SUSITNA-WATANA HYDRO

Meeting Notes
Riparian IFS: Riparian / Riverine Modeling
Technical Team Meeting
April 29-30, 2014

LOCATION: **Anchorage AEA Offices**

TIMES: **April 29, 8:30-4:30 pm AKST**
April 30, 8:30-4:00 pm AKST

SUBJECT: **Riparian IFS Modeling, Metric Development & Study Integration**

GOAL: ***Similar to the November IFS-TT meeting, this Riparian IFS-TT meeting is intended to (1) provide a forum to review and discuss various riparian / riverine-related modeling and study integration efforts, and (2) present and discuss proposed metrics. The overall goal of the meeting is to seek, in a smaller work group format, input from participants regarding the models that are being developed and how these models will be used to address riparian specific questions and issues pertaining to project operations.***

ATTENDEES:
Kevin Fetherston R2, **Greg Auble** USGS, **Bill Fullerton** Tetra Tech, **Bob Henszey** USFWS, **John Zufelt** HDR, **Michael Lilly** GW Scientific, **Michael Mazzacavallo** R2, **Aaron Wells** ABR, **Colin Kikuchi** USGS, **Terry Schick** ABR (Day 2), **Martin Bozeman** AEA, **Gary VanDerVans** NHC, **Melissa Hill** ADNR, Lori Verbrugge USFWS (Day 2), **Justin Crowther** AEA

ON PHONE: Kate Knox R2, **Dudley Reiser** R2, **Mike Harvey** Tetra Tech, **Becky Long** Susitna River Coalition, **Dara Glass** CIRI (Day 1), **Stuart Beck** R2, **Jose Vasquez** NHC, **Sharon Cramer** HT Harvey, **Lyle Zevenbergen** Tetra Tech, **Tyler Rychener** Lewis Berger Group (FERC contractor), **Hal Shepard** Center for Water Advocacy, **Chris Holmquist-Johnson** USGS, **Dan Healy** NW Hydr. Consultants (Day 2), **Steve Ertman** HDR (Day 2), **Laura Noland** Environ

This two day modelers meeting provided a forum to discuss the Riparian IFS (Study 8.6) modeling efforts and the integration of related models and study components. Licensing participants were encouraged to request clarification concerning modeling approaches being pursued by AEA and its consultants. Clarification requests or suggested changes after this meeting are to be communicated to Betsy McGregor at BMcGregor@aidea.org.

All data provided in the meeting materials and discussed throughout the meeting are preliminary and have not been fully QA/QC'd. This included the model results which were provided as examples only and were based on models that were in the initial stages of development. The model results should not be cited or used in any way to describe Project effects. The following meeting notes are intended to capture major discussion points, and questions and comments raised, in addition to the presentation materials provided on the Project website (http://www.susitna- watanahydro.org/). The meeting agenda and meeting materials including the presentations given by the different model leads are

available under the "Past Meetings" tab (link provided under the "Meetings" tab) on the Project website (http://www.susitna-watanahydro.org/meetings/past-meetings/).

DAY 1 – April 29, 2014

Review of Agenda, Meeting Objectives, and RIFS Study Overview – Kevin Fetherston

Kevin Fetherston briefly reviewed the agenda for the two day meeting and referred participants to the meeting goals, structure and purpose. Kevin began by presenting a high level overview of all RIFS studies (Study 8.6). Status of the following study components was discussed and TWG comments are noted:

Seed release study (RSP Section 8.6.3.3.1)

- Bob Henszey asked if a three-week delay of seed release following spring flow peak was typical. Kevin responded that study plan includes literature review of cottonwood seed release, climate and weather patterns. Kevin indicated measured seed release pattern and weather temperature will be incorporated with flow in the final model.

- Bob Henszey asked if this seed release study will be done in 2014. Kevin responded that the seed release study is not planned for 2014 but a 2nd year is planned for 2015.

- Jose Vasquez asked if RIFS studies examine potential vegetation encroachment over the next 25-50 years and will that information contribute to geomorphology studies. Kevin indicated that potential vegetation encroachment assessment was an objective of the riparian study.

- Gary Van Der Vans noted both snow melt and seed release are functions of temperature which could correlate with seed release timing.

