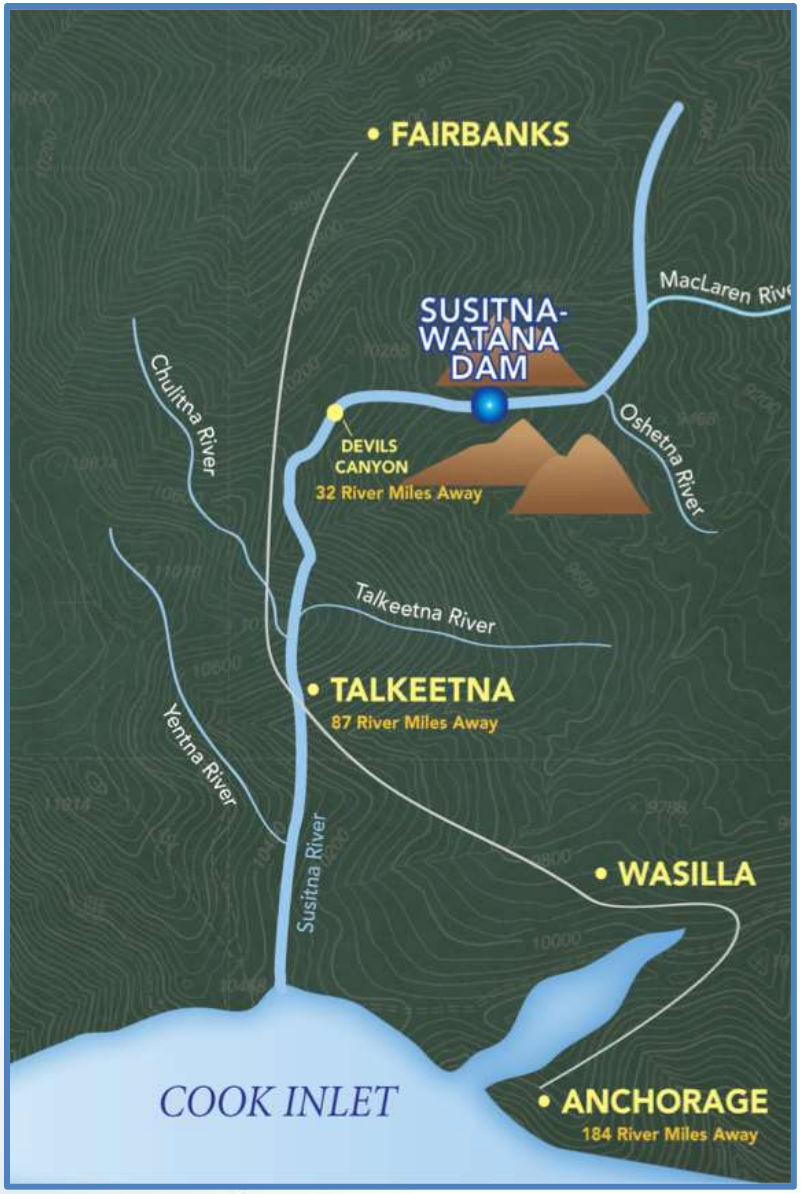


SUSITNA-WATANA HYDRO *Clean, reliable energy for the next 100 years.*

Technical Workgroup Meeting

Groundwater Study Q2/Q3 2013 Update

June 25, 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

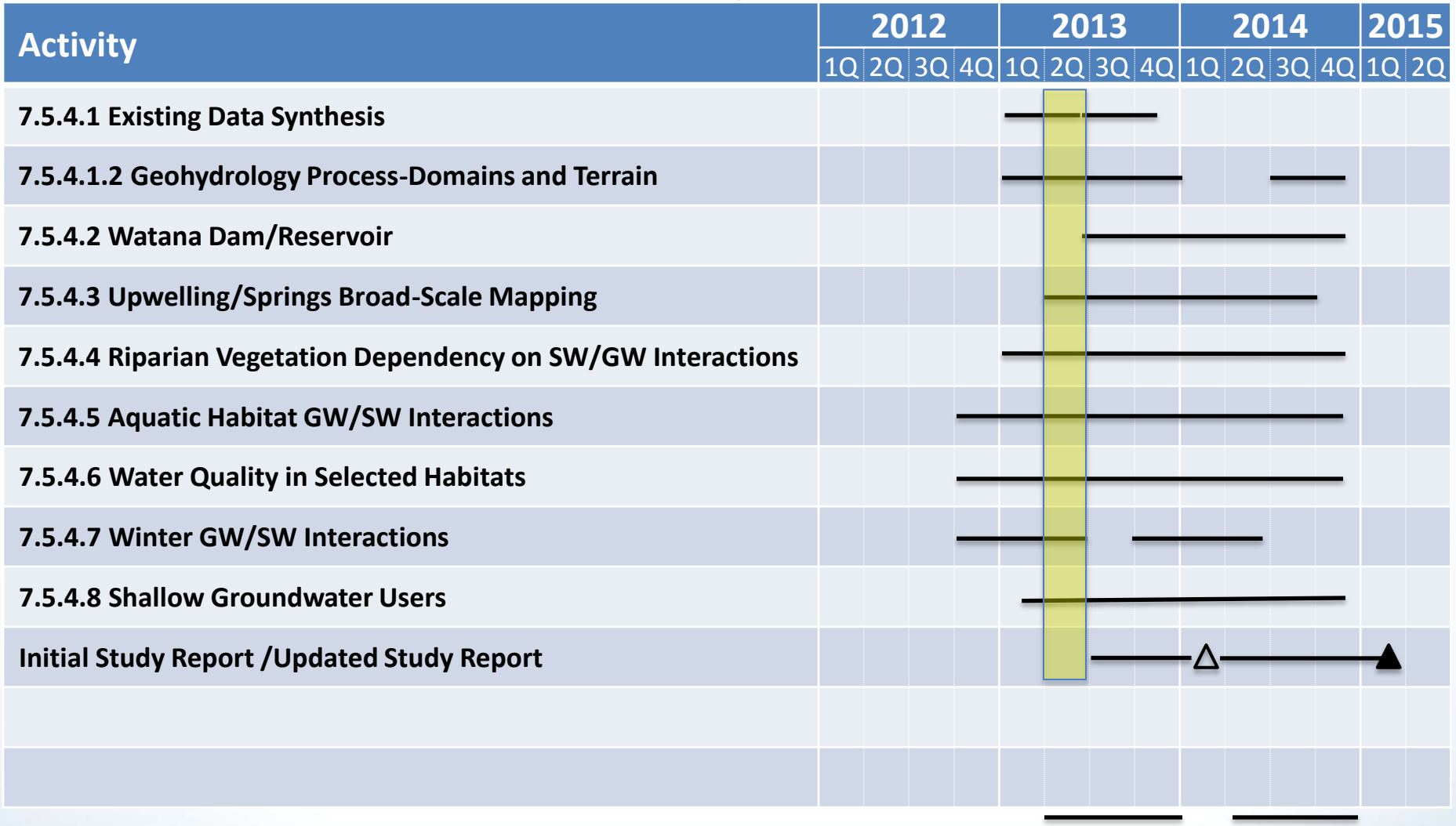
GW Scientific measuring water quality and levels in Whiskers Slough, May 25, 2013

