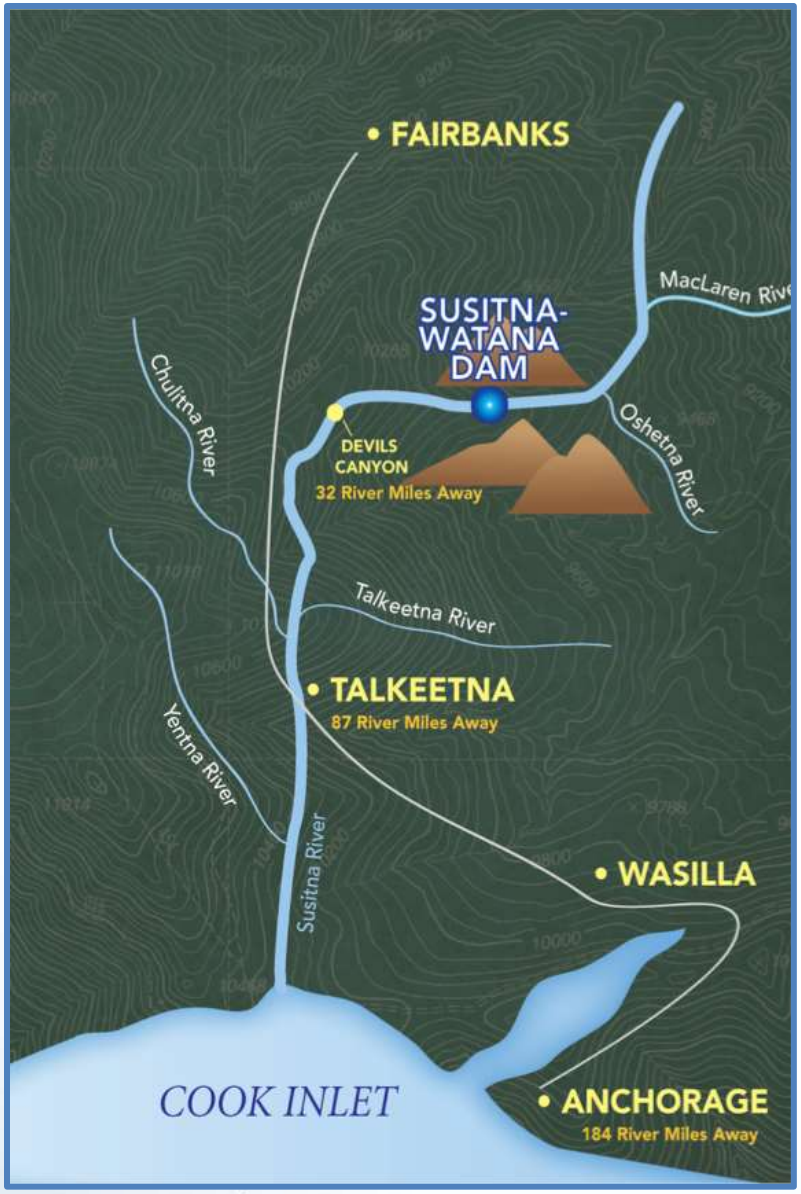


Technical WorkGroup Meeting

Q3 2013 TWG

Geomorphology Studies

September 25, 2013

Prepared by

Tetra Tech. Inc.

Watershed GeoDynamics

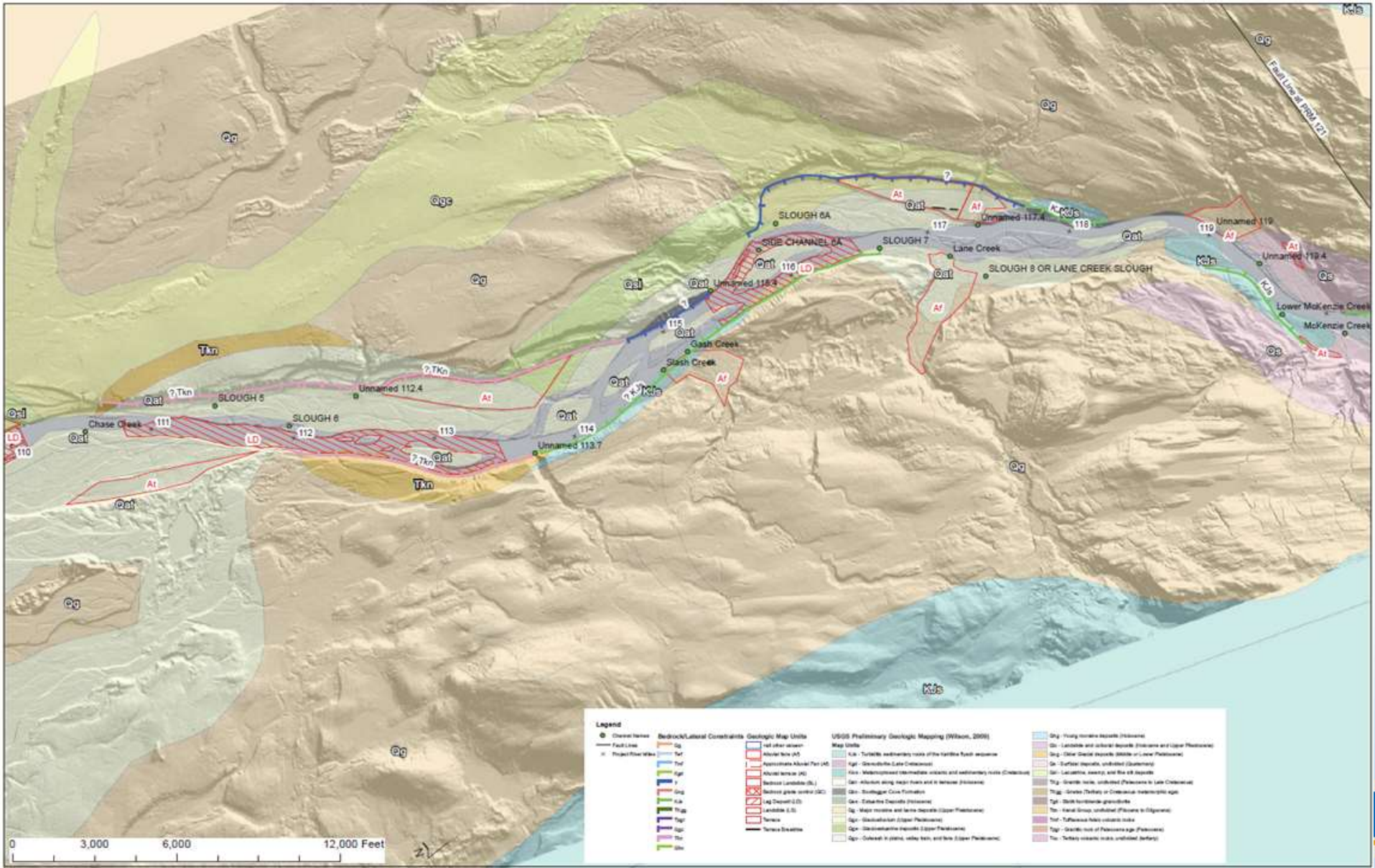
RSP 6.5 and 6.6 Presentation Overview

- *Q3 2013 Data Collection*
  - *Field verify mapping of paleo/relic geomorphic features (RSP 6.5.4.1.2.3)*
  - *USGS Sediment Transport Data Collection (RSP 6.5.4.2)*
  - *Aerial Photographs (RSP 6.5.4.4 and 6.5.4.7)*
  - *LiDAR (RSP 6.6.4.1.2.9 and Modeling Approach TM)*
  - *Large woody debris surveys (LWD) (RSP 6.5.4.9)*
  - *1-D Modeling Data Collection (RSP 6.6.4.1.2.9.1)*
    - *Cross section data*
    - *Bed material sampling*
  - *Tributary Surveys (RSP 6.6.4.1.2.9.3)*

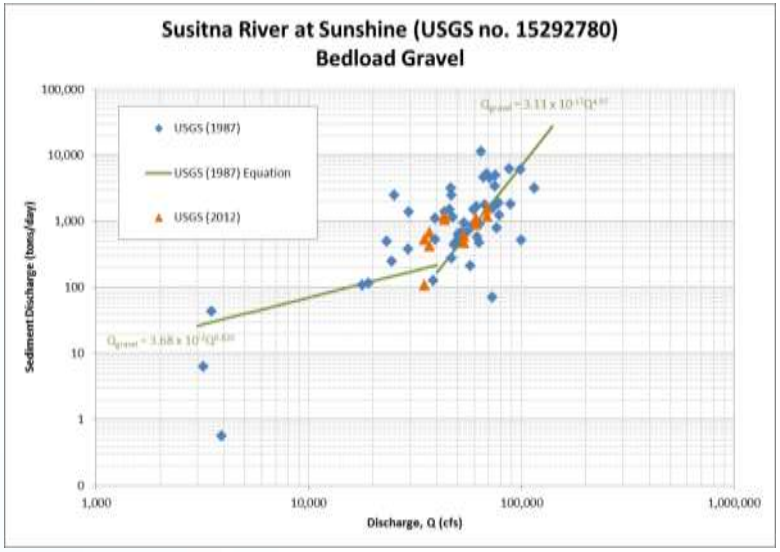
Presentation Overview (Cont.)

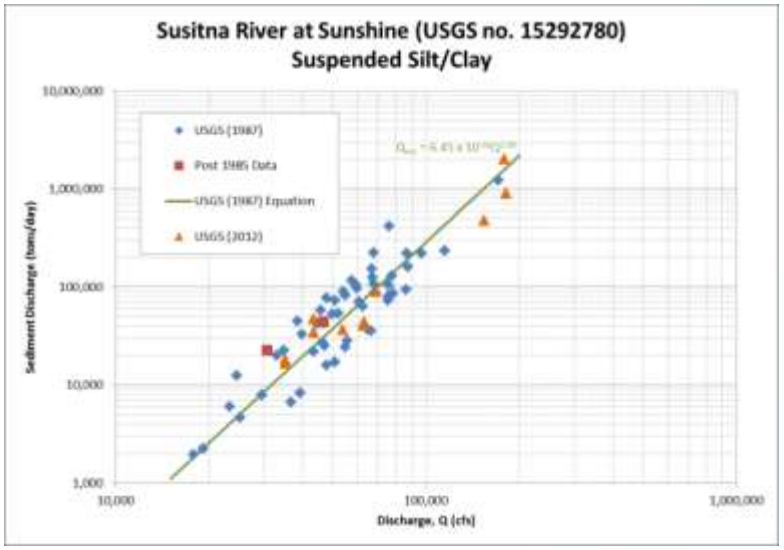
– *2-D Modeling / Focus Area (RSP6.6.4.1.2.9.2)*
  - *Bathymetry and topography*
  - *Bed material sampling*
  - *Geomorphic mapping and assessment*

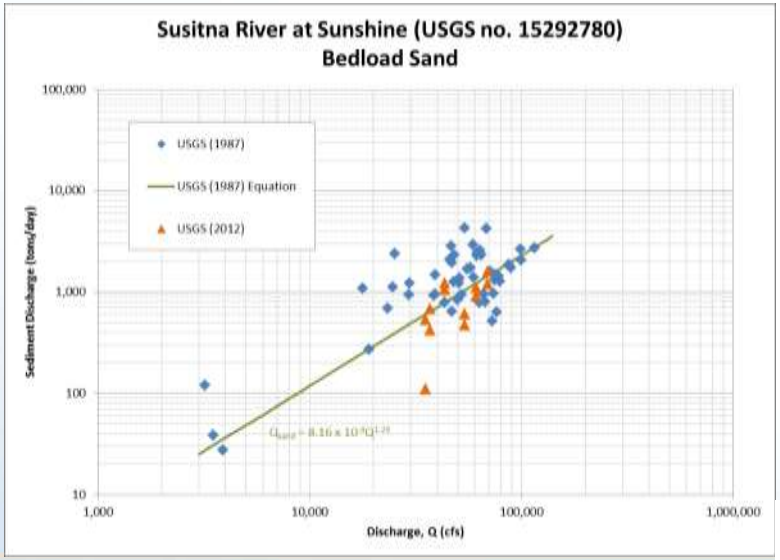
Field Verify Mapping of Paleo/Relic Features (RSP 6.5.4.1.2.3)

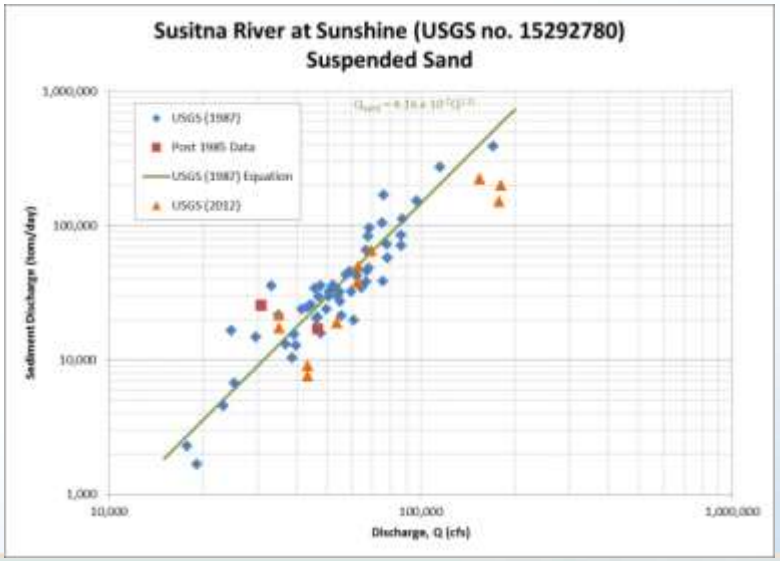


USGS Sediment Transport Data Collection 1980s and Current (RSP 6.5.4.2)