Seedling Establishment study (RSP Section 8.6.3.3.2)

Kevin presented initial results of the first year of this longitudinal survival study. He discussed how transects were oriented in different landscape positions with varying degree of exposure to flow shear stress. Kevin and Bill Fullerton discussed a figure of bed shear stress related to the seedling establishment study (see presentation slides, Day One). Each dot in the figure represents a model mesh element. Modeling mesh size differs between main channel, smaller channels and floodplain areas. Initial hypothesis is that lower shear stress zones may have higher seedling survival and thus see successful seedling establishment and vegetation encroachment. Figure 4 from Auble and Scott (1998) was discussed as an example of how sites become "seedling safe" (see presentation slides, Day One). Safe sites relate to flooding, scouring, high and low water elevations and fluctuation.

- Licensing Participants asked why the seedling figure appears to show more seedlings at Focus Area FA-128 (Slough 8A) in the figure presented. RIFS team responded that the apparent difference in seedling number is due to transect length, substrate, and geomorphic position within the Focus Area and that the graph should not be interpreted with trends between Focus Areas at this point. It was noted that it would be helpful to have future data presentations show seedling density per plot

rather than total number of seedlings per transect. The current preliminary data presentation was not normalized to length of transect.

- Colin Kikuchi asked what the expected maximum flow through the dam will be and what is the preliminary expectation of flow.

- Greg Auble asked whether the rest of the seedling establishment plots will look as clean as the one presented today and expressed interest in seeing plots for other transects. Kevin responded that there will likely be variability in responses between transect locations. Kevin noted is the presence of a log in the middle of transect FA-128 STR1 (see presentation slides, Day One).

Dendrology study (RSP Section 8.6.3.5)

Kevin presented figures showing draft tree core age data for FA-104 (Whiskers Slough) and FA-128 (Slough 8A). He noted that vegetation age sequence tracks the geomorphology observations of floodplain surface age. Bill Fullerton agreed that overlaying the tree ages with floodplain turnover analysis results in a very good match.

- Licensing Participants asked whether FA-128 (Slough 8A) will have denser sampling than shown on the preliminary map. Kevin responded that more dendrology sampling is proposed throughout FA-128 (Slough 8A) in next sampling year. He also noted that many tree core samples have been collected but have not yet been aged and are not showing up on the maps.

- It was asked whether there will be tree ages available at all the ice scar wedge sample locations. Kevin responded that the tree ice scar wedge technique was used for ice scar aging rather than increment core and that the study objective is to date the age of the ice scar event, not the age of the tree. The tree scar wedges allow dating of ice scar events but not tree age.

Vegetation mapping and sampling (Study 11.6) (Aaron Wells)

Aaron wells gave an overview of 2012-2013 riparian vegetation study design and structure of surveys and data analysis for the Riparian Vegetation Study (RSP Study 11.6).

- Licensing Participants asked whether the riparian vegetation and fluvial geomorphology studies are using the same geomorphic surface mapping layer. Aaron responded that at this time they are independent, as the fluvial geomorphology mapping scale is different from the riparian vegetation mapping scale. As study progresses riparian and geomorphology teams will do a cross-walk between the two studies and ensure the data overlaps well.

- Colin Kikuchi asked for an explanation of what is the bigger picture purpose of this analysis. Aaron responded that this study will allow development of a relationship between surface water inundation and frequency of inundation by plant community type. Statistical relationships will be built to show which communities may be maintained by frequent flooding. This understanding will allow consideration of Project effects of change frequency and/or duration of flooding on plant community distribution. With Project operations modeling, the study will

model where vegetation is likely to change with projections of spatially explicit plant community maps across the study area.

- It was asked how flood maps would be translated into community changes. Aaron responded that the plant communities will be associated with a flood regime, similar to determining maintenance flows for a given plant community. It is expected that a combination of disturbance regimes on the river (sediment, ice, water) control where vegetation is becoming established and maintained. If existing relationships are understood it should be possible to project out areas/zones where plant communities will change if the open water flooding and ice effects zone change. Spatially explicit models in GIS combined with a conceptual model for vegetation succession pathways and difference in flow duration and flood frequency will allow creation of a map of change in vegetation over the study area by ecotype over time.

