# SUSITNA-WATANA HYDRO

**Meeting Notes**
**Initial Study Report (ISR) Meetings**
**Ice Process (Study 7.05), Instream Flow (Study 8.05) Riparian Instream Flow (Study 8.06) and Riparian Vegetation Downstream of the Proposed Susitna-Watana Dam (Study 11.06)**
**March 24, 2016**

**LOCATION:** Cook Inlet Region Inc.
725 E Fireweed Ln
Anchorage, AK 99503

**TIME:** 8:30 am – 4:45 pm AKST

**SUBJECT:** ISR Meetings for Ice Process, Instream Flow, Riparian Instream Flow, Riparian Vegetation Downstream of the proposed Susitna-Watana Dam (RSP Sections 7.5, 8.5, 8.6, and 11.6)

**Goal:** To review variances, results, decision points, proposed modifications, steps to complete studies, and discuss licensing participants' comments on ISR materials

**Attendees:** **Betsy McGregor** AEA, **Bryan Carey** AEA, **Doug Ott** AEA, **Dan Smith** AEA, **Wayne Dyok** H2O EcoPower, **Julie Anderson** DMS, **Matt Love** VNF, **Steve Padula** McMillen Jacobs, **Kathryn Peltier** McMillen Jacobs, **Sydney Hamilton** ATD, **Sunny Morrison** ATD
**Bill Fullerton** Tetra Tech, **Lyle Zevenbergen** Tetra Tech, **Jon Zufelt** HDR, **Dudley Reiser** R2, **Phil Hilgert** R2, **Aaron Wells** ABR,
**David Turner** FERC, **Matt Cutlip** FERC, **Ken Hogan** FERC,
**Dirk Pedersen** Stillwater Sciences, **Fred Winchell** Louis Berger, **Tyler Rychener** Louis Berger, **Tim Ruga** AKRF, **Jay Stallman** Stillwater Sciences, **Matthew Burak** Louis Berger,
**Joe Klein** ADF&G, **Ron Benkert** ADF&G, **Marie Steele** DNR,
**Betsy McCracken** USFWS, **Douglass Cooper** USFWS, **Sue Walker** NMFS, **Sean Eagan** NMFS, **Jeanne Hanson** NMFS,
**Chris Holmquist-Johnson** USGS, **Hal Geiger** St. Hubert Research Group, **Jeff Davis** ARRI, **Jason Mouw** Floodplain Resources, **Jim Munter**, JA Munter Consulting, Inc.,
**Matthew LaCroix** EPA, **Cassie Thomas** National Park Service
**Becky Long** Susitna River Coalition, **Mike Wood** SRC,

**On Phone:** **Kate Machata** R2, **Mike Gagner** R2, **Laura Arendall** R2, **Kevin Fetherston** R2, **Bill Miller** Miller Ecological Consultants, **Terry Schick** ABR,
**Woohee Choi** FERC, **Monir Chowdhury** FERC,
**Dan Reichardt,** ADEC
**Bjorn Lake** NMFS**, Tom Meyer** NOAA**,**
**Greg Auble** USGS, **Leanne Hanson** USGS,
**Heide Lingenfelter** Ahtna, Inc., **Whitney Wolff** Talkeetna Community Council, **Jan Konigsberg**

Alaska Hydro Project, **Cameron Wobus** Stratus Consulting, **Sarah O'Neal** Fisheries Research and Consulting, **Bob Prucha** Integrated Hydro Systems

## Introduction

As part of the Federal Energy Regulatory Commission's (FERC) Integrated Licensing Process (ILP), Alaska Energy Authority (AEA) is required to hold meetings with licensing participants and FERC to discuss the study results and AEA's plans to modify the Study Plan as outlined in the Initial Study Report (ISR). The ISR Parts A, B, and C for each study were filed with the FERC on June 3, 2014. For many studies, additional information was filed in technical memoranda September through December 2014. In the fall of 2015, Study Implementation Reports (SIR) and Study Completion Reports (SCR) were filed with FERC to report on the status or in some cases completion of studies since the previous ISR filings. ISR Part D, filed on November 6, 2015, provided a "roadmap" of the various components of each study, updates to the study progress, variances, modifications, and steps to complete the study. The ISR Meetings were held in Anchorage over five days, March 22, 23, 25, 29 and 30, 2016, covering the 58 FERC-approved Study Plans for the Susitna-Watana Project.

The following meeting notes are for the March 24, 2016 meeting and intended to capture any significant discussion/information in addition to the materials provided on the Project website (http://www.susitna-watanahydro.org/). The meeting agenda and presentations are available under the "previous meetings" tab (link provided under the meetings tab) on the Project website.

