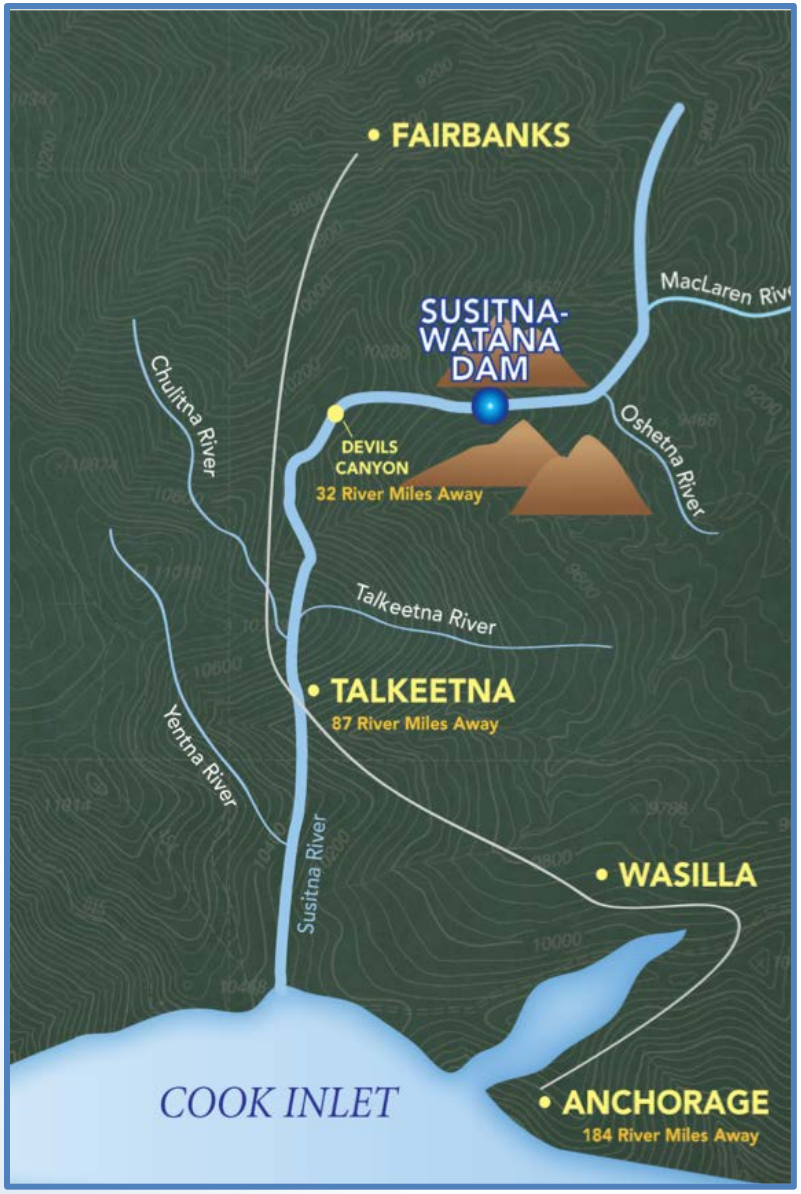


SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Technical WorkGroup Meeting

Q3 2013 TWG

Groundwater Study Q3/Q4 2013 Update

September 24, 2013

Prepared by
GW Scientific

Groundwater Study (GW) Objectives

- 7.5.4.1.1 Data Synthesis
- 7.5.4.1.2 Geohydrologic Process-Domains
- 7.5.4.2 Watana Dam/Reservoir
- 7.5.4.3 Upwelling/Springs Broad-Scale Mapping

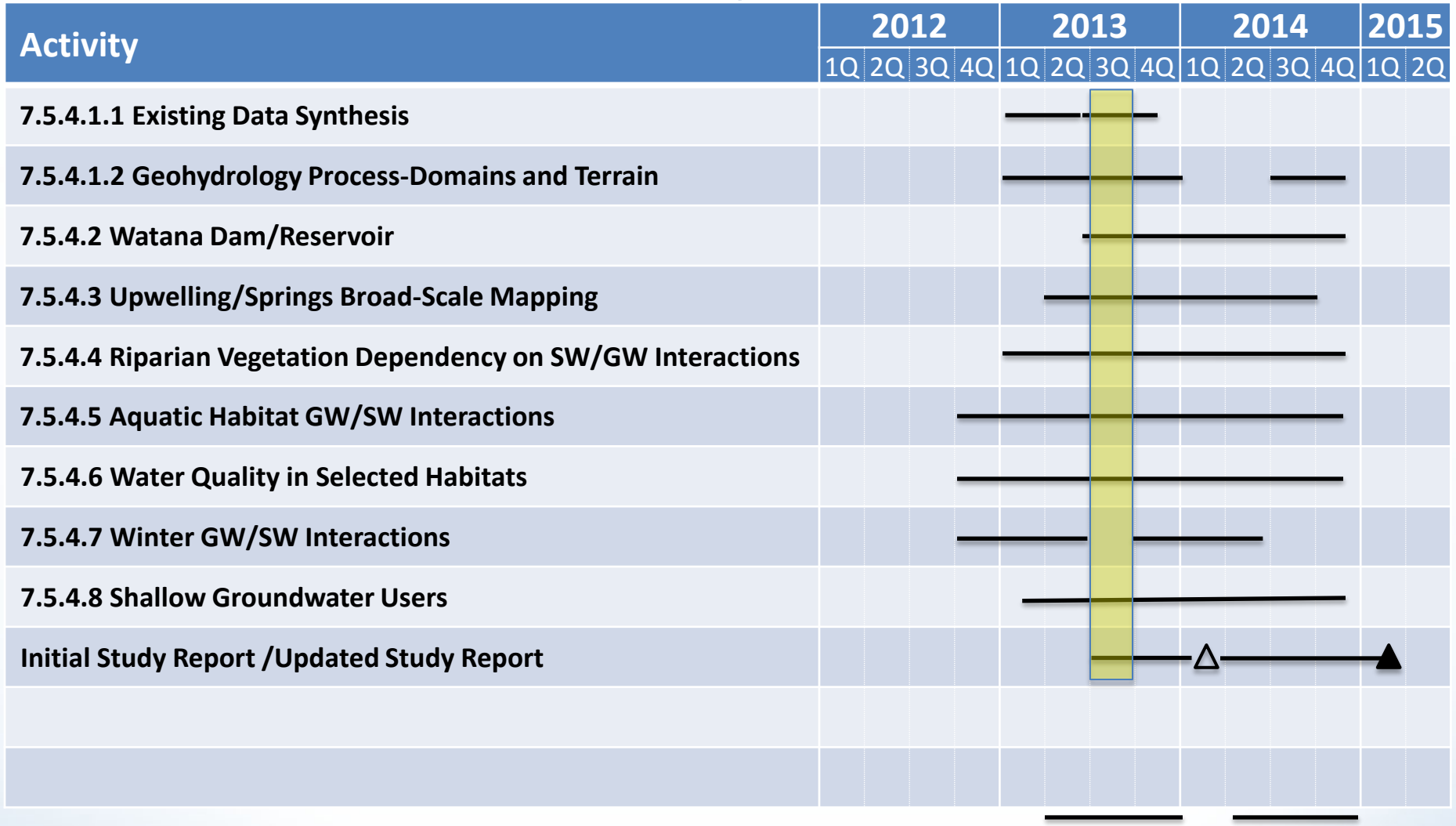
Getting ready to sling-load portable drill to next well location in FA104 – Whiskers Slough, using custom cradle/drilling platform, August 24, 2013

Groundwater Study (GW) Objectives

- 7.5.4.4 Riparian GW/SW
- 7.5.4.5 Aquatic GW/SW
- 7.5.4.6 Water Quality in Selected Habitats
- 7.5.4.7 Winter GW/SW
- 7.5.4.8 Shallow Groundwater Users

FA115 Lane Creek FA (Slough 6A) spring-fed stream in upper area; FA113 Oxbow1 Side Channel with stream inflow, July 15, 2013

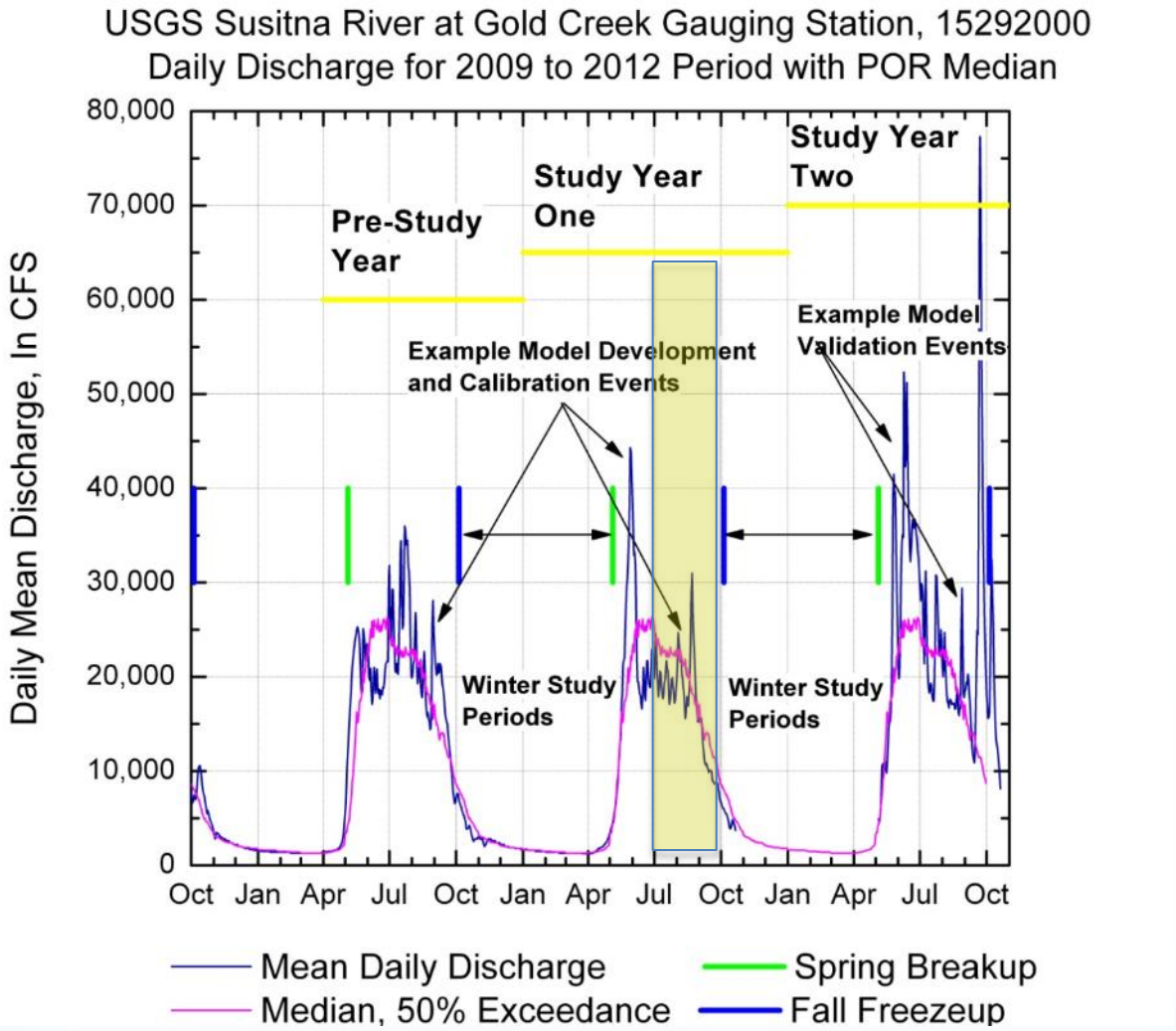
GW Study Schedule



SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Planned Activity
Follow-up Activity
Initial Study Report
Updated Study Report