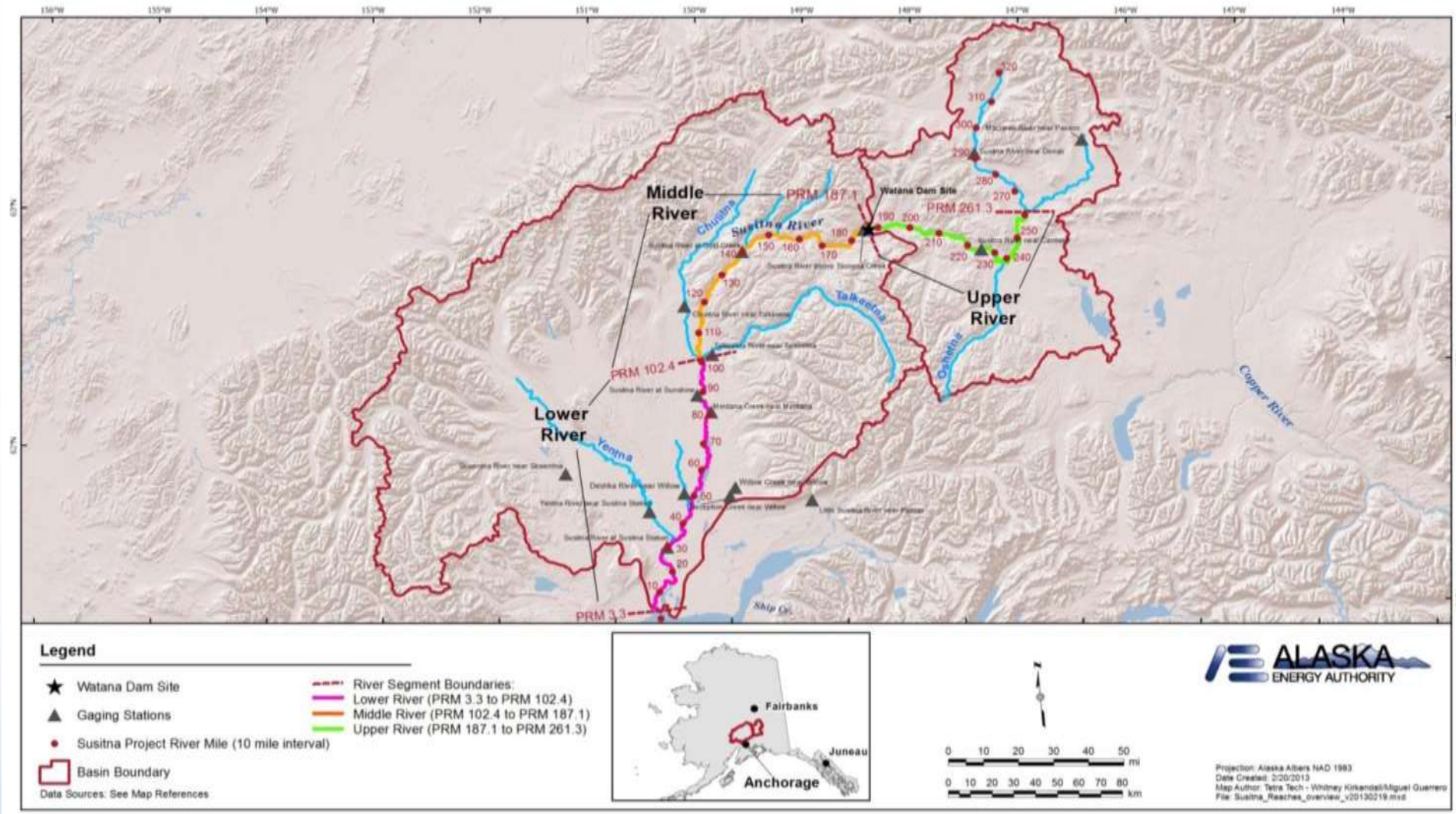






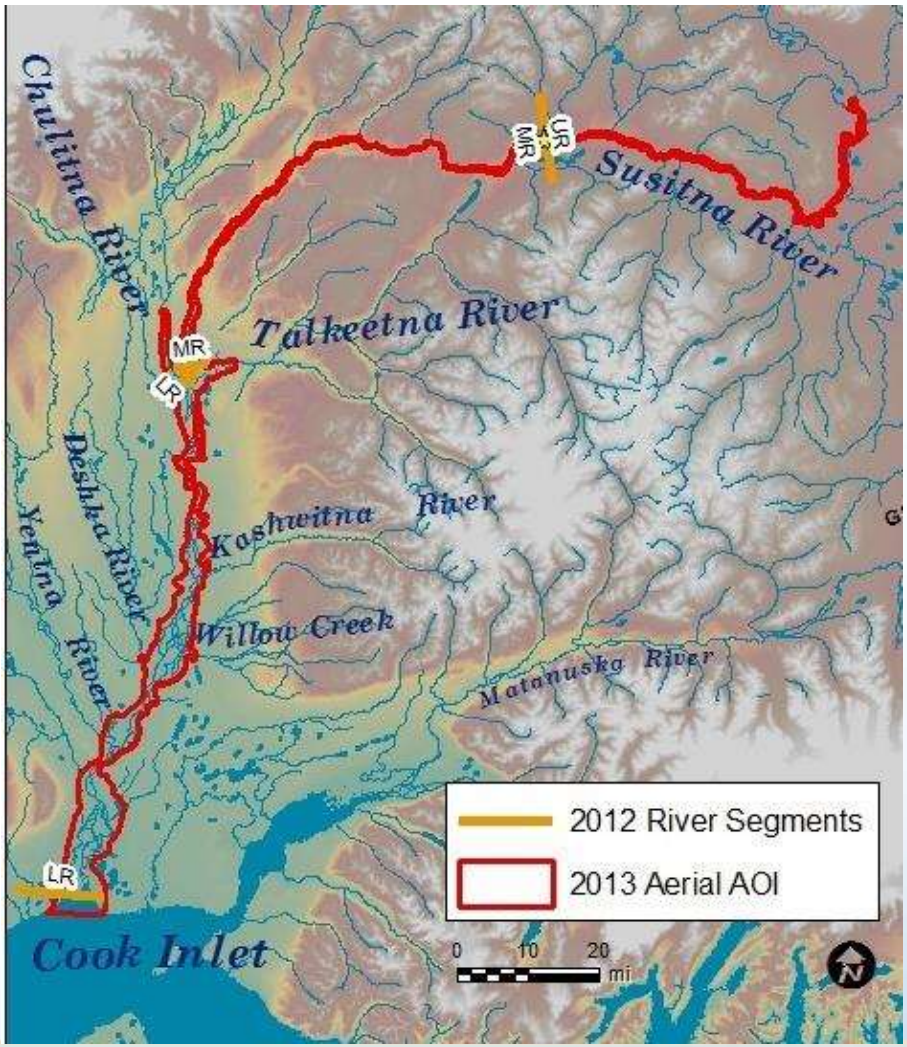


Susitna River –Aerial Photo Acquisitions (RSP 6.5.4.4, 6.5.4.5 and 6.5.4.7)



Collection of 2013 Aerials (RSP 6.5.4.4 and 6.5.4.7)

- *Collect complete UR, MR and LR*
  - *Target 12,500 cfs Gold Creek (MR and UR)*
  - *Target 40,000 cfs Sunshine (LR) (36,600 cfs in RSP)*
  - *Goal is to collect aerials at flows w/in 10% of target Q*

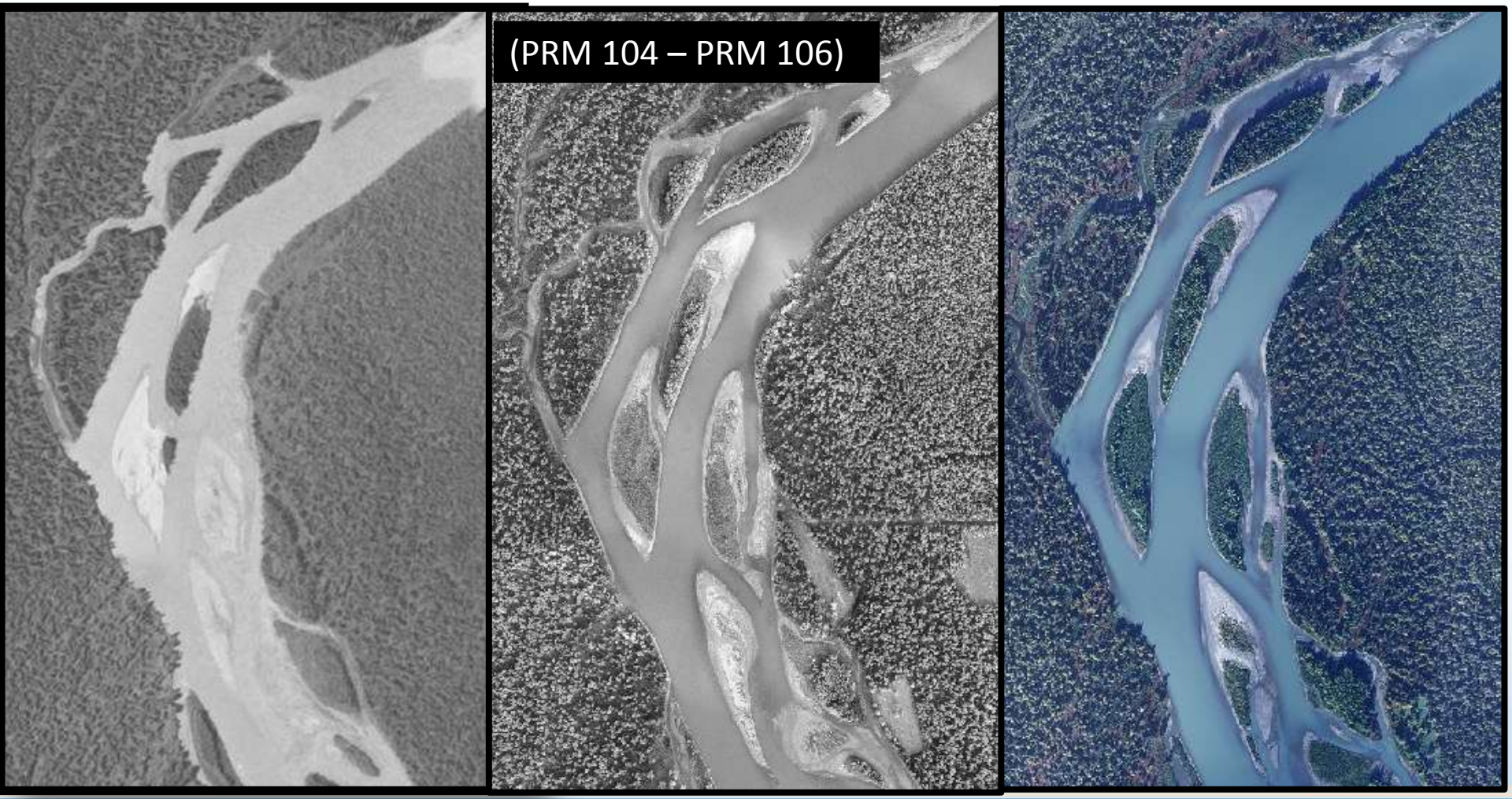


Acquire and Process 1950s Aerials for MR and LR (RSP 6.5.4.4)