After introductions, Steve Padula, McMillen Jacobs, presented a brief overview of the history of major filings and milestones of the Project and an updated FERC schedule. AEA will file the ISR Meeting Summary April 24, 2016. Licensing participants file requests for modifications to the existing Study Plan or requests for new studies June 23, 2016. Steve reviewed the regulatory requirements for requesting a study plan modification to an existing study or a new study, and made reference to the poster boards in the room. AEA and other licensing participants file responses to the requests August 22, 2016. FERC will make its study plan determination on the meeting summaries and any disagreements or recommendations for modified or new studies by October 21, 2016. These details are in the "Introduction to ISR Meetings" presentation.

## 7.6 Ice Processes in the Susitna River Study

Jon Zufelt, HDR, provided an overview of the objectives, components, variances, modifications, and a summary of the results. In addition to the June 2014 ISR, a tech memo describing detailed ice observations between October 2013 and May 2014 was filed with FERC September 17, 2014. The SIR filed with FERC November 2015 provides a visualization of the ice progression observed in the Susitna River and River 1D and River 2D model calibration during the open-water period. Completed tasks include: literature review of the existing cold region hydropower project operations and effects and model capabilities; documentation of freeze-up and break-up 2012-2014; and assessment of operational effects on the Lower River. The modeling is ongoing.

In the ISR Part D, AEA had proposed three modifications. Changes to the location or use of time lapse cameras is no longer considered a modification to the Study Plan (Slide 9). Rather than having a time lapse camera at FA-151 (Portage Creek), a remote telemetered camera was installed near the mouth of Portage Creek. Watana dam site ice conditions were obtained through aerial video flights during freeze-up, the open lead surveys, and breakup rather than through time lapse cameras. Since the documentation of the timing, progression, and physical processes of

freeze-up and break-up is complete, the modifications in ISR Part D, Section 7.1 are now considered variances. The proposed modification to develop an alternate visualization of freeze-up progression and open lead survey data was completed and provided in the SIR Appendix A. AEA proposes to modify the Study Plan by taking additional field measurements of ice thickness, snow depth, and water surface elevation at FA-128 (Slough 8A) to assist in calibration of the River 1D and 2D models.

In response to a question on the ice modeling schedule, data such as open leads and ice thickness has been collected over a number of years. The one dimensional model is being calibrated over the last major year of data collection. Calibration of the ice model has taken longer than anticipated. The modelers believe that the existing data is sufficient. However, AEA would collect more data if it becomes necessary to refine the 1-D model.

Ice processes appear to have changed little from the 1980s. For example, the open thermal and velocity leads are similar to what was observed in the 1980s, both in numbers and location.

Sue Walker, NMFS, asked how the channel will change in the ice free zone downstream of Watana dam, including vegetative changes. These are actually effects that will come from the geomorphic and riparian vegetation models, not the ice model. The ice model will identify the effects of ice progression and ice reduction downstream of Watana dam. Warmer winter water temperatures will result in an ice free zone downstream of Watana dam. AEA's consultants are coordinating their efforts. The ice modelers are providing information to the riparian vegetation modelers about where the ice will be downstream of the dam. For example, at Project River Mile 112, with a reduced supply of ice, the model will assess progression timing, ice jam length and thickness, and associated water levels such that Study 11.6 could assess impacts to vegetation.

To address ice in the side channels and sloughs, inferences may need to be made in terms of water levels. Locations like FA-173, which is now mostly dry in winter, may be different in the future.

In response to a question (Matt LaCroix, EPA), the 1-D model will address water levels and shorefast ice. This information will be used to make changes in the 2-D model for the Focus Areas. In looking at other hydro projects in northern climates like Idaho Falls, there is less collapse of the ice cover than what might be expected. Large changes in flow are needed to accomplish that. The model balances dynamic forces and can predict water elevations. Ice shear is built into the model to determine where failure will occur.

Dan Healy, NHC, and a consultant for the Services, noted that ice front progression plots by season may be useful to compare modeled and actual conditions. He cautioned against using just models to assess Project effects as models have limitations. He recommended a strategy for extending the results of the model, including adding in observations. The ice modeling is a state of the art. At this time, the model can only prescribe the location of initiation of an ice cover or a jam location. Border ice is not a process that can be simulated. He asked about strategies for dealing with the ice modeling limitations and for meeting other modeling needs.

Preliminary model observations during different freeze-up flows (e.g., 5,000 cfs in the main channel and then a lower discharge two days later) indicate the FA-128 side slough with a static (smooth) ice cover and a velocity of about 2 fps. With a Manning's n of 0.02, ice was about one foot thick. AEA is using observations to improve the 1-D and 2-D model results.

