

# Susitna-Watana Hydroelectric Project Document ARLIS Uniform Cover Page

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**Susitna-Watana Hydroelectric Project  
(FERC No. 14241)**

**Technical Memorandum:  
Characterization and Mapping of Aquatic Habitats**

Prepared for

Alaska Energy Authority



Prepared by

HDR

June 2013

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## LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
AEA	Alaska Energy Authority
AWC	Anadromous Waters Catalog
FDAIP	Fish Distribution and Abundance Implementation Plan
FERC	Federal Energy Regulatory Commission
HRM	historic river mile
ISR	Initial Study Report
PRM	Project river mile
Project	Susitna-Watana Hydroelectric Project
RSP	Revised Study Plan
TM	Technical memorandum
ZHI	zone of hydraulic influence

## 1. BACKGROUND

On December 14, 2012, Alaska Energy Authority (AEA) filed with the Federal Energy Regulatory Commission (FERC) its Revised Study Plan (RSP), which included 58 individual study plans (AEA 2012). Included within the RSP was the Characterization of Aquatic Habitats Study, Section 9.09. This study focuses on the characterization and mapping of aquatic habitats with the potential to be altered and/or lost as the result construction and operation of the proposed Susitna-Watana Hydroelectric Project (Project). Alteration or loss could result from changes in habitat access, as well as changes in flow, water surface elevation, sediment regime, and temperature regimes associated with reservoir filling and hydropower operations.

RSP Section 9.09 provides goals, objectives, and proposed methods for identification, classification, and measurement of habitats in the area potentially affected by the proposed Project.

On February 1, 2013 FERC issued its Study Plan Determination (SPD) for 44 of the 58 studies, approving 31 studies as filed and 13 with modifications (FERC 2013a). A decision on the remaining 14 studies was deferred until AEA filed additional information and held meetings with stakeholders to discuss the new information. RSP Section 9.09 was one of the 14 deferred.

On April 1, 2013, FERC issued its SPD for 14 of the 58 proposed individual studies in the RSP (FERC 2013b). When approving the Characterization of Aquatic Habitats Study, RSP Section 9.09, FERC made certain recommendation.

In accordance with FERC's SPD, the recommended modifications have been incorporated into the draft Final Study Plan.

## 2. FERC STAFF RECOMMENDATIONS

In its April 1 SPD, FERC recommended seven modifications to RSP Section 9.09. This technical memorandum (TM) addresses one of those six recommended modifications in detail. As stated in the SPD, FERC recommended the following:

*We recommend that AEA consult with the TWG and file no later than June 30, 2012, the following information to quantify small and low-order tributaries in the Upper River study area:*

- a. A detailed description of the specific methods to be used for selecting a representative sample of small and low-order Upper River tributaries for aquatic habitat mapping.*
- b. Documentation of consultation with the TWG, including how its comments were addressed.*

AEA addressed the other five recommended modifications as follows:

- a. We recommend that AEA remove the level 5 calculation of edge habitat from the habitat classification system. See April 1 SPD at 208.*

AEA Response: Level 5 edge habitat was removed from the classification system  
See Section 9.1.4.5 and Table 9.9-4 of the Final Study Plan.

- b. *We recommend changing the classification of backwater, beaver complex, and clearwater plume habitats from level 3 (mainstem habitat) to level 4 (mainstem and tributary mesohabitats). See April 1 SPD at 210.*

AEA Response: Classification of mainstem backwater, beaver complex, and clearwater plume habitats in the mainstem was revised from Level 3 to Level 4. See Section 9.1.4.5 and Table 9.9-4 of the Final Study Plan.

- c. *We recommend modifying the study plan to have AEA identify and give specific consideration to backwater habitats, as defined by the agencies (i.e., the confluence of off-channel habitats with main channel habitats), as a unique habitat feature and ensure a representative subsample of these locations when selecting transect locations for one-dimensional or two-dimensional aquatic habitat modeling within Middle River and Lower River instream flow study sites. See April 1 SPD at 212.*

AEA Response: The RSP has been revised to identify backwater as a unique habitat feature and to ensure modeling of backwater habitat in Focus Areas. See Section 9.1.4.5 and Table 9.9-4 of the Final Study Plan.

