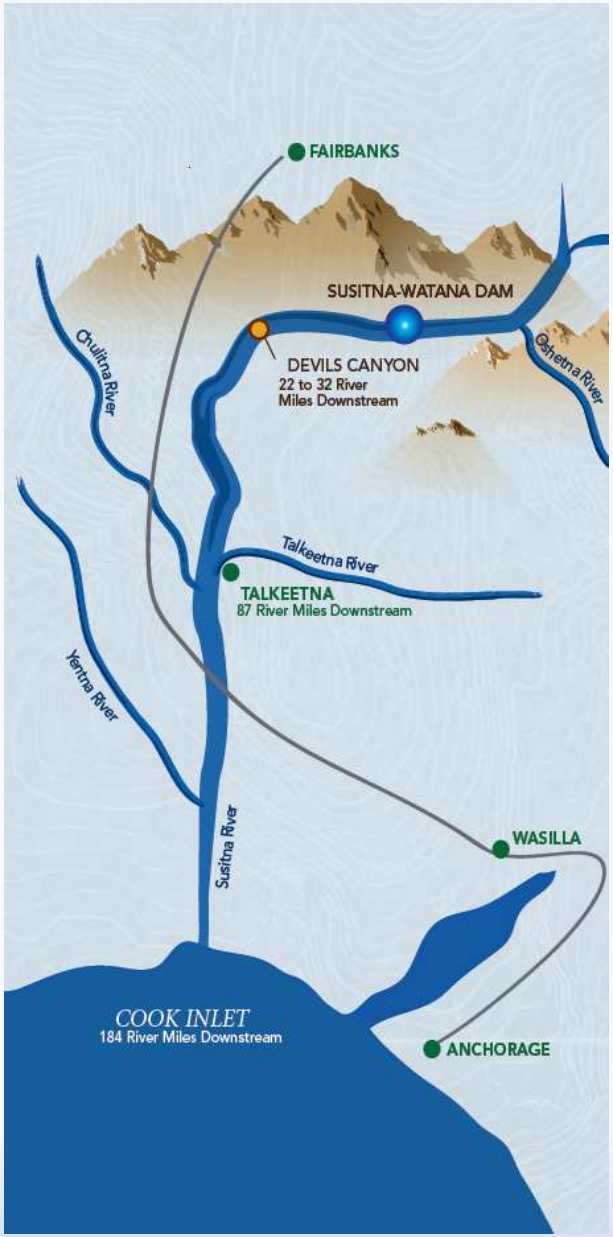


Initial Study Report Meeting

Study 8.6 Riparian Instream Flow

October 17, 2014

Prepared by

R2 Resource Consultants

Study 8.6 Objectives

- Synthesize historic physical and biological data for Susitna River floodplain vegetation, including 1980s studies, studies of hydro project impacts on downstream floodplain plant communities, and studies of un-impacted floodplain plant community successional processes
- Delineate sections of the Susitna River with similar environments, vegetation, and riparian processes, termed *riparian process domains* (RPDs), and select representative areas within each riparian process domain, termed *Focus Areas*, for use in detailed 2013–2014 field studies
- Characterize seed dispersal and seedling establishment groundwater and surface water hydroregime requirements. Develop a predictive model of potential Project operational impacts to seed dispersal and seedling establishment
- Characterize the role of river ice in the establishment and recruitment of dominant floodplain vegetation. Develop a predictive model of potential Project operational impacts to ice process regimes and dominant floodplain vegetation establishment and recruitment
- Characterize the role of erosion and sediment deposition in the formation of floodplain surfaces, soils, and vegetation. Develop a predictive model of Project operations changes to erosion and sediment deposition patterns and associated floodplain vegetation
- Characterize natural floodplain vegetation groundwater and surface water maintenance hydroregime. Develop a predictive model to assess potential changes to natural hydroregime and potential floodplain vegetation
- Develop floodplain vegetation study synthesis, scaling of Focus Areas to riparian process domains, and Project operations effects modeling