- Bob Henszey asked whether the study is able to calculate both frequency and duration of flooding. Bill Fullerton responded that both frequency and duration data are available. Kevin responded that the study will examine duration of flooding as well as peak flow flood frequency.

- Licensing Participants asked if floodplain forest succession model is in the riparian vegetation RIFS study. Aaron responded that it is really an integration of the two studies but it lies within the Riparian Vegetation Study (RSP 11.6)

- ACTION ITEM: Bob Henszey requested that the studies show limitations and assumptions for each study component so that agencies have confidence in what /how good the study leads think the data is and what limitations are for its use in decision making.

- Greg Auble expressed concern about the complexity of modeling riparian effects over time. He suggested keeping things simple and that the analysis focus on modeling *regime changes* rather than mechanistic-based changes.

- Licensing Participants noted that fish and instream flow studies are using representative years in the analysis, and asked if the riparian studies are using these same three scenarios of wet/dry/average years to model succession. Fluvial geomorphology study will supply the flow information integrated over the long term with many years represented and not with each individual year. The flood flow and duration relationship is an aggregated result not the result of any one specific year that can be used to map probabilities of change.

Aaron described percent cover estimates reached from ITU and ELS plots. He noted that ocular estimates of percent cover have higher error than for point intercept estimates of percent cover. Plots have data for cover by strata, stem density, diameter and age.

- Licensing Participants asked for the difference between a successional model that is developed from ITU versus the ELS plots, and asked if the entire study area could be modelled. Aaron responded that ITU plot data will be used to determine accuracy of the model, and that the model will be completed for the entire study area. The two plot types give similar data, but

intensive plot data are used to improve accuracy within Focus Areas and ELS data with DEM will be used to extrapolate to non-Focus Areas. Vegetation and physical process data is available at different levels in Focus Areas and non-Focus Areas. Scaling up from Focus Area to study area will be done in this more specific way rather than by simply multiplying by river mile within a process domain or reach.

- Bob Henszey noted that the study seems to be putting a lot of effort into forest communities and should not neglect the herbaceous communities. Aaron responded that many plots have been collected in herbaceous communities. Ongoing studies will look at the driving factors for change in herbaceous communities. For example, is hydroregime in the herbaceous dominated areas driven by riverine or upland/hillslope hydrologic sources? Hydrology studies will develop a hydrogeomorphic classification of domains of hydrology (riverine, hillslope, and transitional/mixed) and therefore analyze which areas are likely to be affected by change in riverine hydrology. There are some beaver complexes that appear to be dominated by hillslope hydrology, so change in flood regime will likely have a lower impact on those associated herbaceous communities.

- Bob followed up that he would like to see modeling focus on herbaceous wetlands as well as the forest communities. Aaron responded that the mapping completed to date has riverine wet meadow and lowland wet meadow distinction for herbaceous communities. These two herbaceous communities appear to have different species composition and likely different hydrology inputs.

- Colin Kikuchi asked whether it is possible to do the analysis with a forest succession model from 1950-2014 imagery to check succession model relevance using historic data. Bob suggested this might be considered just in the Focus Areas or in random point locations to compare with what the model predicts for change at a given location. Kevin responded that this effort is underway in Focus Areas to some extent, but will not be done across the whole study area using aerial photograph sequence from 1950s-1980s-2013 and flow regime information.

- Bill Fullerton noted that using historic channel change data, known change will lend confidence to hydrologic model and channel change predictions. A lengthy discussion of succession modeling followed.

Fluvial Geomorphology: channel / floodplain evolution model; hydraulic and sediment modeling study objectives (Bill Fullerton)

Bill explained the channel change aerial photography analysis comparing 1951, 1983, and 2012 imagery to calculate area of conversion between channel and vegetation throughout the study area.

- Greg Auble and Colin Kikuchi asked about applying predictive geomorphic and stream migration models to historical stage data and comparison of model outputs to aerial photographs from the 1950s and 1980s. Both indicated they thought this would be an easy way to build confidence intervals for future predictive models.

