

Initial Study Report Meeting

Study 7.5 Groundwater

October 16, 2014

Prepared by GW Scientific



Study 7.5 Objectives

- **Synthesize** historical and contemporary groundwater data available for the Susitna River groundwater and groundwater dependent aquatic and floodplain habitat, including that from the 1980s and other studies including reviews of **GW/SW interactions in cold regions**
- Use the available groundwater data to **characterize large-scale geohydrologic process-domains/terrain of the Susitna River** (e.g., geology, topography, geomorphology, regional aquifers, shallow groundwater aquifers, GW/SW interactions)
- **Assess** the potential effects of **Watana Dam/Reservoir** on **groundwater and groundwater-influenced aquatic habitats** in the vicinity of the proposed dam
- Work with other resource studies to **map groundwater-influenced aquatic and floodplain habitat** (e.g., upwelling areas, springs, groundwater-dependent wetlands) within the Middle River Segment of the Susitna River including within selected Focus Areas (see Fish and Aquatic Instream Flow Study Section 8.5.4.2.1.2)
- Determine the **GW/SW relationships of floodplain shallow alluvial aquifers** within selected Focus Areas as part of the **Riparian Instream Flow Study** (Riparian Instream Flow Study, Section 8.6)
- Determine **GW/SW relationships** of **upwelling/downwelling** in relation to spawning, incubation, and rearing habitat (particularly in the winter) within selected Focus Areas as part of **the Fish and Aquatics Instream Flow Study** (Fish and Aquatic Instream Flow Study 8.5)
- **Characterize water quality** (e.g., temperature, dissolved oxygen [DO], conductivity) of **selected upwelling areas** that provide biological cues for fish spawning and juvenile rearing, in Focus Areas as part of the **Fish and Aquatics Instream Flow Study** (Fish and Aquatic Instream Flow Study (Study 8.5))
- Characterize the **winter flow in the Susitna River** and how it relates to **GW/SW interactions**
- Characterize the **relationship** between the **Susitna River flow** regime and **shallow groundwater users** (e.g., domestic wells)

Study 7.5 Components

- **Existing Data Synthesis** (ISR Part A, Section 4.1; pg 3)
- **Geohydrologic Process-Domains** (ISR Part A, Section 4.2; pg 4)
- **Watana Dam/Reservoir** (ISR Part A, Section 4.3; pg 5)
- **Upwelling/Springs Broad-Scale Mapping** (ISR Part A, Section 4.4; pg 7)
- **Riparian Vegetation Dependency on Groundwater/Surface-Water Interactions** (ISR Part A, Section 4.5; pg 8)
- **Aquatic Habitat Groundwater/Surface-Water Interactions** (ISR Part A, Section 4.6; pg 13)
- **Water Quality in Selected Habitats** (ISR Part A, Section 4.7; pg 15)
- **Winter Groundwater/Surface-Water Interactions** (ISR Part A, Section 4.8; pg 16)
- **Shallow Groundwater Users** (ISR Part A, Section 4.9; pg 17)

Study 7.5 Variances

- The schedule for completion of the annotated bibliography and literature review was adjusted to be complete in 2014. (ISR Part A, Section 4.1.1)
- The schedule for completion of the mapping of geohydrologic units and associated analysis will be completed in 2014. (ISR Part A, Section 4.2.1)
- The schedule for completion of the groundwater flow models, including model input and calibration data sets, files and model documentation was rescheduled into 2015. (ISR Part A, Section 4.5.1)
- The schedule for completion of the groundwater flow models, including model input and calibration data sets, files and model documentation was rescheduled into 2015. (ISR Part A, Section 4.6.1)
- The schedule for completion of the groundwater flow models, including model input and calibration data sets, files and model documentation was rescheduled into 2015. (ISR Part A, Section 4.7.1)
- Water quality data from other studies completed in the first study year will be used in the next year of study to describe the differences between productive and non-productive habitat types. (ISR Part A, Section 4.7.1)