GW Hydrologic Study Schedule



GW Q3, Q4 Status

- 7.5.4.1.1 Data Synthesis
  - Review and summaries in Q3, Q4
- 7.5.4.1.2 Geohydrologic Process-Domains
  - Review and summaries in Q3, Q4
- 7.5.4.2 Watana Dam/Reservoir
  - End of Season Conditions in Q3, Q4
- 7.5.4.3 Upwelling/Springs Broad-Scale Mapping
  - Review and summaries in Q3, Q34

Slough 19 and beaver-influenced hydrology are part of FA141 study activities, July 15, 2013

GW Q3, Q4 Status

- 7.5.4.4 Riparian GW/SW
  - Field Implementation in Q2, Q3
  - End of main data collection early Q4
  - End of winter, breakup hydrology observations in Q4
- 7.5.4.5 Aquatic GW/SW
  - Field Implementation in Q2, Q3
  - End of winter, breakup hydrology observations in early Q4

Slough 21 and Side Channel 21 are part of FA144 study activities, July 15, 2013

GW Q3,Q4 Status

- 7.5.4.6 Water Quality in Selected Habitats
  - Primary activities started Q3
  - Summary of 2014 FA efforts in Q4
- 7.5.4.7 Winter GW/SW
  - 2013/14 Winter Planning Q3
  - Primary activities starting Q4
- 7.5.4.8 Shallow Groundwater Users
  - Review and Installations in Q3, Q4

Getting ready to drill next well location in FA104 – Whiskers Slough, Riparian data station location in forest, August 25, 2013

GW RSP 7.5.4.1.1 - Data Synthesis Highlights

- Review of Literature Index Sources
- Identification of Key References, Areas and Information to Pursue

Moving drill and supporting supplies and tooling to next station; sling loading has minimized land disturbances and increased drilling progress, August 26, 2013

GW RSP 7.5.4.2 - Watana Dam/Reservoir Highlights

- Identification of 2013 End-of-Summer Conditions, Q4
- Main Activities and Interaction with Engineering Studies Begin Q4
- Field Visit to Upper End of Proposed Reservoir With IFS/Riparian to Document Riparian and Hydrology Conditions in Q4

GW RSP 7.5.4.3 - Upwelling/Springs Broad-Scale Mapping Highlights

- Identification of 2013 Summer Conditions, Q3/Q4
- Coordination with Ice Processes, IFS – Winter Gaging Program, Q4 Reporting

FA128 – Skull Creek Complex (Slough 8A) - Measuring groundwater upwelling in Slough 8A before Spring snowmelt in aquatic habitat, May 5, 2013

IFS Task3 Winter Gaging Q3,Q4 - GW 7.5.4.4 2013/14 Winter Coordination

- 2 Measurement Periods, Late January, Late March/Early April
- Coordination with IFS, Ice Processes and Groundwater Studies
- Discharge, Stage, Ice Thickness and Elevation, Snow Cover, Frazil Ice

Geovera staff conducting RTK surveying at ESS40, GW Scientific and Brailey Hydrologic ice drilling, January 2013

GW RSP 7.5.4.4 – Riparian GW/SW Highlights

- Q3 – Shallow GW Wells, Installation of Stations, Data Collection
- Q4 – End of Season Data Collection, Methods and Data QC

GW and IFS-Riparian Study staff explaining coordinated field data collection programs to IFS Program Lead, August 2, 2013

GW RSP 7.5.4.4 – Riparian GW/SW Highlights

- All Data Stations Setup in Focus Areas
- Data Stations Setup in Lower-River Riparian Transects
- Manual Observation Points Established

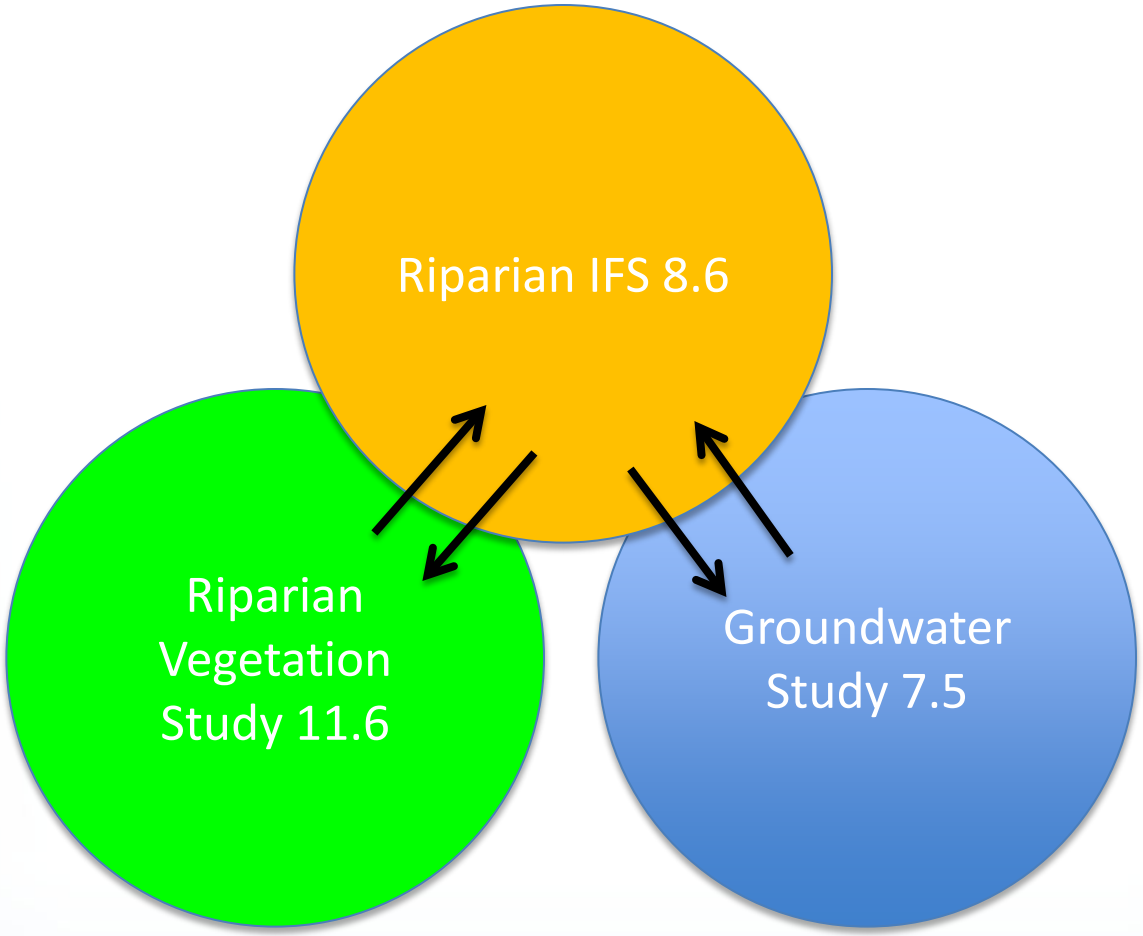
FA104 – Whiskers Slough - surveying a new well installation to measure water levels to Project datum and accuracy standards, August 27, 2013

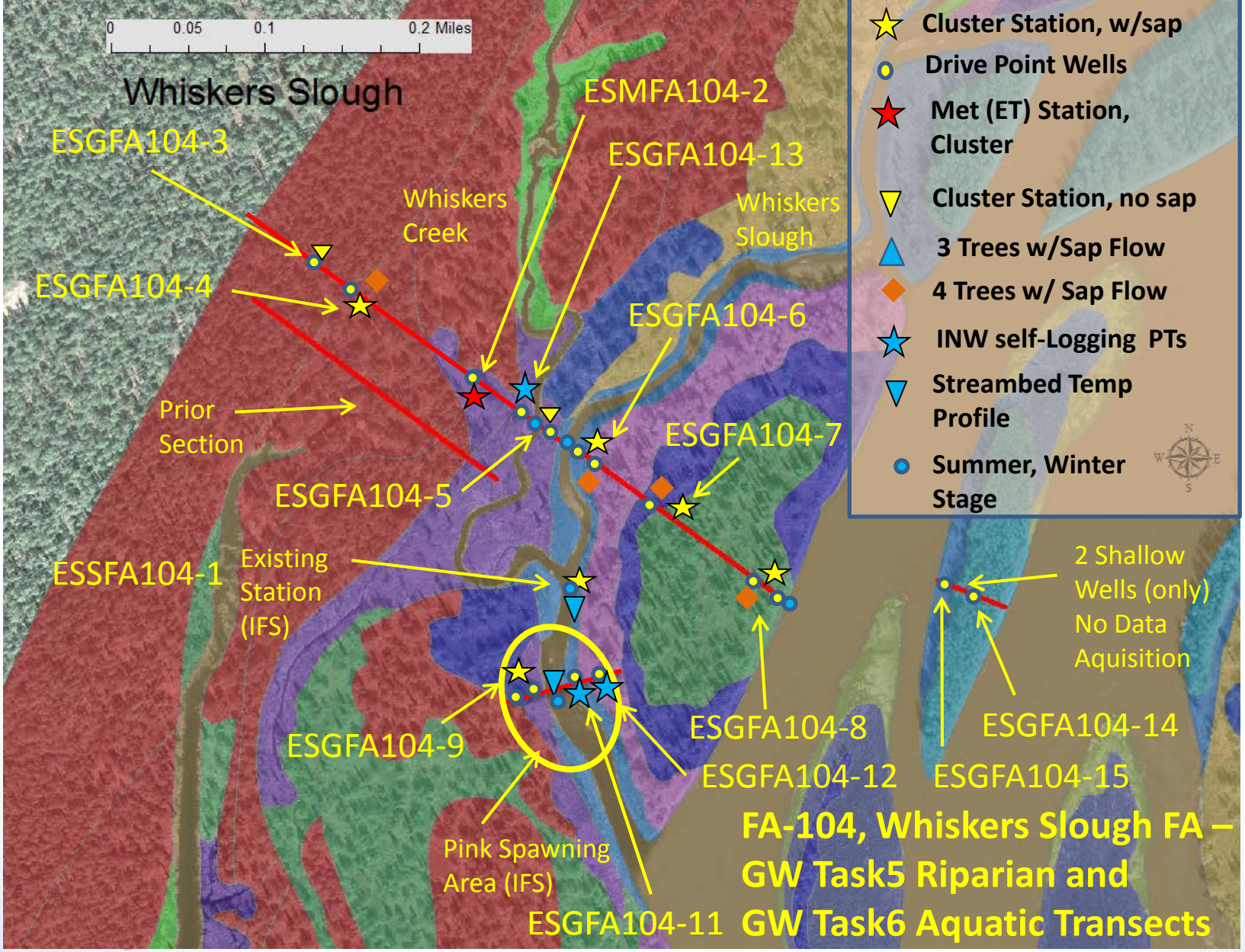
GW RSP 7.5.4.4 – Riparian GW/SW Highlights

- Manual Data Collection Ongoing During Summer During Station Installations
- Close Integration With IFS-Riparian Field Teams
- All Water Levels Tied to Project Elevation Control and Standards.

