SUSITNA-WATANA HYDRO

Meeting Notes
Fish and Aquatic Technical Team Meeting
December 2, 2014

LOCATION: **Teleconference/webinar meeting**

TIME: **1:00 pm – 4:00 pm (AKDT), 2:00 – 5:00 pm (PDT)**

SUBJECT: **Aquatic macrohabitat ground-truthing and remote line mapping review and Fish Barriers fish passage criteria. (Study 9.9. RSP Section 9.9.5.4 and Study 9.12 RSP Section 9.12.4)**

PARTICIPANTS: **Betsy McGregor,** AEA; **Doug Ott,** AEA; **Rachel Thompson**, AEA; **George Gilmour,** Meridian; **Sue Walker,** NMFS; **Laurie Marczak,** R2; **MaryLou Keefe,** R2**; Kevin Petrone,** R2**; Phil Hilgert,** R2**; Dudley Reiser,** R2; **Joetta Zablotney**, R2; **Lyle Zevenbergen**, Tetratech; **Betsy McCracken,** USFWS; **Matt Love**, VNF; **Matt Cutlip**, FERC; **Bill Fullerton**, Tetra Tech; **Jeff Davis**, ARRI; **Jan Konigsberg**, Hydropower Reform Coalition

Materials for this workshop were posted on the Susitna-Watana Hydroelectric Project website at: http://www.susitna-watanahydro.org/meetings/. Posted materials included:

- Agenda
- Characterization and Mapping of Aquatic Habitats – Errata to Initial Study Report Part A – Appendix A, Remote Line Mapping, 2012
- Characterization and Mapping of Aquatic Habitats – Revised Map Book for 2012 Remote Line Mapping
- Powerpoint presentation: Study 9.12 Fish Passage Barriers

Information handed out at the meeting included:

- Handout, 2014
- Handout: Relevant Study Data Location Maps, September 9-11, 2014

Study 9.9 Characterization and Mapping of Aquatic Habitats

After introductions, Laurie Marczak began the meeting with a brief introduction of the Study 9.9 Habitat Mapping and Characterization task. She reviewed the purpose of the meeting: to describe the protocol that was used for comparing data collected by field crews in 2013 with the remote line map developed in 2012. This is a first step in the process, as 2014 data collection was completed in September and there is an ongoing task to compare 2014 field data to the line map as well.

Laurie Marczak also explained that remote line mapping was completed in 2012, using aerial imagery collected during 2011. Some of that imagery was obtained outside the optimal flow range (as high as 30,000 cfs or as low as 5,000 cfs depending on river location) although most was within the target range of about 16,000-18,000 cfs. Additional aerial imagery from 2013 is available that typically fell within the 12,000-16,000 cfs range. This dataset was used to assist with the comparison of habitat calls between the line mapping and ground truthing field surveys because the 2013 imagery was taken at flows closer to the reference range (11,600 cfs) for some locations.

There also was discussion of how changes in the categorization hierarchy of beaver complexes, backwaters, and clearwater plumes affected the mapping study. At the time that the 2012 map was developed, AEA categorized these habitats as macrohabitat types and thus, the remote map depicts them as such. The FERC SPD came out after the map was produced and recommended changing these three habitat types to mesohabitats. R2 explained that this change was implemented prior to the collection of the 2013 data, and the remote map database had been updated to reflect this hierarchical change. In addition a new map would be produced that reflected this change as well as the results of the ground-truthing evaluation. Thus, the hierarchical changes did not create any potential discrepancies between the remote and field habitat calls.

Jeff Davis, ARRI, asked for clarification on the source of aerial imagery that was used for the remote line map. Jeff questioned the use of anything other than the 2012 video, and suggested that it was a change from the study plan to do so. R2 explained that the 2012 video was used to bolster the interpretation of aerial photography for the mainstem in areas where the image was less than optimal and that this was consistent with the RSP (see post-meeting clarification at end of the meeting notes).

There was also some discussion about the flows that occurred during field data collection. In 2013, the field survey teams encountered some unavoidably high flow conditions, even though every effort was made to avoid these flows as per the revised study plan. However, in an attempt to meet the study schedule, some 2013 surveys were conducted at higher than optimal flows in the less flow-sensitive habitats (e.g. tributaries). In 2014, surveys were conducted at flows that were more stable and consistently closer to the reference flow of 11,600 cfs. There was some discussion of the collection of data that occurred over variable flows and references flows. Laurie indicated that the point of the ground-truthing surveys was to collect on-the-ground data to verify the remote map and that AEA was able to accomplish that goal,even with variable flows in 2013, as demonstrated by the low number of actual habitat typing discrepancies. The fact that data were consistent even with different flows was a testimony to the strength of the remote data set.