Jon Zufelt, HDR, responded to a question about whether the 1-D model can model the full ice-affected period by stating that the model is broken into separate models to model ice processes. These are cool down, ice production,

freeze-up, mid-winter, and break up. The ice cover apparently is on the bed in many places with conduits of flow through the ice fields. The modelers are trying to correctly model the water levels with the 1-D model.

In break up there is some melt, but as flow increases the cover moves up and overflow results. When the ice is lifted off the bed, it just all fails and goes downstream. The situation is very different from what happens on the Peace River in Canada. Break up may go in pieces or like it did in 2013. This will be a test for the model for post-Project effects. There are less large dynamics to model in post-project conditions.

For existing conditions, AEA has a better handle on freeze-up. During winter ice sits on the bed. For operational scenarios, data will be gleaned from existing conditions to determine what will happen over the course of a day.

Modeling existing conditions is challenging because the amount of ice coming down the river is unknown. Only visual information is available. For operational it may be easier to estimate as the open water and water temperature are starting points.

Dan Healy, NHC, had no issue with the model not being able to continuously simulate a season, but thought that for post-Project conditions it would be preferable to simulate a continuous condition. He suggested using the natural channel geometry and asked if there was value in considering another tool.

It was noted that if all the flow passes through a deep spot, shear stress may not be truly represented. Since there are cross sections with wide shallow sections, during lower flows (e.g., 1000 feet wide and one foot deep) ice thickness calculations may not work. Those issues will be addressed during the calibration process.

Since there is some expectation of model uncertainty, Dan Healy, NHC, suggested considering tools like HEC-RAS that are well known. He questioned if proposing strategies for managing study results are study plan modifications. Jon Zufelt, HDR, responded that what the model can and cannot do are understood and that expertise must be applied and inferences drawn. Jon Zufelt also noted that he looks at HEC-RAS to see if the ice will jam.

Sean Eagan, NMFS, said he liked the visualization plots showing the ice front. During mid-winter Sean has observed jumble ice at PRM 138 that is 8 feet thick, whereas ice in the slough was smooth and six inches thick. During the mid-winter, the jam may form multiple times, backing up water four to five feet for a few hours. He asked if the model would be able to address these variable processes, if there will be more or less jams and will they stay in place for longer or shorter periods post-Project. The model will be able to respond to discharge changes during break up, including where break up will occur and how severe it will be. In mid-winter the ice does ground, so it may be necessary to deal with grounded ice in a partial sense.

Jim Munter, JA Munter Consulting, asked if the Project could increase icing significantly in certain places if water flows over top of the ice cover, whereas during the existing conditions, ice generation is protected by the ice cover. Jon Zufelt, HDR, indicated that at temperatures about 20 F, some ice would be generated at the upstream end of the cover. With flow increases, the ice cover will rise with some water moving along the shore cracks. As flow decreases, ice will set back on the bed. With temperatures of 30 below F, lots of frazil ice will be generated at low discharges, then as the discharge increases, the ice will compress and thicken. As flow decreases, the extent of the cover may behave like an accordion.

Jon Zufelt, HDR, acknowledged that the model does not incorporate snowfall.

Sue Walker, NMFS, commented that she had the opportunity to spend 5 days at PRM 138 and observed miles and miles of open leads. She postulated that this might be more like post-Project conditions. She suggested that the jumbled ice might be a proxy for post-Project conditions where ice forms and consolidates. She noted that this was a concern raised in the 1980s.

Jon Zufelt, HDR, indicated that field crews were out at PRM 104 and 128 a few weeks earlier. He observed that it is possible to get warm ups and have water on ice. Flow variations this winter were not as great as what will occur under Project operations. In the 2013 freeze up temperatures were initially cold. Then air temperatures warmed up. It took time for the ice cover to reach Gold Creek. Jon Zufelt agreed that there is a potential for greater ice during Project operations locally in some locations, but overall, there will be less ice in the in the Middle River. There may be 20 to 30 miles of open water below the dam. Gold Creek to Currie may see the most significant changes. This will be confirmed when various operating scenarios are modeled.

Jeff Davis, ARRI, commented that the resolution of the model would be low. This is the time period for salmon eggs and juvenile rearing. He asked how this would be modeled in the instream flow study and suggested different alternatives should be pursued. The 1-D model will describe trends but will not be able to evaluate velocities in every 10 feet of river and lateral habitats. The 2-D model which will occur in the Focus Areas will provide a better idea of the potential for velocities and ice thicknesses and what effects those have.

Jeff Davis, ARRI, recommended that AEA undertake an intensive winter study to identify the location of fish during the winter and important habitats.