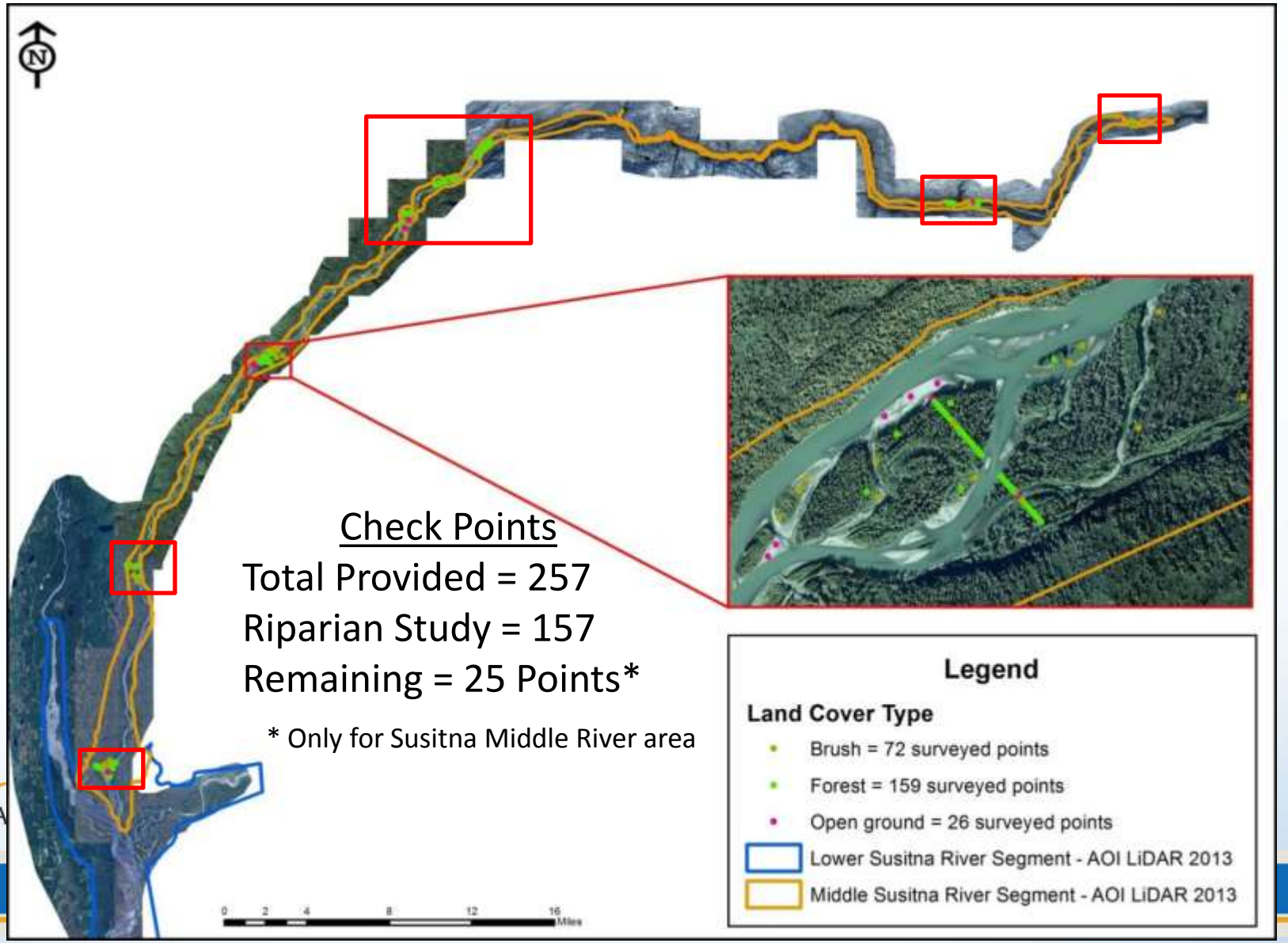
May 25, 1951
8,810 cfs @ Gold Creek

September 11, 1983
12,500 cfs @ Gold Creek

September 10, 2012
12,900 cfs @ Gold Creek

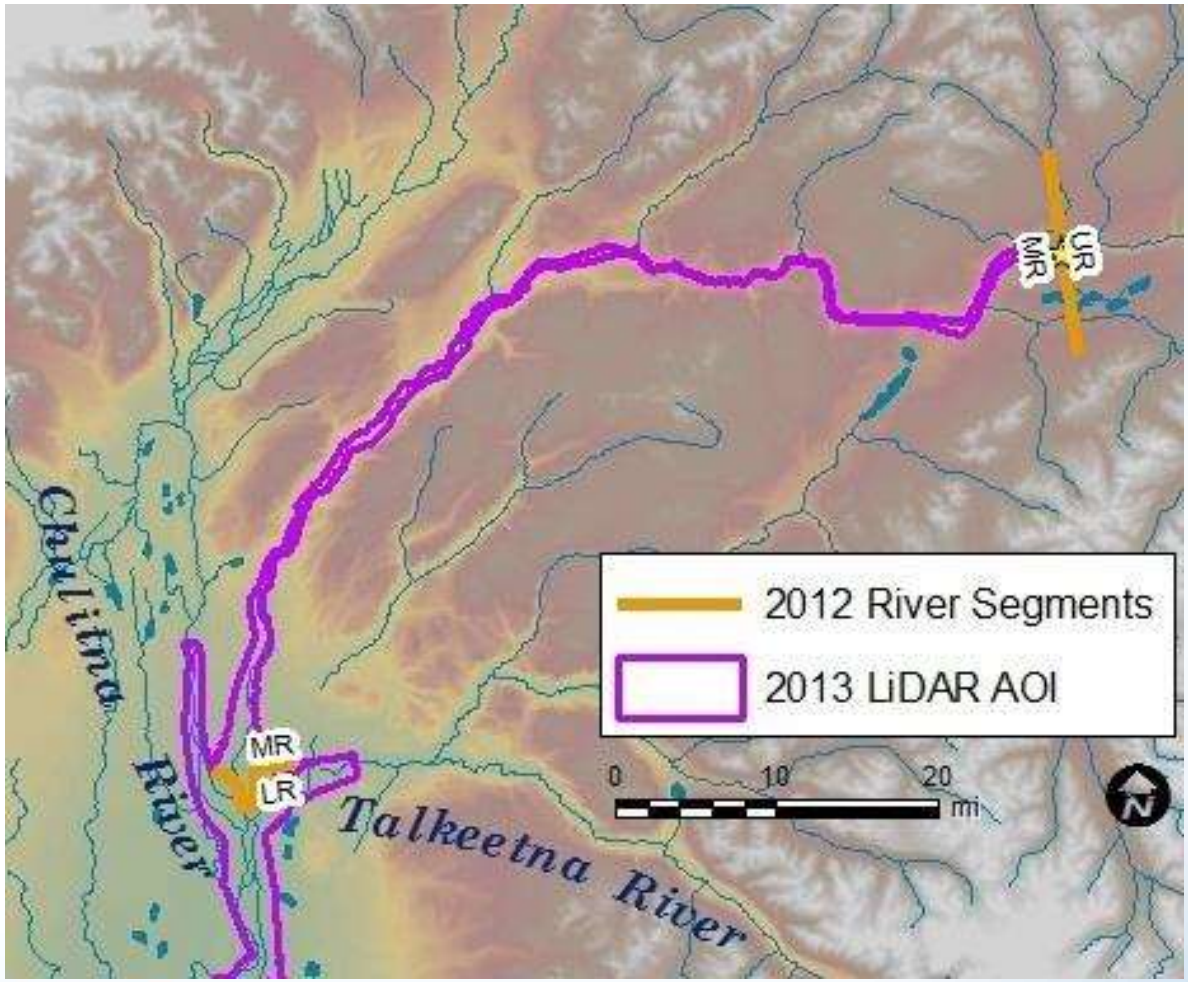


LiDAR Verification: Land Survey Check Points by Cover Type Map (RSP 6.6.4.1.2.9)



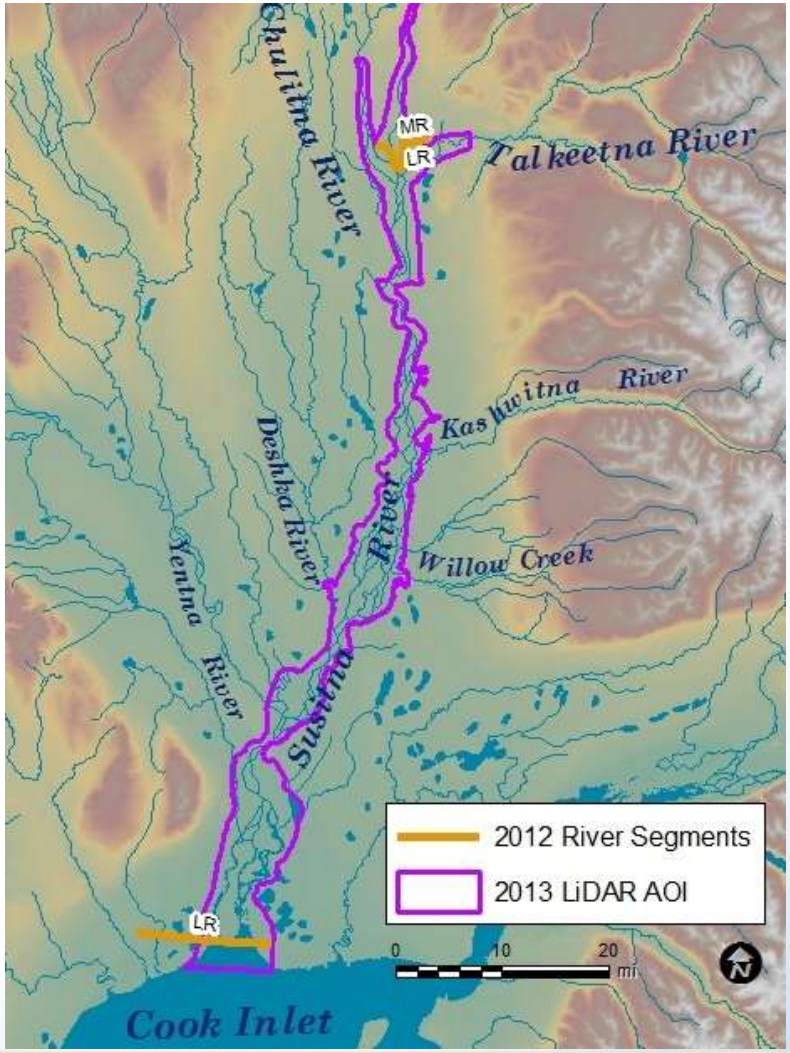
2013 High Density LiDAR Acquisition (Modeling Approach TM)

- *Purpose: Provide above water topo for MR & LR*
  - *1-D cross sections*
  - *Focus Areas*
  - *Support engineering (UR)*



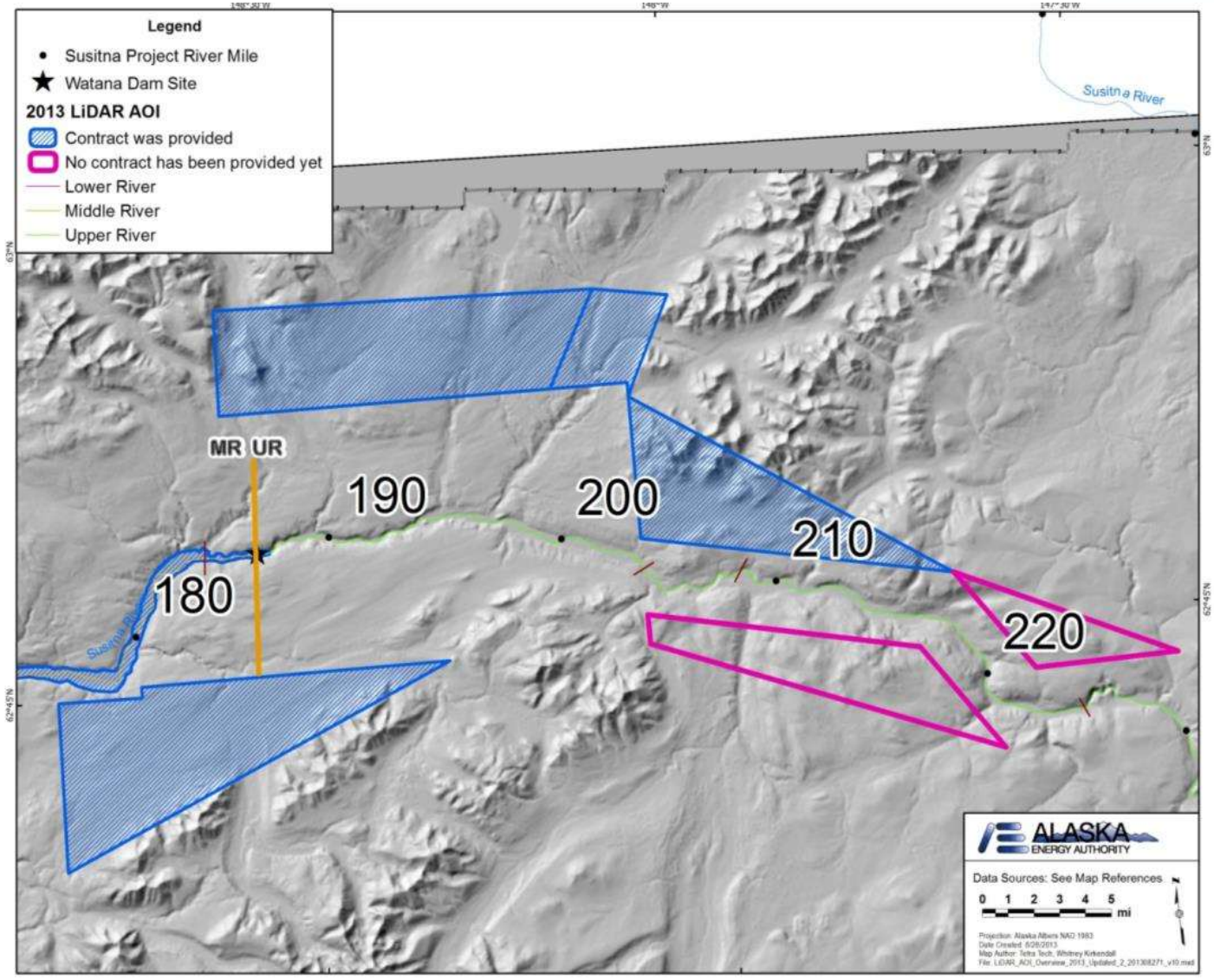
2013 High Density LiDAR Acquisition: Characteristics (Modeling Approach TM)

- *2011 MatSu Borough:*
  - *1 pts/m² (0.6 actual)*
- *2013:*
  - *9 pts/m²*
- *Target accuracy*
  - *Exposed bed: 0.5 ft.*
  - *Flood Plain: 1 ft.*
- *Collect at low flow*
  - *< 17k cfs MR (Gold Cr)*
  - *< 55k cfs LR (Sunshine)*
  - *< 15k cfs Chulitna (Ch.)*
  - *< 20k cfs Talkeetna (Gold Cr.)*
  - *Low Tide for LR bl. PRM 17*