- Mike Harvey added that channel change prediction is due to not just flows but also sedimentation associated with flows so both flooding and sediment load/sedimentation need to be included in predictive models. As vegetation gets established, the efficiency of trapping by vegetation goes up and results in surface aggradation. Models will track what is trapped by the dam and what will be carried through and what may be entrained from channel bed and or tributaries.

- Lyle Zevenbergen added that the combination of flows, deposition, and channel conveyance all work together and all affect each other. The aerial imagery analysis showed that channel conveyance was higher in 1950s for a particular flow event.

- Licensing Participants asked whether there were known large flood events prior to the 1950s. Lyle responded that flow record prior to 1950 is not available. Since there is no flow data for Susitna River, the only option to gain insight into flows prior to 1950 (start of Gold Creek gage) is to look at regional hydrology and climate to see if higher flows would have been expected for that period. The key point from the aerial imagery analysis is that the Susitna River system is not highly dynamic.

- Mike Harvey noted that a lot of alluvial floodplain areas in the Middle River are directly upstream of relatively permanent constrictions. There are non-alluvial controls and constraints in the Middle River.

After lunch, the fluvial geomorphology study PowerPoint presentation continued, Bill explaining that this study will look at Project effects on velocity, flow depths, shear stress, sediment loads, bank instability, inundation, flood frequency curves, floodplain accretion, LWD production, areas of island and floodplain features, etc. Bill gave an explanation of information available from 1-D versus 2-D modeling.

The overtopping discharge map will allow the riparian instream flow study to look at the floodplain and identify at what discharge any given location gets inundated. It is then possible to get an annual frequency of inundation, with peak flow analysis, or determine the duration of inundation using flow records. It would be possible to plot number of days of floodplain surface inundation or frequency of inundation. Mike Harvey noted that the overbank channel data for frequency and duration of inundation may be a bit misleading because the surfaces were created by mapping elevation of channels without determining whether they are connected at the upstream end at a given flow. The tables presented show average values for how frequently each floodplain surface type is inundated.

- Bob Henszey said he would like to know what is the flood duration for the flood for each recurrence interval (rather than flow duration per year averaged over all years). It is important to know how many days the surface is inundated when it does get inundated. Kevin would need to look at that information based on individual annual hydrographs.

- Mike Harvey pointed out that one of most important things on slide 15 (Fluvial Geomorphology Presentation) is how infrequently these surfaces are being inundated relative to what would be expected. This low frequency of open-water flow flood recurrence suggests one or more of

several things: (1) that there is something else going on, or these systems don't need inundation for maintenance (e.g., precipitation provides water source); (2) ice processes may be causing more frequent inundation and flood duration. Fluvial geomorphology study looks only at open channel and not flooding that may be due to ice dam processes.

- Bill Fullerton noted that suspended sediment is low during winter flows. Mike Harvey observed that at the end of last summer, there was a huge amount of storage of sediment in the channel. This sediment is available during break-up, and a frequency curve from 1-D ice modeling could be included. In the Middle River where geomorphic controls (plan form channel constrictions) are present, models should be able to develop a frequency curve using flow and ice in combination to determine full picture of inundation area and frequency.

- Jose Vasquez asked whether the vertical accretion rate on the floodplain is known. Kevin responded that there are several approaches underway to get sediment deposition rates and understanding of open water flow versus ice dam backwater effects. First sediment cores to 1.5 m in depth were collected and will be analyzed for Cs137 and Pb210 to try to estimate deposition rate. Data will be available sometime in summer 2014. Second, the dendrology study includes excavating sediment to the tree root collar for each aged tree to estimate rate of sediment deposition.

- Licensing Participants asked whether it is possible to come up with combined flood recurrence interval for ice and open water flow. Inundation is likely due to stochastic ice jams and not just due to staging of ice during normal winter conditions.

- Mike Harvey reiterated the very low turnover rate in the Susitna River system and that the system is not that dynamic. Ice is a very important factor as both constructive and destructive force. As tree density goes down and successional transition from poplar to spruce/birch woodland/open forest, ice may push through these open woodlands causing more floodplain scour channels.

Bill Fullerton explained a proposed metric, the Sediment Delivery Index (SDI) which combines duration of inundation and suspended sediment load.