Laurie Marczak then reviewed the following steps taken for the ground-truthing analysis. AEA:

1. Completed a text-based comparison in the database – aligning the macrohabitat call from the 2012 remote line mapping against the macrohabitat call from the 2013 field survey and flagging any discrepancies between the two. She noted that although this comparison was for macrohabitats, the data are structured by mesohabitats within macrohabitats – so that complicates giving simple counts of the number of macrohabitat call differences.

2. Identified approximately two dozen locations with differences in calls between 2013 field surveys and the 2012 remote line mapping.
3. Visually examined the apparent discrepencies using GIS and found that, in the majority of cases, discrepencies represented either: a new feature, a difference based on geometry, or a difference due to different flow levels between observations.

Laurie then reviewed three examples where the 2012 remote line mapping macrohabitat call was upheld over the field-based call.

1. ID555 – was a **FLOW** based decision. Field crews surveyed at higher than desirable flows of about 31,200 cfs whereas the imagery at 16,000cfs was closer to the reference range.
2. ID7 – was an example of a **GEOMETRY** based call. The field crew identified this as one piece of a Split Main Channel but did not subsequently disagree with the line mapping call (of Side Channel) for what would be the other arm of the Split Main Channel. The field crew agreed that the Side Channel should remain a Side Channel. Subsequent review of the 2013 imagery confirmed this and so the proposed category change was rejected.
3. ID11 – was a **NEW FEATURE** – a backwater – that was not identified on the remote line mapping. Field Crews had instructions to identify these features whenever they were encountered. We have added these features to both the project database and the GIS.

There was discussion in the middle of the presentation of the examples that included questions about habitat calls depicted in the slide presentation. One Side Slough call in particular, that was not a potential discrepancy between remote and 2013 field data, was called into question by Jeff Davis. Jeff, Sue Walker, and George Gilmour all questioned the definitions that were used to make this call, suggesting that the definitions were not consistent or detailed enough for the same call to be made repeatedly and allow for confidence in the map. R2 staff refuted that suggestion, noting the detail in definitions (see post-meeting clarification at end of the meeting notes), citing from FERC approved documents as well as the fact that two independent teams (remote and field) identified this as a Side Slough due to a lack of more permanent vegetation and more frequent overtopping at its head.

Discussion ensued about how there was no perfect fit when trying to draw a box around a continuous and dynamic characteristic and that the dynamic nature of aquatic habitat limits the amount of precision that was realistic when mapping habitats. R2 indicated that the ground-truthing was conducted in order to try to understand the amount of error in the line map and thus far the consistency of the data suggest the error rate is low. How low will not be known until incorporation of the 2014 field data is complete. NMFS and their contractors repeated their request for sufficiently detailed definitions to enable them to evaluate error in the mapping.

A recommendation was made for an all-day meeting to discuss and come to agreement on habitat call discrepancies between the data collected and interpretation by Jeff Davis. AEA suggested that NMFS should provide a list of any potential differences they see from the map and then AEA would consider the best way to respond to those. AEA then requested that R2 continue their presentation of the results.

Laurie Marczak continued explaining that there were four features where field crews disagreed with the 2012 remote line mapping call and these were confirmed during the post-field assessment. In all four cases these were FLOW-based differences where the imagery used for the 2012 line mapping was outside the optimal range whereas flows during field mapping were closer to the reference range. The groupreviewed each case in turn.

1. ID8 – Side Channel to a Side Slough – FLOW – Remote line mapping imagery obtained above 30,000 cfs; field survey was at 16,600 cfs. At that lower flow this habitat is a Side Slough.
2. ID70 – Side Channel to a Side Slough – FLOW – Identical scenario as ID8: Remote line mapping imagery obtained above 30,000 cfs; field survey was at 16,600 cfs. At that lower flow this habitat is a Side Slough.
3. ID335 – Side Channel to a Side Slough – FLOW – 2013 photos (11,300 cfs) and field survey (19,900 cfs) both identify this as a Side Slough with clear water behind a gravel berm.
4. ID493 – Side Channel to a Split Main Channel – FLOW – 2012 line mapping was based on aerial imagery taken at a low flow of ~5,200 cfs; 2013 photo series at about 12,000cfs confirms this as a Split Main Channel (field survey was at a high flow of 31,200 cfs).