Study 8.6 Components

- Synthesize Historic Physical and Biological Data for Susitna River Floodplain Vegetation, including 1980s Studies, Studies of Hydro Project Impacts on Downstream Floodplain Plant Communities, and Studies of Un-impacted Floodplain Plant Community Successional Processes (hereafter, Literature Review of Dam Effects on Downstream Vegetation) (ISR Part A, Section 4.1; pg 4)
- Focus Area Selection-Riparian Process Domain Delineation (ISR Part A, Section 4.2; pg 5)
- Characterize Seed Dispersal and Seedling Establishment Groundwater and Surface Water Hydroregime Requirements. Develop Predictive Model of Potential Project Operational Impacts to Seedling Establishment (hereafter, Seed Dispersal and Seedling Establishment (ISR Part A, Section 4.3; pg 8)
- Characterize the role of river ice in the establishment and recruitment of dominant floodplain vegetation. Develop predictive model of potential Project operational impacts to ice processes and dominant floodplain vegetation establishment and recruitment (hereafter, River Ice Effects on Floodplain Vegetation) (ISR Part A, Section 4.4; pg 15)
- Characterize the role of erosion and sediment deposition in the formation of floodplain surfaces, soils, and vegetation. Develop a predictive model of Project operations changes to erosion and sediment deposition patterns and associated floodplain vegetation (hereafter, Floodplain Stratigraphy and Floodplain Development (ISR Part A, Section 4.5; pg 18)
- Characterize natural floodplain vegetation groundwater and surface water maintenance hydroregime. Develop a predictive model to asses potential Project operational changes to natural hydroregime and floodplain vegetation (hereafter, Riparian GW/SW Hydroregime) (ISR Part A, Section 4.6; pg 21)
- Floodplain Vegetation Study Synthesis, Focus Area to Riparian Process Domain Model Scaling and Project Operations Effects Modeling (hereafter, Riparian Vegetation Modeling Synthesis and Project Area Scaling) (ISR Part A, Section 4.7; pg 27)

Study 8.6 Variances

- Completion of the literature review was scheduled for Q4 2013 and is now scheduled for 2014 (see ISR Part A, Section 4.1).
- The first year (0+) balsam poplar and willow establishment study was restricted to documenting the current cohort of seedlings less than 1 year old rather than all woody plants less than 1 meter in height. In response to this variance, AEA anticipates conducting a clonal reproduction study to characterize asexual recruitment patterns in 2015 field season (see ISR Part A, Section 4.3.2).

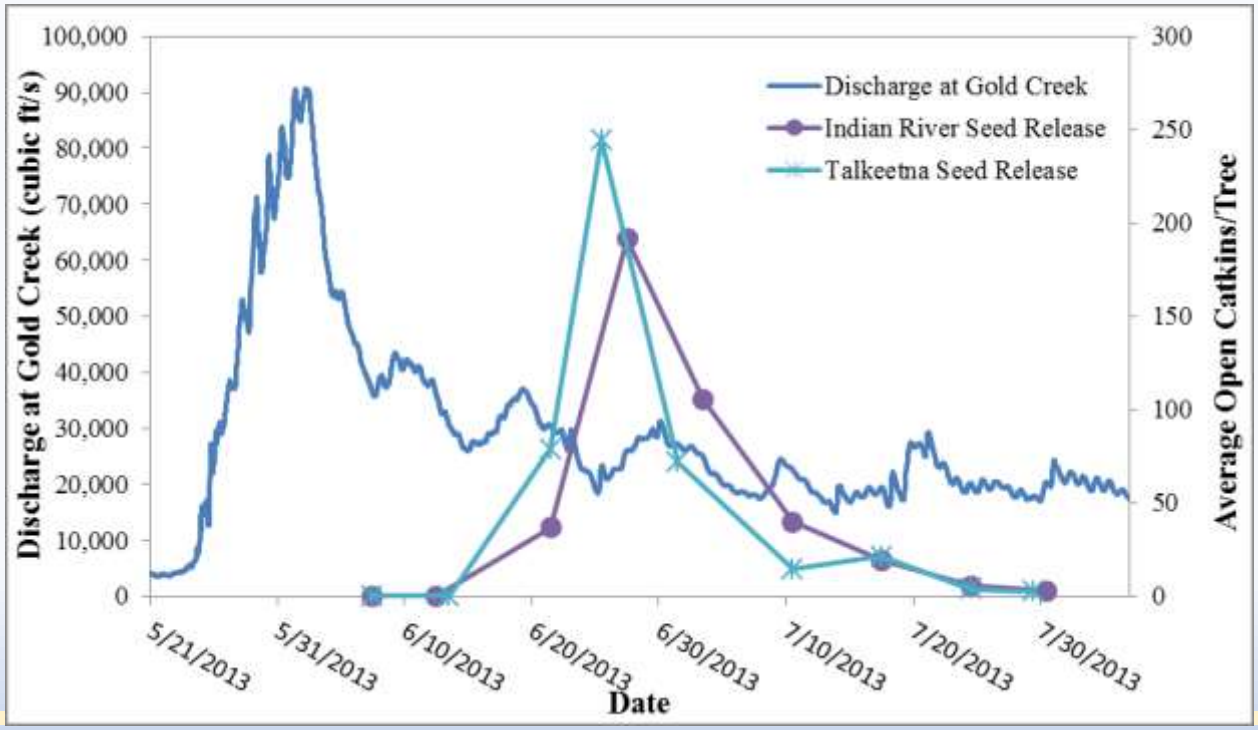
Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