- Greg Auble asked whether it would be possible to put together depositional regime by surface by flood regime with and without dam.

- Jose Vasquez noted that the dam is expected to change discharge, change suspended load, and result in reduction of size of the load. Thus velocity for deposition will need to be slower because smaller particle size combined with reduced frequency of flooding would all tend toward a lower rate of floodplain accretion.

- Bob Henszey asked whether channel armoring will decrease rate of channel degradation. Bill responded that this is not yet known as additional surveys were just completed during winter studies and data is being analyzed.

- Bob Henszey asked if it is possible to distinguish between ice and water deposited sediment in samples. Kevin responded that it is likely possible by comparing results of the flow routing model and historic records of flood frequency relative to results from the sediment isotope analysis and tree ice scar analysis. If we can date when sediment was deposited and show that it was deposited when open-water did not breach there, then we can test the hypothesis that other factors are in play. Mike Harvey noted that ice deposited sediment often has gravel-boulder sized particles mixed in somewhere in the profile which would not be present from fluvial overtopping. However, it is difficult to map these differences at the study area scale.

Kevin explained that multiple lines of evidence will be used to document how ice is affecting floodplain formation. Open water flow models will predict peak flows and flood events under existing conditions and generated by dam operations. Ice processes study may suggest where ice dams will form and where they will not. Zones of change and magnitude of effect may be predicted.

- Jose Vasquez expressed concerns that SDI may not be best metric and it does not properly include change in sediment size or change in floodplain area.

- Stuart Beck presented results of the open water flow routing model for a 4 mile long reach of Susitna from PRM 113-117 as a draft check of modeling at 50K and 100K cfs for 2- and 100-yr flood return, respectively. A key point is that there are large portions of valley that are not inundated under open water flow conditions. The open water flow routing model results are consistent with Mike Harvey's observations that there are portions of valley that are not inundated under open flow conditions that may be inundated by ice process back water flooding. Mike Harvey asked whether there is a known direct connection between the upper end of the floodplain channel near PRM 117. He thought the paleo channels were likely not connected to the main channel at the upstream end. Breaching flow to get water flowing through the side channels to Focus Area FA-115 is not known at this time.

Riparian hydrology / groundwater study modeling and metrics details (Michael Mazzacavallo)

Michael Mazzacavallo gave an overview of the riparian GW/SW study status.

- Bob Henszey requested that figures show daily totals of rainfall rather than hourly totals for precipitation records.

- Bob Henszey asked for an explanation of the importance of knowing how much water plants are using at the landscape scale and noted that this factor may be more important in arid SW than in the wet boreal forest. The team agreed this metric may not be as important but the information is needed for completing the MODFLOW model and noted that understanding plant water use could prove to be important for certain plant ecotypes.

- Bob Henszey noted that a new Alaska region wetland indicator status list was published recently by USFWS and suggested the ratings may not be the best line of evidence for developing plant functional groups. For example, POBA (*Populus balsamifera)* is FACU in Alaska and not hydrophytic.

- ACTION ITEM: Dara Glass provided a reminder to note where studies are including local knowledge in data gathering in the ISR.

    - Colin Kikuchi noted that MODFLOW input for canopy transpiration flux rate is a ratio between sap flow and canopy area. Kevin and Michael Mazzacavallo explained that sap flow is sap velocity (which is directly measured be the sap flow sensor s) multiplied by individual tree sap wood area (determined by tree cores). Kevin Fetherston and Michal Mazzacavallo mentioned that in addition to sap flow measurements, we are measuring leaf area index to measure canopy area across the flood plain.

DAY 2 – April 30, 2014

Hydrology/Groundwater: Empirical Studies and Modeling (Michael Lilly)

Michael Lilly gave a PowerPoint presentation providing the context, framework, key questions and objectives of the hydrology/groundwater study. He discussed the interaction between Groundwater/Hydrology, Ice processes, Riparian, Geomorphology, and Fish studies. Modeling will be used in combination with other studies to guide understanding of the groundwater / surface water system interactions. A detailed explanation of GW system understanding at FA-104 (Whiskers Slough) was presented.