Groundwater Study (GW) Objectives

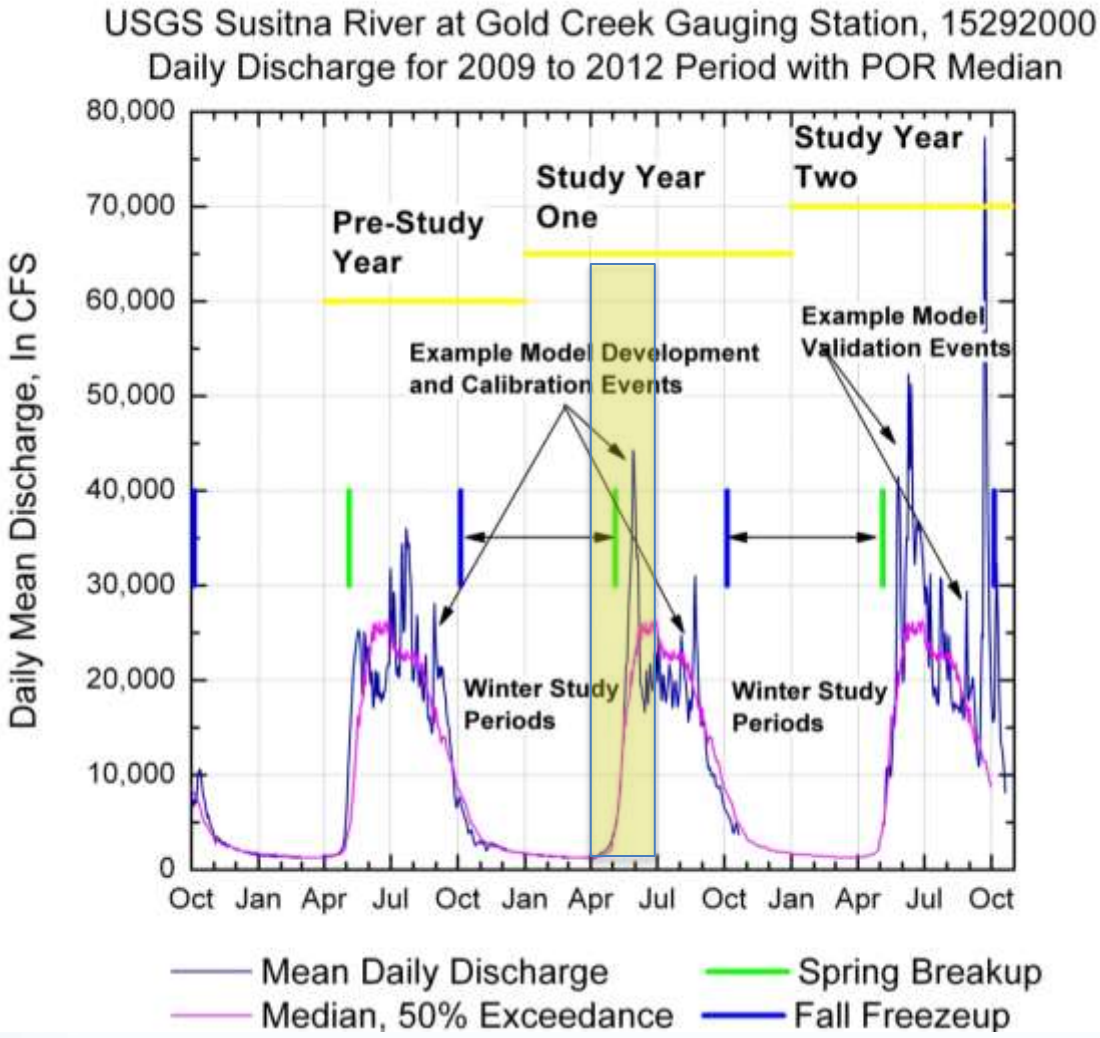
- 7.5.4.4 Riparian GW/SW
- 7.5.4.5 Aquatic GW/SW
- 7.5.4.7 Water Quality in Selected Habitats
- 7.5.4.7 Winter GW/SW
- 7.5.4.8 Shallow Groundwater Users

GW Scientific Hydrology Station in Whiskers Slough, May 25, 2013, Ready for Breakup

GW Study Schedule



GW Hydrologic Study Schedule



GW Q2, Q3 Status

- 7.5.4.1 Data Synthesis
  - Startup, main activities in Q3, Q4
- 7.5.4.1.2 Geohydrologic Process-Domains
  - Startup, main activities in Q3, Q4
- 7.5.4.2 Watana Dam/Reservoir
  - Document breakup, icing, aerial surveys inQ2, main activities in Q3 to Q3 2014
- 7.5.4.3 Upwelling/Springs Broad-Scale Mapping
  - End of winter conditions in Q2, main activities in Q3 to Q3 2014

Ice Conditions in Oxbow1 Focus Area, Looking South, May 25, 2013

GW Q2, Q3 Status

- 7.5.4.4 Riparian GW/SW
  - Planning, procurement in Q2
  - Field Implementation in Q2, Q3
  - Photo documentation of “Leaf-Out”
  - End of winter, breakup hydrology observations

- 7.5.4.5 Aquatic GW/SW
  - Planning, procurement in Q2
  - Field Implementation in Q2, Q3
  - End of winter, breakup hydrology observations

Snowmelt Recharge in the “Cut” West of Whiskers Slough Focus Area, Fish Overwintering in Upland Sloughs had Access to Chulitna River, May 25, 2013

GW Q1,Q2 Status

- 7.5.4.6 Water Quality in Selected Habitats
  - Startup & Planning in Q1
  - Primary activities starting Q3
- 7.5.4.7 Winter GW/SW
  - Startup and Planning Q1
  - Primary activities starting Q1
- 7.5.4.8 Shallow Groundwater Users
  - Startup and planning Q1, minor activities in Q2, main activities in Q3, Q4

Whiskers Slough Near Side Channel Inlet, No Surface-Water Inflow, 12:23, May 25, 2013

GW RSP 7.5.4.1 - Data Synthesis Highlights

- Planning discussions with ARLIS, Study Team
- Identification of Early References, Areas and Information to Pursue

Whiskers Slough Near Side Channel Inlet, Break-Up Flooding Inflow, 16:25, May 25, 2013

GW RSP 7.5.4.2 - Watana Dam/Reservoir Highlights

- Identification of 2012/13 End-of-Winter Conditions, Q2
- Main Activities and Interaction with Engineering Studies Begin Q3

Whiskers Slough Near Side Channel Inlet, Break-Up Flooding Packs Channel With River Ice, 14:26, May 26, 2013

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

- Startup and Planning Q2
- Identification of 2012/13 End-of-Winter Conditions, Q2
- Coordination with Ice Processes, IFS – Winter Gaging Program, Q3 Reporting

FA-114, Lane Creek, Slough 6A, Shallow Water Table Lead to Springs That Flow All Winter Long, May 25, 2013

Winter Gaging Q1,Q2 - GW 7.5.4.4 Coordination

- 2 Measurement Periods, Late January, Late March/Early April
- January – Cold Conditions
- March/April – Main Focus
  - Ice Processes – March 4-12
  - USGS – March 25-29
  - RIFS – March 25 – April 5