Betsy McGregor, of AEA, asked the group to remember where we are in the ILP process. AEA has completed the Initial Study Report but is still working to QAQC data collected in 2014. She asked the group to also remember what the data is being used for: a baseline characterization of the types of habitats found in the mainstem Susitna River and some tributaries. Betsy McCracken asked if the data would be used to make predictions. Phil Hilgert and Dudley Reiser answered by describing the different datasets collected by the IFS program that support the 2D instream flow and geomorphic models. These models will rely upon some of the habitat metrics collected by the aquatic habitat field crews. AEA also will be integrating with the geomorphic data for predictions of encroachment, changes in bed elevation, and will be using that to evaluate potential habitat changes. George Gilmour indicated that the Services will be looking for a Habitat Management Plan that identifies effects thresholds that would trigger different operational scenarios if reached.

Study 9.12 Fish Passage Barriers in the Middle and Upper Susitna River and Susitna Tributaries

The topic switched to the Fish Barriers Study and Kevin Petrone, of R2, introduced the study purpose and the objective of the meeting: review target species and criteria. He referred to the powerpoint posted on the AEA website that was updated from the one used to present these topics in March 2014.

The first point discussed was the target species. Kevin had indicated that AEA was not planning to include three of the agency recommended target species because they did not occur in the Upper River or Middle River. The agencies commented that AEA should reconsider Northern Pike as it is an invasive species and discussion ensued on the distribution of pike in the Susitna River. MaryLouise Keefe indicated that AEA would be addressing pike and their distribution and potential project effects during impact analysis but that since they are not present in the Middle River now, applying a physical model to Middle River habitats regarding pike barriers seemed premature. Matt Cutlip, of FERC, indicated that FERC had requested an assessment of the potential for project related temperature effects to influence pike and assured the group that this would need to be addressed in the license application and supporting documents. Some further discussion ensued about eulachon and Bering cisco. Sue Walker indicated that NMFS would be submitting a request for extending this study into the Lower River so that including these species would be appropriate at that point.

Kevin Petrone then moved on to presenting the different types of passage criteria proposed for the study. The discussion about the criteria centered on the number of exclusionary thresholds that would not allow for evaluation of partial barriers that affect only a portion of the population. Stormy Haught also noted that the thresholds looked high for Arctic lamprey and that ADF&G had some evidence that these fish were excluded at lower velocities (~5 ft/s) in a culvert study. MaryLouise Keefe indicated that absent data on Artic lamprey, the values were developed for Pacific lamprey. AEA also had some concerns and requested that ADF&G share the study discussed. Greg Ruggerone commented on the need to consider fish condition if evaluating burst speed. Jeff Davis suggested that AEA neededto add in the time-to-exhaustion when evaluating velocity criteria and the synergistic effects of velocity and gradient. MaryLouise asked for other criteria recommendations for AEA to consider if others knew of them and indicated AEA would take input after the meeting.

Jeff Davis mentioned the California Instream Flow approach was a reasonable one and that it relies on transects every meter. He suggested that AEA consider a regression approach like that used by CDFG using six observations of discharge and passable width. He asked if AEA would be doing additional surveys in 2015 to obtain such coverage. Kevin answered no, that all of the data had been collected but that AEA would be using the 2D model in Focus Areas so the coverage would be strong even if not every meter.

Kevin then introduced the topic of application of the criteria to the model outputs and Lyle Zevenbergen, of Tetra Tech provided a brief summary of the model to the team.

The meeting was adjourned at 4pm as scheduled.

Post-Meeting Clarification to Assertions Made During the Meeting

Remote line mapping data sources:

As noted in the minutes above, NMFS questioned the use of anything other than the 2012 video to develop the remote line map, and suggested that it was a change from the Revised Study Plan (RSP) to do so.

RSP Sections 9.9.5.4.1. and 9.9.5.4.2 describe the proposed method for remote mapping of the mainstem river and they provide for the use of aerial imagery, LiDAR and video. .

