Section 7. Identification and Location of existing Physical Barriers to Fish Passage 5	
18. It is still unclear from the combined RSP 9.12 and Draft Implementation Plan if surveys will be conducted throughout the Middle River to locate and categorize all existing fish barriers within the project zone of influence including falls, cascades, beaver dams, road or railroad crossings or if the study plan is proposing to locate and categorize potential barriers only within the 20 tributaries listed. If only for 20 listed tributaries, there is no assessment of the representativeness of this sample.	Sections 7.3 and 7.4 of the Fish Passage Barriers Implementation Plan describes the application of 2-D modeling to assess barriers in off-channel habitats of Focus Area. The actual sites to be modeled will be determined as part of the Fish and Aquatic Instream Flow (RSP Section 8.5) and Ice Processes (RSP Section 7.6) studies. Section 7.5 of the Fish Passage Barriers Implementation Plan identifies 27 tributaries in the Middle River which will be surveyed for physical barriers to fish passage within the zone of hydrologic influence (see Table 2). These tributaries represent 34 percent of all the tributaries in the Middle River and include both the largest tributaries and numerous smaller perennial tributaries that are known to support target species in the Middle River.

19. Based upon our review of the video, beaver dams occur most often in upland sloughs and side sloughs. Fish access to rearing habitat within a beaver dam could occur during high flow conditions that allow passage during breaching or backwater conditions. The total number of beaver dams within each geomorphic reach must be known to determine if those located within the Focus Areas are representative and to extrapolate project effects on fish migration to this habitat type to the Middle and Lower River. All road or railroad crossings should be surveyed to determine if they are within the zone of project influence, and if passage is flow dependent. Similarly, all tributary mouths should be surveyed to determine low mainstem flow passage conditions.	Regarding Agencies' comments on beaver dams, please see Response to Comment 14. Furthermore, AEA will identify beaver dams with high resolution aerial imagery. The location of beaver dams also will be identified as part of the implementation of RSP 10.11 – Aquatic Furbearer Study. AEA will use this information to map the distribution of beaver dams in GIS. These data will also be available, as applicable, for extrapolation purposes. Section 7.5.1 of the Fish Passage Barriers Implementation Plan has been revised to include GIS mapping of potential physical barriers (including beaver dams) using aerial imagery.
20. The passage criteria in RSP 9.12 including the references to Powers and Osborn, ADNR 2007, and the decision tree have all been developed to evaluate barriers to adult salmon migration. As state in the Services RSP comments, passage criteria need to be established for juvenile salmon and resident fish species prior to conducting barrier surveys.	Regarding development of passage criteria, please see AEA Response to Comments 2 and 3. Passage criteria for barrier assessment are typically applied after passage barrier field data are collected. The parameters of a barrier, such as depth, velocity, and barrier height, are measured independent of the criteria. The timing of the establishment of the criteria does not impact the type of field measurements to be taken. AEA is not adopting the Services' recommendation because it would result in unacceptable and unnecessary delays in the collection of field data.

Comment	AEA Response
Section 7.6 Study of Fish Passage Barriers to the Lower River	
21. Recommendations A draft study plan should be developed for the Lower Susitna River, identifying target fish species, passage criteria, study methods, and study locations.	Consistent with the February 1 SPD, the Fish Passage Barriers Implementation Plan does not include identification of a list of target fish species, passage criteria, study methods, and locations for study in the Lower River. This agency recommendation pertaining to the Lower River is beyond the scope of the issues addressed in the Fish Passage Barriers Implementation Plan. However, as stated by FERC and quoted in the Fish Passage Barriers Implementation Plan: "If 2013 results, as presented in the [ISR], indicate that the Project will cause significant adverse effects on fish passage into tributaries and off-channel habitats in the Middle River then additional study sites will be added in the Lower River in 2014, or in subsequent study years (FERC 2013)." Following the filing of the ISR, AEA will seek the input of the TWG when determining the need for fish passage barrier studies in the Lower River.