2013 High Density LiDAR Acquisition: UR Additions (RSP 16.6 Seismic Study)

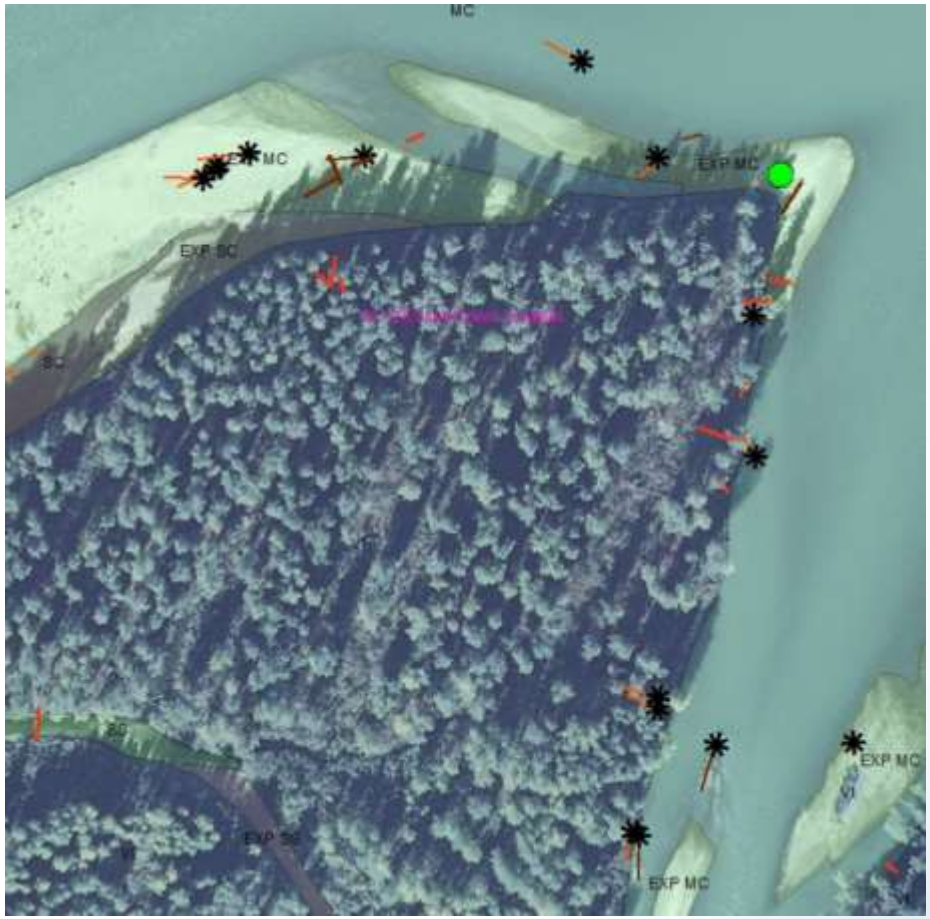
- *Additional 186 sq. mi of LiDAR for the Site Specific Seismic Hazard Study*
- *Help identify seismic sources*
- *Not covered by 2011 MatSu*



SUSITNA-WATANA HYDRO

Large Wood Debris Study – Field Inventory (RSP 6.5.4.9)

Field inventory of 7 Focus Areas and 10 additional areas in Middle and Lower River; over 1,000 single pieces of wood and 200 log jams surveyed as of September 1, 2013



Large Wood Debris Study – Initial Observations (RSP 6.5.4.9)

Input mechanisms: bank erosion, ice, beavers

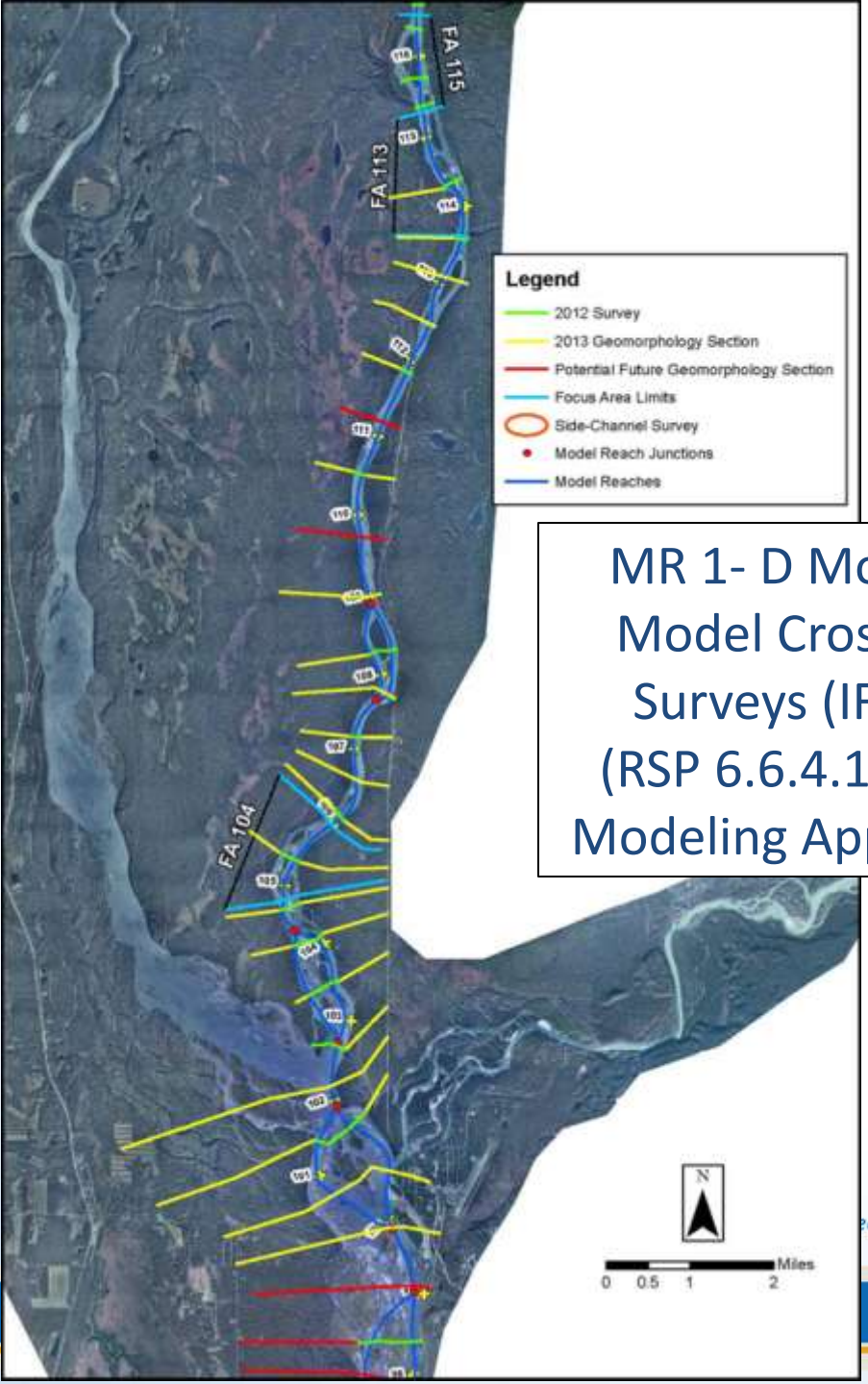
Balsam Poplar prevalent species (over 50%)
Lots of fresh wood (25% still have leaves)
Wood very mobile in main channel

Large Wood Debris Study – Initial Observations (RSP 6.5.4.9)

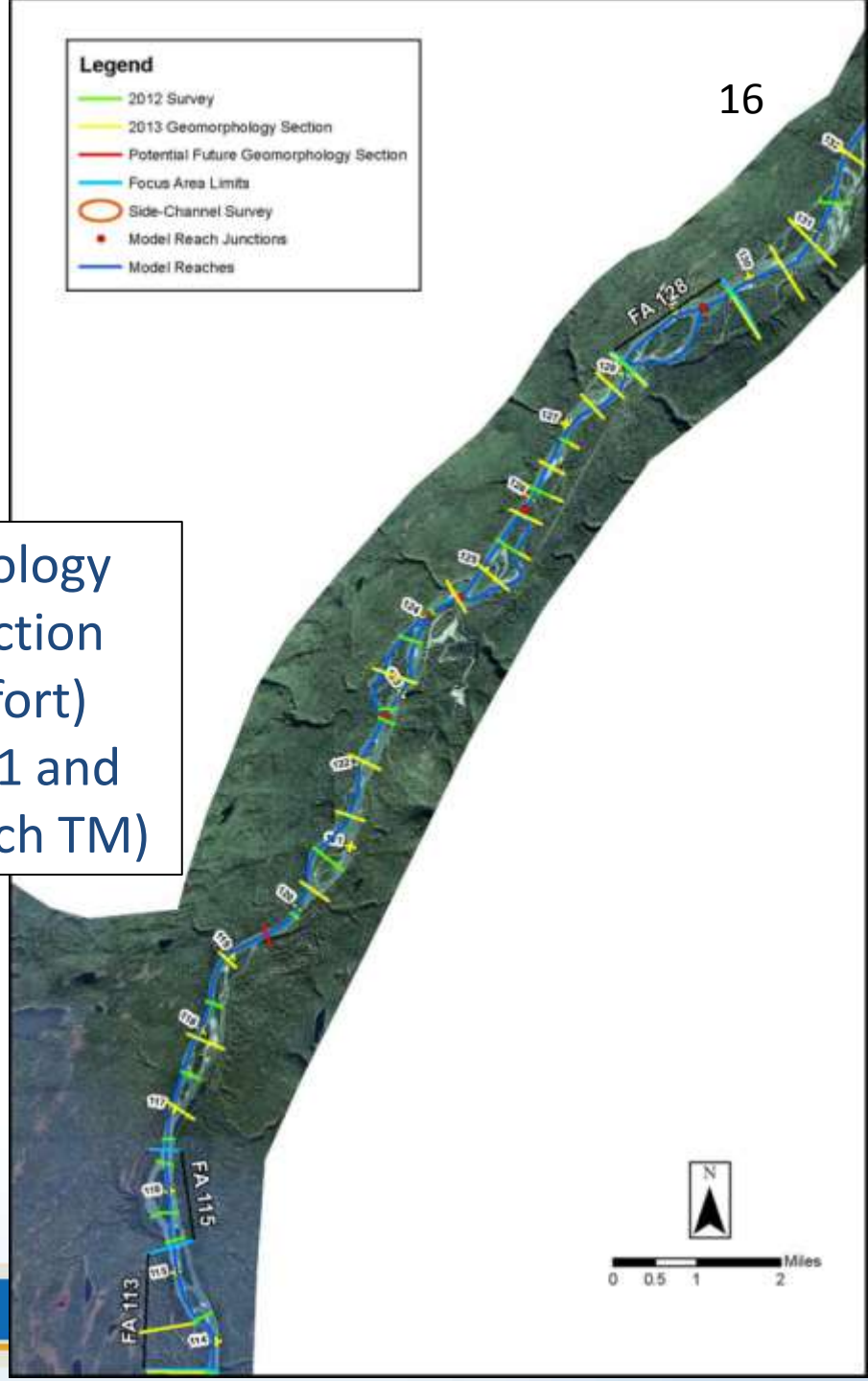
Geomorphic effects unclear in main channel; wood mobile; local hydraulic effects (scour pools around large root wads)

Sloughs/small side channels – wood more stable/effective – aquatic cover

Jams found on most apex bars, also on sides of channels if wood is lodged on obstructions.



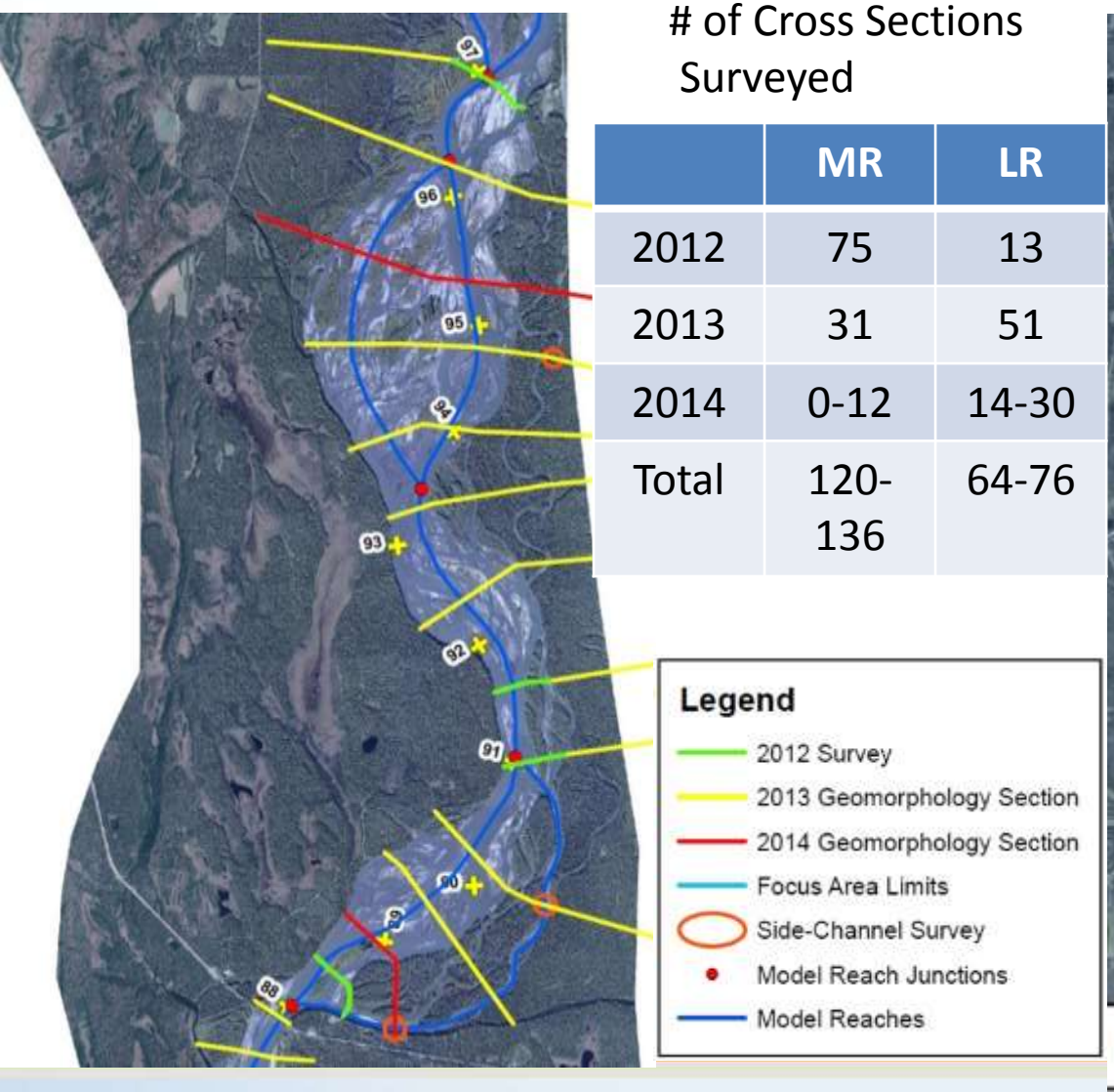
MR 1- D Morphology Model Cross Section Surveys (IFS-Effort) (RSP 6.6.4.1.2.9.1 and Modeling Approach TM)