- Colin Kikuchi asked for a clarification on the purpose of modeling for 1) explanation and understanding, 2) prediction, and 3) modeling for prediction outside range, in combination with other studies. Michael Lilly responded that the GW study is not building a regional GW model, but it is the process understanding of the system guided by specific questions in local environments which leads to prediction and that the models will not directly be used to make predictions.

- Bob Henszey noted that at earlier TT meetings prior to FSP, they thought the GW study would use a grid of wells rather than the transect layout that has been selected. He expected the grid to give more information and provide multiple replicates versus the single transect layout. He noted that USFWS is uncomfortable with the transect basis.

- Michael Lilly responded that the transect layout is being used in conjunction with numerous other lines of evidence and that the proposed approach will allow the study to meet all key study questions and objectives. He noted the transect approach is an intensive study effort. Processes identified at all the FAs will be used to derive understanding of the study system.

- Colin Kikuchi asked for clarification on how the riparian GW/SW study is looking at developing relationships for different vegetation types with regard to the GW/SW model effort. Kevin responded that the riparian GW/SW study is working to develop an understanding of (1) which plants are using which water sources (precipitation, snowmelt, SW, GW) and (2) relationship between plant communities and GW/SW. Isotope studies and rooting depth studies in combination with GW study will be used to measure the relationship between plants and GW/SW. Field measurements and MODFLOW will be used to correlate plant communities with

GW regime (e.g., in terms of 7-day moving average during growing season or other groundwater metrics).

Michael and Kevin described the strategy to map which areas of the floodplain are dominated by upland/hillslope and riverine hydrologic sources, as well as transitional zones, where either riverine or upland hillslope hydrology dominate depending on river stage. Suggestions were given to incorporate thermal infrared, DEM and flood inundation modeling; and aerial photography and vegetation mapping to scale from Focus Area to the riparian process domain. Colin Kikuchi suggested incorporating tracers in addition to stage and discharge measurements to help indicate hydrologic boundary locations and better identify contribution of river water and groundwater to wetlands and beaver complexes. He suggested temperature, conductivity measurements, or water isotope samples.

- Bob Henszey asked about the strategy of scaling for the GW study from Focus Areas to river segment scale.
- Colin asked whether the GW metric of 7-day average will use minimum depth, maximum depth, or average depth or other metric under Project operations. Kevin responded that the study will look at range of different metrics to quantitatively describe the GW regime and that the metrics are under development as data is becoming available.
- Bob Henszey asked whether well caps will be surveyed every year to account for ice jacking. Michael Lilly responded that yes, caps will be resurveyed each year.
- Bob Henszey asked if the stomatal conductance measurements are being done on poplar for comparison with sap flow results. Michael Mazzacavallo responded that poplar trees cannot be done with hand measurements as field staff cannot access the tree canopy to do hand measurements. Smaller alders are measured.

General agreement was confirmed for the conceptual model of GW levels for FA-138 shown on Slide 17. It was suggested to use water quality measurements (conductivity, isotopes, temperature, etc) to make chemical hydrologic boundary determinations for springs and seeps using end of winter conditions before snowmelt.

Michael Lilly discussed findings at beaver pond complexes (e.g., FA-138 and FA-115). First year observations showed stable stage conditions in these complexes with water flowing throughout the season lacking clear hydrologic connection to surface water levels during winter months.

Ice Processes: study objectives and riparian evaluation metrics (Jon Zufelt)

Jon Zufelt gave a summary of breakup status, explaining that this year ice is undergoing thermal breakup rather than dynamic breakup which occurred in 2013. There will likely not be big ice jams this year as much of the channel is opening up slowly. The science of when the river breaks up is not as well understood as science of when the river freezes up. Forecasting breakup is done by looking at history of what has happened since 1949. In 2013, there was extended cool weather with quick transition to warmer weather which resulted in dynamic breakup and lots of ice jams. Ice jams can cause significant

rise in stage during freeze-up and break-up. Photographs of historical observations by the railroad were presented which give anecdotal evidence of ice jam depths and locations. He noted that the railroad representatives noted that about every 5 years they get worried about damage in key areas from ice events, but do not have open water flow floods with damage to the tracks. Ice models will look at effects of daily flow variation on ice cover. Potential for attenuating the wave or dampening downstream was noted as the ice cover is expected to move up and down in response to discharge from dam outlet. Potential Project impacts in ice processes were noted:

- At freeze up there may be higher discharge, higher water levels. Warmer water from dam release may delay freeze up, and produce thicker freeze-up ice cover. In mid-winter there may be higher water levels and large fluctuations at upstream edge of ice cover. At breakup, there may be lower discharge, earlier breakup, warmer water coming from dam, thermal versus dynamic breakup, less flooding and lower damage potential.