- Seed dispersal was surveyed at four seed dispersal study sites and preliminary models were developed.(ISR Part A, Section 5.3.1)
- First year (0+) balsam poplar and willow seedling establishment were documented with thirty-five transects and 824 plots across five Focus Areas. Counts of established seedlings were completed in late-July through early August and again in September 2013. To characterize white spruce establishment patterns, twelve eight-meter-wide (26.25 feet wide) belt transects were surveyed covering approximately 3.5 hectares (8.7 acres) on seven mid-channel islands in the Middle River Segment.
- A systematic riverbank survey of tree ice scars was conducted from PRM 102.2 through PRM 145.8 between September 15 and 29, 2013. A total of 222 ice scarred trees, 190 locations with no visible ice-scars, and 29 locations with signs of ice damage that were not measurable were surveyed. In addition, 48 ice scarred trees were sampled for dendrochronologic analysis of ice floodplain vegetation interaction frequency and magnitude.
- Tree and shrub composition and abundance were measured at 80 ITU and mid-channel island plots in the Middle and Lower River Segments. Tree core samples for dendrochronologic analysis were collected at all ITU plots.
- Riparian Groundwater/Surface Water studies included collection of 659 plant samples, 545 soil samples, and 100 water samples for isotopic analysis of water source. Transpiration of woody species was measured with TDP sensors installed at 21 trees at FA-104 (Whiskers Slough) and 27 trees at FA-128 (Slough 8A). Transpiration by herbaceous and small shrub species was measured through collection of 3,602 individual stomatal conductance measurements, including measurements from 1,747 herbaceous plants (11 species), 1,771 shrubs (11 species), and 79 trees (3 species).

Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

5.3.1. Seed Dispersal

- Catkins releasing seed from six female balsam poplar (*Populus balsamifera*) trees and six to twelve female willow (*Salix* spp.) shrubs were counted weekly at each of four seed release study sites distributed across the Middle and Lower River Segments
- Depending on site, the peak period of seed release for poplar began 17 to 20 days following peak discharge (ISR Part A, Section 5.3.1)



Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

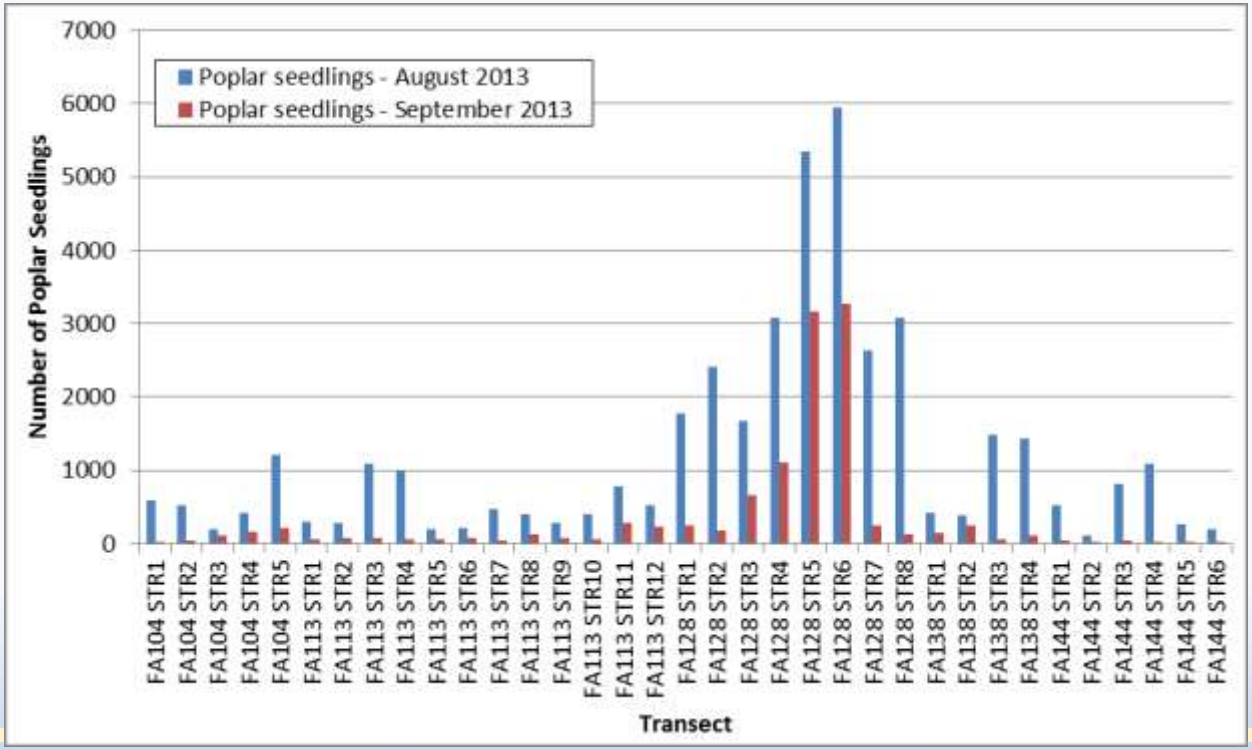
5.3.2. Seedling Establishment and Recruitment

- Significant mortality was observed as a result of the mid August peak flow. Seedling survival occurred in sheltered terrain positions whereas high seedling mortality was observed resulting from both channel bed scour and sediment burial in exposed lateral channel margins.
- Seedling establishment study identified previously unreported White spruce establishment in Tall Alder seral stage. White spruce was shown to establish throughout early floodplain forest successional stages.
- Only Balsam poplar and willow year 0+ seedlings were observed in woody seedling reconnaissance surveys.
- Clonal reproduction of Balsam poplar appears to be a significant recruitment process in high ice flow disturbance zones. What appeared to be poplar sexual reproduction in these terrain areas is not. This finding has potential significance relative to assessment of Project operations effects on ice regime interactions with riparian vegetation, an assessment objective of the vegetation ice processes study.

Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

5.3.2. Seedling Establishment and Recruitment

• Significant mortality was observed as a result of the mid August peak flow in Year 1. Seedling survival occurred in sheltered terrain positions whereas high seedling mortality was observed resulting from both channel bed scour and sediment burial in exposed lateral channel margins.



Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

5.4. River Ice Effects on Floodplain Vegetation

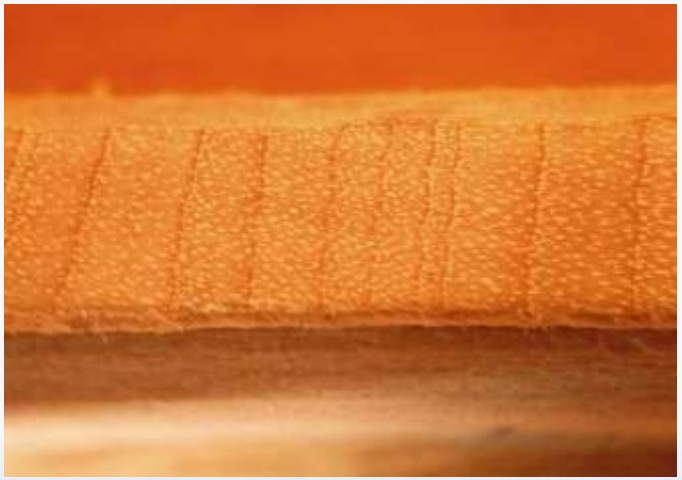
• A systematic riverbank survey of tree ice scars was conducted from PRM 102.2 through PRM 145.8 between September 15 and 29, 2013. A total of 222 ice scarred trees, 190 locations with no visible ice-scars, and 29 locations with signs of ice damage that were not measurable were surveyed. In addition, 48 ice scarred trees were sampled for dendrochronologic analysis of ice floodplain vegetation interaction frequency and magnitude. An additional 25 ice scarred trees were sampled in August 2014.