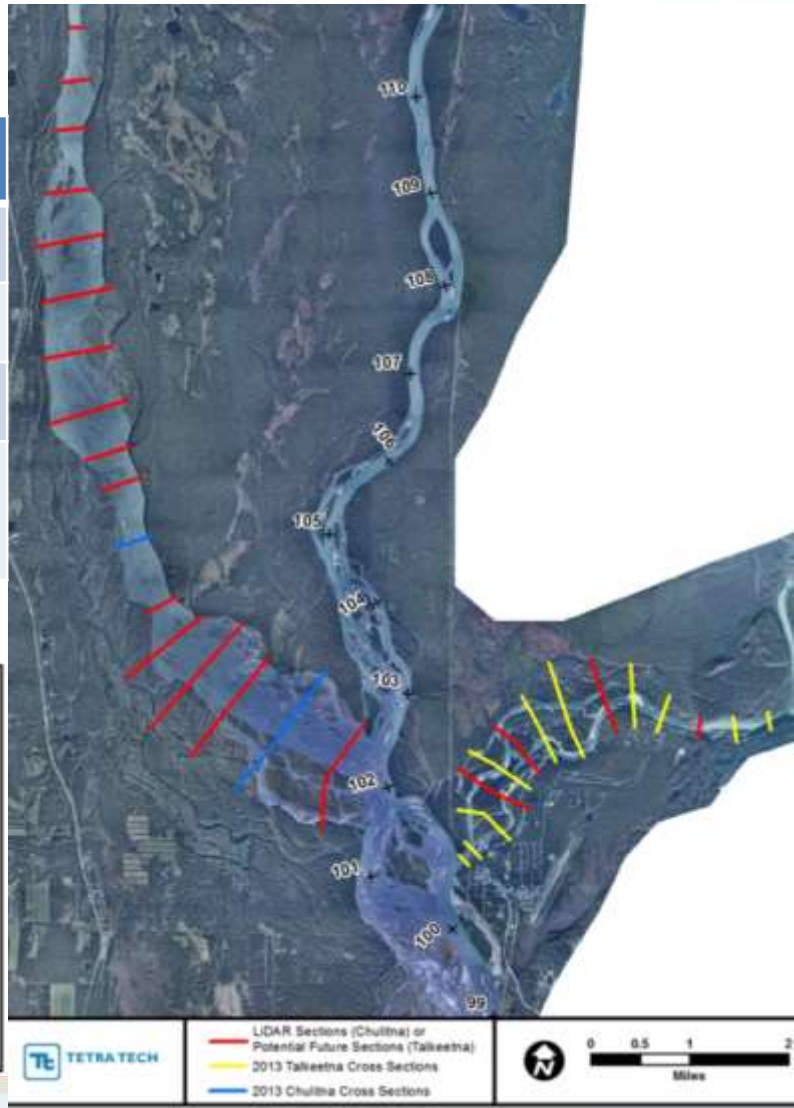


1-D Cross Section Lower River and Three Rivers Confluence (IFS-Effort) (Modeling Approach TM)

of Cross Sections Surveyed

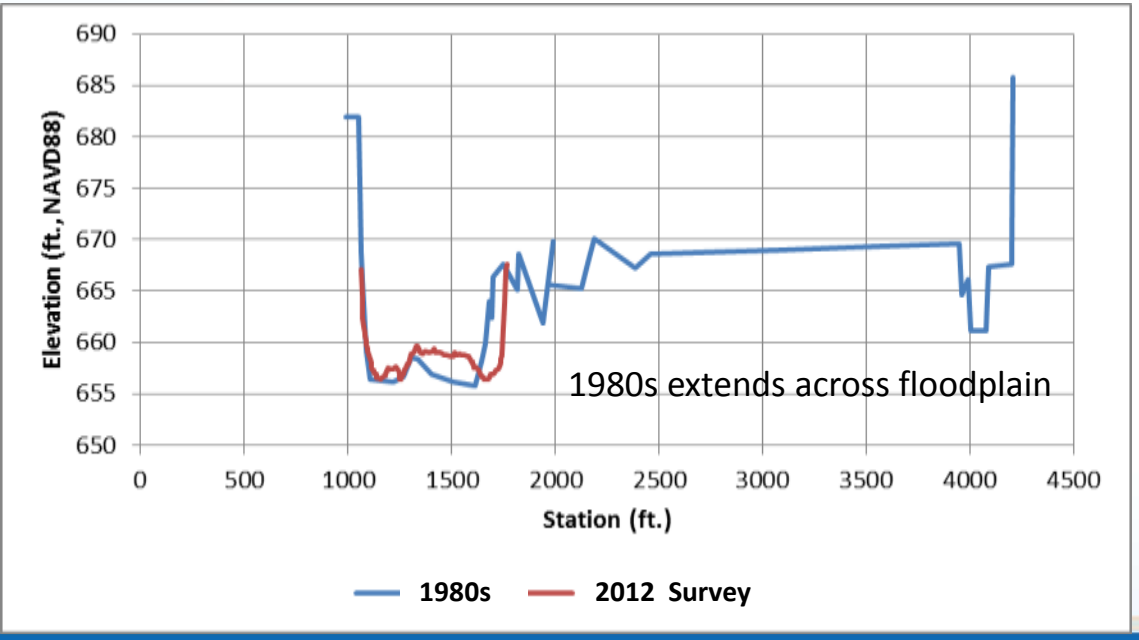
	MR	LR
2012	75	13
2013	31	51
2014	0-12	14-30
Total	120-136	64-76

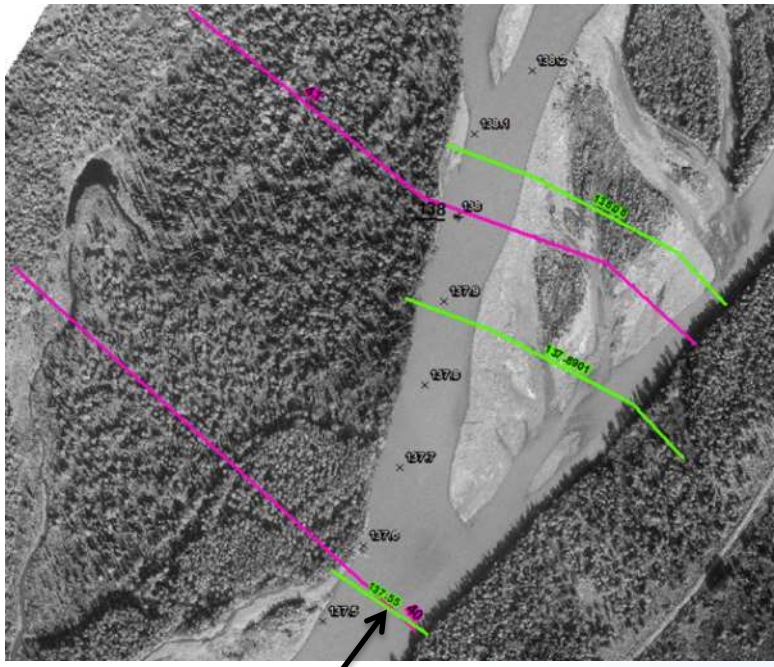




Example 2012 Cross Section Plot and Comparison with 1980s (RSP 6.6.4.1.2.9.1)

Cross Section Comparison Plot





Section 137.55

Cross Section Observations (RSP 6.6.4.1.2.9.1)

- *Floodplain n-value estimate*
- *At select sections*
  - *Upper bank material sample*
  - *Lower bank pebble count*
  - *Water surface elevation survey*

Bed Material Sampling: Pebble Counts for Surface Samples (RSP 6.6.4.1.2.9.1)

Performed at the head of bars 3 locations that follow lines of flow/embrication

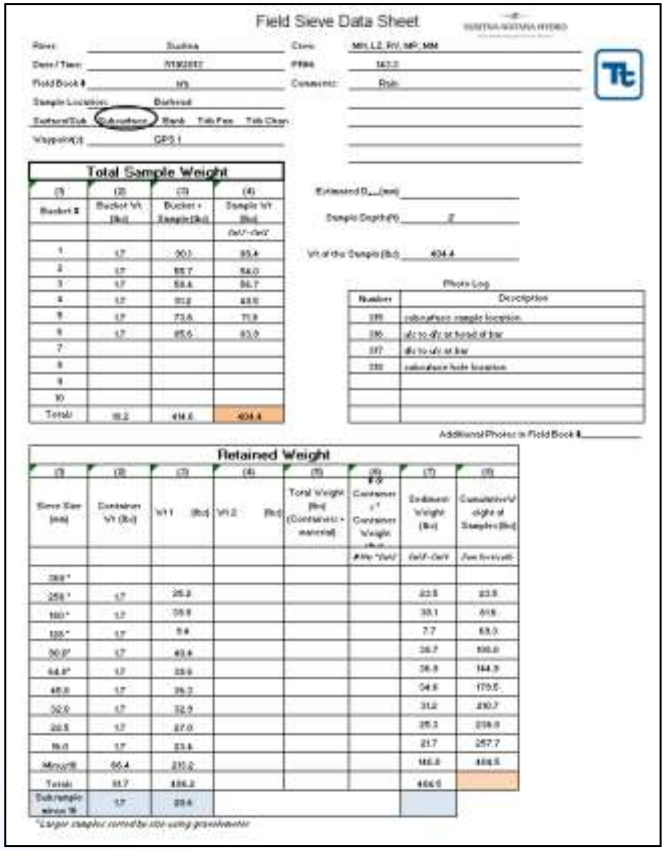
100’ tapes are laid out along the bars for measurements

Median axis measured with a gravelometer

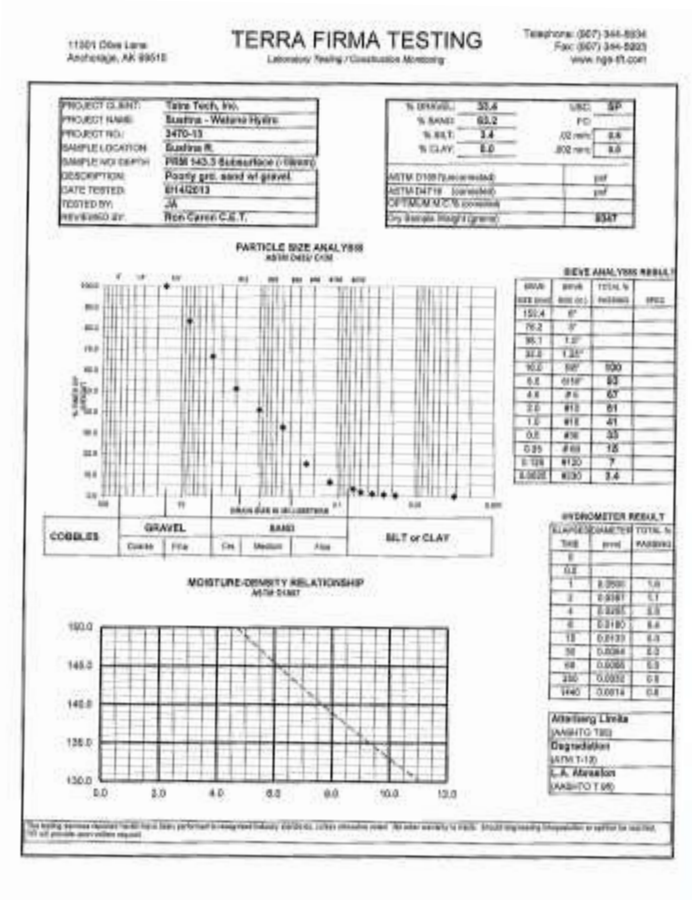
Field Sieve Subsurface Samples (RSP 6.6.4.1.2.9.1)

1. *Collect subsurface sample*
2. *Weigh samples*
3. *Sieve 64mm to 16mm, gravel-ometer for plus 64mm*
4. *Weigh minus 16 and subsample to lab*

Subsurface Bed Material Data Reduction (RSP 6.6.4.1.2.9.1)