- Jose Vasquez asked about potential impacts to the sediment load and whether there will be more or less potential for sediment deposition on the floodplain with-Project scenario. Jon responded that most sediment deposition on the floodplain occurs during breakup. Since it is likely that breakup will not result in as large ice dams due to earlier occurrence, at lower discharge, and thermal breakup, it is likely that less sediment will carried by the flow to the floodplain and thus likely get less floodplain sediment deposition.

Riparian ice studies modeling and metrics (Kevin Fetherston)

Kevin discussed the Ice Processes study in context of the Riparian IFS study based on the first 1.5 year of observations. He presented details and preliminary findings of the riparian ice study including tree ice scar mapping and tree ice scar wedge sampling. He discussed the importance of mapping flood recurrence intervals and open water flow flood elevations relative to ice scar observations illustrated with an example at FA-104 (Whiskers Slough). Goal of surveys is to show whether ice is a major determining factor for Salicaceae plant communities (Balsam poplar and willows). If Project operations alter dynamic ice dam occurrence then predictions may be made with vegetation succession models as to what effects a reduced ice disturbance regime will have. Forests may not be maintained in young successional state with reduced ice disturbance regime.

- Dan Healy commented that it seems as though incremental changes in frequency and relative magnitude of ice jam event will inform ice processes impacts with respect to riparian study. If there is enough data to develop a frequency curve for ice jam elevation at given sites, then it may be possible to make predictions for Project impacts on the riparian environment. Dan asked if it is feasible for ice modeling to generate data to populate frequency curves.

- Jon Zufelt noted that this exercise could be valuable if the stage for overbank flooding, island inundation, etc. are known. Kevin stated the challenge would be getting enough samples to develop the curves. He estimated that it might be reasonable to get about 100 ice wedge samples and these could be collected from several discrete locations where known ice jam

events have occurred (e.g. near PRM 104, PRM 115, and PRM 135). Kevin noted that this topic is worthy of further discussion and consideration.

- Greg Auble reiterated interest in having an integrated disturbance and stage regime where ice and open water flow regime are included. If it is clear that ice induced flooding is happening above open channel flow, then there may be considerable Project effects in this area. Predictions of change in frequency of jamming would be important.

- Licensing Participants asked how the 1-D model will show whether thermal or dynamic breakup is expected to occur and whether there is a clear weather signature for occurrence of dynamic breakup.

Riparian IFS Output: wildlife habitat metrics (Terry Schick, ABR)

Terry Schick presented a conceptual approach to looking at how changes in riparian habitat may result in changes in wildlife habitat. He described methods for integrating Wildlife and Riparian Vegetation Studies, 10.19 and 11.6. Based on the riparian vegetation succession modeling and predicted habitat changes, the wildlife study can map aerial changes in wildlife species richness and habitat values. Terry noted that it would be best to have Project specific habitat data with an understanding of populations and frequency of observation by habitat for each species for this exercise, however, it is hard to get enough observations to be able to do that analysis, so the a literature assessment of habitat usage by species is the alternative. Integrated terrain unit (ITU) variables that make up habitat will be used to make a post-development ITU map using state transition model. There will be changes in habitat types; however, 50 years is a short time frame for looking at vegetation change.

- Sharon Kramer asked what is meant by "regularly used" and whether that is related to one or more life stage or activity. Terry responded that habitat value is a combination of habitat use through all life stages combined to rank score individual species.

- Sharon Kramer asked whether there are any weighting factors for conservation concern species. Terry responded that species can be weighted in any way, but the current draft conceptual model does not include such weighting.

- Sharon Kramer asked whether the model is accounting for effects of climate change. Terry responded that it would be theoretically possible to account for climate change effects to habitat/wildlife use but the current draft models do not incorporate that variable.