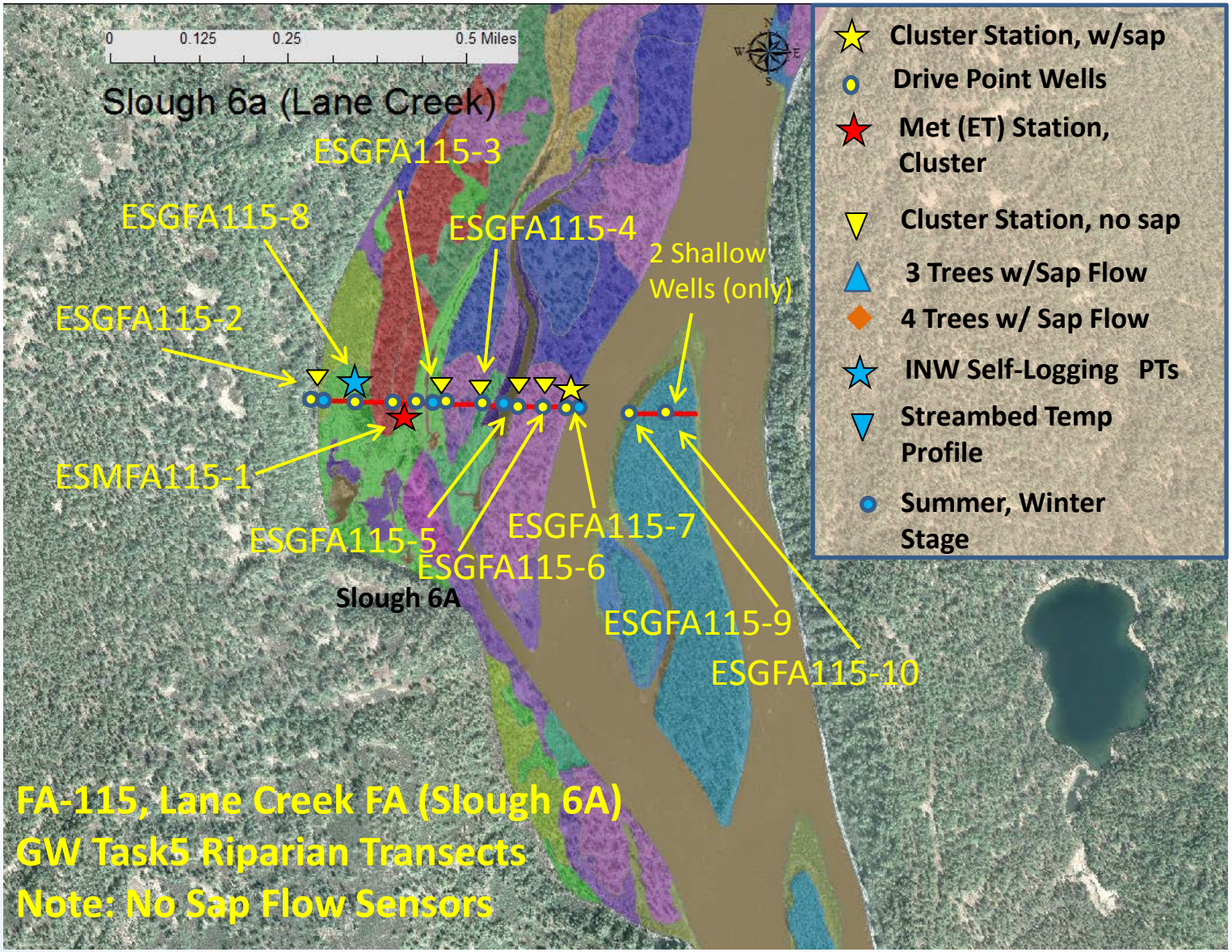
FA104 - Whiskers Slough coordinated geotechnical sensor installations between GW and IFS-Riparian field staff; installing a temperature profile string and soil sampling, August 27, 2013

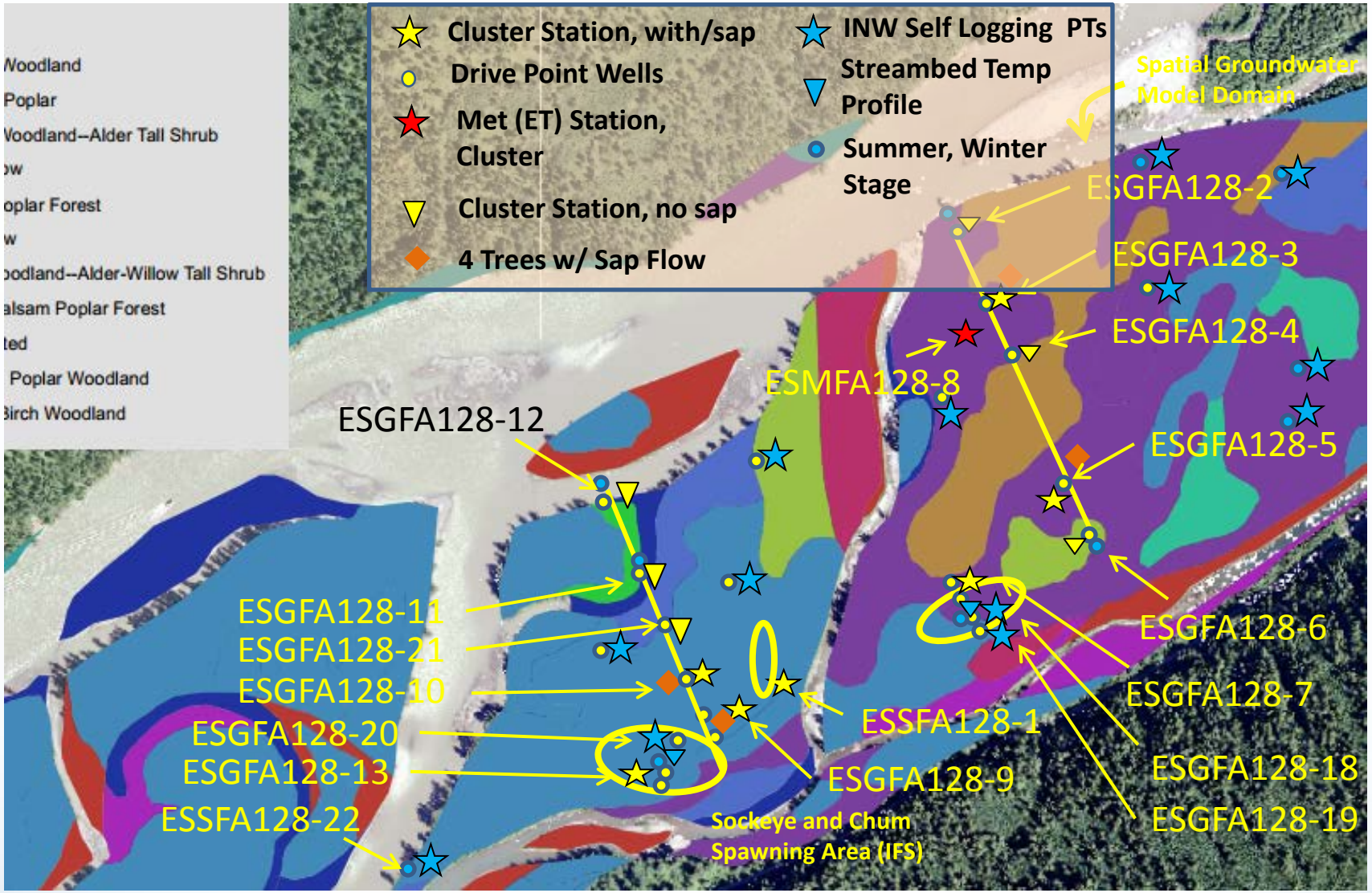
Integrated Riparian Groundwater (RIPGW) Studies