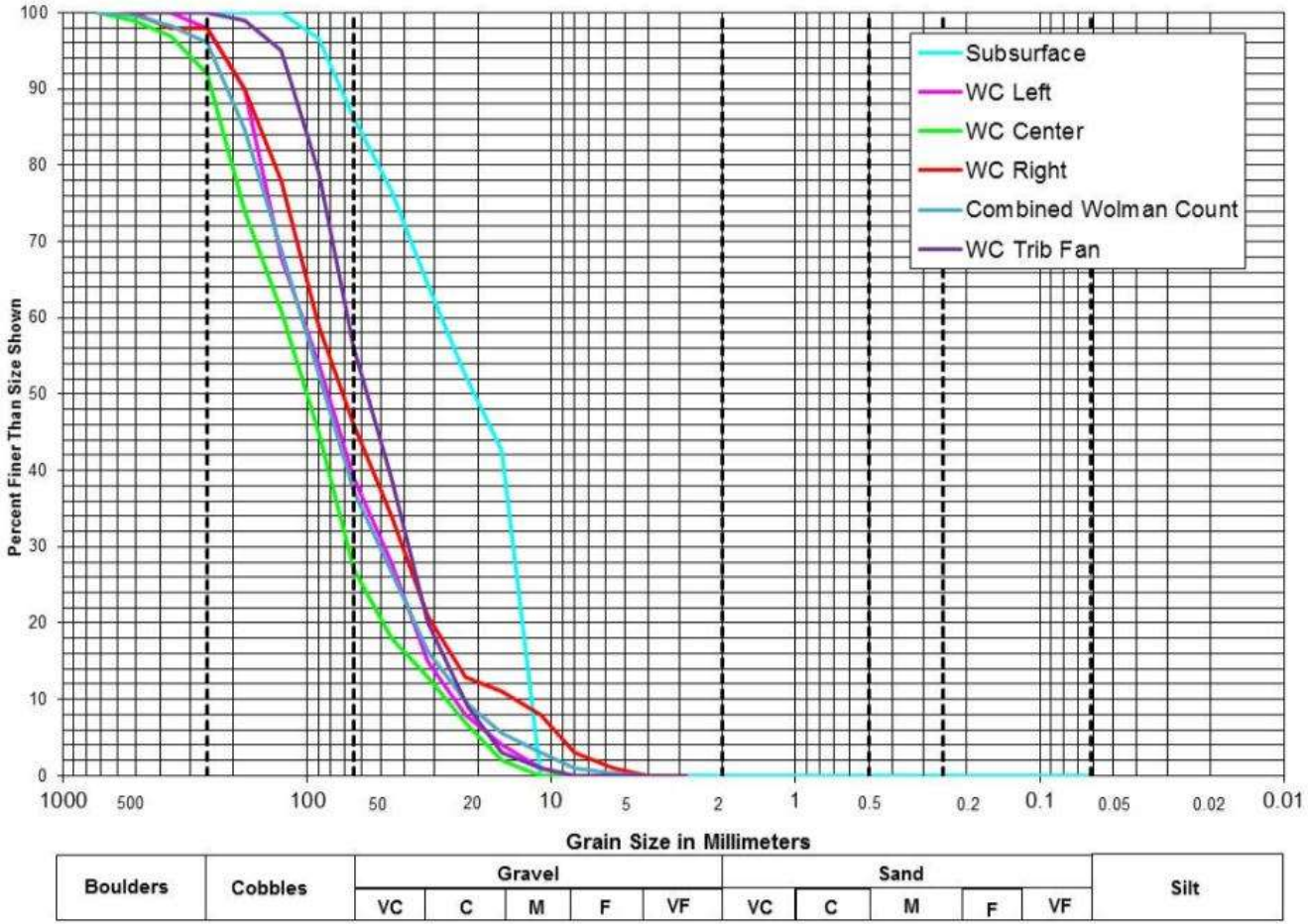

Field Sieve Data Sheet
Total Sample Weight
Retained Weight

Field Sieve Data Sheet


TERRA FIRMA TESTING
PARTICLE SIZE ANALYSIS
MOISTURE-DENSITY RELATIONSHIP
COBBLES
GRAVEL
SAND
SILT or CLAY

Lab Data Sheet

Plotted Surface and Subsurface Samples (RSP 6.6.4.1.2.9.1)



Tributary Surveys for 1-D and 2-D Model (RSP 6.6.1.2.9.3)

Lane Creek Channel

Lane Creek Fan

- *Purpose – Provide sediment load to 1-D and 2-D models of the mainstem and FAs*
- *Collect surface and subsurface samples to characterize the stream and the fan (if fan is present)*
- *Survey cross sections in tributary channel to develop 1-D hydraulics for bed load estimate*
- *Survey profile of fan if percent*

MR FGM: Tributary Deltas (RSP 6.6.4.1.2.9.3)

Tributary Name	PRM	Bank	Geo. Reach	Focus Area	Sed. Input only	1-D or 2-D
Tsusena Creek	184.6	RB	MR-2		X	1-D
Fog Creek	179.3	LB	MR-2		X	1-D
Unnamed	174.3	LB	MR-2	FA173		2-D
Unnamed	173.8	RB	MR-2	FA173		2-D
Portage Creek	152.3	RB	MR-5	FA151		2-D
Unnamed*	144.6	LB	MR-6	FA144		2-D
Indian River*	142.1	RB	MR-6	FA141		2-D
Gold Creek*	140.1	LB	MR-6		X	1-D
Skull Creek*	128.1	LB	MR-6	FA128		2-D
Lane Creek*	117.2	LB	MR-7		X	1-D
Unnamed*	115.4	RB	MR-7	FA115		2-D
Gash Creek*	115.0	LB	MR-7	FA113		2-D
Slash Creek*	114.9	LB	MR-7	FA113		2-D
Unnamed*	113.7	LB	MR-7	FA113		2-D
Whiskers Creek*	105.1	RB	MR-8	FA104		2-D

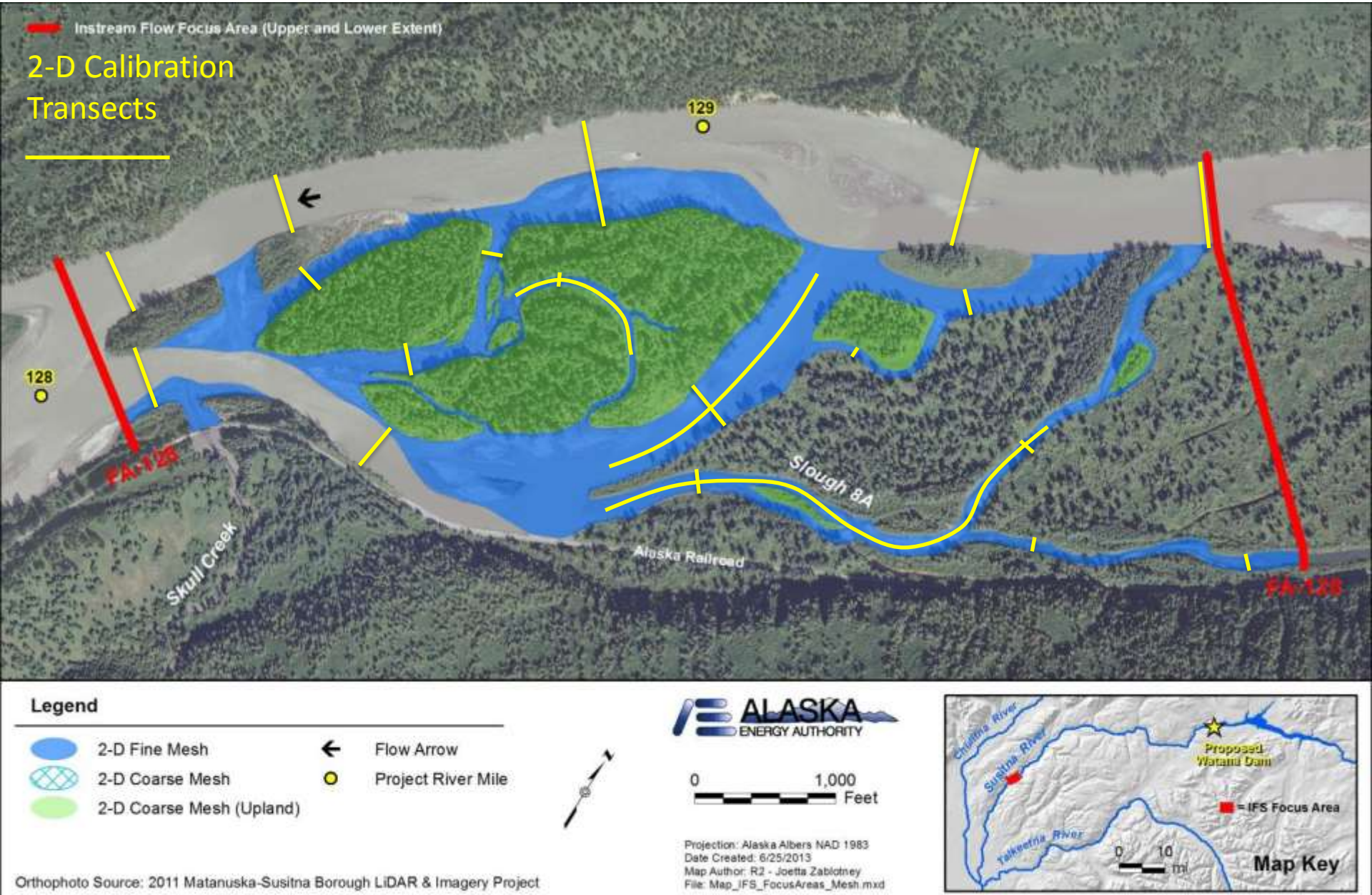
* Tribs that will be analyzed in 2013

LR FGM: Tributaries (Modeling Approach TM)

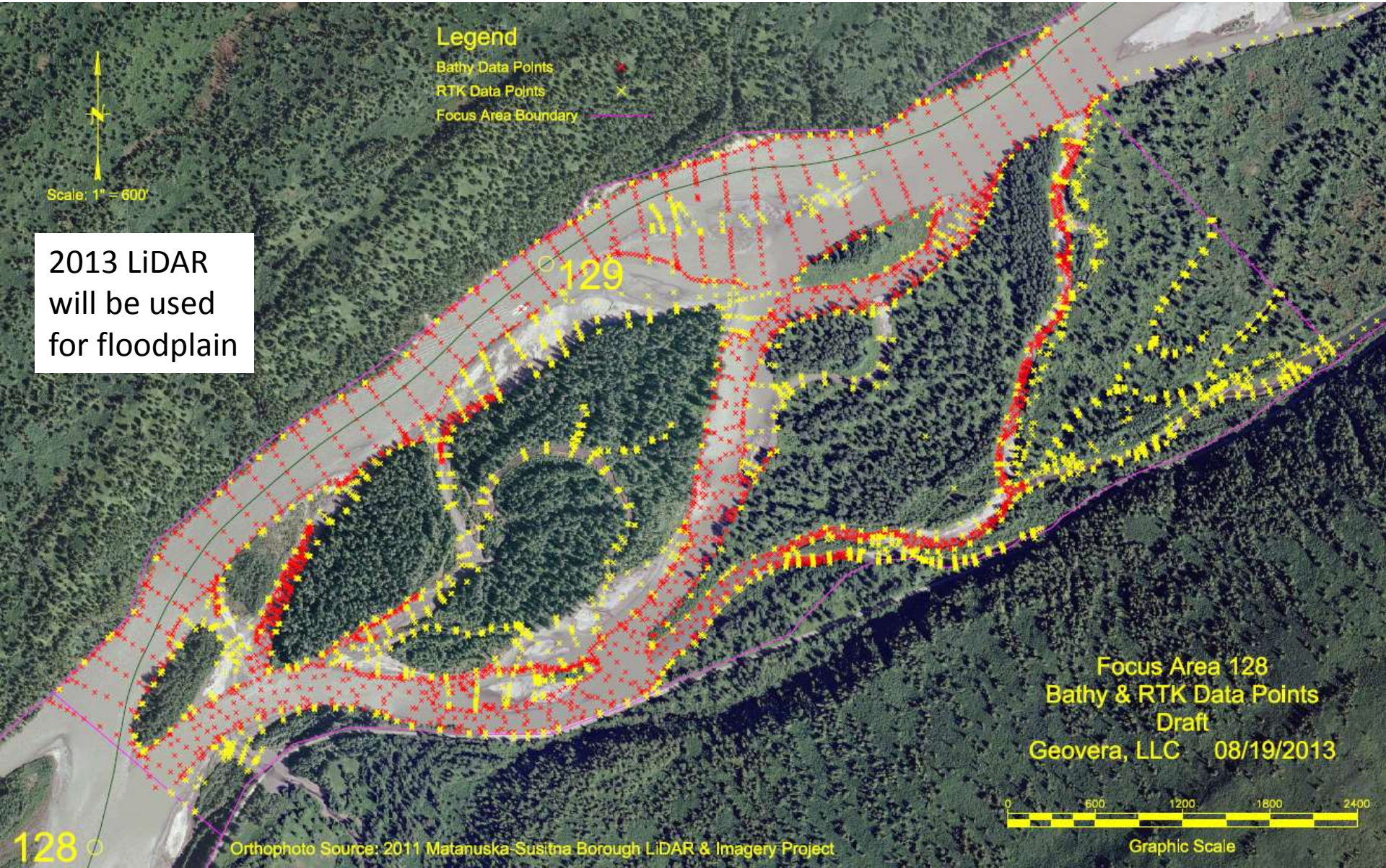
Tributary Name	PRM	Bank	Geo. Reach	Focus Area	Sed. Input only	1-D or 2-D
Trapper Creek*	94.5	RB	LR-1			1-D
Birch Creek*	92.5	LB	LR-1			1-D
Sheep Creek	69.5	LB	LR-2			1-D
Caswell Creek	67.0	LB	LR-2			1-D
Deshka River*	45.0	RB	LR-3			1-D