- d. *We recommend modifying the study plan to have AEA classify Middle River tributary reaches within the zone of hydrologic influence into geomorphic reaches based on tributary basin drainage area and stream gradient to provide a general understanding of the relative potential value to fish and aquatic resources, and report on these attributes in the initial and updated study reports. See April 1 SPD at 213.*

AEA Response: The RSP has been revised to state that Middle River tributary reaches within the zone of hydrologic influence will be classified into geomorphic reaches based on tributary basin drainage area and stream gradient and that these attributes will be reported in the Characterization of Aquatic Habitats Study Initial Study Report (ISR) to be filed with FERC in February 2014.

- e. *We recommend that AEA provide a detailed description of methods and results of 2012 and 2013 habitat mapping in the initial study report, including a complete set of photographic base maps delineating macrohabitats (level 3) and mesohabitats (level 4) for all mapped locations. See April 1 SPD at 214.*

AEA Response: The RSP has been revised to state that a detailed description of methods and results of 2012 and 2013 habitat mapping will be provided in the Characterization of Aquatic Habitats Study ISR to be filed with FERC in February 2014

### **3. PROPOSED TRIBUTARIES FOR HABITAT MAPPING IN THE UPPER RIVER/MIDDLE RIVER ABOVE DEVILS CANYON**

Habitat in 20 primary and secondary tributaries will be typed to the mesohabitat level shown in Table 1 using a combination of video and ground mapping sampling methods. Tributaries in the list of 20 that are not conducive to aerial video mapping, such as those with obscured view of the river due to riparian vegetation, will be mapped using ground methods only.

The 20 tributaries proposed for mapping include a combination of smaller- and larger-primary tributaries and four secondary (lower order) tributaries that are known to support Chinook or are in watersheds known to support Chinook. These tributaries are the same 20 tributaries that were selected for fish sampling as described in Susitna River Fish Distribution and Abundance Implementation Plan (FDAIP) (AEA 2013).

*Tributaries upstream of Devils Canyon selected for fish distribution and abundance sampling include all known Chinook salmon-bearing tributaries and other tributaries that are not currently listed in ADF&G's Anadromous Waters Catalog (AWC; ADF&G 2012). Initially 20 tributary streams were selected for sampling based on: AWC catalog listings, drainage basin, historical sampling efforts, and the potential for impact/inundation from the project.*

The selection of these tributaries as being representative for upper river fish distribution and abundance sampling was approved by FERC in the April 1, 2013 RSP 9.5 SPD (FERC 2013b), page B-121.

### **3.1 Description of Specific Methods Used for Selection of a Representative Sample of Small and Low-order Upper River Tributaries**

Four of the 20 tributaries proposed for mapping in this TM and the draft Final Study Plan were added in response to FERC's April 1, 2013 RSP 9.09 Study Plan Determination that recommended mapping additional smaller and lower order tributaries. The four tributaries were also added to be consistent with sample site selection in Study 9.5 – FDAIP. The added four tributaries are shown as shaded grey in Table 1. Note that the added four tributaries are smaller primary tributaries. No lower-order (secondary) tributaries were added for reasons described in Section 3.2 below.

In addition to the selection criteria used by fish distribution and abundance (Study RSP 9.5), the method or rationale used for selecting representative tributaries to habitat map above Devils Canyon is described as follows, in order of priority.

- 1) Select primary tributaries that represent a range of larger and smaller tributaries that, in combination, are known to support the species assemblage in the Susitna River watershed above Devils Canyon.
- 2) Select primary and secondary (lower order) tributaries that are known to support Chinook salmon.
- 3) Select a sub-set of secondary tributaries (lower order) that are in watersheds that are known to support Chinook salmon.
- 4) Select tributaries that are within the zone of direct Project impact (reservoir inundation zone).



