FIGURES

Susitna-Watana Hydroelectric Project (FERC No. 14241)

Fluvial Geomorphology Modeling Study (6.6)

Figures

Initial Study Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared by

Tetra Tech and

Watershed GeoDynamics

February 2014 Draft

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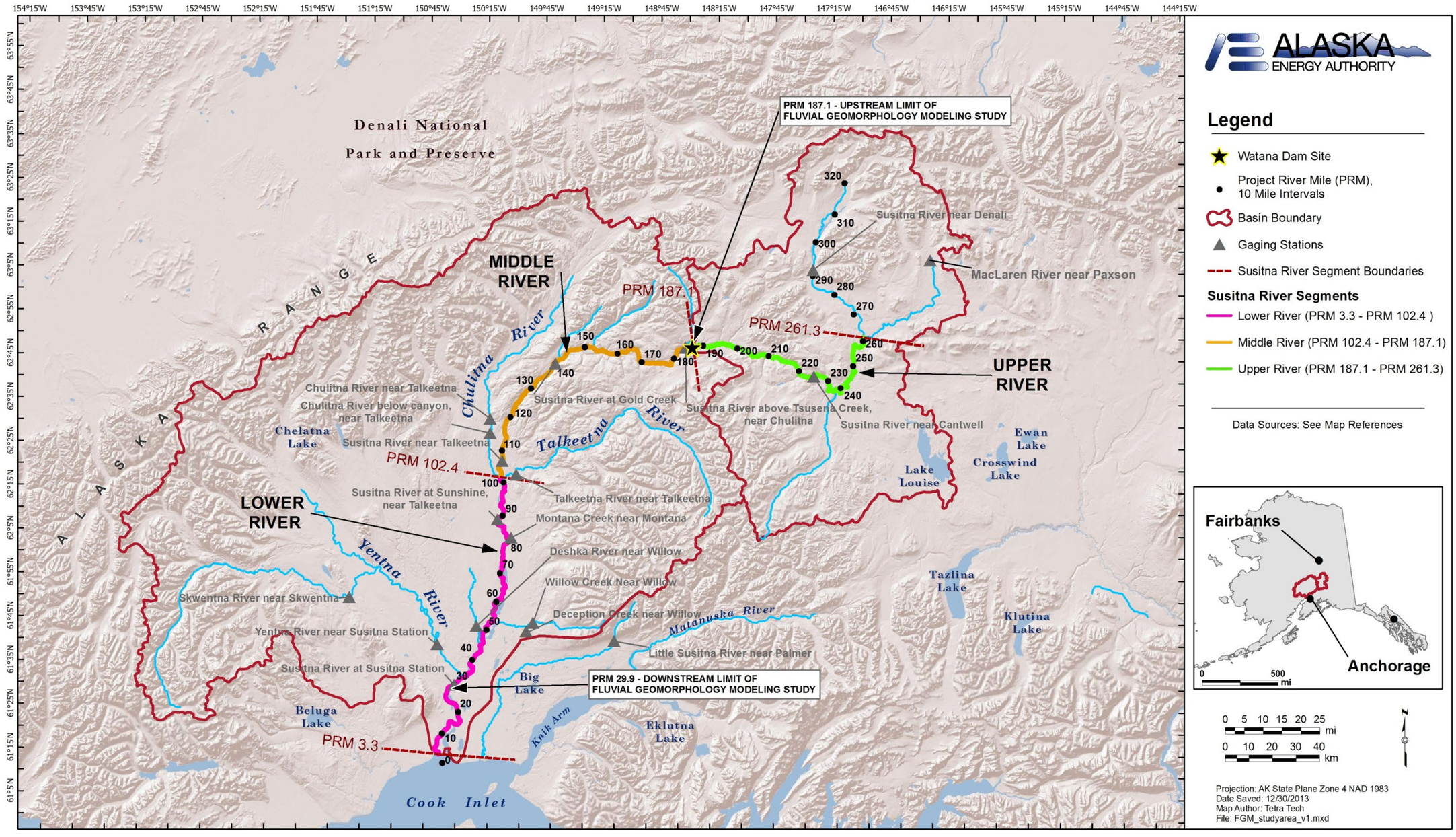


Figure 3.1-1. Current limits of the Fluvial Geomorphology Modeling Study and large-scale river segments.