Study 7.5 Summary of Results in ISR (ISR Study 7.5, Part A – Section 5)

- Completed all the planned **57 hydrology station installations and 66 shallow groundwater wells** by end of 2013 summer
- Data collection at continuously operated stations since installation in 2013
- Manual empirical measurements of groundwater and surface water
- Data station collection efforts continued during the winter season.
- **Empirical data collected over spring snowmelt and breakup, summer, fall freeze-up and winter hydrologic periods** is improving understanding of groundwater processes
- Empirical data **providing all of the physical process modeling efforts** (aquatic IFS, riparian IFS, water quality, geomorphology, and ice processes) **on-the-ground empirical benchmarks** for calibration and verification of physical process models.
- **Shallow groundwater found to be prevalent in the Middle River study area.**
- **Upland hydrological recharge from adjacent sides of the river valley to the floodplain** were observed and measured: springs and seeps, upland beaver ponds, areas without winter snow due to shallow groundwater conditions, and observed **winter open water conditions** in sloughs and creeks (open leads).

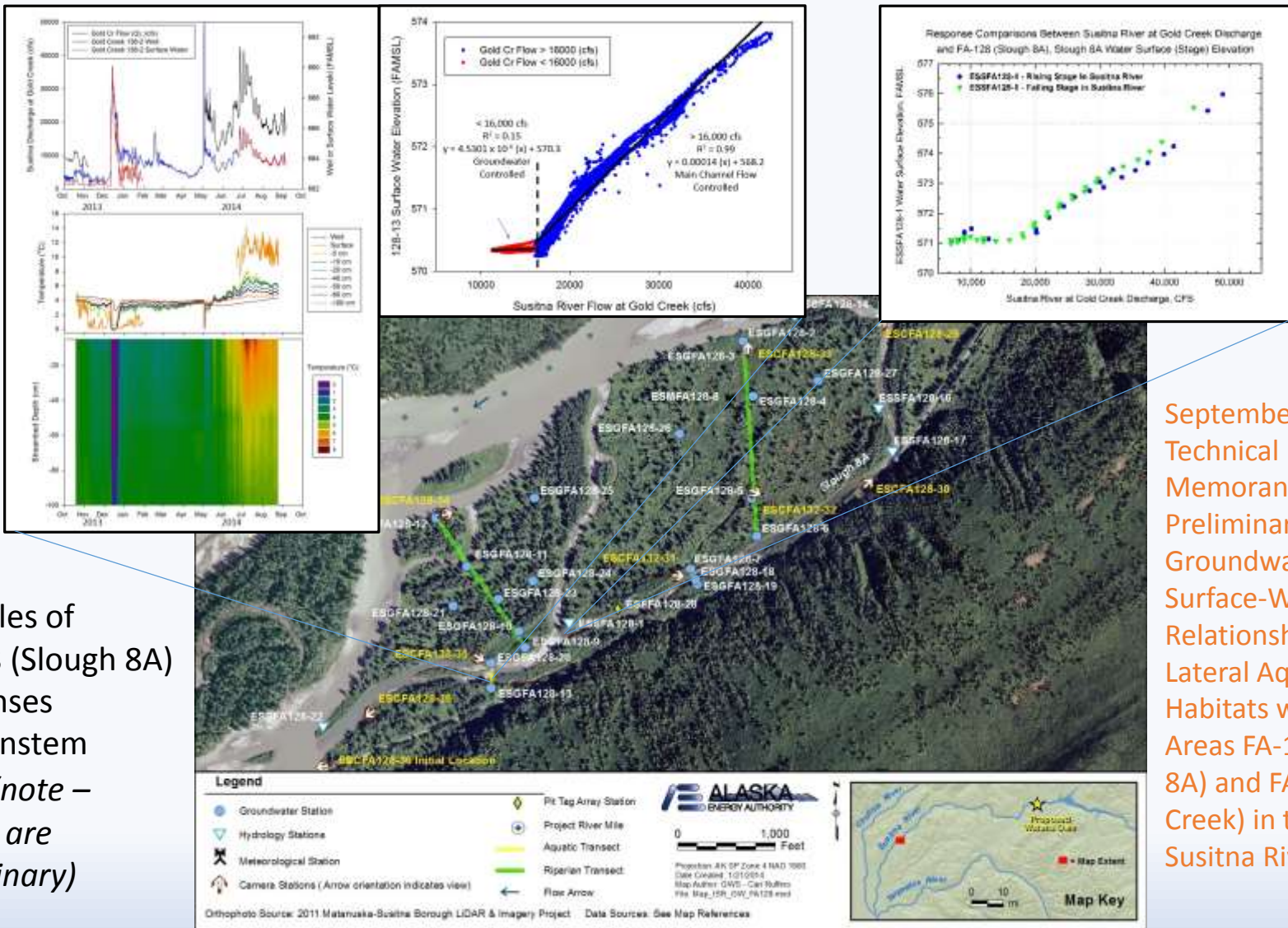
Study 7.5 Summary of Results since ISR

(September 2014 Tech Memo - Preliminary Groundwater and Surface-Water Relationships in Lateral Aquatic Habitats within Focus Areas FA-128 (Slough 8A) and FA-138 (Gold Creek) in the Middle Susitna River)

- End of winter hydrologic measurements, discharge measurements to determine groundwater recharge fluxes.
- Installation of 42 new staff gage locations in 2014. Discharge measurement planned at 25 of these locations in Fall of 2014.
- New staff gage stations located at FA-144 (Slough 21) and FA-141 (Indian River) and PRM-112.
- Continued data collection at the following Focus Areas:
 - FA-138 (Gold Creek)
 - FA-128 (Slough 8A)
 - FA-115 (Slough 6A)
 - FA-113 (Oxbow 1)
 - FA-104 (Whiskers Slough)