### 3.2 Tributaries above Devils Canyon Proposed in Response to FERC Study Plan Determination

The 20 tributaries listed in Table 1 represent the set of selection priorities described above. As seen in Figure 1 below and in more detail in Appendix B, most smaller- and lower-order tributaries that have any part in the inundation zone are short, appear to be steep, and only have a small portion in the inundation zone.

- PRM 155.0 to PRM<sup>1</sup> 187.1 (Appendix B – pgs. 1 and 2): This section of river is below the proposed dam location. There are no secondary (lower order tributaries) within the zone of hydrologic influence (ZHI<sup>2</sup>) in this reach. Fog Creek secondary tributary L1 was selected for mapping as representative of a secondary tributary in a watershed known to support Chinook salmon.
- PRM 187.1 to PRM 204.0 (Appendix B – pg. 3): This section of river is within the proposed reservoir inundation zone. There are several secondary tributaries in this reach. With the exception of Watana Creek, which is documented to support Chinook, secondary tributary sections within the inundation zone (below 2050 feet elevation) are mostly short and/or steep. With the exception of Watana Creek, habitat mapping of the secondary tributaries within the inundation zone was considered to be of lower value so it is not proposed.
- PRM 204.0 to PRM 217.0 (Appendix B – pg. 4 and 6): This section of river is within the proposed reservoir inundation zone. There are fewer secondary tributaries in this reach. Secondary tributary sections within the inundation zone (below 2050 feet elevation) are mostly short and/or steep. Habitat mapping of the secondary tributaries within the inundation zone was considered to be of lower value so it is not proposed.
- PRM 217.0 to PRM 235.2 (Appendix B – pg. 5 and 6): Except for the upper 2 miles, this section of river is within the proposed reservoir inundation zone. However, in this upper reach the inundation boundaries do not extend far up the tributaries. All of Oshetna River and Goose Creek are above inundation zone. Two secondary tributaries, Tsihi Creek on Kosina Creek and Black River on Oshetna River, were selected in this upper reach, outside of the inundation zone, because of the known or potential use by Chinook salmon.

The four smaller primary tributaries that were added in response to the FERC SPD are briefly described below.

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<sup>1</sup> Project River Mile (PRM) 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.

<sup>2</sup> The ZHI (zone of hydrologic influence) 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.

A detailed inventory and description of tributaries above Devils Canyon sampled for fish in 2012 is provided in Appendix A. Appendix A visually demonstrates that the relative size of the 20 tributaries selected for habitat mapping and for 2013/2014 fish distribution and abundance is a good representation of size in comparison to the range of tributaries. The description includes a video capture image of the tributary mouth.

### **Unnamed Tributary - 206.0 (HRM<sup>3</sup> 203.7)**

This unnamed tributary flows into the Susitna River from the south at PRM 206.0. The stream drains less than 31 mi<sup>2</sup> and includes a few tributaries and lakes, including Watana Lake. The main channel of the stream is roughly 7.4 mi long. This stream was assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified. Fish distribution sampling occurred downstream of an elevation of 2,050-feet.

Backpack electrofishing was conducted in the main channel over a distance of 100 ft of stream. Mesohabitat sampled was defined as cascade and pocket-water run (60.0 percent and 40.0 percent, respectively). A total of 29 fish were captured or observed, all of which were sculpin. The tributary plume was also sampled with a boat-mounted electrofisher. Sculpin was the only fish captured or observed.

### **Unnamed Tributary - 204.3 (HRM 201.8)**

This unnamed tributary flows into the Susitna River from the southwest at PRM 204.3. The stream drains less than 31 mi<sup>2</sup> and includes a few tributaries and lakes. The main channel of the stream is roughly 6.2 mi long. High gradient cascades and falls located roughly 0.4 and 0.6 mi upstream from the Susitna River were identified as potential barriers to adult salmon. These habitats are located below, or downstream of an elevation of 2,050-feet. Sampling occurred downstream of these barriers.