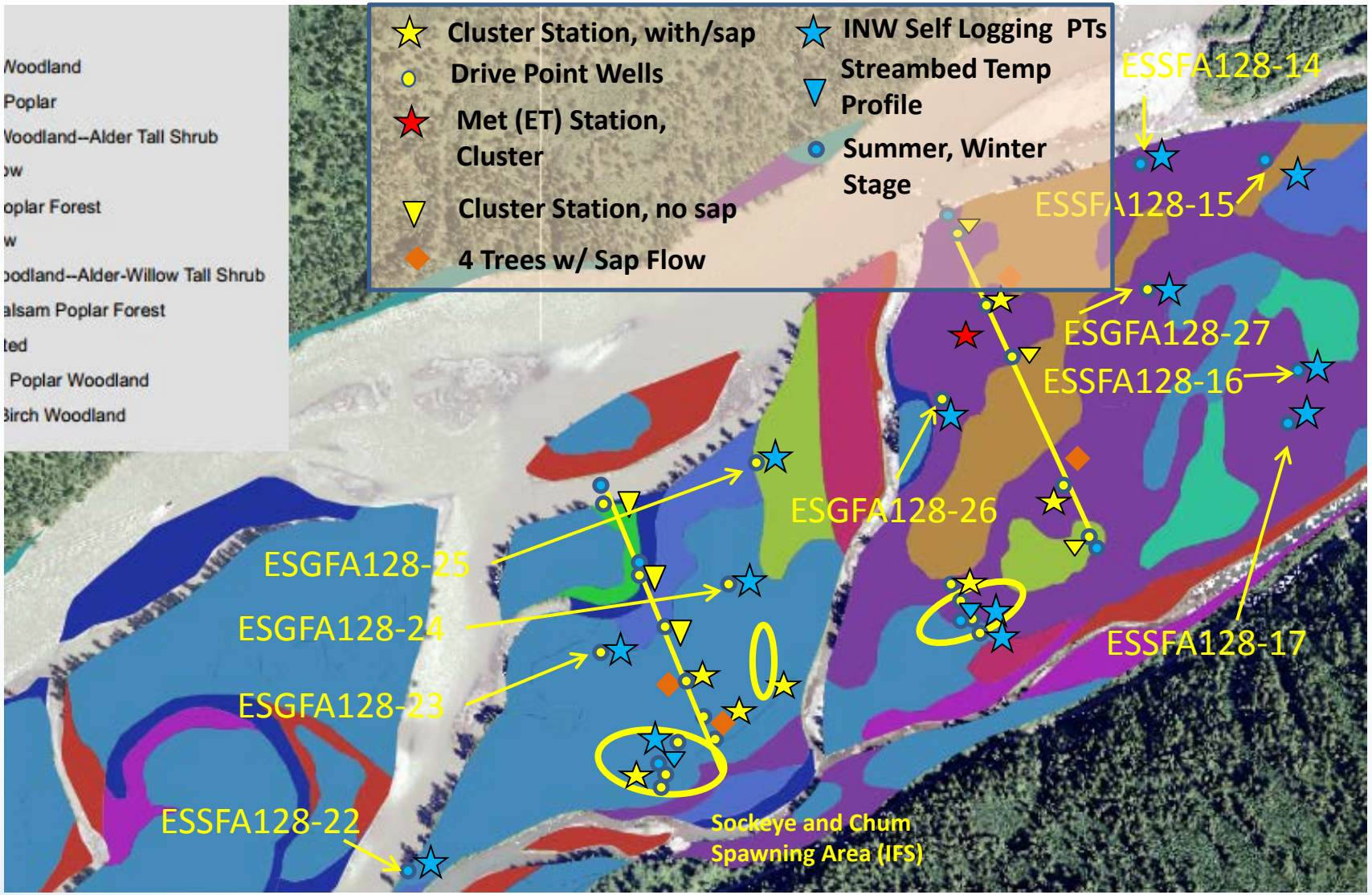


FA-104, Whiskers Slough FA – GW Task5 Riparian and GW Task6 Aquatic Transects

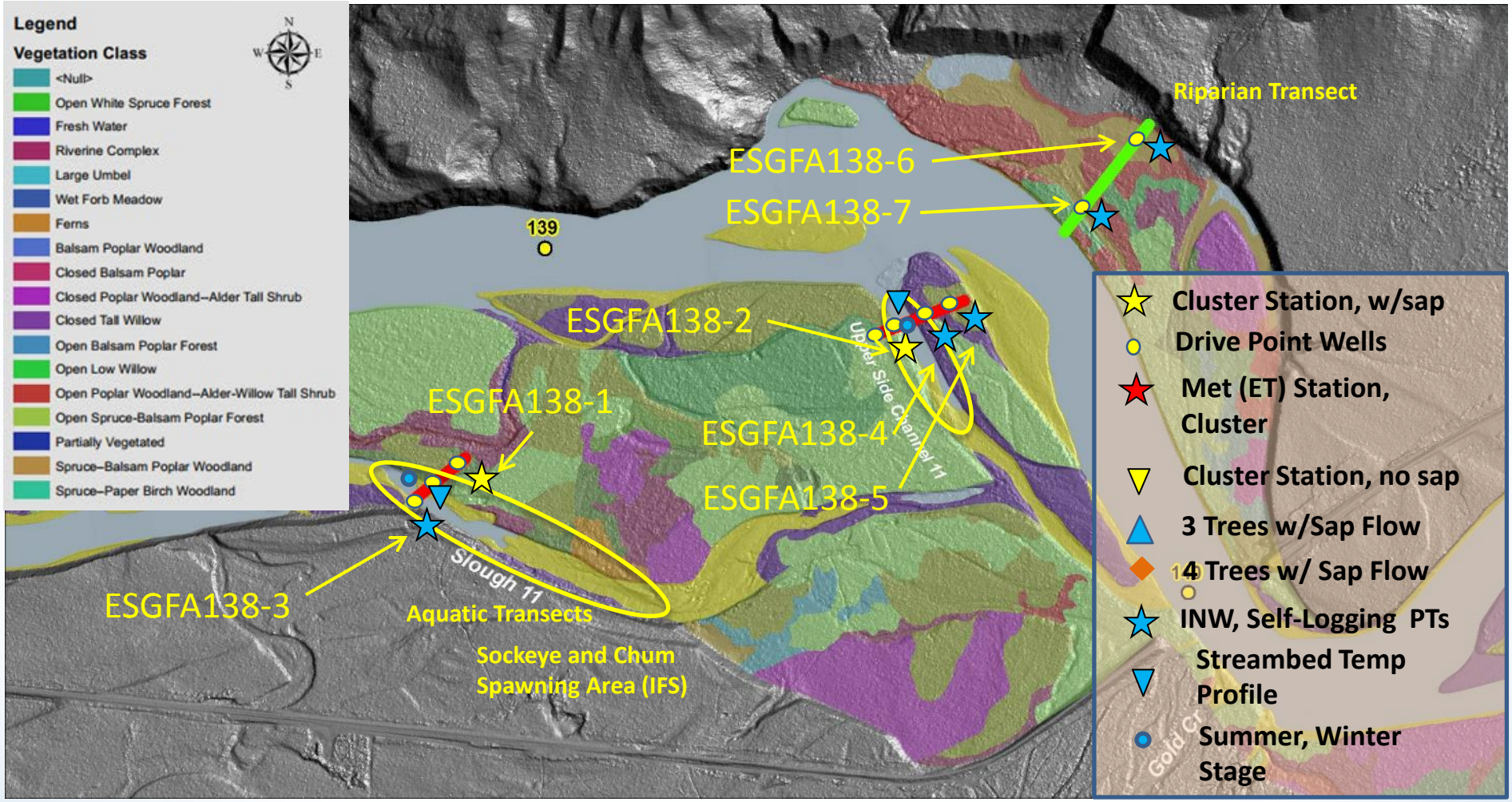

0
0.125
0.25
0.5 Miles
Slough 6a (Lane Creek)
ESGFA115-3
ESGFA115-8
ESGFA115-4
2 Shallow Wells (only)
ESGFA115-2
ESMFA115-1
ESGFA115-5
ESGFA115-7
ESGFA115-6
Slough 6A
ESGFA115-9
ESGFA115-10
Cluster Station, w/sap
Drive Point Wells
Met (ET) Station, Cluster
Cluster Station, no sap
3 Trees w/Sap Flow
4 Trees w/ Sap Flow
INW Self-Logging PTs
Streambed Temp Profile
Summer, Winter Stage
FA-115, Lane Creek FA (Slough 6A)
GW Task5 Riparian Transects
Note: No Sap Flow Sensors



Skull Creek Complex FA (Slough 8A) Aquatic and Riparian Stations



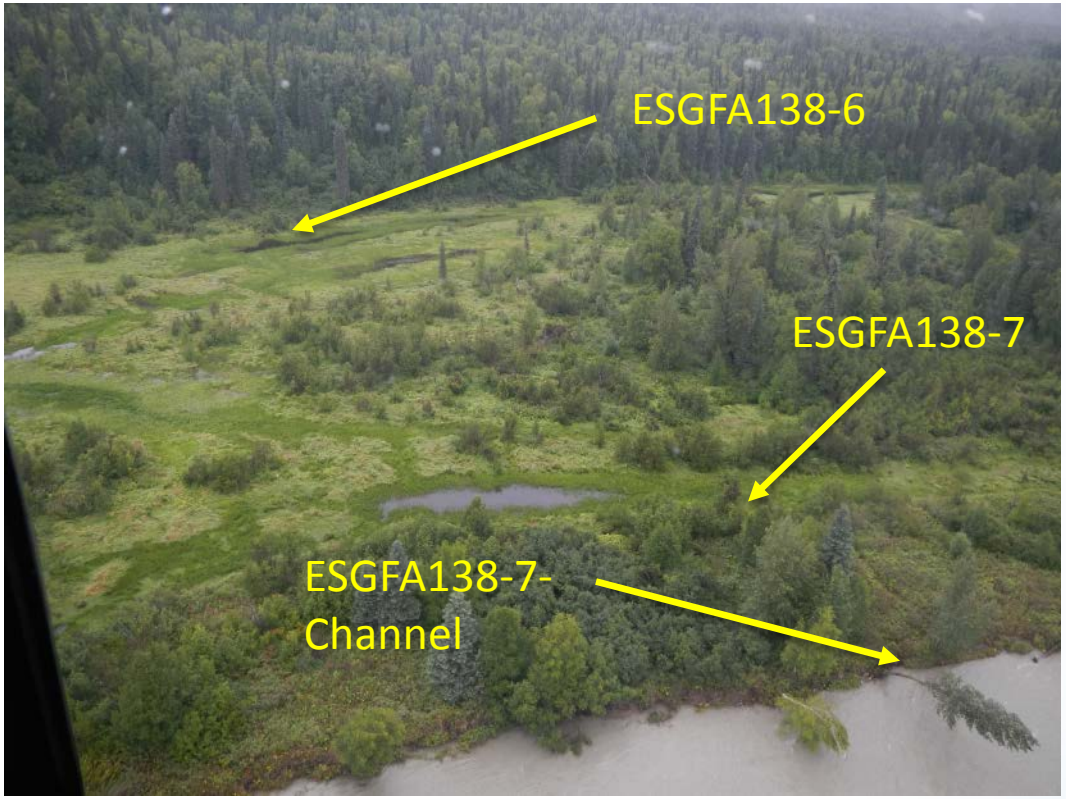
Skull Creek Complex FA (Slough 8A) Aquatic and Riparian Stations



FA-138, Gold Creek Focus Area, GW Task6 Aquatic, Task5 Riparian Stations

FA-138, Gold Creek Focus Area Upland Wetland Hydrology Observations

- How Are Upland Sloughs and Wetlands Impacted By River Stage Levels?
- How Does this Vary Over The Annual Hydrologic Cycle?
- At What Scale are GW/SW Interactions Significant?



FA-138, Gold Creek Focus Area, Right Bank Upland Sloughs and Wetlands, during heavy rainfall and precipitation flood peak on the Susitna River, August 22, 2013

FA-138, Gold Creek Focus Area Upland Wetland Hydrology Observations

- Does Recharge From Groundwater Help Maintain Wetland Vegetation?
- What Winter Observations Help Understand This?
- What Snowmelt Transition Observations Help Understand This?

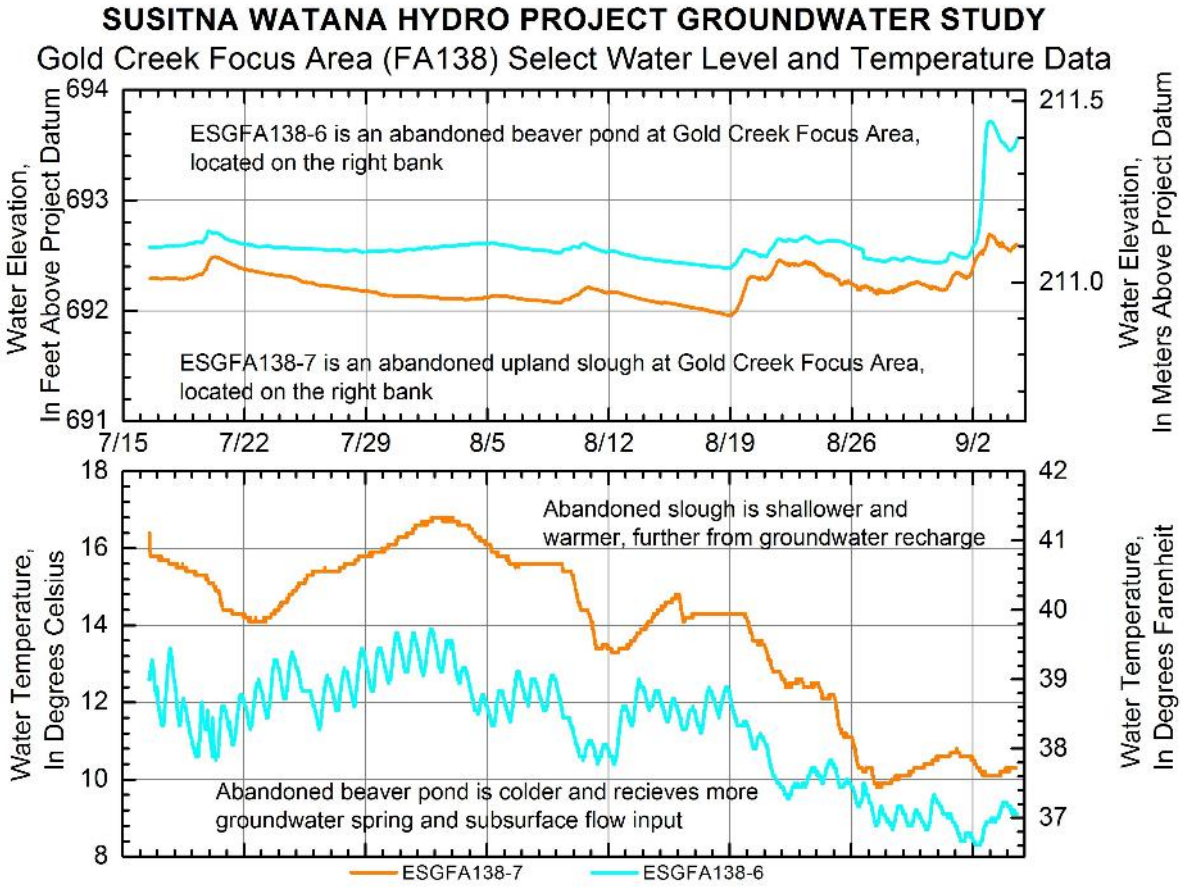
FA-138, Gold Creek Focus Area, Right Bank Upland abandoned beaver pond during periods of heavy rains, August 22, 2013