* Tribs that will be analyzed in 2013

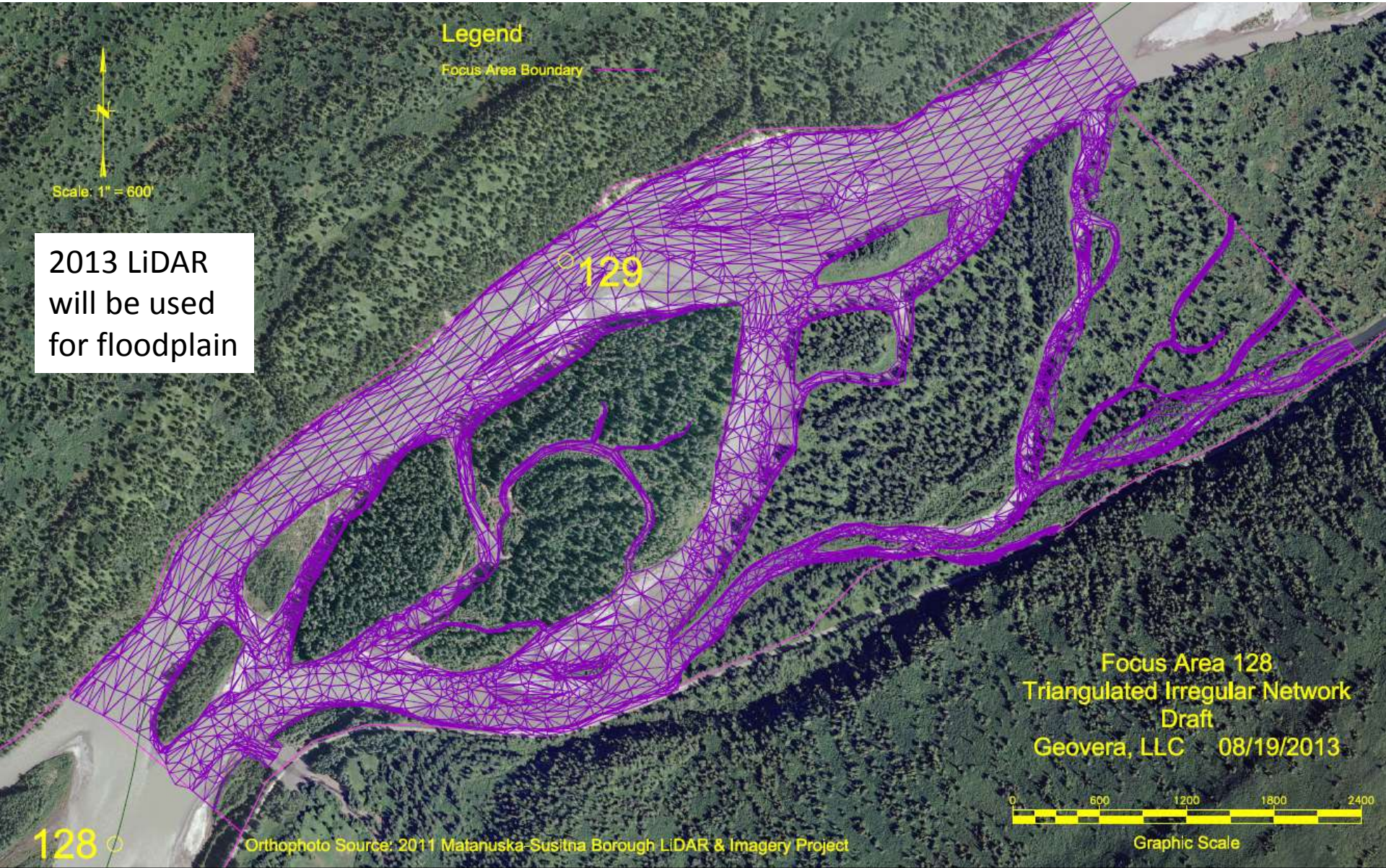
FA Topo and Bathy Surveys (IFS Effort): Survey Resolution and ADCP Calibration Transects – 2-D Model (RSP 6.6.4.1.2.9.2)



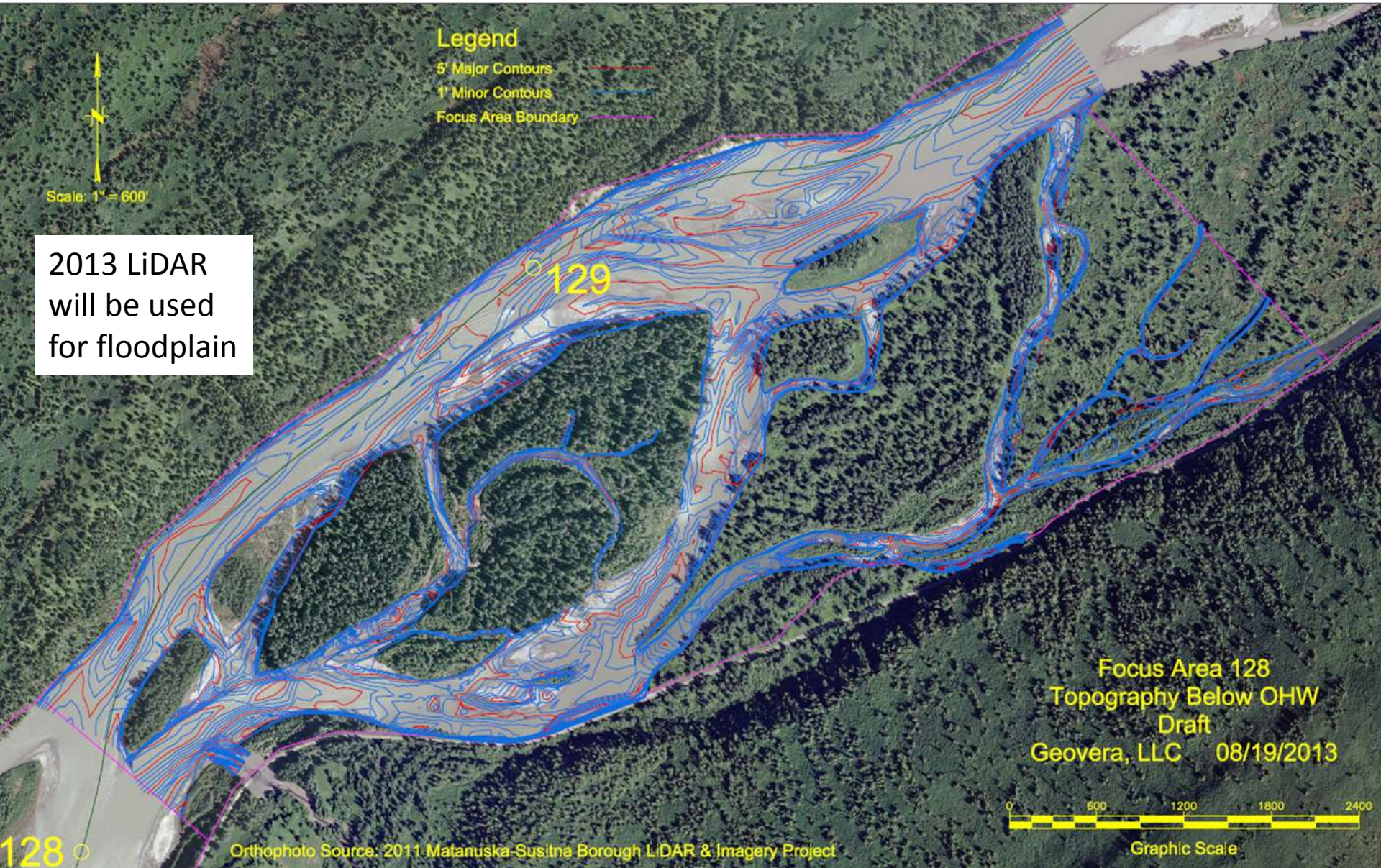
FA Topographic and Bathymetric Surveys (IFS Effort) Survey Points (RSP 6.6.4.1.2.9.2)



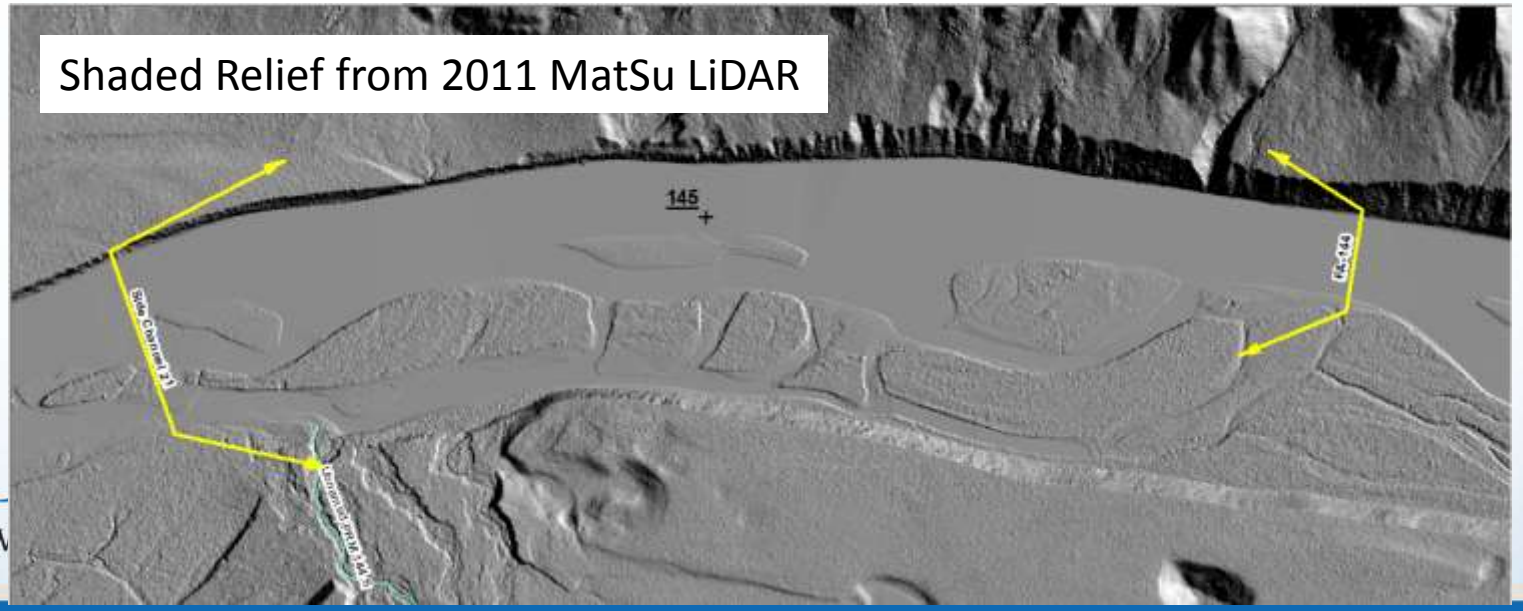
FA Topographic and Bathymetric Surveys (IFS effort) Triangulated Irregular Network (TIN) (RSP 6.6.4.1.2.9.2)



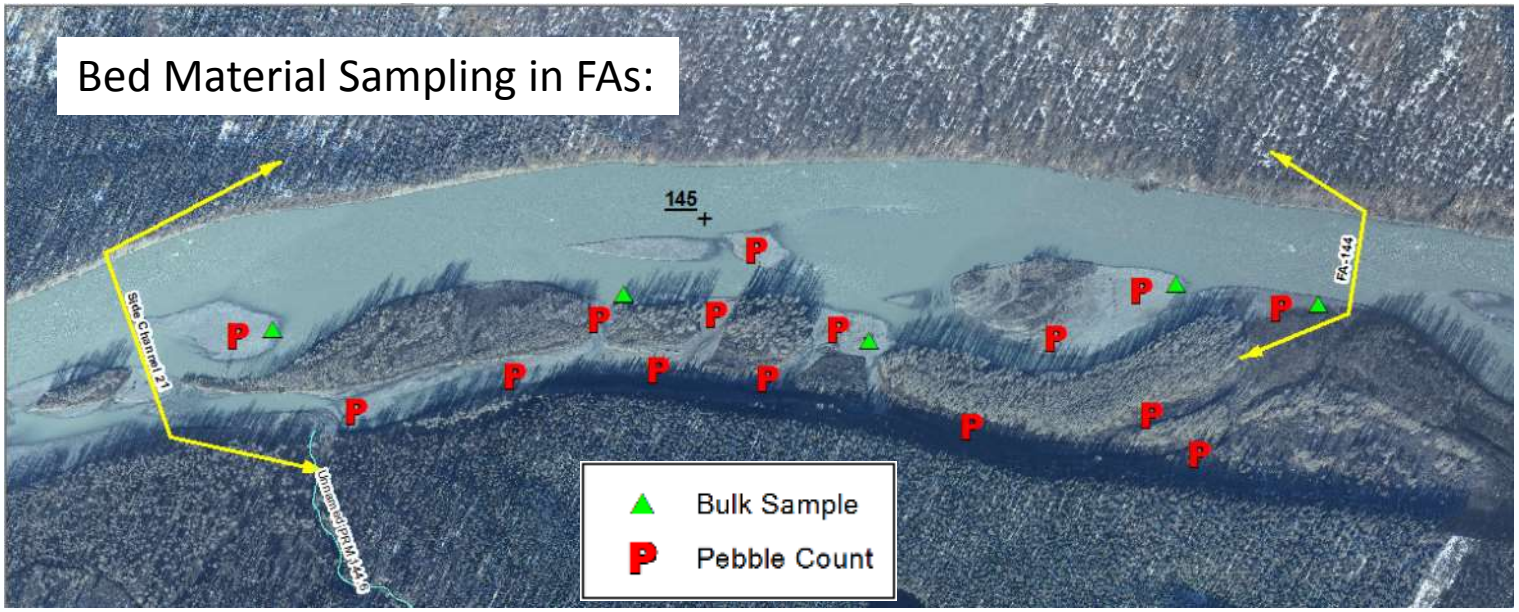
FA Topographic and Bathymetric Surveys (IFS effort) Contour Map (TIN) (RSP 6.6.4.1.2.9.2)