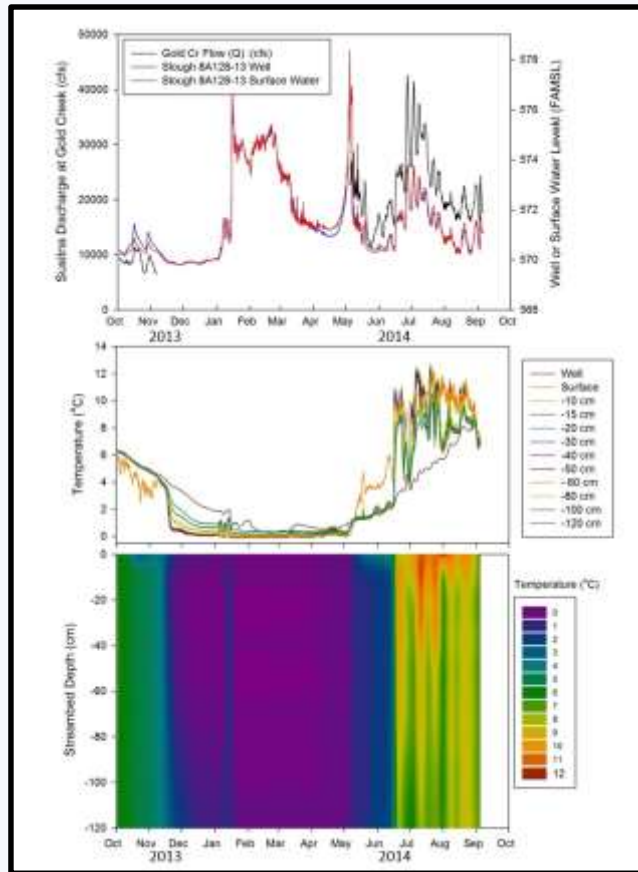
Study 7.5 Summary of Results since ISR



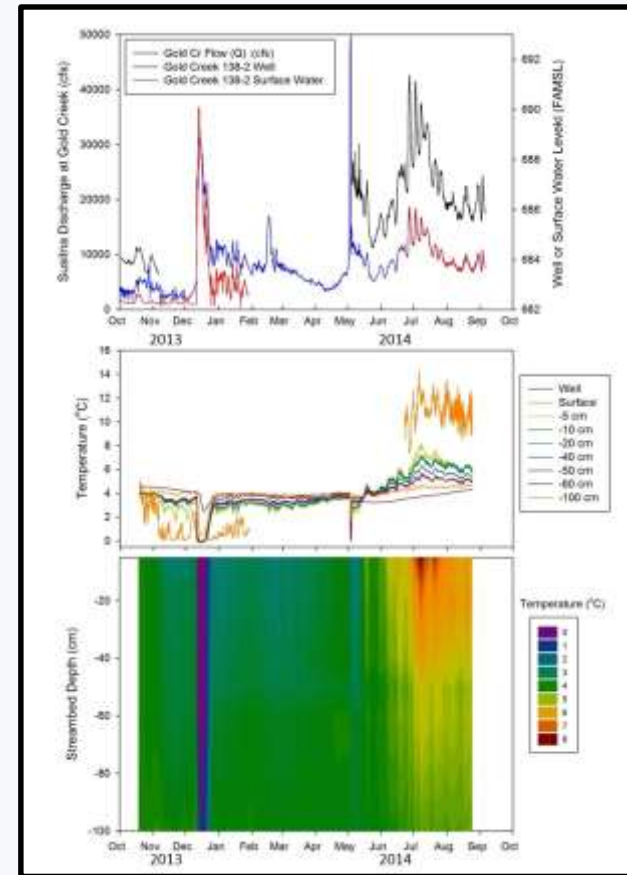
Examples of FA-128 (Slough 8A) Responses To Mainstem Flow (note – results are preliminary)

September 2014 Technical Memorandum - Preliminary Groundwater and Surface-Water Relationships in Lateral Aquatic Habitats within Focus Areas FA-128 (Slough 8A) and FA-138 (Gold Creek) in the Middle Susitna River.

Study 7.5 Summary of Results since ISR



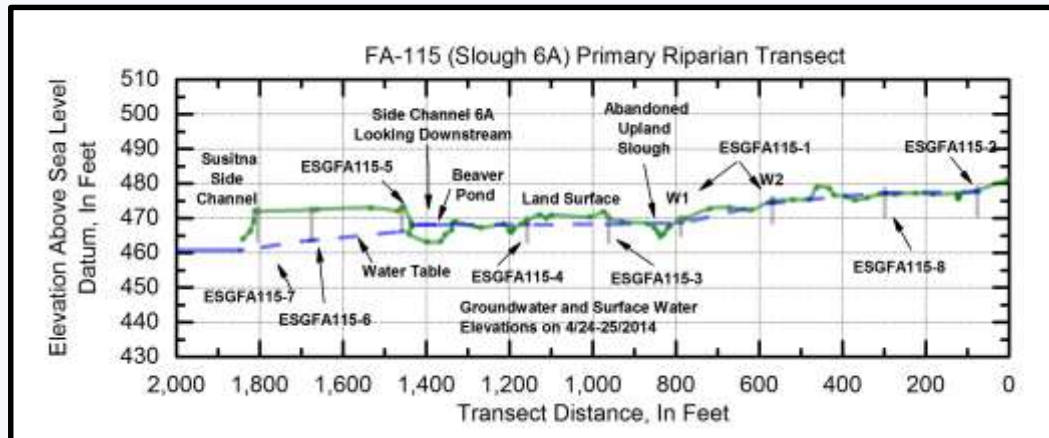
FA-128 (Slough 8A)
Middle Side Channel 8A
Lower Aquatic Transect
Downwelling Example