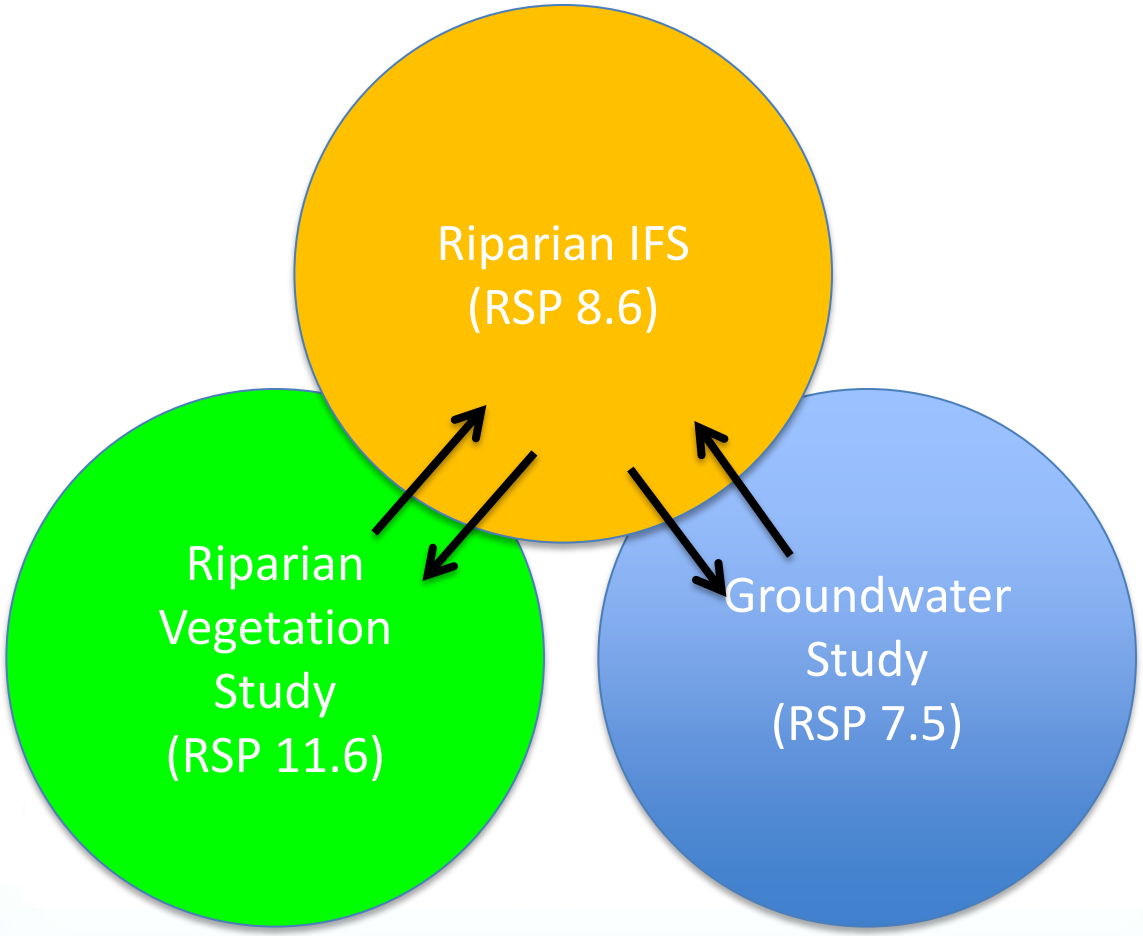
Geovera staff conducting RTK surveying at ESS40, GW Scientific and Brailey Hydrologic ice drilling, January 2013

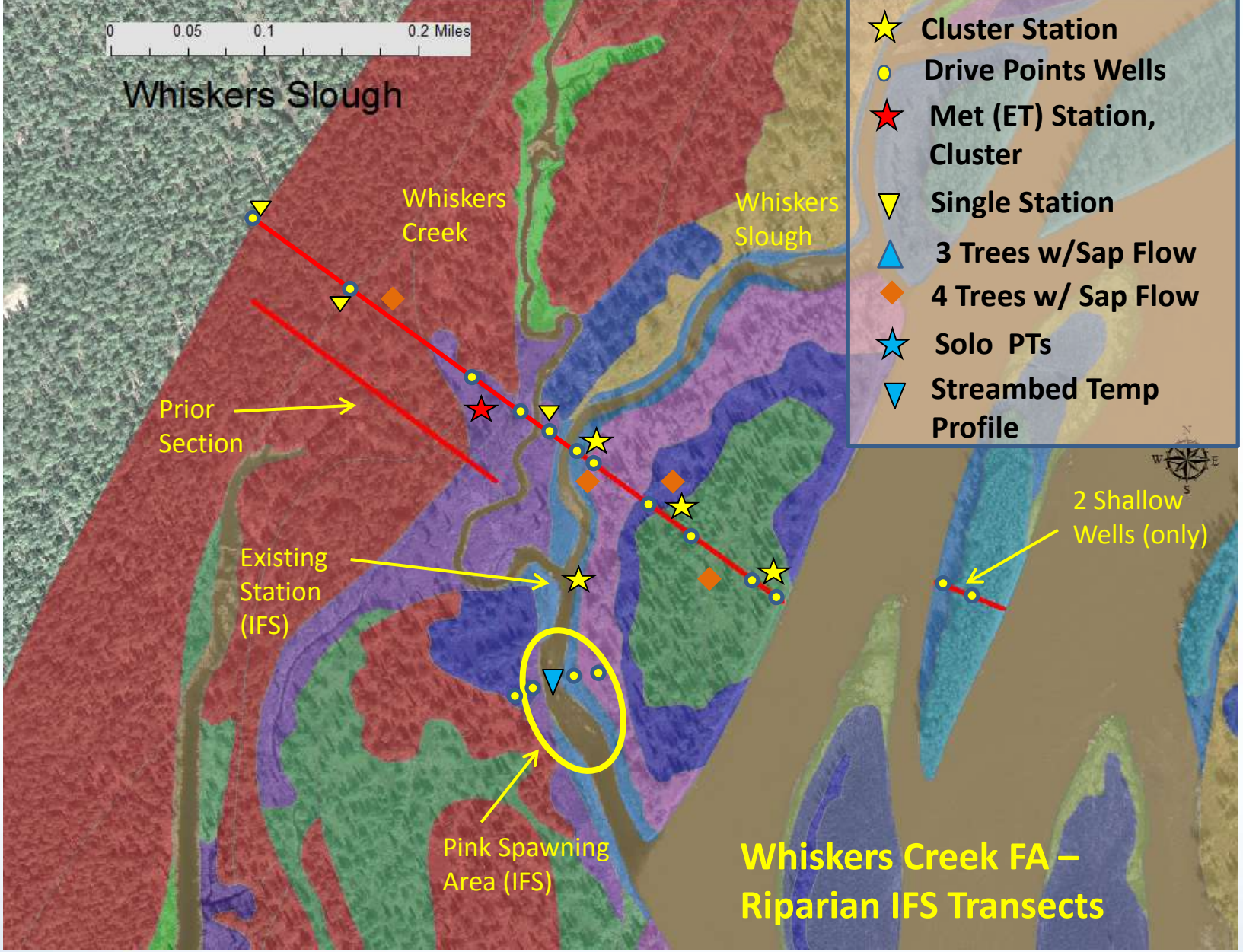
GW RSP 7.5.4.5 – Riparian GW/SW Highlights