FA-138, Gold Creek Focus Area Upland Wetland Hydrology Observations

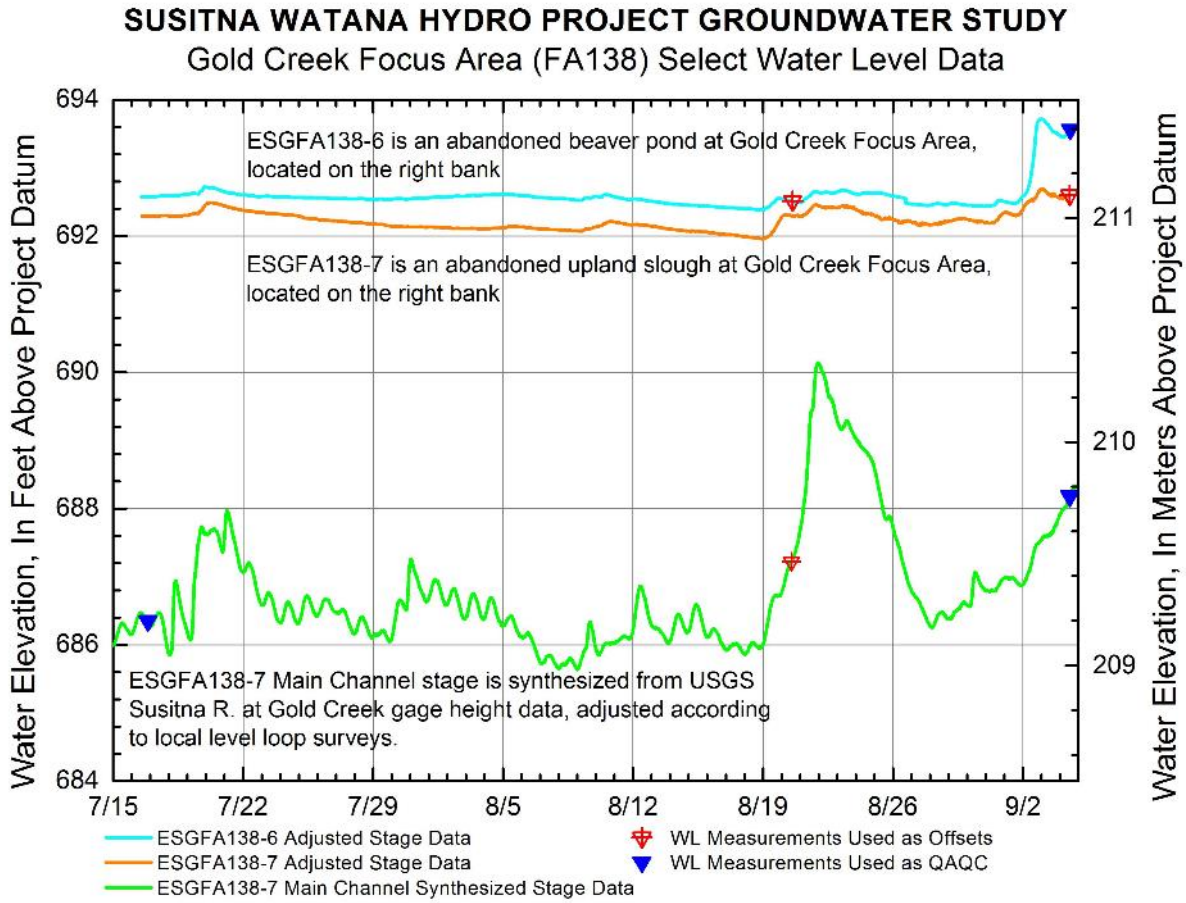
- Future Shallow Groundwater and Surface Water Level Monitoring
- Seasonal Observations
- Measuring Interactions (Or Lack Of) With River

FA-138, Gold Creek Focus Area, Right Bank Abandoned Upland Sloughs and Wetlands, During Periods of Heavy Rain, August 22, 2013

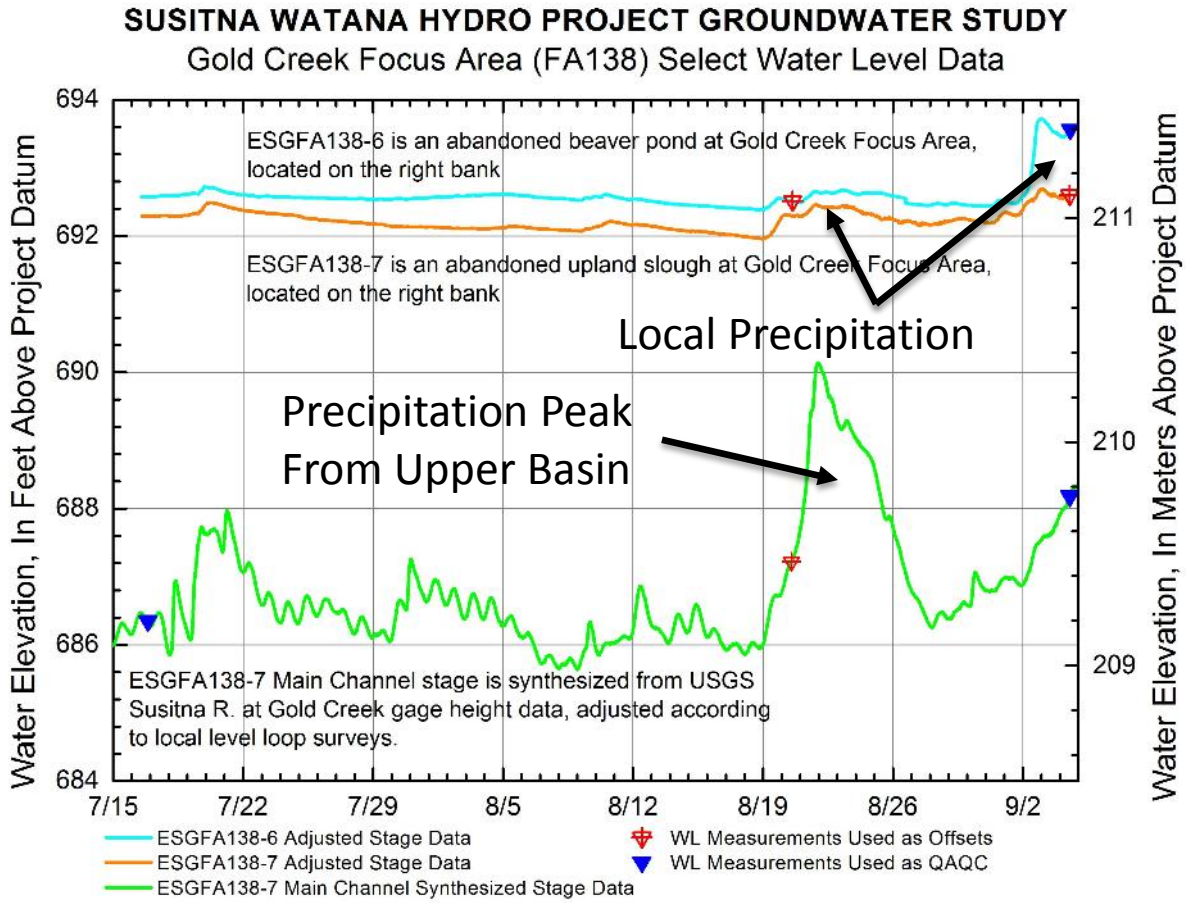
FA-138, Gold Creek Focus Area Upland Wetland Hydrology Observations



FA-138, Gold Creek Focus Area Upland Wetland Hydrology Observations



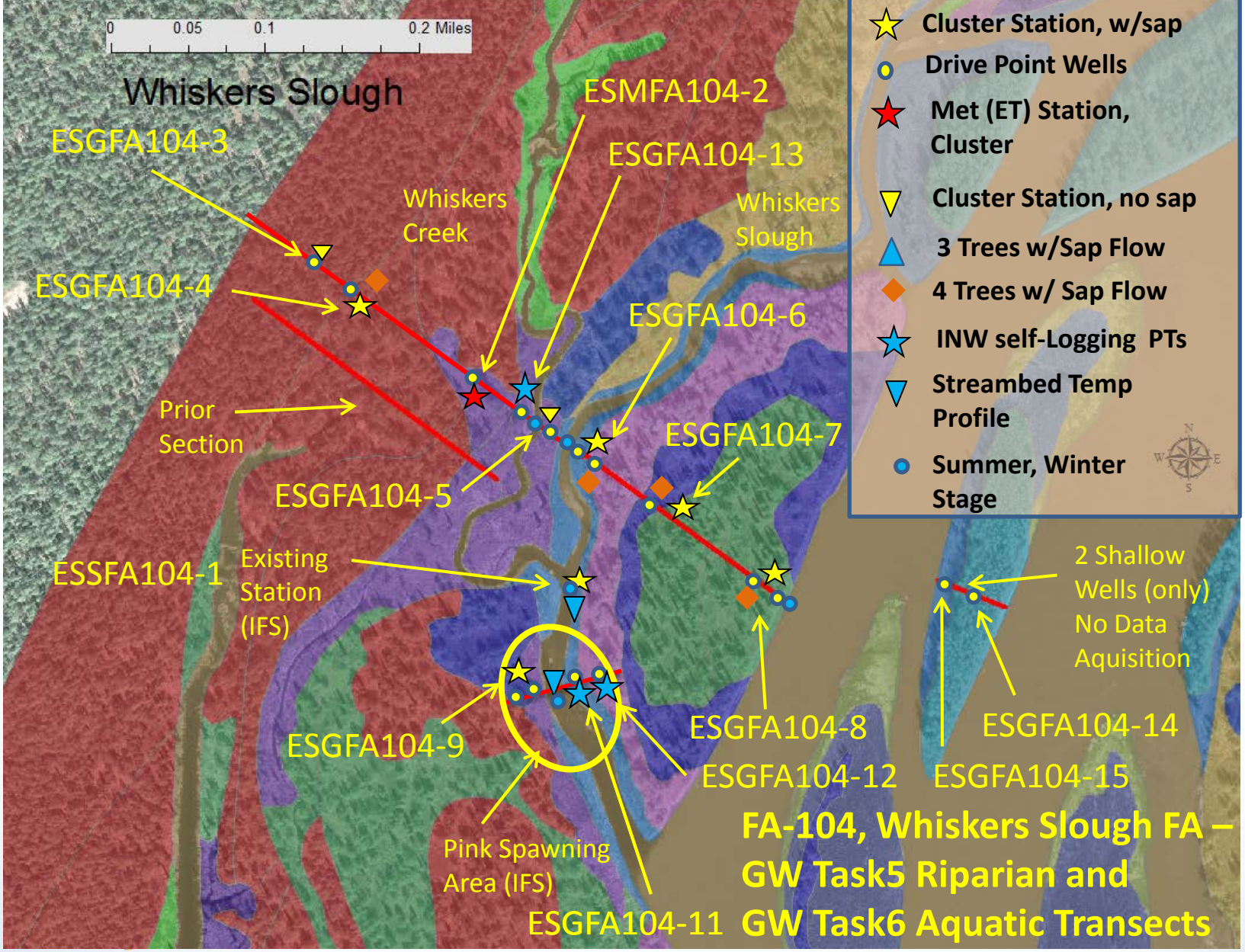
FA-138, Gold Creek Focus Area Upland Wetland Hydrology Observations



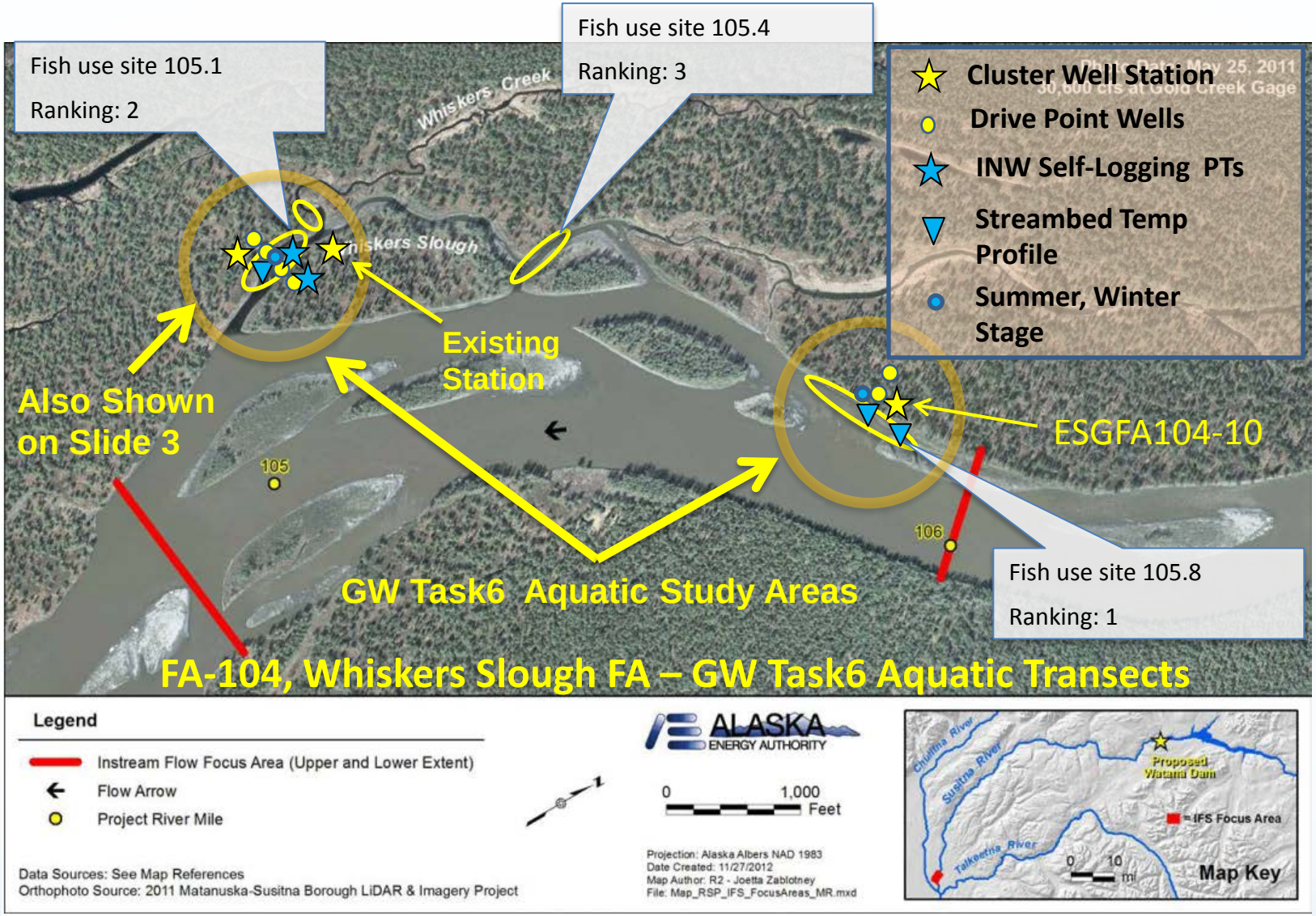
GW RSP 7.5.4.5 – Aquatic GW/SW Highlights