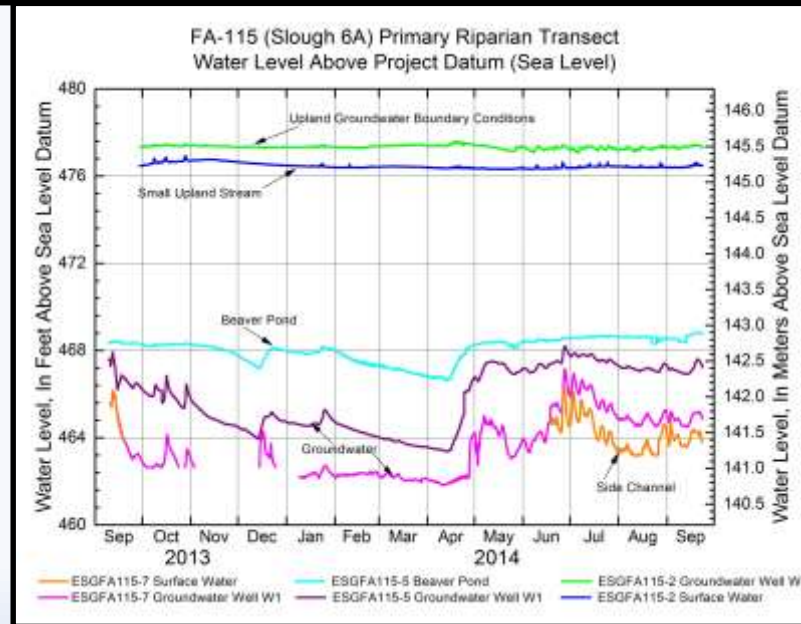
FA-138 (Gold Creek)
Upper Side Channel 11
Upper Aquatic Transect
Upwelling Example

September 2014 Technical Memorandum - Preliminary Groundwater and Surface-Water Relationships in Lateral Aquatic Habitats within Focus Areas FA-128 (Slough 8A) and FA-138 (Gold Creek) in the Middle Susitna River.

Study 7.5 Summary of Results since ISR



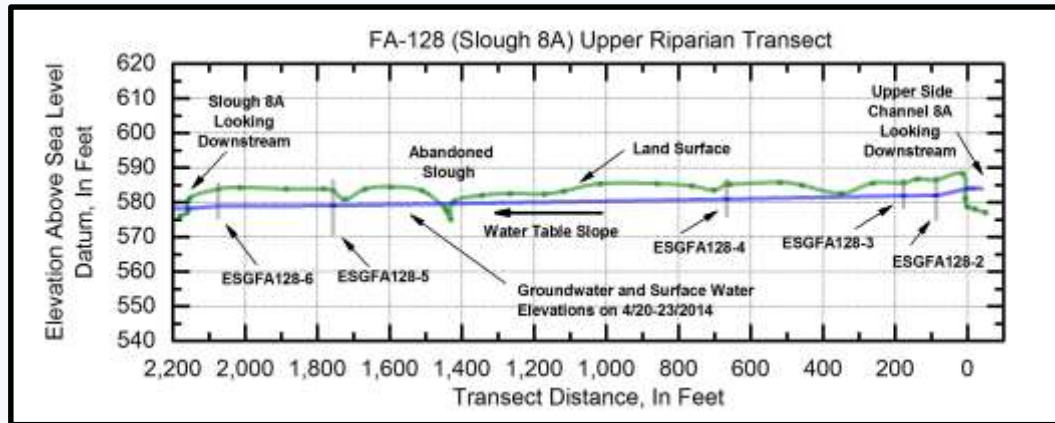
FA-115 (Slough 6A)
Primary Riparian Transect
Lateral Hydraulic Gradients