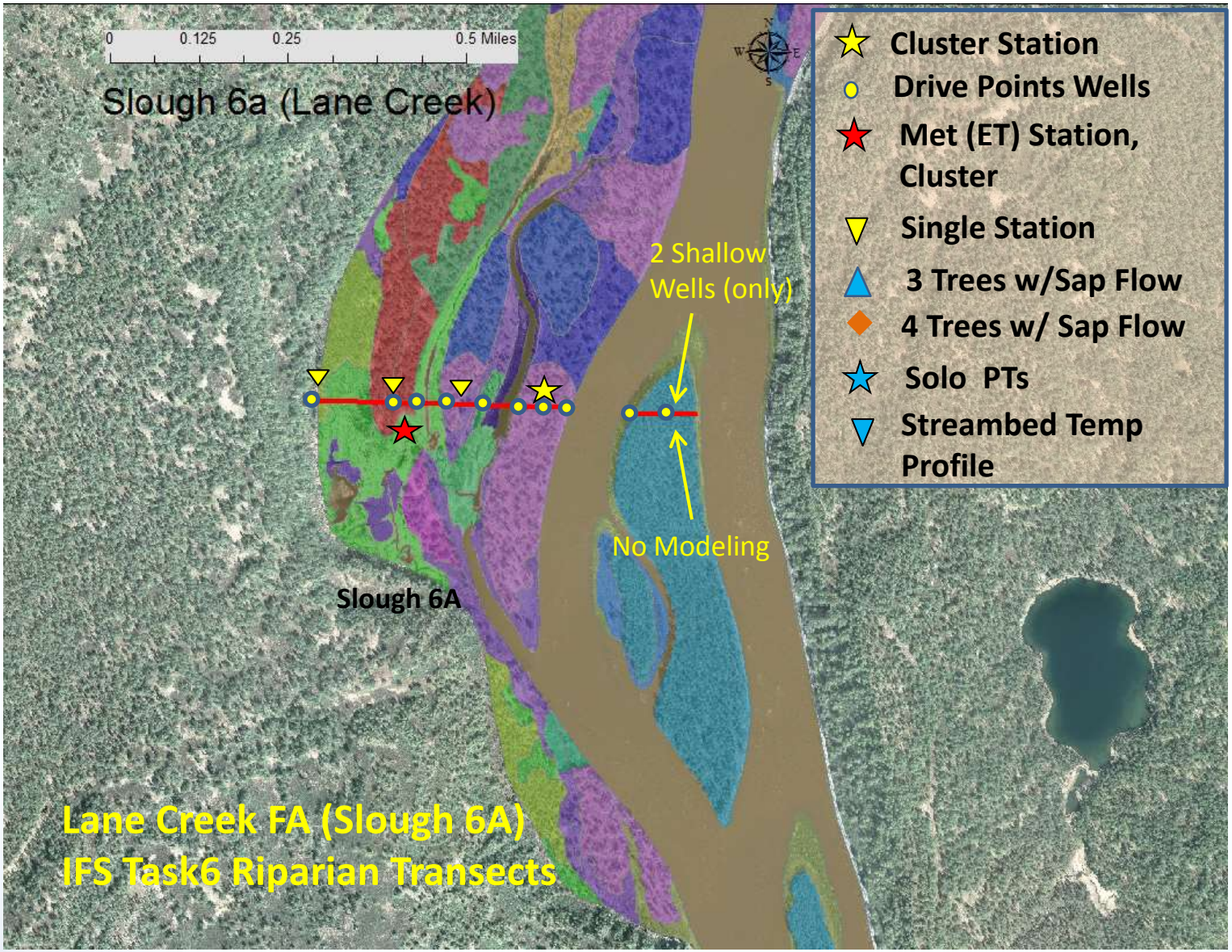
- Q2 – Planning, Procurement, Field Recon, Breakup Field Observations
- Q3 – Shallow GW Wells, Installation of Stations, Data Collection

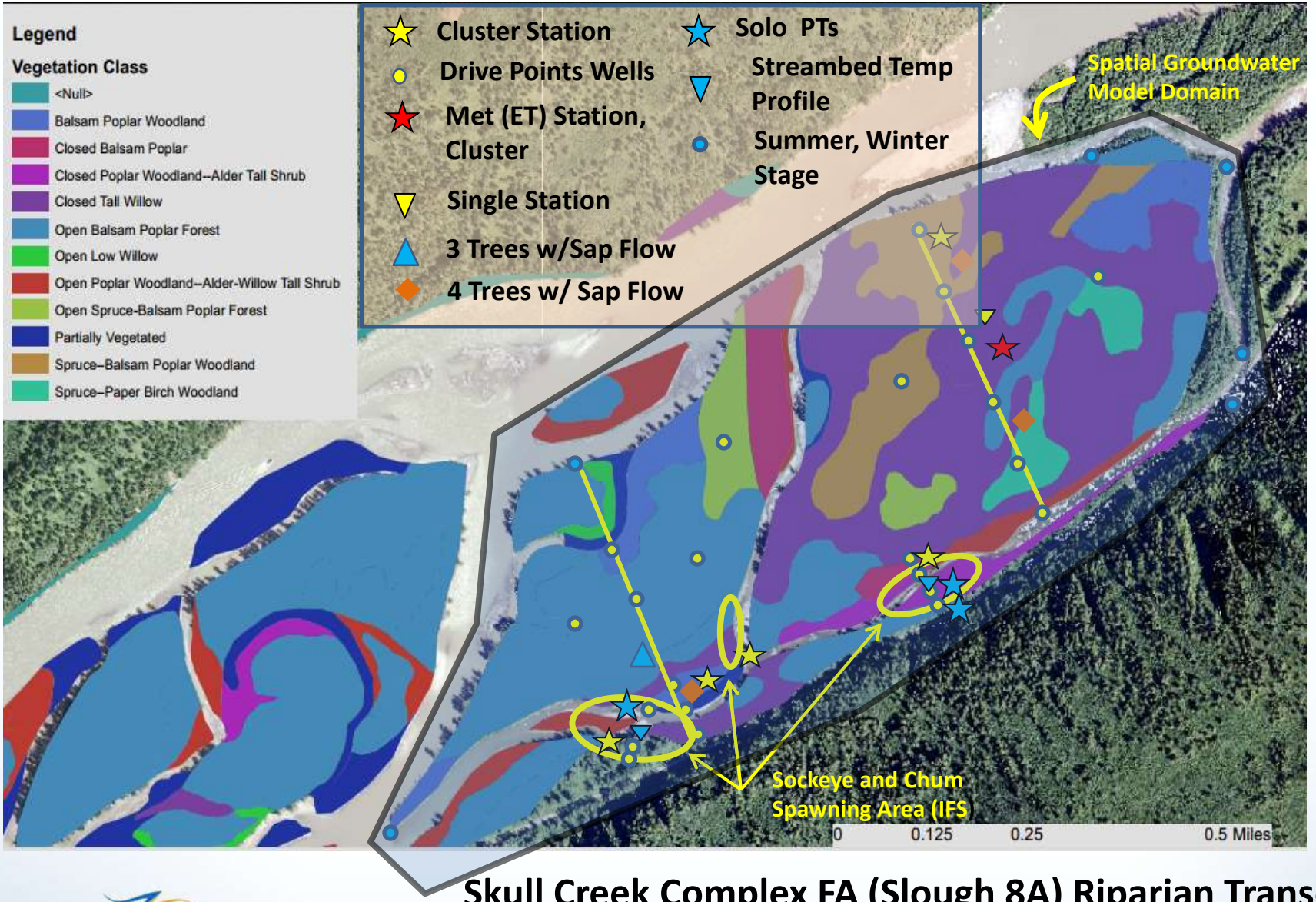
Break-Up Flooding Pushing Ice Over Tops of Islands, ~PRM 132, May 26, 2013