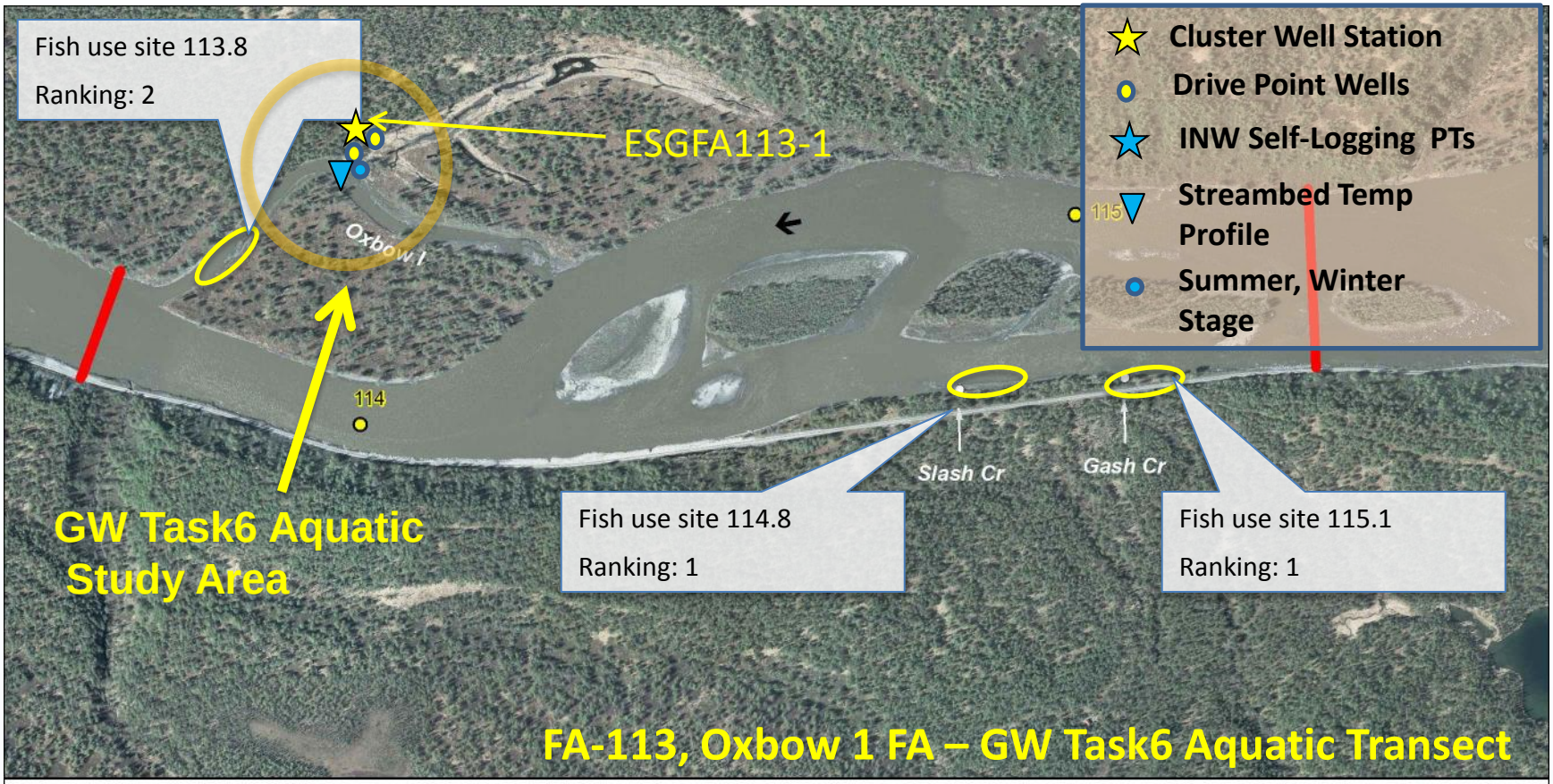
- Q3 – Shallow GW Wells, Installation of Stations, Data Collection
- Q4 – End of Summer Season Data Collection, Data QC

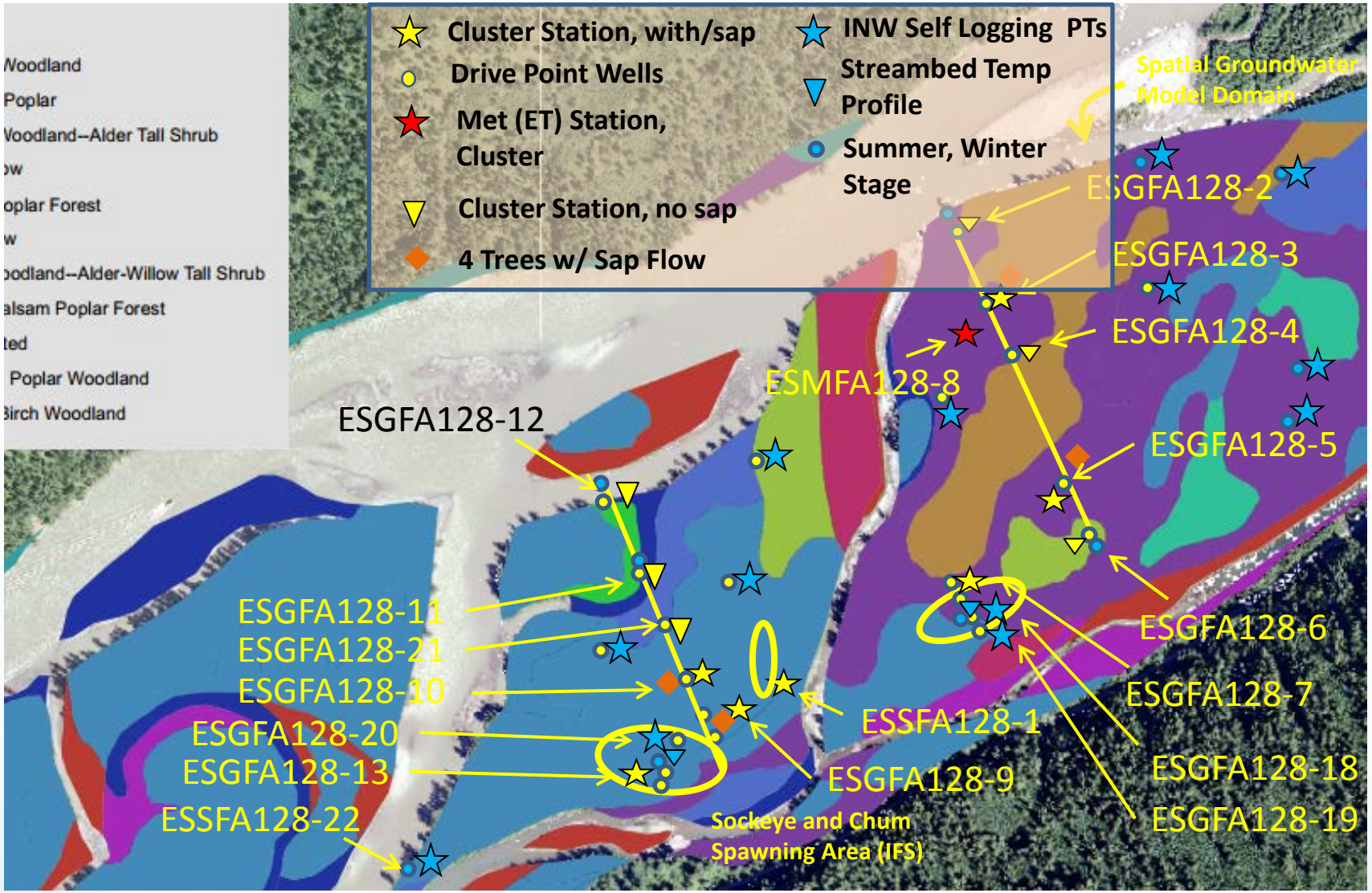
Mobile Drill Minuteman portable drill being used to pre-drill drive point well installation borings, drill is sitting on custom sling-load cradle, August 23, 2013



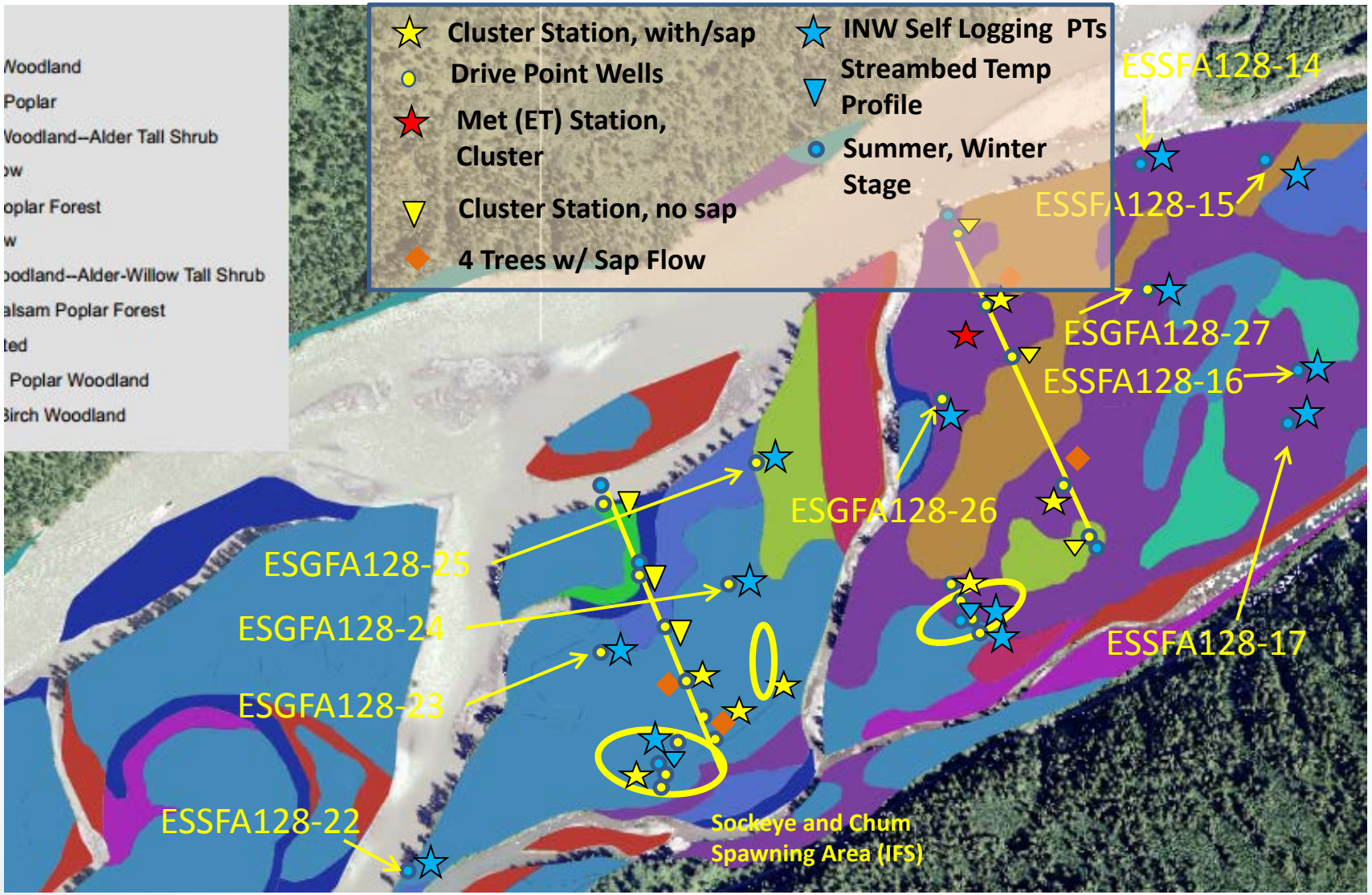
FA-104, Whiskers Slough FA – GW Task5 Riparian and GW Task6 Aquatic Transects