Matt LaCroix, USEPA, indicated that he liked the visualization of the ice progression, and followed up with a question regarding the cause of the independent ice cover initiation at various locations. Jon Zufelt, HDR, responded that they occurred at geometric hydraulic constrictions, locations where ice is expected to stop moving. Jon Zufelt was able to identify these areas using maps prior to going in the field and they were verified in the field. There is enough information known at these locations to be able to model. AEA has velocity, depth, width, and frazil ice concentration information. That information is used to determine shear Froude number, along with rules of thumb to undertake the modeling.

Mike Wood, SRC, thought that AEA may need a different tool. From his perspective modeling break up conditions is near impossible. He is waiting to see the models for freeze up and winter. He has personally observed that at 30 below F there is lots of overflow. It is important to understand what happens naturally. In 2012, there was a huge flood. Fish were not in Whiskers Slough. He thought that fish were pushed into upland areas. He thought that during break up fish were able to get back in the system. Mike added that ice jamming in the fall is the reverse of spring break up. He wondered what would happen to the river with the Project if there isn't any break up or flooding.

Regarding Dan Healy's, NHC, question, the severity and frequency of ice jams with and without the dam, AEA will be able to look at the extent of jamming with the Project. If there is a controlled discharge, it should be possible to look at effects at other locations.

Sean Eagan, NMFS, asked if the processes in the middle of the winter create significant incision or aggradation or if these processes occur at the surface and the bottom of the main channel remains the same. The bed characteristics do not seem to change within the main channel of the Middle Susitna River.

Jan Konigsberg, Alaska Hydro Project, asked if the Susitna River ice processes affects ice formation and jamming processes in the major tributaries (e.g., Chulitna, Talkeetna, and Yentna rivers). There may be impacts right at the confluences of the Chulitna, Talkeetna and Susitna Rivers only because of the higher mid-winter discharge. So there may be higher water elevation at the mouths of the Talkeetna or the Chulitna. It is possible for a change in progressions, based on progression past Talkeetna. Otherwise, Jon Zufelt, HDR, does not see how the ice processes within those tributaries would be affected. Further downstream in the Lower River by the Yentna, there will be no impact from the dam at all. Jon added that there are probably some tributaries in the Middle River that may have some changes at their confluences, especially where there would be open water conditions with-Project, such as Portage Creek possibly. He noted that many of the tributaries where this change in the mainstem Susitna would occur are fairly steep and the impacts on their ice processes from the Susitna are probably non-detectable. Jan commented that this is not part of the study objective.

Betsy McCracken, USFWS, asked about ice on the Project reservoir, noting that since there will be increased deposition at the head of the reservoir, there is a fish passage concern during the winter. AEA noted that reservoir ice is being addressed through the EFDC water quality model. Regardless of load following operations, the overall reservoir elevation will slowly decrease over the course of the winter. AEA will be looking at water level and ice changes over the winter. Biologists can then use this information to assess if there are fish passage concerns.

Mike Wood, SRC, reiterated that ice in the reservoir is important, particularly how it affects habitat. He also asked about ice effects on turbines at other northern projects. AEA does not see this as a problem at Susitna-Watana because water will not be supercooled when it passes through the turbines.

### 8.5 Fish and Aquatics Instream Flow Study

Dudley Reiser, R2, and Phil Hilgert, R2, provided an overview of the study status, variances, results, proposed modifications, and steps to complete the study as explained in the SIR and ISR Part D.

AEA proposes 5 modifications to the Study Plan (Slides 26 and 27): 1) three instead of five representative years to represent wet/warm (1981), average (1985), and dry/cool (1976) conditions because there is not enough distinction to include warm and cold Pacific Decadal Oscillations; 2) final IHA and EFC metrics will be developed after the Open-water Flow Routing Model is finalized; 3) use of MWH-ROM reservoir operations model to forecast reservoir outflows instead of HEC-ResSim; 4) defer LR-2 field studies (near PRM 67) to the next study year; 5) defer finalizing and describing the final approaches for both the temporal and spatial analysis to the next study year.

Jason Mouw, FRC, questioned how the mesohabitat was accounted for in designing the Habitat Suitability Criteria (HSC) study. He expressed concern that the distribution of habitat was not considered in structuring the surveys and that data validity could be affected. Further he did not see the hierarchical habitat model carried through. For example when assessing spawning habitat availability he did not see a comparison to what habitat was available. R2 explained that habitats were used for selection, but that macrohabitats rather than mesohabitats were used to develop a stratified random sampling approach as described in the reports. In addition, fish distribution data was considered as well to ensure that data was collected where fish actually occurred to be able to identify what microhabitat features were important. During the study planning process, it was determined that macrohabitats

would provide a good representation of habitat. R2 also clarified that in addition to collecting HSC measurements in association with fish observations, habitat measurements were also taken at areas without observed fish to assess habitat availability.