Integrated Riparian Groundwater (RIPGW) Studies

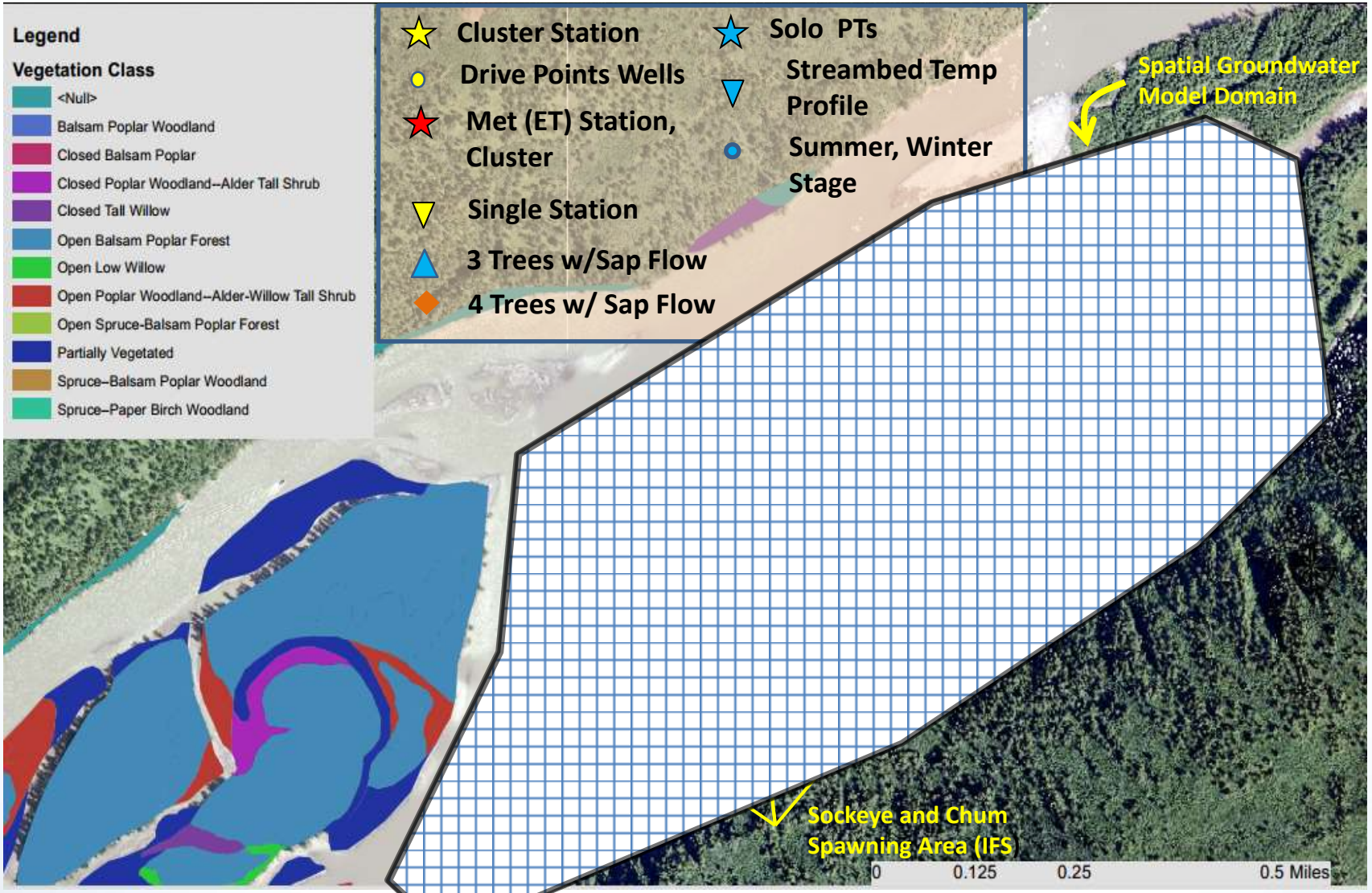



0
0.05
0.1
0.2 Miles
Whiskers Slough
Whiskers Creek
Whiskers Slough
Prior Section
Existing Station (IFS)
Pink Spawning Area (IFS)
2 Shallow Wells (only)
Cluster Station
Drive Points Wells
Met (ET) Station, Cluster
Single Station
3 Trees w/Sap Flow
4 Trees w/ Sap Flow
Solo PTs
Streambed Temp Profile
Whiskers Creek FA – Riparian IFS Transects