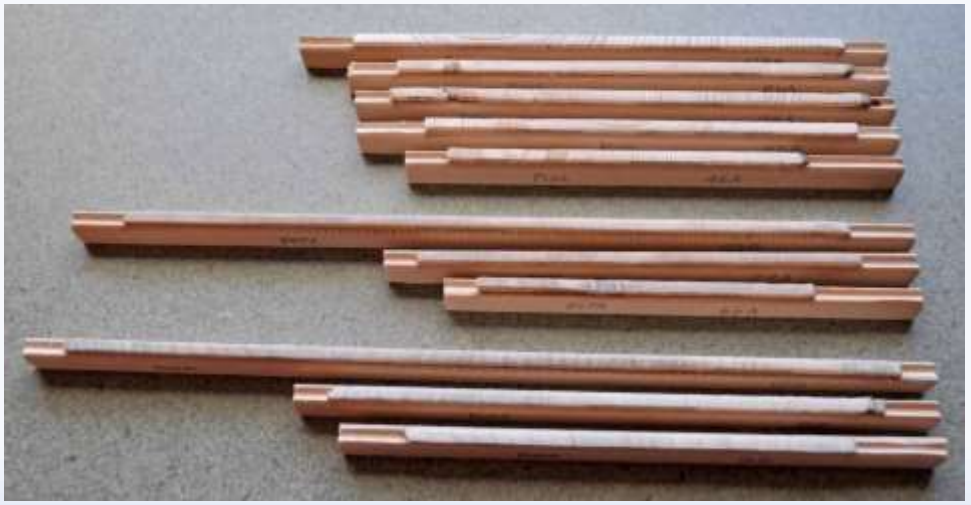
• Ice dam backwater flooding was observed to deposit up to 20-30 cm of fine sand burying existing floodplain vegetation. Sediment deposition during ice dam backwater was observed to be a local phenomena associated with ice dam backwater floods. Ice process generated floodplain sediment deposition is potentially a significant driver of local floodplain vegetation pattern.

Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

5.5. Floodplain Stratigraphy and Floodplain Development

- Tree and shrub composition and abundance were measured at 80 ITU and mid-channel island plots in the Middle and Lower River Segments. Tree core samples for dendrochronologic analysis were collected at all ITU plots.



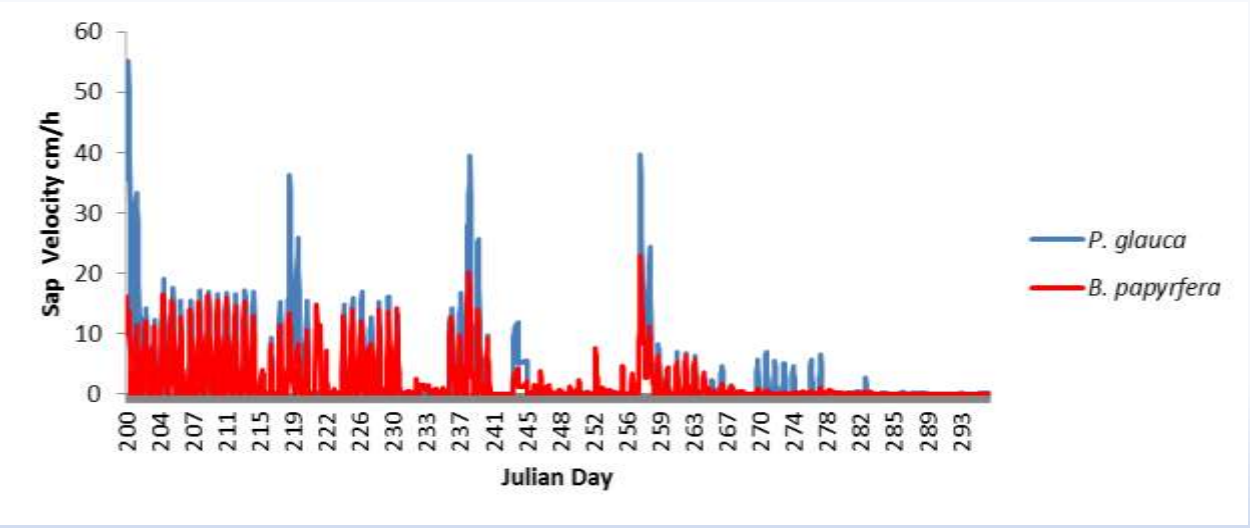


Study 8.6 Summary of Results in ISR (ISR Study 8.6, Part A – Section 5)