9.9.5.4.1 Upper River Mainstem

> *The Upper River will be mapped using hierarchically-nested habitat typing adapted to feasible identification levels based on the use of aerial still imagery, LiDAR, and aerial videography.*

9.9.5.4.2. Middle River Mainstem

The Middle River mainstem will be mapped in similar fashion to the Upper River. The hierarchical tiered classification system will be implemented to identify habitat from aerial still imagery, LiDAR, and aerial videography.

Macrohabitat definitions:

Jeff Davis asserted during the meeting that a Side Slough located in the western portion of FA-104 should have been designated as an Upland Slough because that particular slough had some vegetation at its upper end, and that according to his interpretation of the side slough definition, side sloughs do not have any vegetation at their upper end.

This interpretation is echoed in the dichotomous key he proposed where the distinction between the two slough types is as follows:

5a. Side Slough. Upstream end of channel separated from the mainstem by an unvegetated berm, substrate cobble to fine material often with fine/organic material overlying the stable substrate. Channel features can be formed by mainstem flow during high flow events where overtopping flows (typically at or near bankfull flows) create a riffle/pool bedform and deliver large woody debris

5b. Upland Slough. Upstream end of channel is separated from the mainstem by a well-established vegetated berm (shrubs), rarely receives mainstem flow, substrate predominantly fine material particularly near the lower mainstem confluence although may contain an underlying layer of coarse material. Beaver dams are common.

Portions of these definitions are inaccurate and inconsistent with the habitat defintions provided in the RSP, e.g. suggesting overtopping of Side Sloughs associated with bankfull flows when much lower flows (mean monthly flows during summer months) are related to overtopping of Side Sloughs; bankfull flows are more in line with what would result in overtopping of Upland Sloughs. AEA never adopted and has never used these definitions. AEA agrees with Sue Walker that there should be consistency in how habitat calls are made.

AEA has consistently applied the definitions of the various habitat types outlined in the RSP (Table 9.9-4). These definitions also appear in Table 1.1-1 of the ISR for Study 9.9. Even more detailed definitions are provided in the RSP for Study 8.5 (RSP Section 8.5.2.5). These definitions have been applied throughout the Characterization and Mapping of Aquatic Habitats Study and were reviewed during all training of field crews in coordination with the instream flow study to ensure consistency.

Side Sloughs typically have some vegetative cover that separates them from Main Channel or Side Channel areas, but there can be an exposed bar at the upstream end. Two important distinctions between the two slough types relate to 1) the types of vegetation found at the upstream ends of the sloughs – Side Sloughs have low lying vegetation (e.g. willows, sedges, grasses); Upland Sloughs have mature trees and densely vegetated areas; and 2) the frequency with which they are connected to the Main Channel – Side Slough connection occurs much more frequently, at flow levels roughly corresponding to mean monthly flows, versus connection of Upland Sloughs requires rare high flow events governed roughly by bank full elevations. Dudley Reiser mentioned during the call that he had been to the slough in question on multiple occasions and that there was some vegetation at the upper end but that that particular channel is breached relatively frequently by main channel flows which is consistent with the definition of a Side Slough.

The definitions below, excerpted from sections of the RSP, provide more information that distinguishes the slough types:

RSP Section 8.5.2.5 Study Area Selection

A second level of stratification was designated based on classifying riverine-related habitats of the Susitna River into six macro-habitat categories consisting of mainstem, side channel, side slough, upland slough, tributaries, and tributary mouths (Estes and Vincent-Lang 1984). The distribution and frequency of these habitats varied longitudinally within the river depending in large part on its confinement by adjoining floodplain areas, size, and gradient. The habitat types were described by ADF&G with respect to mainstem flow influence in the Susitna Hydroelectric Aquatic Studies Procedures Manual (ADF&G 1984) as follows, with additional clarification added here where considered appropriate:

***Mainstem habitat** consists of those portions of the Susitna River that normally convey stream flow throughout the year. Both single and multiple channel reaches are included in this habitat category. Groundwater and tributary inflows appear to be inconsequential contributors to the overall characteristics of mainstem habitat. Mainstem habitat is typically characterized by high water velocities and well-armored streambeds. Substrates generally consist of boulder- and cobble-size materials with interstitial spaces filled with a grout-like mixture of small gravels and glacial sands. Suspended sediment concentrations and turbidity are high during summer due to the influence of glacial meltwater. Stream flows recede in early fall and the mainstem clears appreciably in October. An ice cover forms on the river in late November or December.*