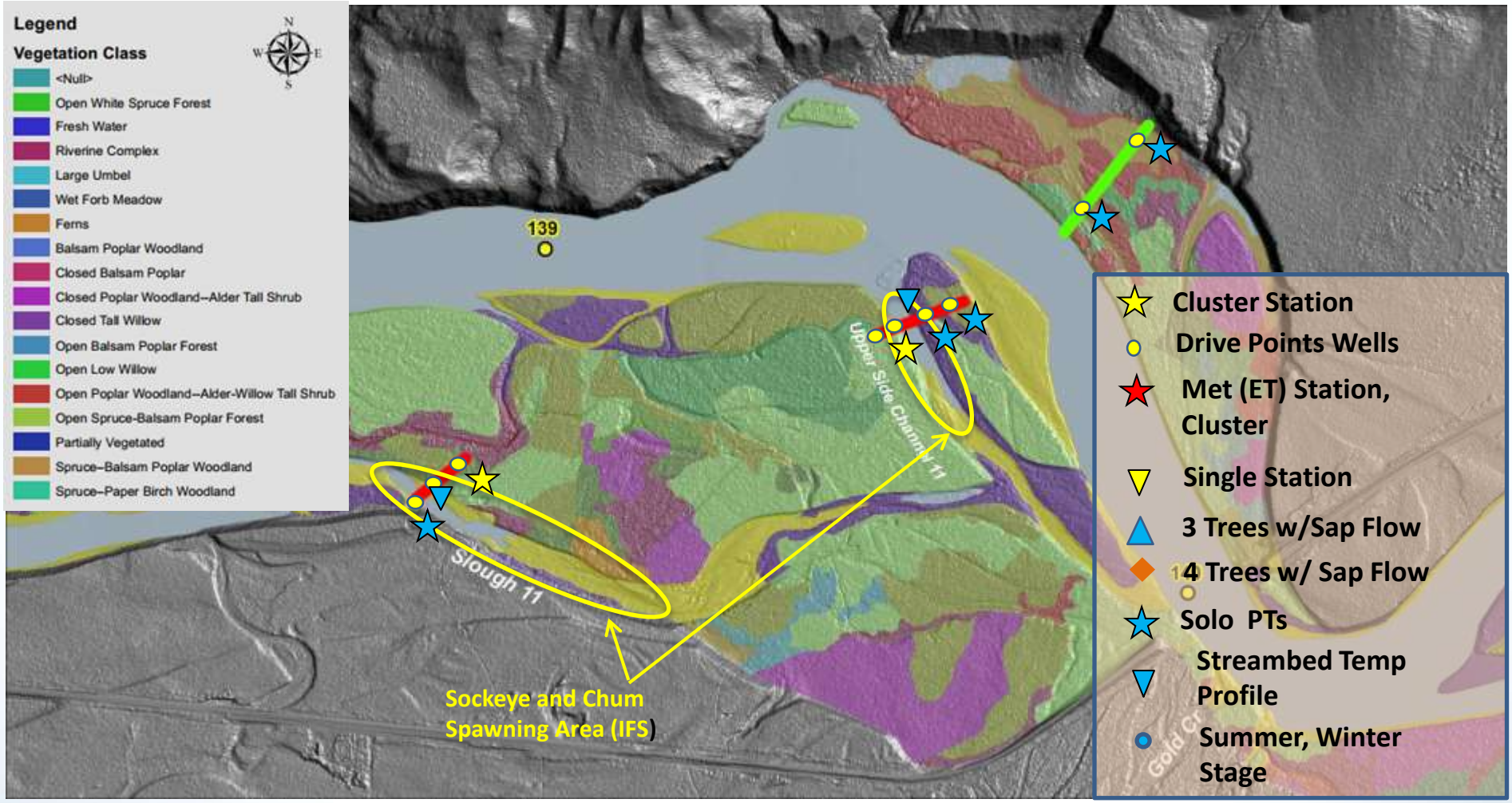

0
0.125
0.25
0.5 Miles
Slough 6a (Lane Creek)
Cluster Station
Drive Points Wells
Met (ET) Station, Cluster
Single Station
3 Trees w/Sap Flow
4 Trees w/ Sap Flow
Solo PTs
Streambed Temp Profile
2 Shallow Wells (only)
No Modeling
Slough 6A
Lane Creek FA (Slough 6A)
IFS Task6 Riparian Transects



Skull Creek Complex FA (Slough 8A) Riparian Transects



Skull Creek Complex FA (Slough 8A) Riparian Transects



FA-138, Gold Creek Focus Area, Riparian Transects

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, Early Stages of Snowmelt, Groundwater Recharge (Springs) Still Occurring at End of Winter, May 25, 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 Sloughs and Wetlands, Early Stages of Snowmelt, Groundwater Recharge (Springs) Still Occurring at End of Winter, May 25, 2013

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

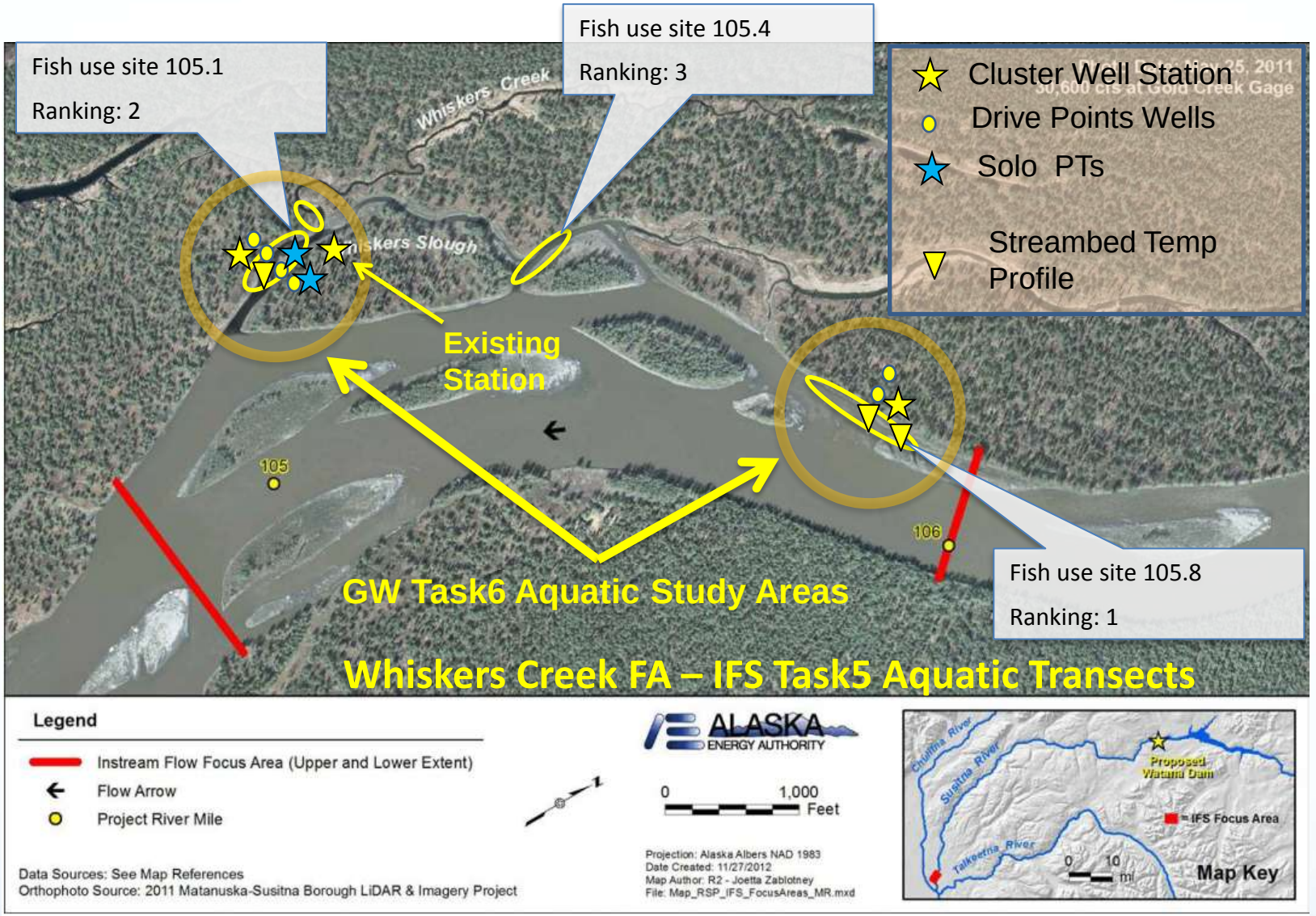
- Future Shallow Groundwater and Surface Water Level Monitoring
- Seasonal Observations
- Measuring Interactions (Or Lack Of) With River