In response to a question on whether the field study considered measuring areas a specific distance upstream and downstream of the observed clusters of spawning salmon, R2 said that extra measurements were not taken upstream or downstream, but there are a number of habitat measurements at sites with no spawning or rearing. However, R2's analysis in the ISR did not include analysis of those habitats that were not used. The field crews attempted to obtain as many observations as they could. Further there is a significant amount of variability in groundwater within 50 to 100 meters of the site. More groundwater data, and groundwater modeling results may become available, allowing expansion outside of the sampling sites.

Hal Geiger, St. Hubert Research Group, suggested that a separate Technical Team meeting be conducted to address questions about the mathematical equations used to describe the HSC model development (Study 8.5, SIR, Appendix D, Habitat Suitability Criteria Development, Section 5.6.1.2 Multivariate Analysis). If possible, the meeting should be held before April 20. Hal Geiger proposed guiding principles. Are the estimates supported by the data? Are the estimates appropriate for their intended use? He also suggested the following approach:

1. A conceptual model
2. How the data are taken and turned into estimates
3. A report on the estimates with standard error
4. Proof the modeling worked

AEA agreed to meet to discuss the modeling approach used to develop HSC; depending on the availability of all parties, the meeting would be scheduled before FERC's filing deadlines, if possible. NMFS expressed concern that they were being asked to make decisions on data that is incomplete.

The USFWS requested the HSC data from the filed reports. It was noted that this data was posted to the Project website in support of the SIR filed November 2015.

In response to a question on upwelling and downwelling, R2 offered that upwelling often cannot be seen. Strong upwelling may be seen or detected by water temperature, but R2 used piezometers to measure upwelling rather than relying on surficial observations. Three to five measurements per site were made to detect upwelling or downwelling. These vertical hydraulic gradient (VHG) measurements were taken near the majority of HSC salmon spawning redds. While most of the chum salmon redds were observed in association with positive VHG measurements, neutral or negative VHG measurements were taken at many other chum salmon redds. A relationship between upwelling and chum salmon spawning was expected, but the VHG data suggested the relationship was not as strong as initially expected. The relationship between groundwater and salmon spawning will continue to be evaluated as additional groundwater modeling data becomes available.

Jason Mouw, FRC, noted that exchanges at the floodplain and channel scale can be important and that he was happy to see some data in clusters, but he commented that it is important to know what is happening outside the clusters. He also noted that depth and velocity do not fall out as the most important for spawning, and that a water quality gradient, mostly temperature, can be more important. Mike Gagner agreed and said he looked forward to looking at the groundwater data that has been collected.

Chris Holmquist-Johnson, USGS, asked if velocity can be predicted under the ice. He noted that modeling comes down to habitat specific variables. He expressed concern about the modeling of future conditions. For example, temperature and dissolved oxygen may not be significant under existing conditions, but may become significant under Project operations (e.g., can Slough 8A water quality be predicted?). He recommended a pilot study to produce actual fish habitat metrics at one Focus Area to help identify whether or not those physical parameters can be predicted under the various operational scenarios. Although the 2013 Modelers meeting and the April 2014 Proof of Concept (POC) meeting were beneficial, AEA now has additional data and modeling results that could be presented as a pilot study to determine which habitat metrics can be effectively modeled to evaluate Project effects. Chris noted that such a study may be important to ascertain if additional data might need to be collected.

In response to a scheduling question from FERC, AEA said that model results for existing conditions and at least one operations scenario would be included in the Updated Study Report. The draft license application will address alternative operating scenarios.

Jason Mouw, FRC, asked if AEA can develop separate HSC models for the main channel, side channels, upland sloughs, etc. He expressed concern about differentiating between a glacier mainstem and an upland slough. He postulated that fish might have different spawning and rearing strategies for these habitats. AEA has collected physical data (e.g., depth, velocity, substrate, temperature, VHG) at HSC spawning and rearing sites over a range of macrohabitats following a stratified random sampling approach and consistent with the study plan. They collected physical data at areas identified for measurement even though target fish species were not observed at those sites. This process provided a large pool of data over all macrohabitat types. AEA will be looking at the attributes of fish use and availability over the range of habitat types but is not intending to develop HSC on a macrohabitat scale.

Hal Geiger, St. Hubert Research Group, noted that the most important variable for spawning is upwelling, although page 36 in AEA's report shows depth and velocity as variables. He asked if AEA has captured a proxy for the most important variable – upwelling? R2 responded that while the majority of measured salmon spawning sites were associated with upwelling, a large proportion (about 32 percent) of salmon spawning sites had neutral or downwelling, as detected using micro-piezometers. VHG, dissolved oxygen (DO) and other factors have been examined and AEA has looked at the factors on a site-specific basis, including how strongly spawning salmon are associated with upwelling. In comparison, the 1980s modeling effort used a binary approach. If there was no upwelling, it was assumed that the site was not suitable for salmon spawning. The recent field measurements suggest it is more complicated than that. While VHG is being used as a measure of upwelling, once results from the groundwater model are available, AEA will have information to supplement the VHG data.