- Sharon Kramer asked whether the models will link species with what happens to habitat value for critical prey species. Terry responded that this variable could be included but it is not in the simple conceptual models developed to date. Rankings could be linked with prey responses to habitat change and predator rankings could be downgraded based on downgrade of key prey habitat types.

- Bob Henszey asked whether islands are supposed to be included in the same way in aerial extent calculations and mainland areas. Terry responded that islands may need to be treated

differently but noted that in summer, some species will not access islands however they may find valuable habitat on islands accessible in winter. For example, moose use the island habitats as high value habitat in winter, but not in summer.

- Greg Auble expressed interest in modeling effects on cavity nesting species.

- Sharon Kramer asked whether there are some species where distance between two habitat types makes a particular site more valuable. She noted it could be important to incorporate proximity to other valuable habitat types. Terry responded that the spatial distribution of habitat types can be incorporated into habitat values, but the conceptual model does not take in to account landscape context. It would be possible to look at size of individual mapped polygon and their location/proximity/landscape context to refine habitat values. He noted that this factor would be more feasible to incorporate along the riverine corridor than for other mapping in the Upper Susitna basin around the reservoir and corridors.

Meeting Wrap-up (Kevin Fetherston)

Kevin requested all attendees provide comments and summary of any issues, concerns, or action items they have based on this meeting. Responses of participants are summarized below.

- Greg Auble said that overall he thought it was a good meeting and was favorably impressed. He could not see how the disciplines could work together better than they are and that the team was making progress on the right path. He noted one area where previous studies he was aware of have gone wrong, or misunderstood impacts of a large hydroregulation project like this, was that studies need to consider completely different or novel types of vegetation transition states than occur under existing conditions, and not just consider existing conditions transition processes. For example, load following operations may create waves through the alluvial aquifer/hyporheic zone that are not seen under the natural flow regime; ice effects may be significantly altered; and new plant species (e.g., invasives) not currently seen may invade. He noted that the projected difference between high and low water on a daily load following basis will likely result in a big change to plant communities and that a varial zone with no plants may develop. He recommended to carefully consider the recruitment box model for the varial zone. Also with peak flows occurring in September, annually established poplar seedlings may be disturbed by flood scouring therefore shifting the pioneer woody community composition. He wonders whether environmental flow releases earlier in the season may be incorporated in future Project operations models. He recommends that other plant community transition states not measurable under current conditions be added to the analysis process.

- Jose Vasquez responded that he is mainly focused on the geomorphology study. He reiterated questions about the proposed metric, SDI. He would like to see a better explanation of the conceptual model of floodplain accretion with further understanding of the physical processes that are driving floodplain accretion.

- Mike Harvey responded that this understanding is being developed, but it is difficult to quantify relationship between forms of discharge and accretion of floodplain surfaces over time. The sediment isotope analysis results may provide insight into this question to help model accretion rate relative to the 50-year hydrograph record. He noted that the floodplain accretion substrate will likely come from tributaries rather than load coming over the dam. Tributary sediment input is being measured. He also noted the importance of considering effects of vegetation change over time (e.g., thinning of vegetation) on potential for channel avulsion in older floodplain surfaces.

- Bob Henszey noted that he appreciated the format of this meeting and opportunity for interchange from this style of meeting. He gained a level of confidence in some areas, but new questions also arose, such as the importance of ice processes. In the GW/SW study, he reiterated concern about scaling up plant communities from plot to Focus Area to study area and assumptions that will be made with that upscaling. He noted that a single GW transect per Focus Area may not be sufficient to link with vegetation plot data effectively.

- Colin Kikuchi observed that a highlight for him is the availability of data on the public website and the he hopes that data transfer continues. He was impressed with the tree ice scar data collection.

Action Item	**Date**	**Responsibility**
Bob Henszey requested that the studies show limitations and assumptions for each study component so that agencies have confidence in what /how good the study leads think the data is and what limitations are for its use in decision making.	USR	AEA
Dara Glass provided a reminder to note where studies are including local knowledge in data gathering in the ISR.	June 2014 ISR	Kevin Fetherston