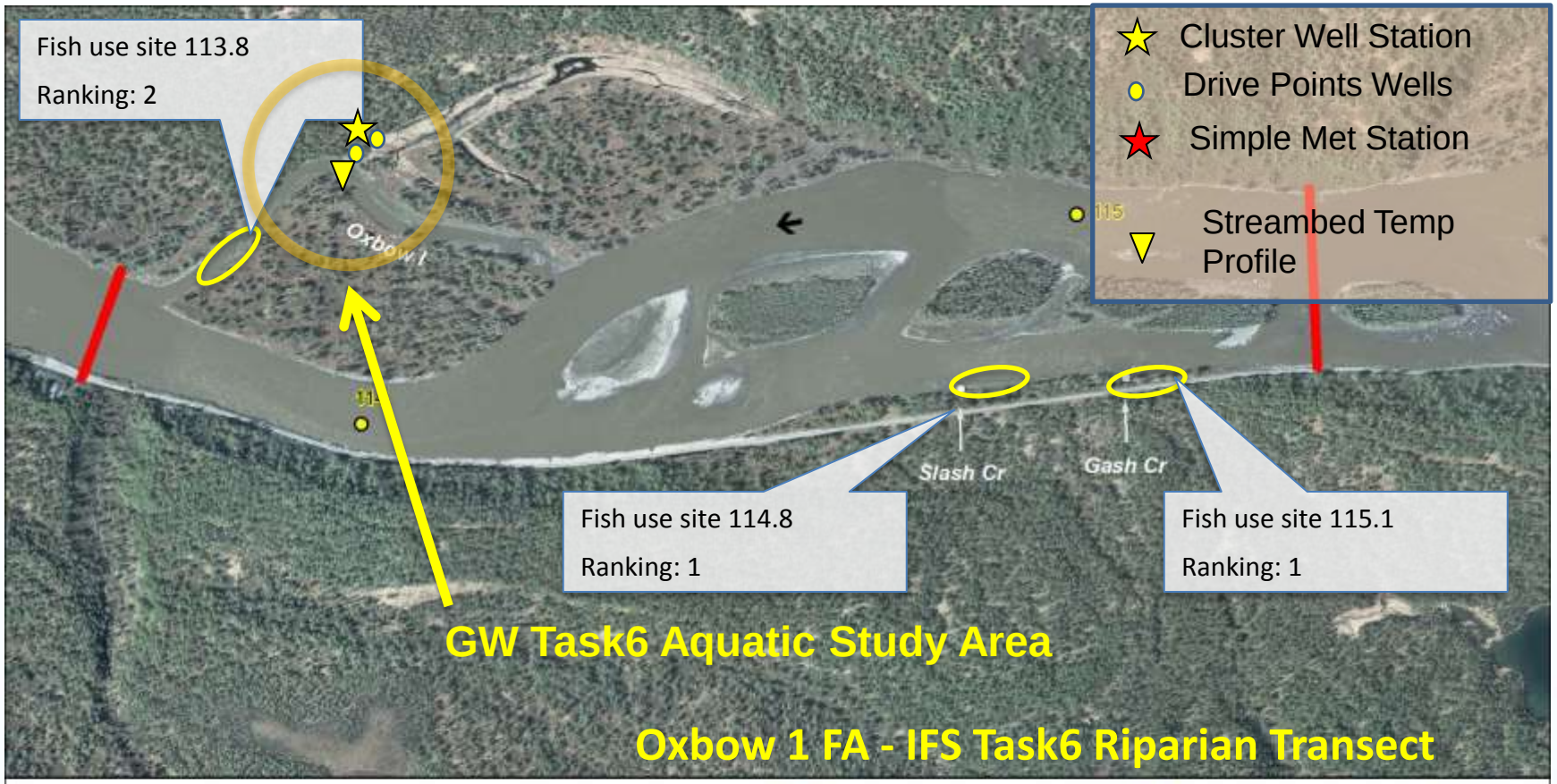
FA-138, Gold Creek Focus Area, Right Bank Upland Sloughs and Wetlands, After Leafout, Snowmelt Recharge Ongoing, Upland Sloughs and Wetland Drain Down Steep Banks to River, June 9, 2013

GW RSP 7.5.4.6 – Aquatic GW/SW Highlights

- Q2 – Planning, Procurement, Field Recon, Breakup Field Observations
- Q3 – Shallow GW Wells, Installation of Stations, Data Collection

FA-128, Skull Creek Complex, Slough 8A, Ice Jam Flooding Resulting in Turbid Main Channel Water Flowing Into Side Channel and Mixing with Clear Slough 8A Recharged By Groundwater, May 26, 2013