5.6. Riparian GW/SW Hydroregime

- Riparian Groundwater/Surface Water studies included collection of 659 plant samples, 545 soil samples, and 100 water samples for isotopic analysis of water source. Transpiration of woody species was measured with TDP sensors installed at 21 trees at FA-104 (Whiskers Slough) and 27 trees at FA-128 (Slough 8A). Transpiration by herbaceous and small shrub species was measured through collection of 3,602 individual stomatal conductance measurements, including measurements from 1,747 herbaceous plants (11 species), 1,771 shrubs (11 species), and 79 trees (3 species).

- FA-138 (Gold Creek) river right floodplain wetlands were shown to not be strongly influenced by surface water fluctuations associated with the Mid August peak flow. This observation was made by measuring floodplain off-channel water body surface water elevations as compared to river stage fluctuations.



Study 8.6 Summary of Results since ISR

- 2014 First year (0+) and Second year (1+) balsam poplar and willow seedling establishment were documented with thirty-five transects and 824 plots across five Focus Areas. Counts of established seedlings were completed in late-July through early August and again in early September 2014.
- Ice scar sampling completed at FA-115 (Slough 6A); 20 ice scar wedges were collected.
- On-going data collection at FA-115 (Slough 6A) and FA-104 (Whiskers Slough)

AEA Proposed Modifications to Study 8.6 in ISR (ISR Study 8.6, Part C – Section 7.1.2)

- Completion of the literature review was scheduled for Q4 2013 and is now scheduled for 2014. (See discussion in RSP Section 8.6.3.1)
- Seedling Establishment and Recruitment Study (RSP Section 8.6.3.3.2)
  - Quantitatively capture where (floodplain terrain locations), and how Balsam poplar clonal establishment and recruitment is occurring
  - Transect sampling at select Focus Area mid-channel islands and lateral floodplain margins to be determined in the field in 2015

Current Status and Steps to Complete Study 8.6

- AEA expects to complete the FERC-approved Study Plan through the filing of the Updated Study Report by February 1, 2016, in accordance with the ILP schedule issued by FERC on January 28, 2014. With regard to this specific study, AEA expects to complete data collection in both the 2014 and 2015 study seasons, which will be reported in the USR.

- Based on data collection completed in 2013, preliminary analyses, and plans for continued data collection in the next study year, the study is on track to meeting all Project objectives.

Steps to Complete Study 8.6 (ISR Study 8.6, Part C – Section 7.1) Tasks Completed in 2014

- Aerial survey completed in Spring 2014 to view thermal ice breakup interaction with riparian vegetation.
- Evapotranspiration (ET) study sap flow sensors were re-installed in May 2014 with on-going data collection to continue through October 2014.
- Seedling transects established in 2013 were re-sampled in August and September 2014.
- Tree ice scar wedges were collected to date ice scar events at select Focus Areas.

Steps to Complete Study 8.6 (ISR Study 8.6, Part C – Section 7.1) Tasks Planned for 2015

- Complete final riparian process domain analysis
- Second season of field work for seed release study and model development to link peak seed release to local climate and discharge records.
- To characterize seedling establishment hydrologic conditions, seedling transects will be revisited and seedlings counted twice during the growing season to capture seedling mortality relative to bimodal peak flow patterns. Clonal poplar and willow surveys will be completed on the lateral channel margins
- Additional White spruce and paper birch seedling establishment transects will be conducted on lateral floodplains, terraces and mid-channel islands.
- ITU plots surveyed by the Riparian Vegetation (Study 11.6) will be sampled to age trees and date the floodplain surface.
- Refinement of mapping and further interpretation of ice scar zones will be done to determine intensive ice floodplain vegetation interaction survey locations.
- Riparian GW/SW model construction will be developed.
- Model development and continued coordination with TWG

Licensing Participants Proposed Modifications to Study 8.6?

- Agencies
- CIRWG members and Ahtna
- Public