Jim Munter, JA Munter Consulting, Inc., recommended that AEA consider a refined node size in the groundwater model in areas where there is upwelling and field data. He added that VHG is not necessarily a reliable indicator of upwelling flux; VHG may be dependent on river stage. Jim thought that during high flows there could be downwelling and then in winter upwelling and it could be neutral at other times. Dudley Reiser, R2, indicated that they are coordinating with the groundwater modelers and looking at the data to see if there are temporal patterns.

There was further discussion on groundwater. Jason Mouw, FRC, spoke to lateral gradients, thermal character, and periodicity, and expressed concern that there could be complicated in different macrohabitat types (e.g., main channel and off channel). He cited Alaska based literature.

Matt Cutlip, FERC, asked if the completed, calibrated model results will be presented in the USR? Phil Hilgert, R2, responded that the USR will include the modeling results for existing conditions and one operating scenario. The analysis of alternate operating scenarios will be in the draft license application.

Mike Wood, SRC, provided two observations. Spawning fish are shy and discrete, making it difficult to observe them. During breakup, he has observed juvenile fish rearing in upland sloughs beyond the main channel and may depend on overland flow during spring break up to rejoin the mainstem river.

Jeff Davis, ARRI, stated that the microhabitat tech memo did not cover the topic as well as he would have liked. He recommended the following study modifications. He suggested that juvenile Chinook and coho salmon be evaluated as separate species/lifestages rather than combined into a juvenile salmon rearing lifestage. Juvenile coho can withstand lower DO levels relative to other species and separating Chinook from coho will allow potential lifestage and species-specific responses to dissolved oxygen levels to be incorporated. AEA should reconsider its equation that juvenile salmon increase with increasing DO.

Since fish use the off channel habitats in winter (e.g., Slough 8a), Jeff Davis, ARRI, asked about the pressure logger data collection frequency. There is concern that water levels can change quickly in these habitats. AEA confirmed that the data loggers record pressure data every 15 minutes.

Although biological sampling was conducted in February, March, and April 2013 and 2014, Jeff Davis, ARRI, recommended sampling in January and February since he has observed changes by mid-March when areas of the river begin to open up. By then Chinook are starting to move around. Thus, it is important to sample under the ice using cameras or other techniques. Sue Walker, NMFS, also recommended sampling occur under ice.

Sue Walker, NMFS, noted that they had funded ARRI to do a 4-year winter juvenile salmon study. NMFS offered to provide this information to AEA. She added that video or minnow traps were more effective than sampling in open water. NMFS will provide their comments on AEA's winter report. R2 responded that they look forward to seeing the NMFS' data and integrating them with the 2012/13 and 2013/14 winter studies.

Jan Konigsberg, Alaska Hydro Project, asked if the Talkeetna and Chulitna River ice processes are affected by Susitna River ice process. If so, it is important to understand how those systems operate

In response to a question from Chris Holmquist-Johnson, Phil Hilgert, R2, stated that licensing participants should comment on the calibration details for the open water model version 2.8. Comments on preliminary operational runs are premature at this time. Study results including fish habitat metrics for Existing Conditions and one operating scenario will be provided in the USR; an analysis of alternate operating scenarios will be presented in the Draft License Application.

Action Items

8.5-1. SIR Study 8.5 Appendix D Figures 5.6-1 through 5.6-25 were compromised as Appendix D was loaded onto the public website at http://www.susitna-watanahydro.org/type/documents/; the Appendix D file was updated with correct figures on 3/25/2016.

8.5-2. AEA agreed to meet to discuss the modeling approach used to develop HSC; depending on the availability of all parties, the meeting would be scheduled before FERC's filing deadlines, if possible. Following the meeting, it was determined that the Services' and AEA's contractors would not all be available to meet prior to the filing the ISR

Meeting Summary. AEA provided documentation of the HSC modeling approach on April 5, 2016. The Services' contractor, Hal Geiger, St. Hubert Research Group, provided questions/comments to AEA on April 15, 2016. AEA is in the process of responding to the comments and will follow-up with Hal during the week of April 25, 2016.

8.5-3. The USFWS requested the HSC data from the filed reports. AEA confirmed that the HSC data presented in SIR Appendix D was posted to the GINA project website October 30, 2015 in support of the SIR filed November 2015. It can be found at the following link:

http://gis.suhydro.org/SIR/08-Instream_Flow/8.5-Fish_and_Aquatics_Instream_Flow/SIR_8_5_Appendix_D_Habitat_Suitability_Criteria/

**8.6 Riparian Instream Flow Study**

Kevin Fetherston, R2 Resources, summarized the status, objectives, components, variances, results, proposed modifications, and steps to complete the riparian instream flow study. During his remarks, Kevin noted that a second field season is proposed for seed dispersal to link peak seed release to local climate and discharge records. AEA has completed the three year willow-poplar establishment and seedling survival field surveys.