Fish use site 105.1
Ranking: 2
Fish use site 105.4
Ranking: 3
Whiskers Creek
Whiskers Slough
Cluster Well Station
Drive Point Wells
INW Self-Logging PTs
Streambed Temp Profile
Summer, Winter Stage
Existing Station
Also Shown on Slide 3
ESGFA104-10
105
106
Fish use site 105.8
Ranking: 1
GW Task6 Aquatic Study Areas
FA-104, Whiskers Slough FA – GW Task6 Aquatic Transects
Legend
Instream Flow Focus Area (Upper and Lower Extent)
Flow Arrow
Project River Mile
Data Sources: See Map References
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project
ALASKA ENERGY AUTHORITY
0
1,000
Feet
Projection: Alaska Albers NAD 1983
Date Created: 11/27/2012
Map Author: R2 - Joetta Zablotney
File: Map_RSP_IFS_FocusAreas_MR.mxd
Chulitna River
Susitna River
Talkeetna River
Proposed Watana Dam
IFS Focus Area
0
10
mi
Map Key

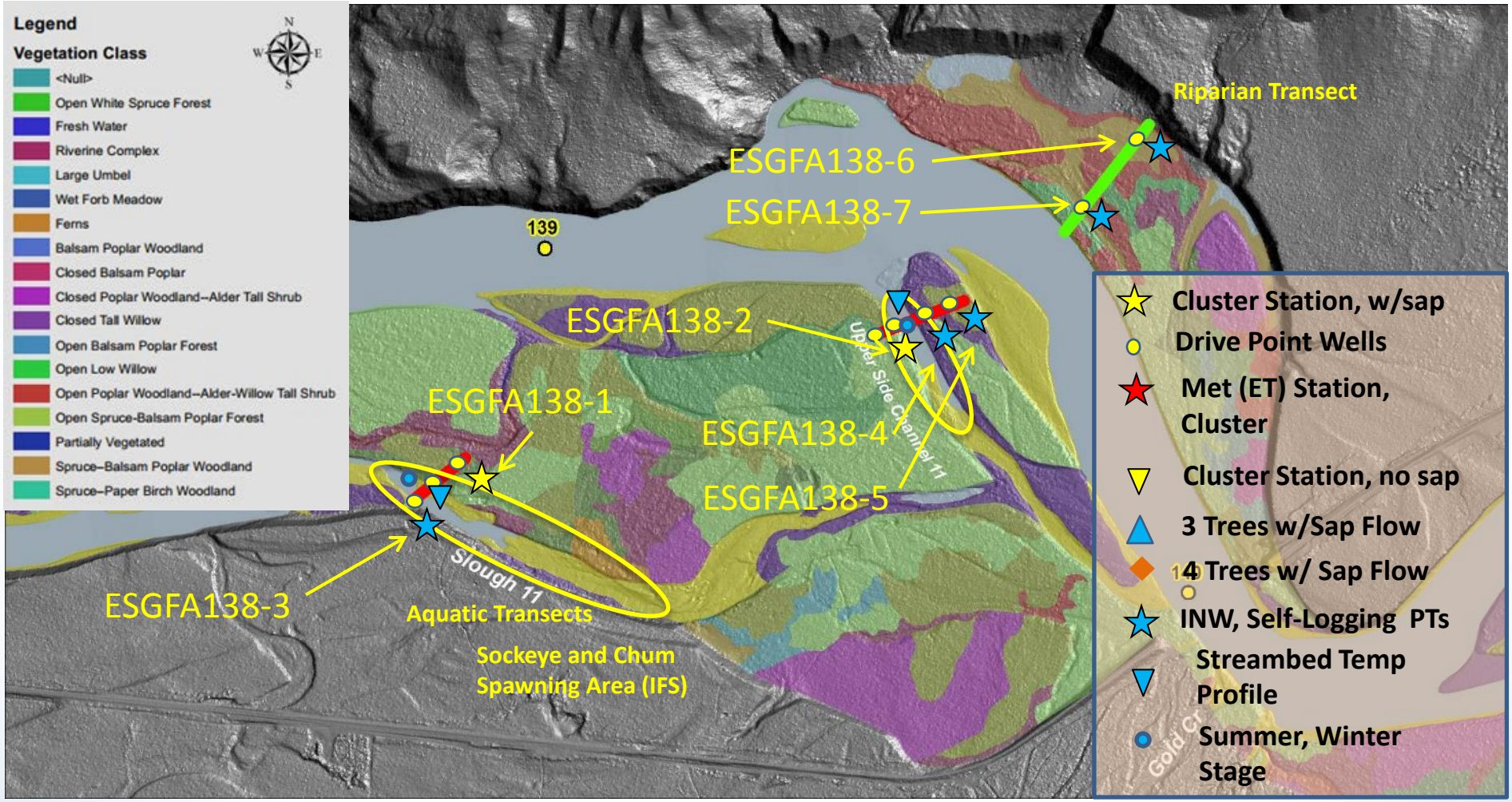

Fish use site 113.8
Ranking: 2
ESGFA113-1
Oxbow I
114
115
Cluster Well Station
Drive Point Wells
INW Self-Logging PTs
Streambed Temp Profile
Summer, Winter Stage
GW Task6 Aquatic Study Area
Slash Cr
Gash Cr
Fish use site 114.8
Ranking: 1
Fish use site 115.1
Ranking: 1
FA-113, Oxbow 1 FA – GW Task6 Aquatic Transect
Legend
Instream Flow Focus Area (Upper and Lower Extent)
Flow Arrow
Project River Mile
ALASKA ENERGY AUTHORITY
0
1,000
Feet
Projection: Alaska Albers NAD 1983
Date Created: 5/7/2013
Map Author: R2 - Joetta Zablotney
Orthophoto Source: 2011 Matanuska-Susitna Borough LiDAR & Imagery Project
Chulitna River
Susitna River
Talkeetna River
Proposed Watana Dam
= IFS Focus Area
0
10
mi
Map Key



Skull Creek Complex FA (Slough 8A) Aquatic and Riparian Stations



Skull Creek Complex FA (Slough 8A) Aquatic and Riparian Stations



FA-138, Gold Creek Focus Area, GW Task6 Aquatic, Task5 Riparian Stations

GW RSP 7.5.4.6 – Water Quality in Selected Habitats Highlights

- Q3 – Site Locations, Coordination with WQ, Well Installations
- Q4 – End of 2013 Summer Season Data Collection, Data QC

FA-141, Indian River, Slough 19, measuring locations for water-quality transect measurements for Water Quality Study team July 13, 2013

GW RSP 7.5.4.7 – Winter GW/SW Highlights

- Q3 – Planning for 2013/14 Winter Studies
- Q4 – Begin Main Winter 2013/14 Observations

Dudley Reiser inspecting a river-ice cast created during Spring 2013 breakup in Whiskers Slough, June 14, 2013

GW RSP 7.5.4.8 – Shallow Groundwater Users Highlights

- Q3 – Identification of Study Well Locations, Begin Station Installation at Selected Wells
- Q4 – Main Installation of Well Installation and Surface-Water Manual Measurement Sites

New residential well installed in FA138 Gold Creek area, adjacent to Slough 11, will be used by study, July 14, 2013

GW RSP Variances

- No Variances Have Been Identified Through the Ongoing Summer 2013 Field Efforts

2013/14 Coordinated Winter Studies

- Coordinated IFS/Fish/GW Study Teams, Data
- Oct/Nov – Fall Freeze-up
- November – Early Observations
- Jan, Feb, Mar, April – Intense Field Trips
- Spring 2014 Breakup

FA128 - Slough 8A beginning of breakup; Whiskers Slough side channel inlet, May 25, 2013

2013/14 Coordinated Winter Studies

- Three Main Focus Areas
  - FA138 Gold Creek
  - FA128 Slough 8A
  - FA104 Whiskers Slough
- Additional Sites in Vicinity in Each FA
- Synoptic Data Collection and Observations

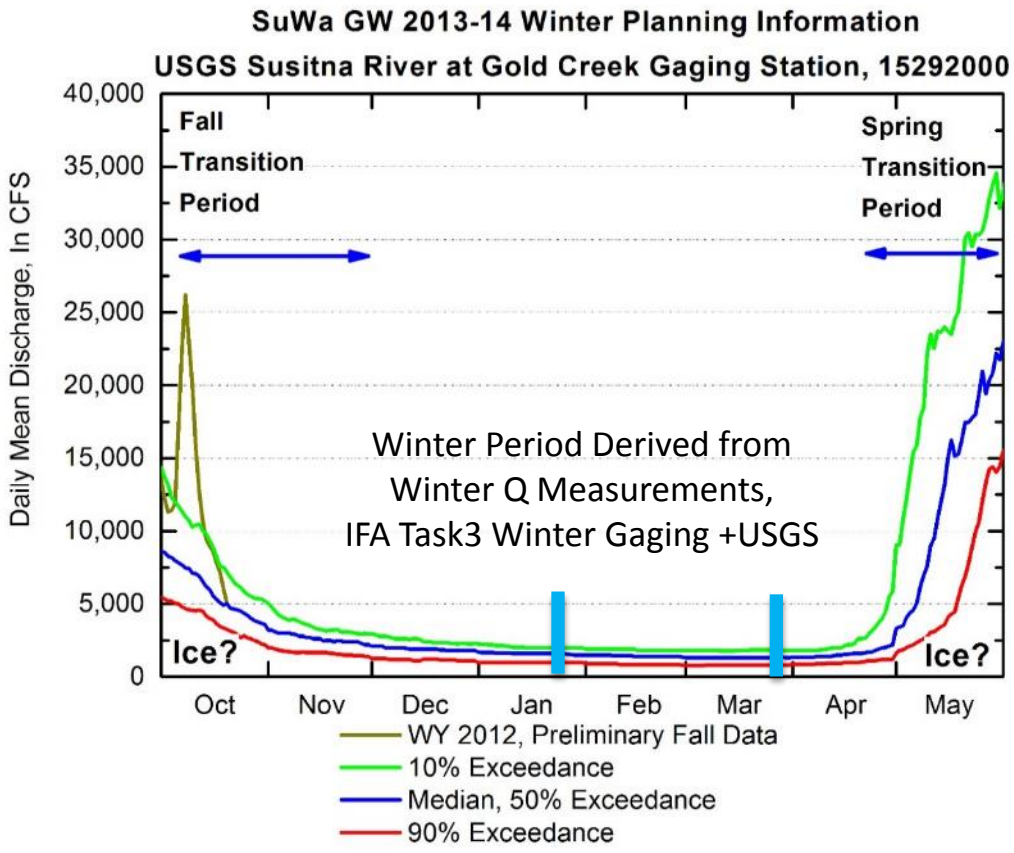
FA128 - Slough 8A beginning of breakup; Whiskers Slough side channel inlet, May 25, 2013