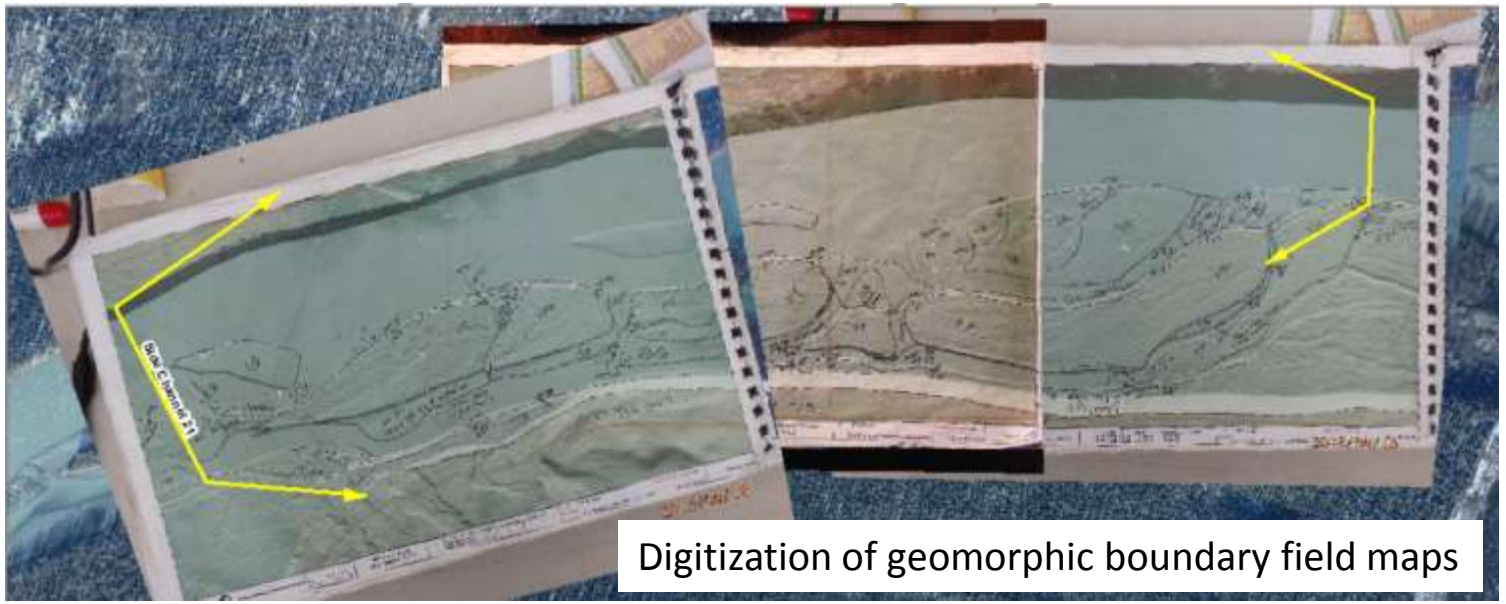
FA Geomorphic Field Assessment and Mapping: Base Maps (RSP 6.6.4.1.9.2)



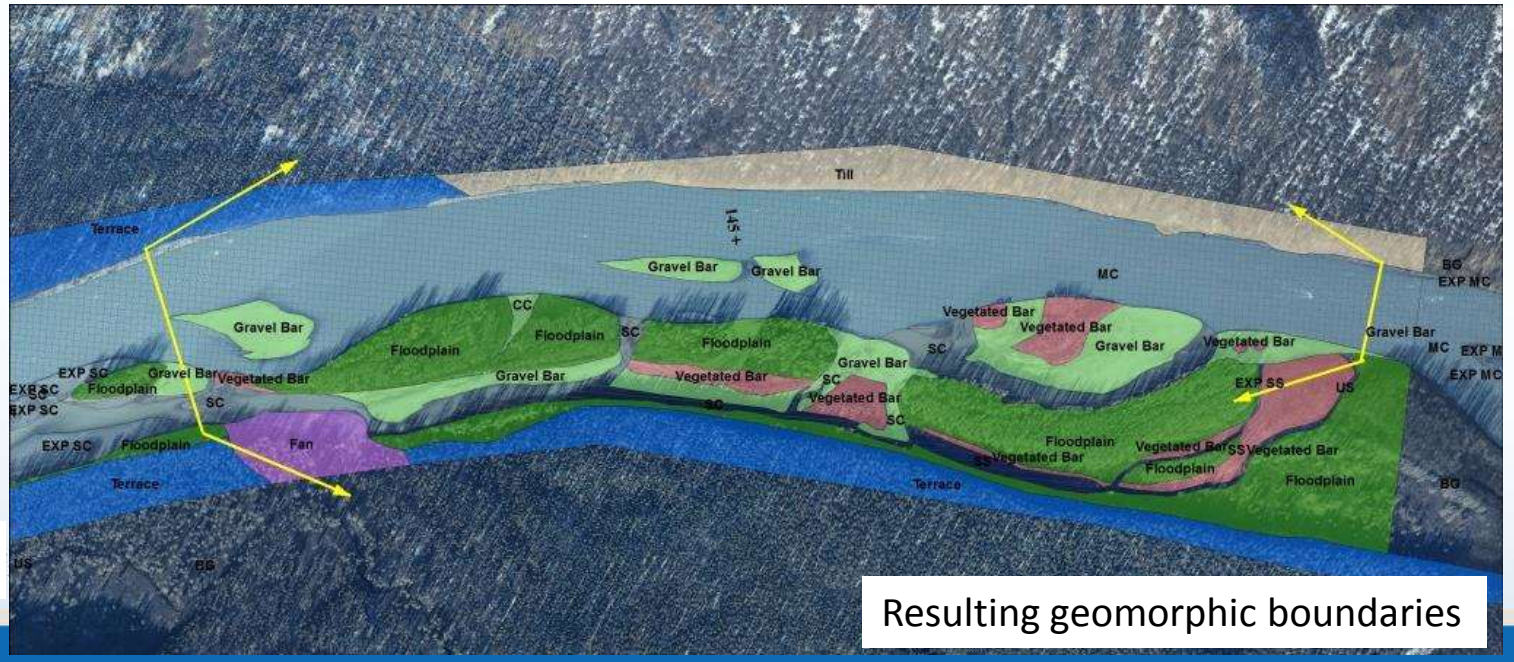
FA Geomorphic Field Assessment and Mapping: Example Data (RSP 6.6.4.1.9.2)



FA Geomorphic Field Assessment and Mapping: Results (RSP 6.6.4.1.9.2)

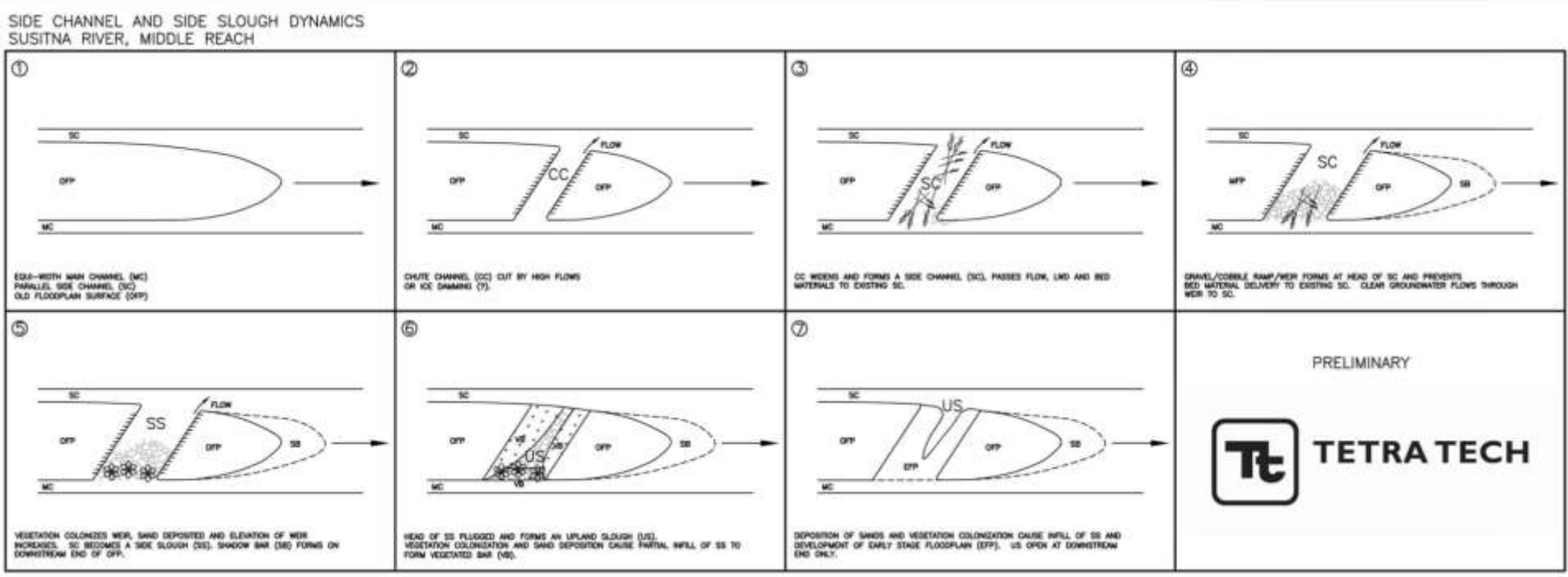


Digitization of geomorphic boundary field maps



Resulting geomorphic boundaries

Identification of Geomorphic Processes - Example Geomorphic Process Model (preliminary) Side Channel and Side Slough Dynamics (RSP 6.5.4.1 and 6.5.4.11)



Variance – Collect 2013 LiDAR Rather Than Using 2011 MatSu Borough (RSP 6.6.4.1.2.9)

- *RSP indicated 2011 MatSu Borough LiDAR would be used to develop the floodplain portion of the FAs and 1-D cross sections*
- *Based on LiDAR Verification, decision made to collect higher resolution LiDAR in 2013*

Variance - Use of LiDAR for Macrohabitat Area: Results and Difficulties with Aerials (RSP 6.5.4.5 MR and 6.5.6.7 LR)

- *2012 could not collect aerials at all target flows*
  - *Flow conditions*
  - *Weather conditions*
- *Comparison at 12,500 cfs indicated appreciable differences in habitat areas*
  - *Some features shifted classification*
    - *Side channel => side slough*
    - *Side Slough => side channel*
  - *Area changes due to geomorphic processes*

Variance - Use of LiDAR for Macrohabitat Area:
Advantages of LiDAR & Hydraulic Based Approach (RSP 6.5.4.5 MR and 6.5.6.7 LR)

- *LiDAR less susceptible to flow conditions*
  - *Single flight required*
- *LiDAR less susceptible to weather*
  - *Can penetrate thin cloud cover*
  - *Sun angle not an issue*
  - *Can be flown at night*
- *Consistent with modeling approach in Focus Areas*

Large Wood Debris – Variances (RSP 6.5.4.9)

- *High flow midway through data collection provided additional information on wood transport:*
  - *Small debris became mobile at approximately 30,000 cfs at Gold Creek gage; large trees started to move at approximately 40,000 cfs*
  - *Wood in some Focus Areas already inventoried was re-checked after August high flow to determine if wood pieces moved or not*

Next Steps

- Aerial and LiDAR (RSP 6.5.4.4 and Modeling Approach TM)
  - Process information
  - Distribute to studies
- Large Woody Debris (RSP 6.5.4.9)
  - Analyze 2013 field data
  - Digitize wood/jams from autumn 2013 aerials if available
- USGS Sediment Transport Data (RSP 6.5.4.2)
  - Receive 2013 data
  - Compare with 2012 and 2013 with 1980s
  - Identify need for 2014 data
- 1-D model (RSP 6.6.4.1 and Modeling Approach TM)
  - Compile and reduce all 2013 field data (RSP 6.6.4.1.2.9.1)
  - Develop 1-D tributary models (RSP 6.6.4.1.2.6)
  - Initiate 1-D HEC-6T morphology model development (RSP 6.6.4.1.2.5)
  - Initial 1-D morphology model run end of Q1 2014 (Modeling Approach TM)

Next Steps (Cont.)

- 2-D Morphology Model (Focus Areas) (RSP 6.6.4.1)
  - Compile and reduce all 2013 field data (RSP 6.6.4.1.2.9.2)
  - Develop hydraulic models for FA-104 and FA-128 (Dec 2013) (RSP 6.6.4.1.2.5)
  - Develop morphology models for FA-104 and FA-128 end Q1 2014 (RSP 6.6.4.1.2.5 and Modeling Approach TM))
  - Final selection of 2-D morphology model , either River2D or SRH-2D end of Q1 2014 (RSP 6.6.4.1.2.1 and Modeling Approach TM)
- Develop Initial Study Report for Geomorphology Study (6.5) and Fluvial Geomorphology Modeling Study (6.6)

END