Backpack electrofishing was conducted in the main channel of the stream over a total distance of 33 ft. Mesohabitat sampled was documented as 100 percent riffle. No fish were captured or observed. The tributary plume was sampled with a backpack electrofisher. A total of 35 fish were captured or observed, including Arctic grayling (n=21), sculpin (n=13), and burbot (n=1).

### **Unnamed Tributary - 197.6 (HRM 194.9)**

This unnamed tributary flows into the Susitna River from the south at PRM 197.6. The stream drains less than 31 mi<sup>2</sup>, and includes a number of tributaries. The main channel of the stream is roughly 5.4 mi. The channel forks at a point roughly 0.75 mi upstream from the Susitna River. Multiple falls located on the main (west) channel roughly 1.3 mi upstream from the Susitna River confluence likely present a barrier to adult salmon. This habitat is located below, or downstream of the proposed reservoir elevation of 2,050-feet.

Fish distribution sampling was conducted in two segments in this tributary, one located near the mouth and the other located farther upstream (above an elevation of 2,050-feet), on the east channel. Sampling was not conducted upstream of the suspected barrier in the west channel.

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<sup>3</sup> Historic River Mile (HRM) referencing those of the 1980s APA Project.

Backpack electrofishing was conducted over a total combined distance of 490 ft. Sampling occurred at nine discrete mesohabitat units; mesohabitat was defined as run (n=5, 64.0 percent), riffle (n=3, 26.9 percent), and scour pool (n=3, 9.1 percent). Additionally, two minnow traps were used at the upper segment. A total of 17 fish were captured or observed at the downstream site; no fish were captured or observed at the upstream segment. Fish captured or observed near the mouth included Arctic grayling (n=3) and sculpin (n=14).

The boat-mounted electrofisher was used to sample habitat in the direct vicinity of tributary mouths within the Susitna River. The size of the plume was very small. Only one fish, an Arctic grayling, was captured; one additional unidentified fish was observed but not netted.

### **Unnamed Tributary - 194.8 (HRM 192.0)**

This unnamed tributary flows into the Susitna River from the north at PRM 194.8. The tributary drains 124 mi<sup>2</sup> and includes a few tributaries and many lakes. The main stream channel is roughly 7.1 mi long. This stream was assessed for the presence of adult salmon passage barriers in 2012; no barriers were identified.

Backpack electrofishing was conducted in two discrete segments over a total distance of 677 ft. Runs were the dominant mesohabitat sampled percent. The remaining mesohabitat sample units were riffle, pocket-water riffle, backwater pool, and scour pool. A total of 34 fish were captured or observed, including Dolly Varden (n=2), Arctic grayling (n=3) and sculpin (n=28).

One sample segment was located downstream of the proposed inundation zone and the other was located upstream of the 2,050-foot elevation. Arctic grayling and sculpin were present in both segments; the presence of Dolly Varden was documented only at the upstream segment.

**Table 1. Tributaries above Devils Canyon selected for aerial video and ground mapping. Grey shaded tributaries are in addition to those listed in AEA December 14, 2012 Revised Study Plan.**