2013/14 Coordinated Winter Studies

- Additional Hydrology Data Collection, Automated Stations
  - FA113 – Oxbow1
  - FA115 – Slough 6A
- Additional Hydrology Data Collection, Manual Measurements
  - FA141 – Indian River
  - FA144 – Slough 21

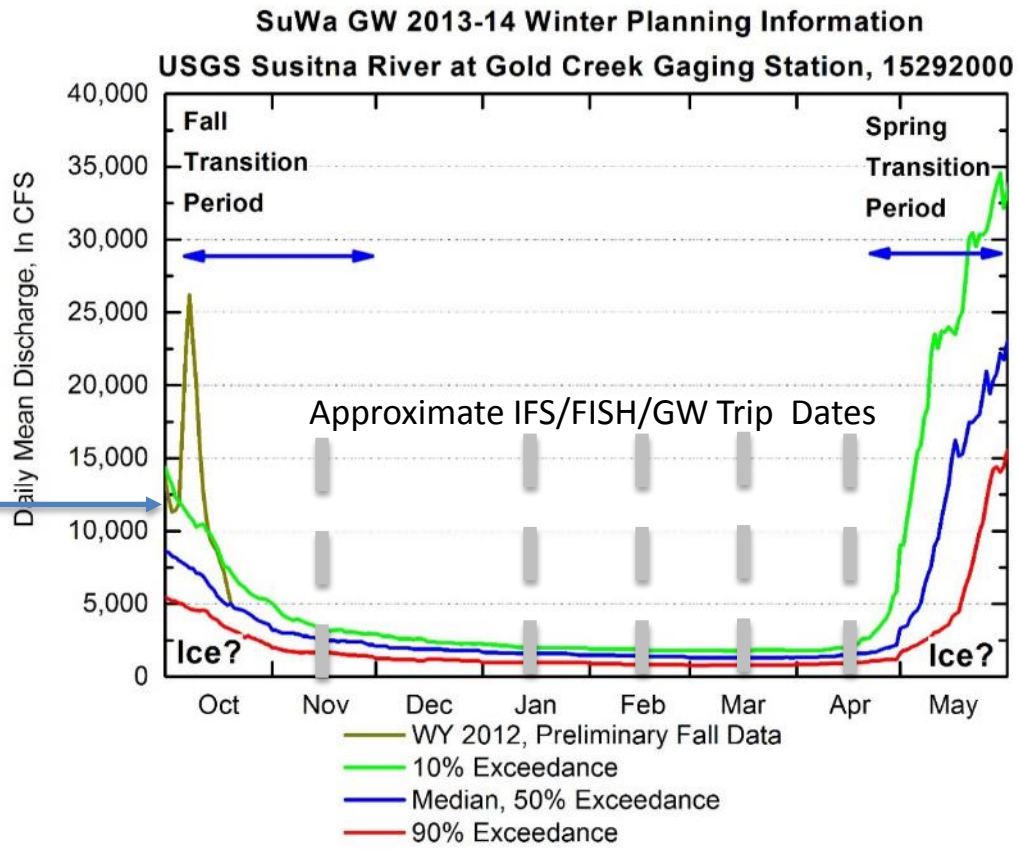
FA104 - Whiskers Slough, side channel inlet following major ice jam flooding, confluence of Whiskers Creek and Whiskers Slough, May 27, 2013

2013/14 Coordinated Winter Studies



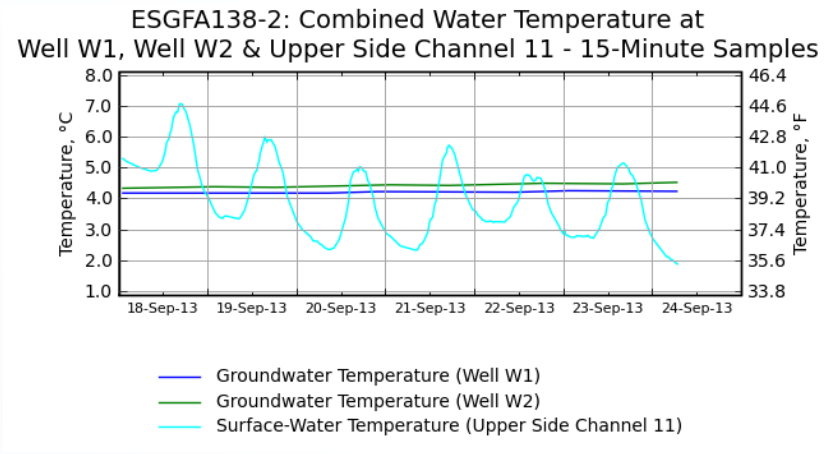
2013/14 Coordinated Winter Studies

Sept 24

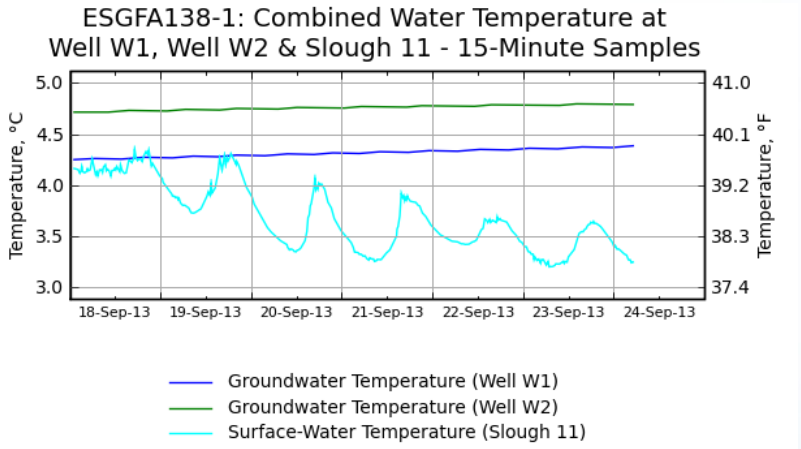


2013/14 Coordinated Winter Studies

- Winter Is Starting – Data is Being Collected

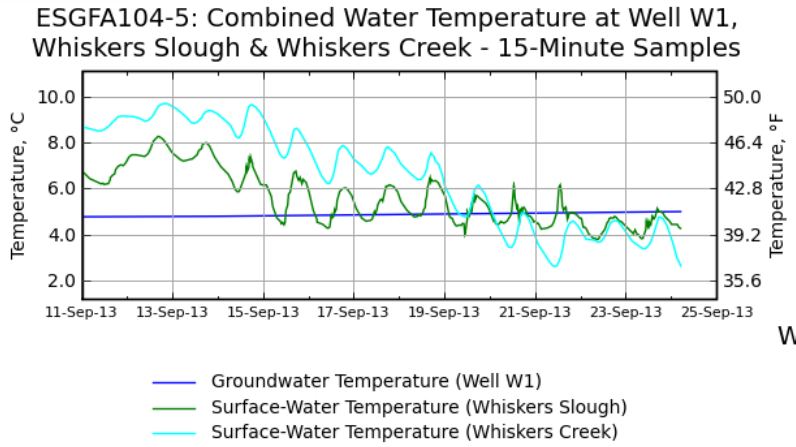


FA138 – Gold Creek
Upper Side Channel 11
Slough 11

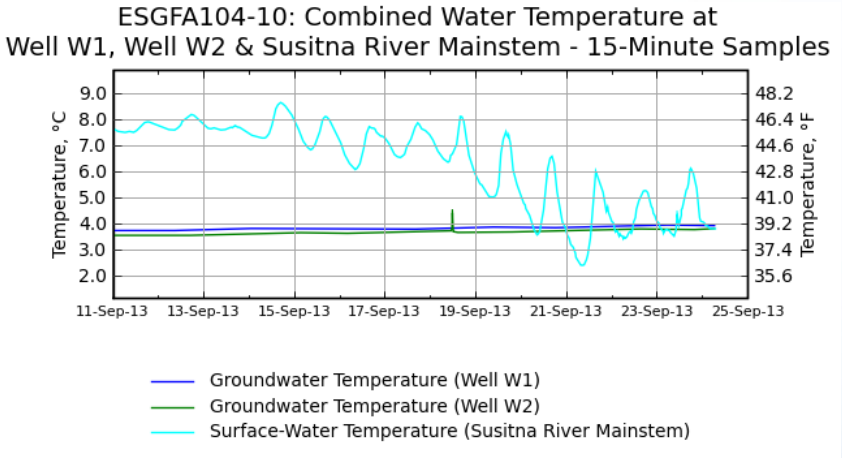


2013/14 Coordinated Winter Studies

- Winter Is Starting – Data is Being Collected

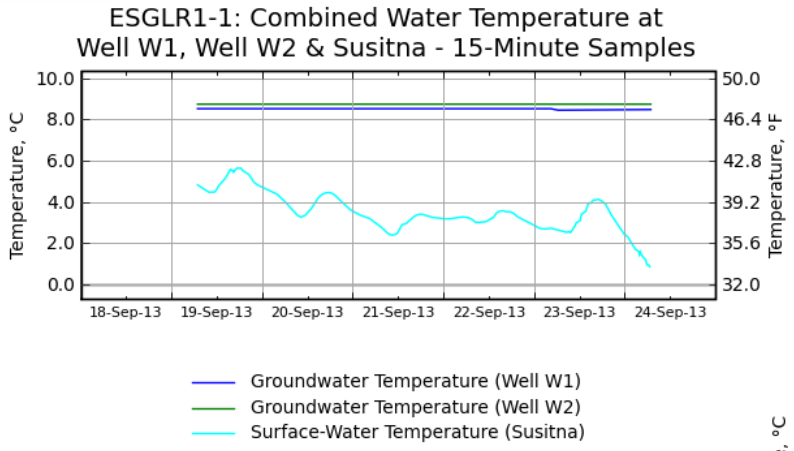


FA104 – Whiskers Slough
Whisker Creek, Whiskers Slough
Susitna Side Channel



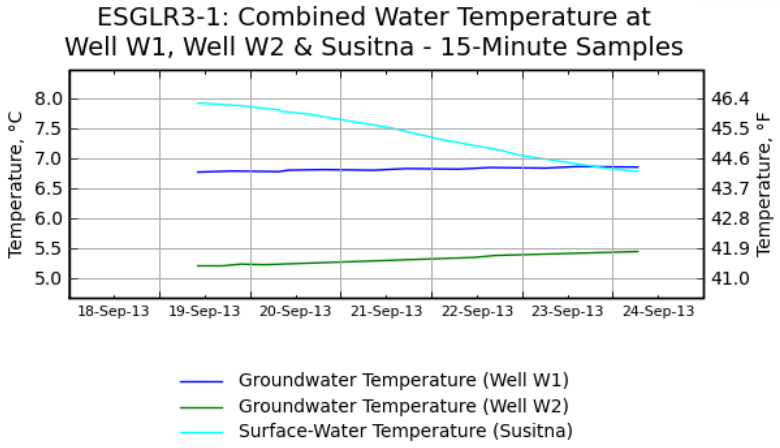
2013/14 Coordinated Winter Studies

- Winter Is Starting – Data is Being Collected



Side Channel in Island Complex across from Trapper Creek, ~PRM 94

Side Channel Above Confluence of Yentna, Across from Kroto Slough, ~PRM 38.5



Groundwater Study

- Thank You!
- Questions?
- More information at:

  www.susitna-watanahydro.org

Portable drill and custom sling-load cradle/sled at FA104 – Whiskers Slough after another successful boring completion, August 24, 2013