AEA proposes two modifications to the Study Plan (Slide 24). For the seedling establishment and recruitment portion of the study, AEA will quantitatively characterize where and how Balsam poplar clonal establishment and recruitment is occurring. Transect sampling at select Focus Area mid-channel islands and lateral floodplain margins will be determined in the field. Secondly, a second year of sap-flow and stomatal conductance evapotranspiration (ET) measurements will not be conducted. This was agreed to during an April 2014 Technical Work Group meeting because the Susitna Valley region is not precipitation limited. ET modeling will use the results of the 2013-2014 measurements. Greg Auble, USGS, concurred with de-emphasizing evapotranspiration measurements. He did not anticipate that the ground water modelers would use that information.

In response to a question from Greg Auble, USGS, Kevin Fetherston, R2, affirmed that overwinter mortality of seedlings can be estimated. This is the biggest driver for vegetation establishment. Additionally Kevin clarified that more than just the first year of establishment is being measured.

Greg Auble, USGS, commented on the amount of sampling the ground water/surface water regime remains to be done. That information is needed to assess project impacts. He asked what combinations will drive the ground water part of the data set. AEA has made a note of vegetative sampling relationship to groundwater. Is vegetation directly influencing ground water which in turn is feeding vegetation? In addition to having this information for FA-128, AEA will have this information along transects for FA-115 and FA-104.

Tyler Rychener, Louis Berger, asked about the timing of the next set of vegetation measurements. He thought that collecting data along transects perpendicular to well transects would entail collecting a lot of data. Kevin Fetherston, R2, agreed that there is more vegetation data to be collected and the current status of removing the wells is unknown. AEA noted that removal of the groundwater wells will be deferred to 2017 or beyond. (AEA intends to remove equipment related to the Instream Flow Study in 2016.) AEA believes it will be able to establish a relationship between the groundwater well data and vegetation.

Jim Munter, JA Munter Consulting, Inc., asked if soil moisture data was being collected above the water table. After Kevin Fetherston, R2, replied that capillary fringe data was being collected, Jim asked if data were being collected

above that since the capillary fringe generally does not extend to the water table. AEA has made soil moisture measurements at weather station locations down to 1.5 meters at FA-128 and FA-104.

Matt LaCroix, USEPA, asked about ice effects on vegetation. Is it fair to characterize ice as a subcomponent to the vegetation domain? What is the role that ice plays in affecting vegetation? Kevin Fetherston, R2, responded that ice affects the distribution of vegetation in the floodplain. Balsam poplar is the dominant tree on fresh gravel deposits. In fall 2012, the 78,000 cfs Gold Creek flood flow was below the elevation where cottonwood were growing. This suggests that ice processes affect vegetation. During the 2013 dramatic ice dam formation and jamming, there were fresh deposits of sediment above the floodplain. There is evidence of active ice dam sedimentation in the floodplain. Further AEA has made direct ice scar measurements. Ice shearing is evident on mid-channel islands, maintaining the islands in early successional states. River breakup effects are the primary processes that control the distribution of poplar on the islands and along the channel margins. The tree ice scars can be used on a map to differentiate between open water flooding and ice effects. Kevin postulated that ice scar information from about 300 trees would be sufficient to develop a frequency distribution. Greg Auble, USGS, stressed the importance of obtaining the ice scar data.

Mike Wood, SRC, commented that these were good observations that were well explained.

Jim Munter, JA Munter Consulting, Inc., asked about floodplain stratigraphy (deposits and stratification). He suggested that the floodplain was a semi-confined aquifer. He noted there were not a lot of backhoe pits and that observations of deposits were needed. He thought that inferences from these observations could feed into the conceptual model within the Middle River corridor.

Kevin Fetherston, R2, noted that AEA has collected sediment cores from 60 centimeters to 1.25 meters. These data provide information on sedimentation geochronology. AEA also has obtained detailed soil samples with several hundred soil plots. Jim Munter, JA Munter Consulting, Inc., thought that was excellent. Aaron Wells, ABR, commented that the soil survey detailed the stratigraphy to a depth up to 1.5 meters. In addition, there are several hundred plots distributed throughout the Middle and Lower River for which predominant texture data down to 50 centimeters was gathered. Kevin Fetherston, R2, added that all the data is in a database.