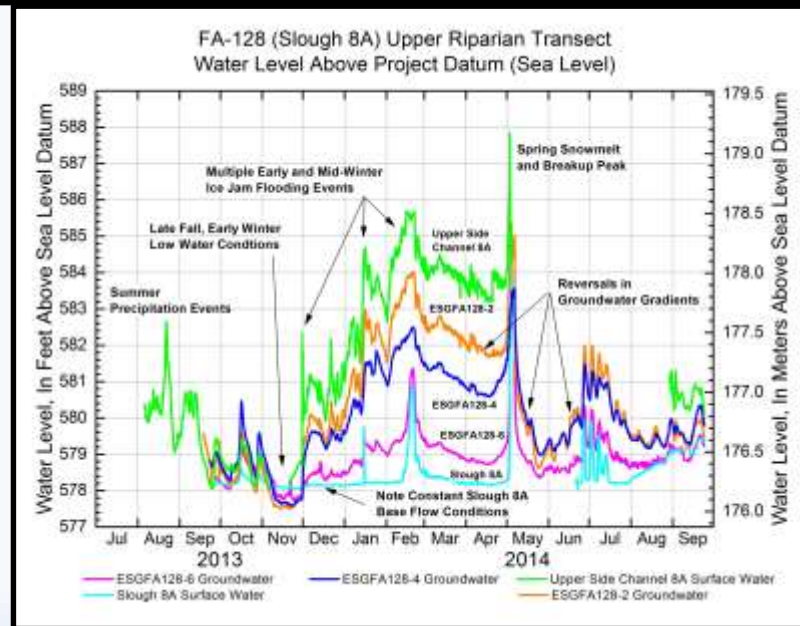
September 2014 Technical
Memorandum - Groundwater
and Surface-Water Relationships
in Support of Riparian Vegetation
Modeling

FA-115 (Slough 6A)
Primary Riparian Transect
Seasonal Water-Level Variation

Study 7.5 Summary of Results since ISR



FA-128 (Slough 8A)
Upper Riparian Transect
Lateral Hydraulic Gradients



•September 2014 Technical Memorandum - Groundwater and Surface-Water Relationships in Support of Riparian Vegetation Modeling

FA-128 (Slough 8A)
Upper Riparian Transect
Seasonal Water-Level Variation

AEA Proposed Modifications to Study 7.5 in ISR (ISR Study 7.5, Part C – Section 7.1.2)

- Schedule for completion of the **groundwater flow models**, including model input and calibration datasets, files, and model documentation is now **scheduled for Q3 2015** to provide better integration with other hydrologic modeling efforts. This change in schedule will not impact the objectives of the study. AEA is scheduled to complete the first phase of groundwater flow models and associated analysis in 2014. (See discussion in ISR Sections 4.5, 4.6, and 4.7)

New Modifications to Study 7.5 since ISR

- The schedule for completion of the ***annotated bibliography*** and ***literature review*** was adjusted to be completed in **2015**. This will allow additional information to be incorporated from the 1980s references located that the ARLIS library is still processing and new information from other studies. This change in schedule ***will not impact the objectives*** of the study.
- Collection of groundwater data from ***shallow groundwater user*** wells and other hydrologic data collection with analysis and reporting completed in **2015**.
- The schedule for completion of the ***mapping of geohydrologic units*** and associated analysis was adjusted to be completed in **2015**. This will allow incorporation of supporting information from other studies to be used to meet the study objectives. This change in schedule ***will not impact the objectives*** of the study.

Current Status and Steps to Complete Study 7.5

- 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 study objectives.

Steps to Complete Study 7.5 (ISR Study 7.5, Part C – Section 7.1)

Tasks Being Completed in 2014

- Collection of water quality data to describe water quality conditions in lateral habitat and potential differences between selected productive and non-productive aquatic habitats.
- Modeling development and documentation of groundwater models and integration methods for linkages to 1D river flow routing models.
- Development of process relationship methods between mainstem flow and flow in select lateral habitat

Steps to Complete Study 7.5 (ISR Study 7.5, Part C – Section 7.1)

- Annotated bibliography and literature review
- Geohydrologic process-domains delineation
- Surveying of select hydrologic sites in Watana Dam area
- Watana Dam aquatic hydrology evaluation
- Upwelling/springs broad scale mapping
- Winter and summer data collection to refine understanding of groundwater/surface-water interactions
- Finalization of the groundwater flow models, model input and calibration datasets, files, and model documentation

Licensing Participants Proposed Modifications to Study 7.5?

- Agencies
- CIRWG members and Ahtna
- Public