Primary Tributary	Secondary Tributary	Geomorphic Reach	Project River Mile	Total Stream Length	Drainage Area Mi	Approximate Elevation and River Mile of Anadromous Barrier	Habitat Mapping Study Area <sup>1</sup>	Documented Chinook in Watershed	Mapping Method	Species Known to be Present in Tributary or Plume <sup>2</sup>													
										Chinook	Dolly Varden	Lake Trout	Arctic Grayling	Round Whitefish	Humpback Whitefish	Whitefish spp.	Salmonid spp.	Burbot	Longnose Sucker	Slimy Sculpin	Sculpin spp.	Rainbow Trout	Sampled [NO FISH]
Oshetna River – LB		UR 3	235.2	55.6	550	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground	X	X		X	X				X	X	X	X		
	Black River - LB	UR 3	12.7 (LB)	NI	NI	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground														
Goose Creek – LB		UR 3	232.6	25.2	103.9	None	PRM 0.0 to 2,200 ft	NI	Aerial and Ground				X					X	X	X	X		
Jay Creek - RB		UR 4	211.0	19.6	61.8	None	PRM 0.0 to 2,200 ft	NI	Aerial and Ground		X		X	X			X	X	X	X	X		
Kosina Creek - LB		UR 4	206.8	39.5	400.2	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground	X			X	X		X	X	X	X	X	X		
	Tsisi Creek1 - LB	UR 4	7.4 (LB)	NI	NI	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground														
Unnamed Tributary - LB		UR 5	206.2	7.43	<31	None	PRM 0.0 to 2,200 ft	NI	Ground only				X							X			
Unnamed Tributary - LB		UR 5	204.3	6.2	<31	Possible – PRM 0.5	PRM 0.0 to 2,200 ft	NI	Ground only				X				X				X		
Unnamed Tributary - LB		UR 6	197.6	5.4	<31	PRM 1.3	PRM 0.0 to 2,200 ft	NI	Ground only				X			X				X	X		
Watana Creek - RB		UR 6	196.8	26.9	174.8	None	PRM 0.0 to 3,000	Yes	Aerial and Ground		X		X	X		X	X	X	X	X	X		
	Watana Tributary - RB	UR 6	8.7 (RB)	UNI	NI	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground														
Unnamed Tributary - RB		UR 6	194.7	7.1	124	None	PRM 0.0 to 2,200 ft	NI	Ground only		X		X	X		X		X	X	X	X		
Deadman Creek - RB		UR 6	189.3	41.9	175.1	≈1,700 ft - PRM 0.4	PRM 0.0 to 2,200 ft	NI	Aerial and Ground		X		X				X	X		X			
Tsusena Creek - RB		MR 2	184.6	30.7	145.3	≈1,700 ft – PRM 3.8	PRM 0.0 to barrier	Yes	Aerial and Ground	X			X	X	X		X	X	X	X	X		
Unnamed Tributary - RB		MR 2	184.0	10.4	<31	≈1700 ft – PRM 1.8	PRM 0.0 to barrier	NI	Aerial and Ground	X	X		X	X		X				X	X		
Fog Creek <sup>2</sup> - LB		MR 2	179.3	27.8	147.2	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground	X	X		X	X		X	X	X		X	X		
	Fog Tributary <sup>3</sup> - LB	MR 2	5.2 (LB)	NI	NI	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground	X													
Devil Creek - RB		MR 4	164.8	15.8	74.8	≈1,400 – PRM 2.2	PRM 0.0 to barrier	NI	Aerial and Ground	X	X		X							X	X		
Chinook Creek - LB		MR 4	160.5	10.6	24.7	None	PRM 0.0 to 3,000 ft	Yes	Aerial and Ground	X	X												
Cheechako Creek - LB		MR 4	155.9	10.7	36.4	≈1,500 – PRM 2.5	PRM 0.0 to barrier	Yes	Aerial and Ground	X	X		X								X		

<sup>1</sup> Above the proposed dam, for streams in watersheds known to support Chinook salmon, the habitat mapping study area will extend to 3,000 feet unless there is a confirmed Chinook barrier between 2,200 and 3,000 feet elevation; in which case the study area will terminate at the impassable barrier. For streams above the proposed dam in watersheds not known to support Chinook salmon, the habitat mapping study area will terminate at 2,200 feet elevation. For streams in the Middle River above Devils Canyon that are known to support Chinook salmon, the habitat mapping study area will terminate at 3,000 feet or the first confirmed Chinook barrier, whichever is lower in the watershed.

<sup>2</sup> Fish species presence based on historical and current surveys. Streams between the low the propped dam

<sup>3</sup>Fog Creek and Fog Creek Tributary were unintentionally omitted from this table in the December 14, 2012 Revised Study Plan.

NI: No information available at this time.