### 11.6 Riparian Vegetation Study Downstream of the Proposed Susitna – Watana Dam

Aaron Wells, ABR, summarized the status, objectives, components, variances, results, proposed modifications, and steps to complete the riparian vegetation study. AEA proposes two modifications to the Study Plan (Slides 23 and 24). For ELS plots the spacing interval for the point-intercept vegetation sampling locations along transect lines was increased from 0.5 meters to 1 meter. Secondly, AEA will conduct additional sampling of rapid vegetation transects (RVTs) to be established in three Focus Areas and one satellite area in the Middle River and along four riparian transects in the Lower River where there are groundwater/surface water transects and groundwater wells. Detailed RVT methods are provided in Appendix A of the SIR.

Aaron Wells, ABR, responded to Matt LaCroix's, USEPA, question that the riparian wetlands observed are predominantly composed of organic soils materials in the upper 50 cm and are primarily found in the Lower River. Aaron noted that in the wetlands observed in the Middle and Upper River, groundwater is creeping in from uphill areas particularly along the periphery of the valley bottom. Matt LaCroix suggested that hydrology of the riparian areas could be maintained by flooding of the overbank, such as by beaver dams. In response Aaron said that beaver dams were mapped in parallel with the riparian vegetation mapping.

Matt LaCroix, USEPA, asked if beaver dams are associated with process domains. In the Middle River, there are lateral wetlands in the vicinity of the beaver dams. In the Lower River, the wetlands are outside of the predominant flood zone; floodplains are wider with more beaver dams present. Accordingly the effect of beaver dams is greater there. There are geographic areas of the valley bottom in which beavers play a large role and geographic areas where they do not. Kevin Fetherston, R2, noted that was something that could be put in as a variable. There could be geographical areas where beaver dams play a large role. AEA can consider the role beaver dams play in the process domain. Beavers are common where water comes off the hillside. However the larger process domain is largely driven by ice. Beavers might be a sub domain.

Greg Auble, USGS, asked about the 30-mile or so reach downstream of Watana dam that would no longer be affected by ice. Kevin Fetherston, R2, responded that AEA will describe the ice free reach and what will happen to the shoreline vegetation. The AEA vegetation team will work with the geomorphic team to understand the changes in this reach and then predict Project effects. Kevin added that the plan is to delineate existing conditions under the current regimes and identify where the various processes are dominant. Once a determination of the post-Project areal distribution is made, AEA will be able to predict areas of vegetation change through the riparian instream flow model.

For the rapid vegetation transects, Greg Auble, USGS, asked if one or more field seasons will be required. Aaron Wells, ABR, responded that the plan is to complete that effort in one field season.

Matt LaCroix, USEPA, encouraged linking vegetative community mapping with process domains. He thought that Project effects might make the Middle River more suitable for beaver habitat. He added that early succession linking should not necessarily be put in as a process, but more of a second tier as part of the analysis. Kevin Fetherston, R2, agreed that this would be a subset of the analysis. Aaron Wells, ABR, added that the vegetation team would work with the wildlife team to assess the impact of potential Project-related changes in riparian vegetation on wildlife.

Jim Munter, JA Munter Consulting, Inc., mentioned that beaver dams can raise water tables in floodplains. He asked how the analysis would proceed downstream of the Three Rivers confluence. Aaron Wells, ABR, explained that this was covered in the October 2014 ISR Meeting. Using data from groundwater wells, groundwater/surface water relationships will be developed and compared to the detailed case studies at FA-104, FA-115 and FA-128. AEA will examine the results of the groundwater/surface water modeling and then use the riparian instream flow model for open water conditions. AEA would assess stage and frequency changes to evaluate the significance of Project effects. Dudley Reiser, R2, added that there are still five wells in the Lower River.

Jim Munter, JA Munter Consulting, Inc., postulated that there may be a need to build a new groundwater model in the Lower River because the lower river is so different from the Middle River. Jim recommended rethinking how to undertake this analysis if the groundwater model is not useful. He thought there could be a reduction in the water table in the Lower River. He stressed the importance of this topic.

**March 24, 2016 Meeting Recap**

Betsy McGregor, AEA, thanked the Cook Inlet Region, Inc. for their generous hospitality in hosting the past three days of meetings. She also thanked the attendees for being prepared to discuss the various meeting topics.

Betsy McGregor, AEA, stated that AEA will include a baseline and analysis of at least one operating scenario on the Updated Study Report for the riverine modeling studies. The license application will include an assessment of

operational scenarios. She added that AEA intends to follow up with various questions that arose during the course of the meetings. Action items will be posted on AEA's website. The meeting transcripts will be filed as is. To the extent possible, areas of agreement will be incorporated into the meeting summary. She encouraged stakeholders to consider the presentations as they contain the most current information and clarification of AEA's proposed modifications to the Study Plans.