***Side channel habitat** consists of those portions of the Susitna River that normally convey stream flow during the open-water season but become appreciably dewatered during periods of low flow. Side channel habitat may exist either in well-defined overflow channels, or in poorly defined water courses flowing through partially submerged gravel bars and islands along the margins of the mainstem river. Side channel streambed elevations are typically lower than the mean monthly water surface elevations of the mainstem Susitna River observed during June, July, and August. Side channel habitats are characterized by shallower depths, lower velocities, and smaller streambed materials than the adjacent habitat of the mainstem river.*

***"Side" slough habitat** is located in spring- or tributary-fed overflow channels between the edge of the floodplain and the mainstem and side channels of the Susitna River and is usually separated from the mainstem and side channels by well-vegetated bars. An exposed alluvial berm often separates the head of the slough from mainstem or side channel flows. The controlling streambed/stream bank elevations at the upstream end of the side sloughs are slightly less than the water surface elevations of the mean monthly flows of the mainstem Susitna River observed for June, July, and August. At intermediate- and low-flow periods, the side sloughs convey clear water from small tributaries and/or upwelling groundwater (Estes et al.*

1981). These clear water inflows are essential contributors to the existence of this habitat type. The water surface elevation of the Susitna River generally causes a backwater to extend well up into the slough from its lower end (Estes et al. 1981). Even though this substantial backwater exists, the sloughs function hydraulically very much like small stream systems and several hundred feet of the slough channel often conveys water independent of mainstem backwater effects. At high flows the water surface elevation of the mainstem river is sufficient to overtop the upper end of the slough (Estes et al. 1981). Surface water temperatures in the side sloughs during summer months are principally a function of air temperature, solar radiation, and the temperature of the local runoff.

***"Upland" slough habitat** differs from the side slough habitat in that the upstream end of the slough is not interconnected with the surface waters of the mainstem Susitna River or its side channels at less than bankfull flows. The upstream end can be vegetated with mature trees, although a morphologic signature of a converging inlet and gravel levee closure can still be discerned. These sloughs are characterized by the presence of beaver dams and an accumulation of silt covering the substrate resulting from the absence of mainstem scouring flows. They are not truly "upland" in the geomorphic sense, but the use of this nomenclature in the 1980s studies reflects the observation that the understanding of floodplain and channel forming processes was in the early stage in fisheries, where some variation in interpretation existed over what constituted a floodplain versus an upland terrace (e.g., see Williams 1978). Essentially, the main distinguishing characteristic between a "side" slough and an "upland" slough was the level of high flow at which each was engaged.*

***Tributary habitat** consists of the full complement of hydraulic and morphologic conditions that occur in the tributaries. Their seasonal stream flow, sediment, and thermal regimes reflect the integration of the hydrology, geology, and climate of the tributary drainage. The physical attributes of tributary habitat are not dependent on mainstem conditions.*

***Tributary mouth habitat** extends from the uppermost point in the tributary influenced by mainstem Susitna River or slough backwater effects to the downstream extent of the tributary plume that extends into the mainstem Susitna River or slough (Estes et al. 1981).*

CDFG Protocol:

Jeff Davis stated during the Barriers discussion, when the California Department of Fish and Game (CDFG) method (2012) was described, that transects are to be placed every meter. The CDFG protocol does not indicate that transects are to be placed every meter. The CDFG protocol specifies the selection of one or more "critical riffles" and not a set number of transects.

Critical riffles are defined in the CDFG protocol as:

"shallow riffles which are particularly sensitive to changes in stream flow due to diminished water depth. Stream flow and associated water depth may limit the hydrologic connectivity of river habitats and impede critical life history tactics of salmon and trout. In such cases, the critical riffle may become a potential barrier to upstream and downstream passage for salmon and trout, which in turn may prevent adults from moving to and from spawning areas, prevent

> *smolts from migrating downstream to staging areas in brackish waters of lagoons and estuaries before the ocean, as well as prevent rearing juvenile salmonids (e.g., steelhead) from being able to move between adequate summer freshwater rearing habitats (CDFG 2012).*

CDFG, 2012, Critical Riffle Analysis for Fish Passage in California. California Department of Fish and Game Instream Flow Program Standard Operating Procedure DFG-IFP-001, 24 p. Available at: http://www.dfg.ca.gov/water/instream_flow_docs.html.