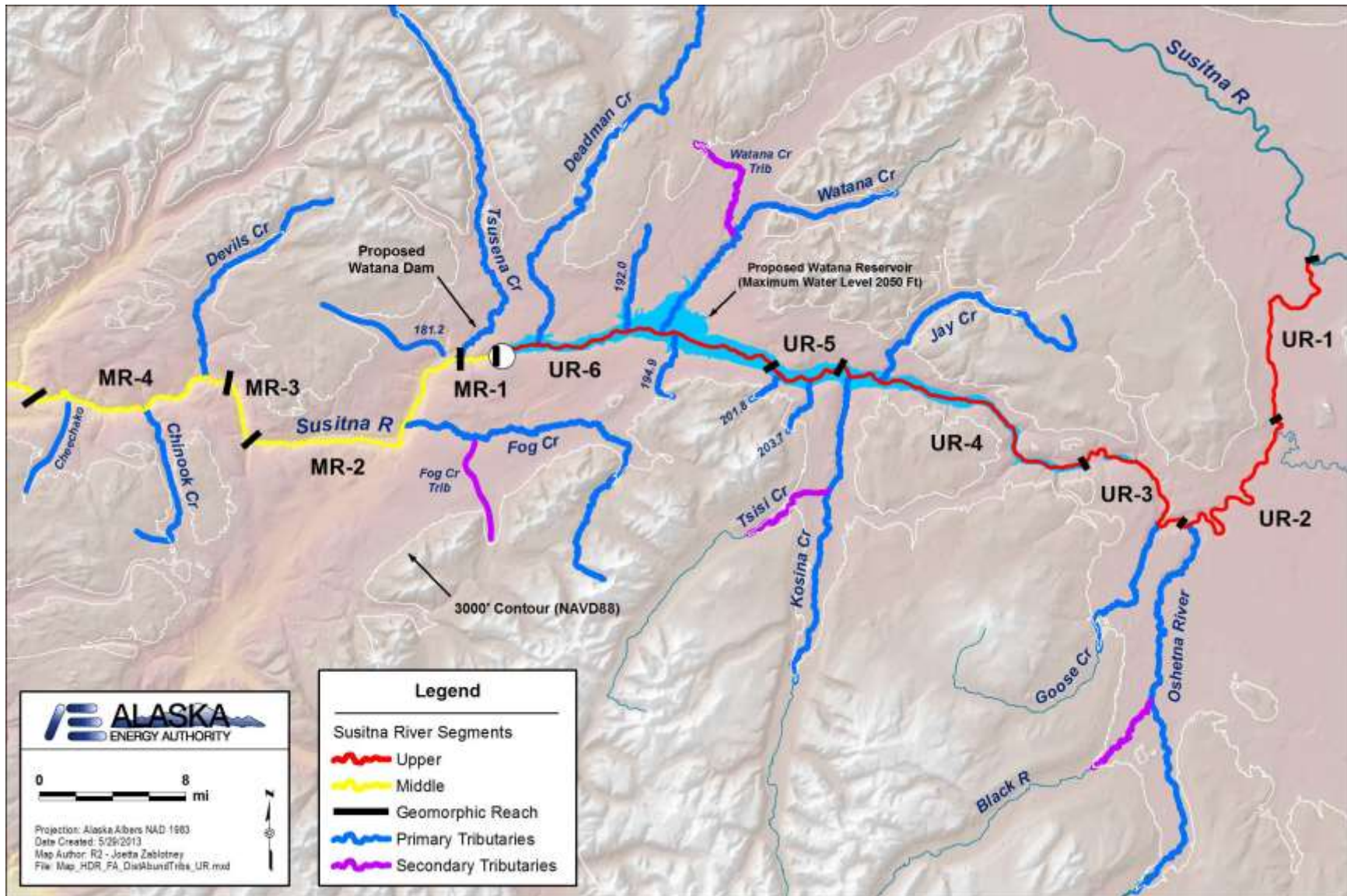


Figure 1. Locations of 20 tributaries upstream of Devils Canyon selected for habitat mapping.

#### 4. REFERENCES

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