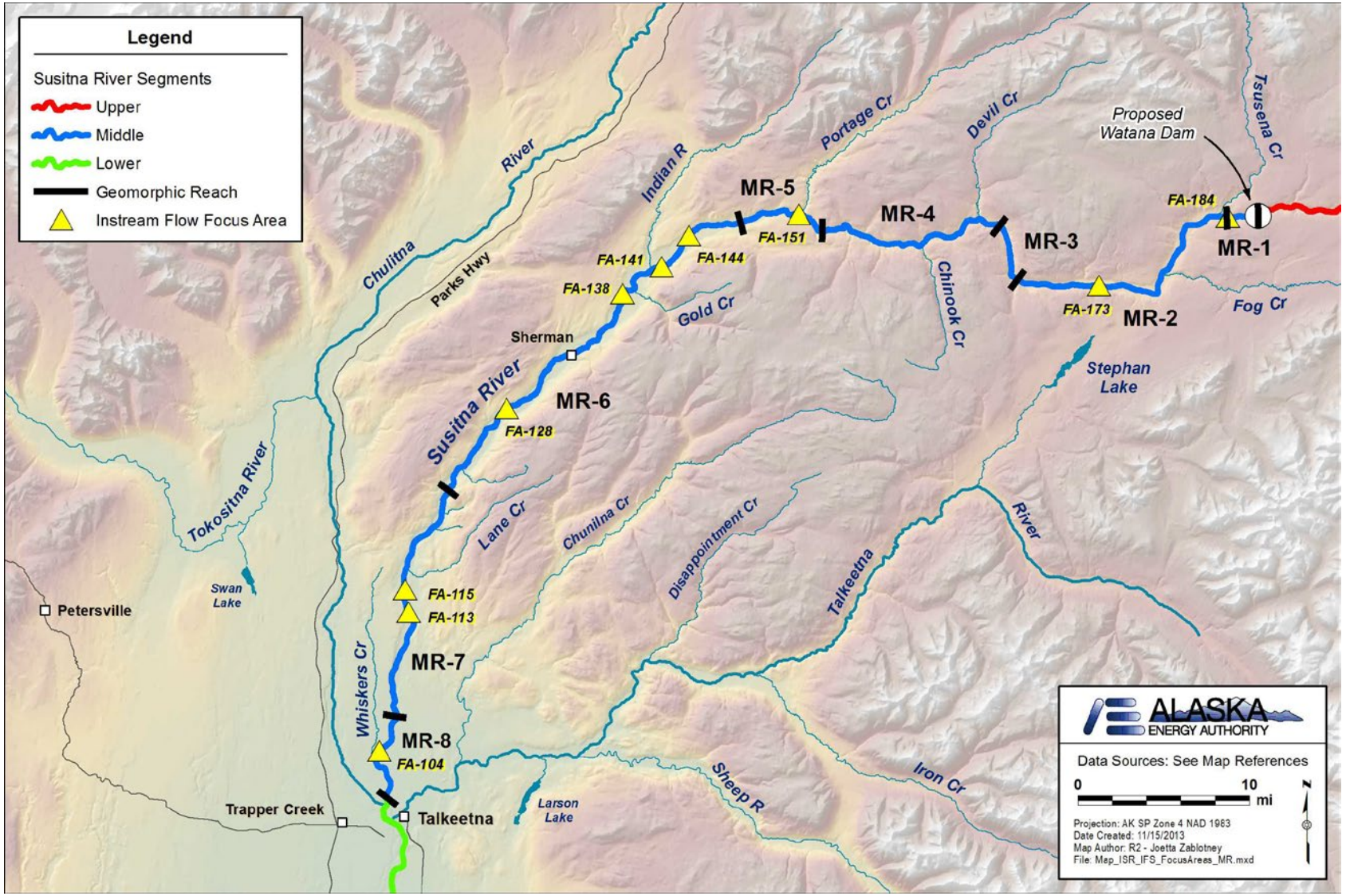


Figure 3.2-1. Location of Focus Areas in the Middle Susitna River Segment with geomorphic reaches shown.

Figure 4.1-1. Sketch of transect locations (identified as L, C and R) for surface sampling at sample location PRM 113.5 (left) and photograph of sample location, view downstream (right).