Fish use site 105.1
Ranking: 2
Fish use site 105.4
Ranking: 3
Cluster Well Station
Drive Points Wells
Solo PTs
Streambed Temp Profile
Whiskers Creek
Whiskers Slough
Existing Station
105
106
GW Task6 Aquatic Study Areas
Fish use site 105.8
Ranking: 1
Whiskers Creek FA – IFS Task5 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
Cluster Well Station
Drive Points Wells
Simple Met Station
Streambed Temp Profile
Oxbow 1
115
Slash Cr
Gash Cr
Fish use site 114.8
Ranking: 1
Fish use site 115.1
Ranking: 1
GW Task6 Aquatic Study Area
Oxbow 1 FA - IFS Task6 Riparian 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
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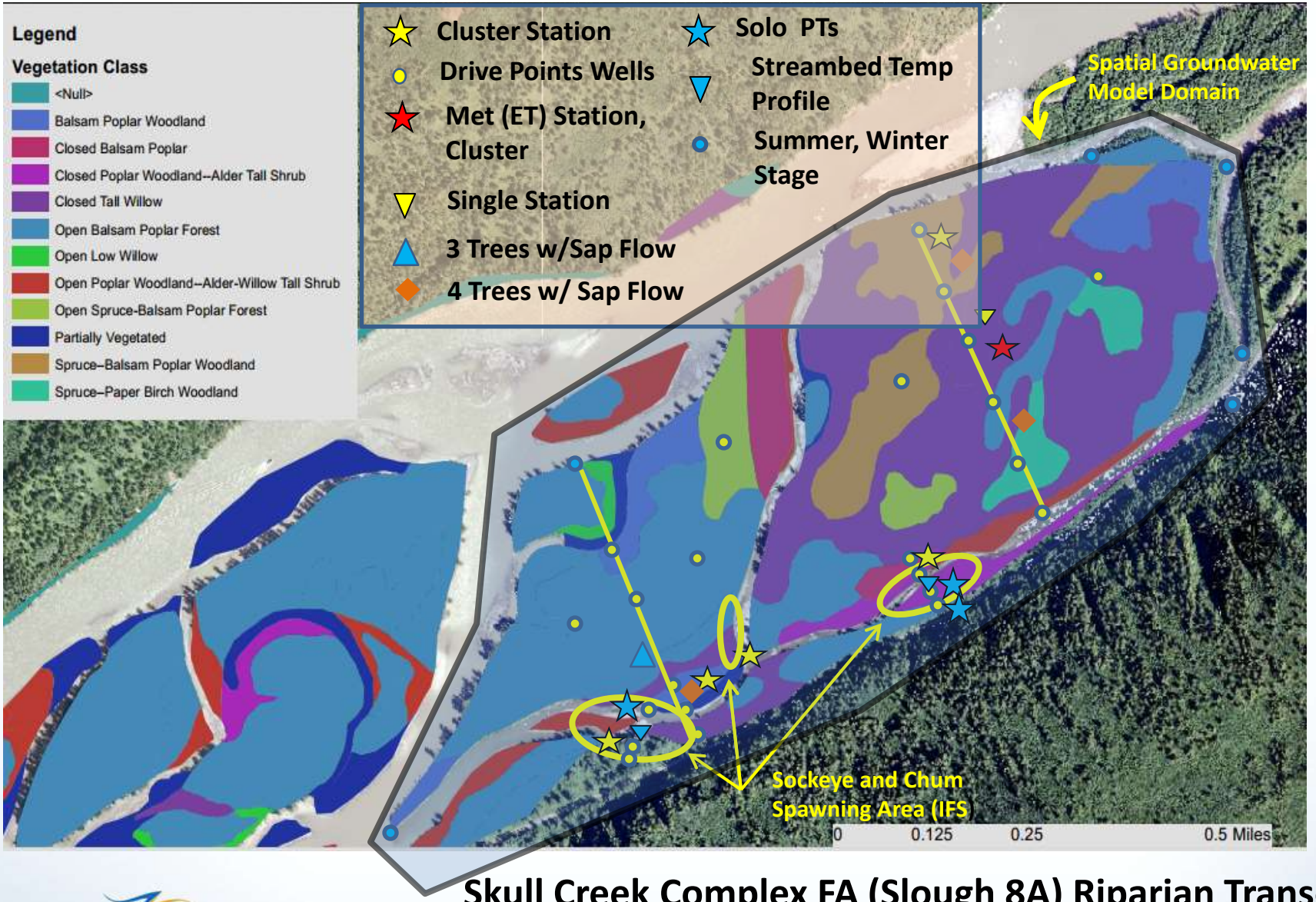
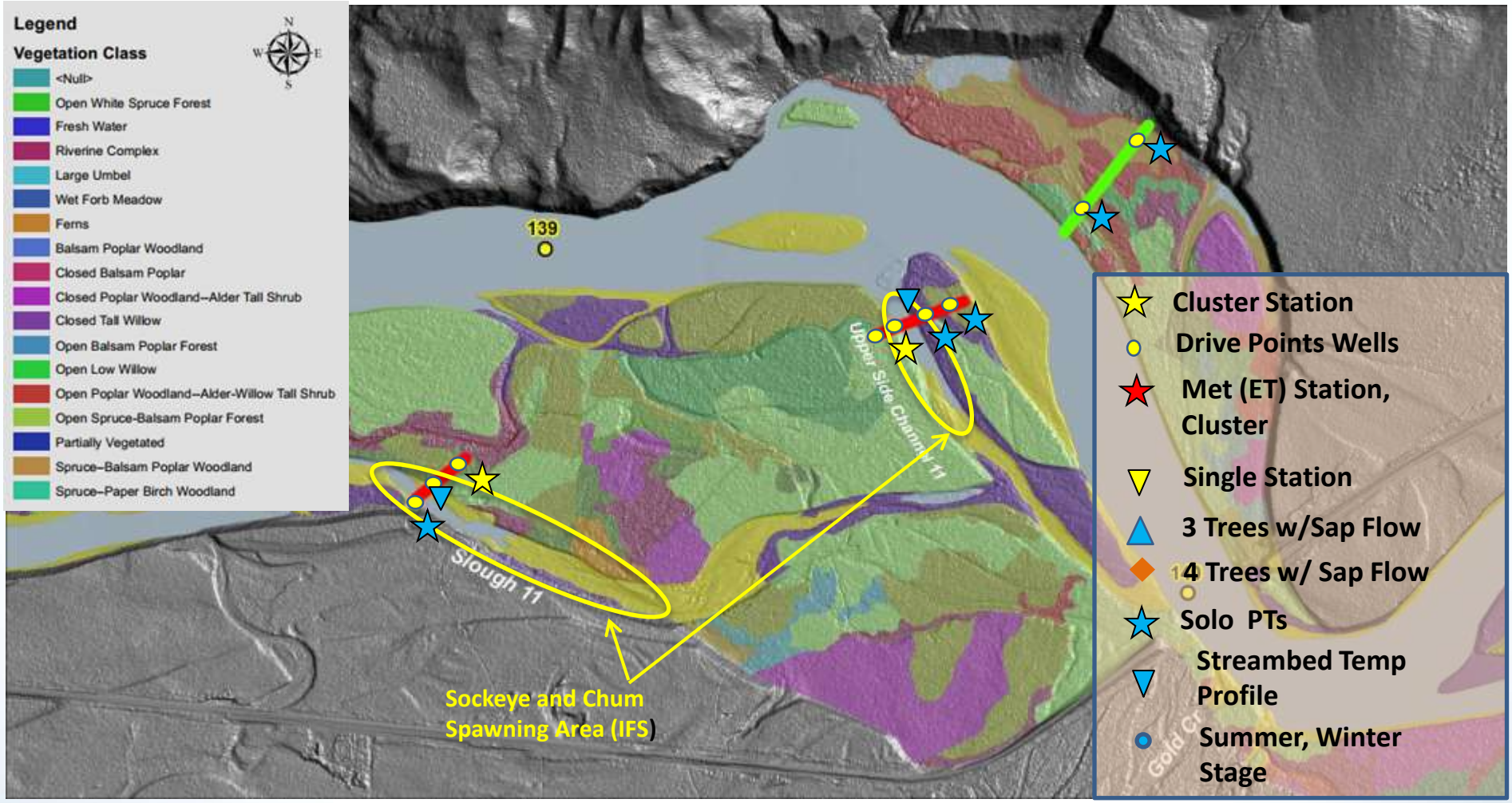
10
mi
Map Key



Skull Creek Complex FA (Slough 8A) Riparian Transects



FA-138, Gold Creek Focus Area, Riparian Transects

GW RSP 7.5.4.6 – Water Quality in Selected Habitats Highlights

- Q2 – Team Planning, Early WQ Sampling in Winter Studies FAs
- Q2 – Key End of 2012/13 Winter, Break-Up Observations at FAs
- Q3 – Begin Main Installation of WQ Sensors

FA-128, Skull Creek Complex, Slough 8A, Ice Jam Flooding Resulting in Turbid Main Channel Water Changing Water Quality In Slough 8A, May 26, 2013

GW RSP 7.5.4.7 – Winter GW/SW Highlights

- Q2 – Continue Winter Studies, 2012/13
- Q3 – April Multi-Team Field Trip, End-of-Winter Recon Observations
- Q4 – Begin Main Winter 2013/14 Observations

Whiskers Creek Outlet At Early Stages of Breakup, Turbid Water Is In Side Channel, May 25, 2013

GW RSP 7.5.4.8 – Shallow Groundwater Users Highlights

- Q2 – Identification of Study Well Locations, Begin Station Installation at Selected Wells
- Q3 – Main Installation of Well Installation and Surface-Water Manual Measurement Sites

Whisker Slough After High Water From Ice Jams Recede, Leaving Ice Stranded In Channels, May 27, 2013

Groundwater Study

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

  www.susitna-watanahydro.org

Whisker Slough at Whisker Creek Confluence After High Water From Ice Jams Recede, Leaving Ice Stranded In Channels, Clear Water From Whisker Creek Mixing With Turbid Water From Slough (Mainstem Source), May 27, 2013