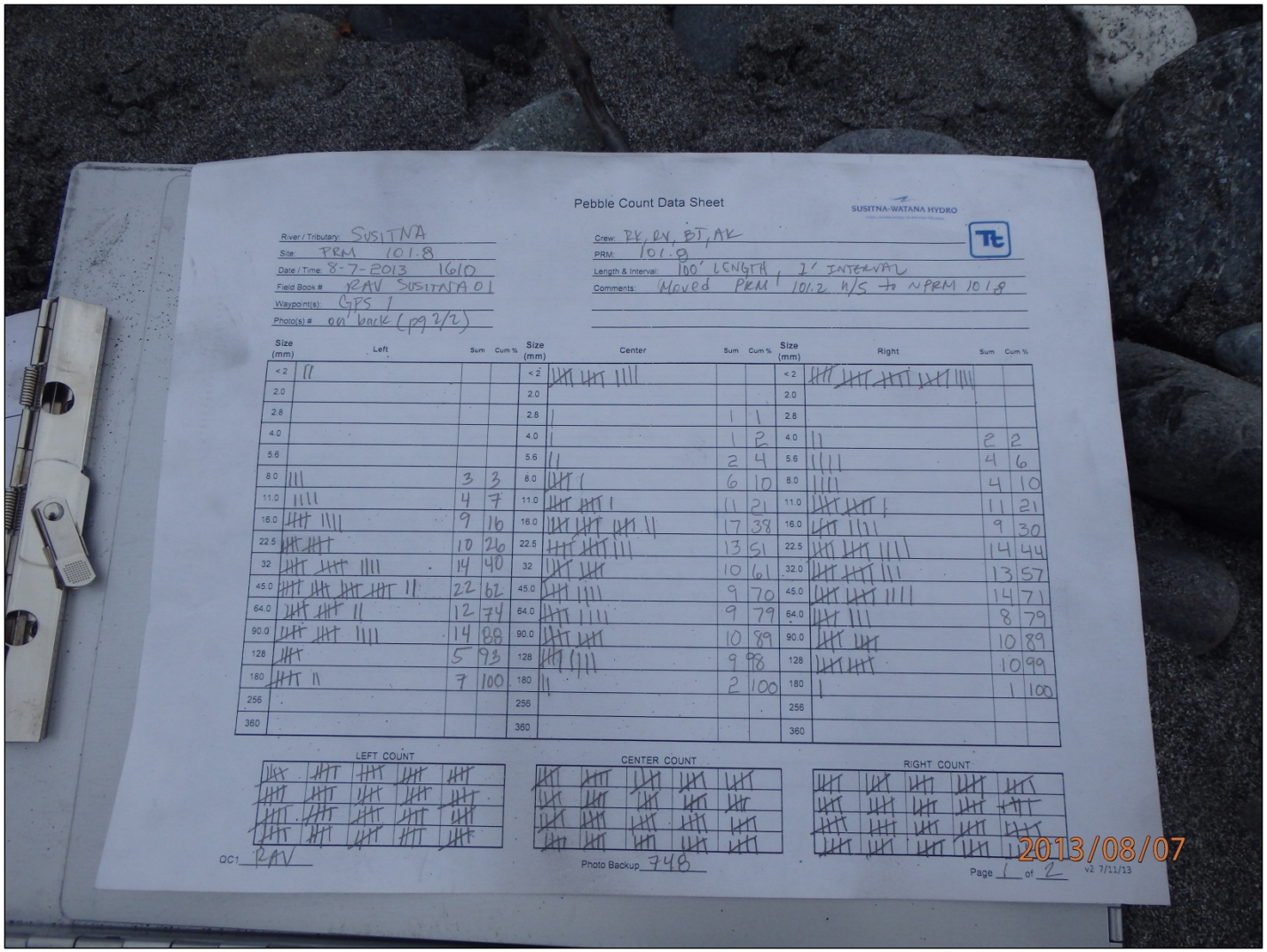


Figure 4.1-2. Example of completed field data form for coarse-grained surface samples.

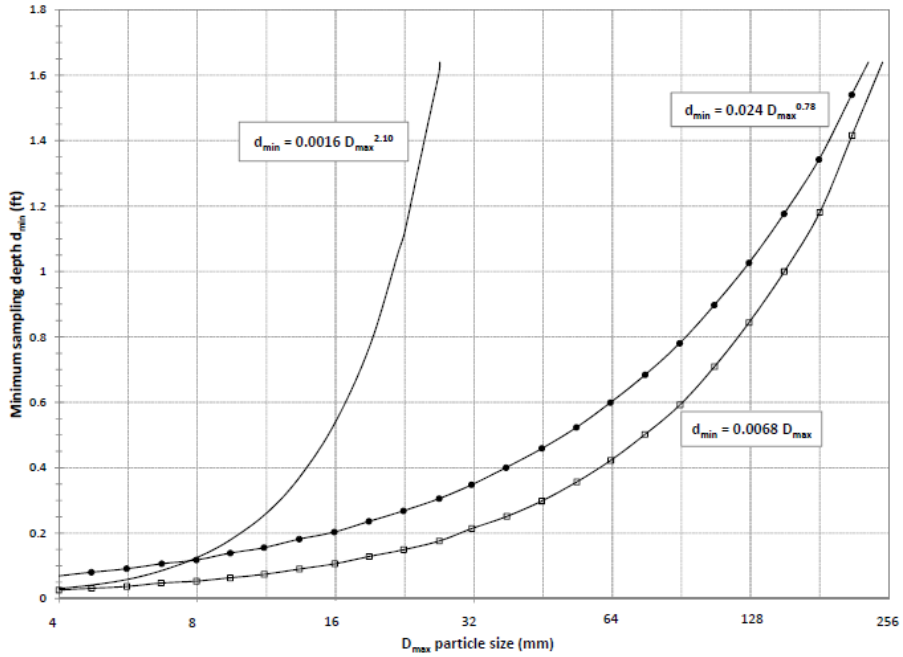


Figure 4.1-3. Three functions to calculate minimum sampling depth (dsample in ft) from the Dmax particle size (Modified from Figure 4.18 from Bunte and Abt, 2001).

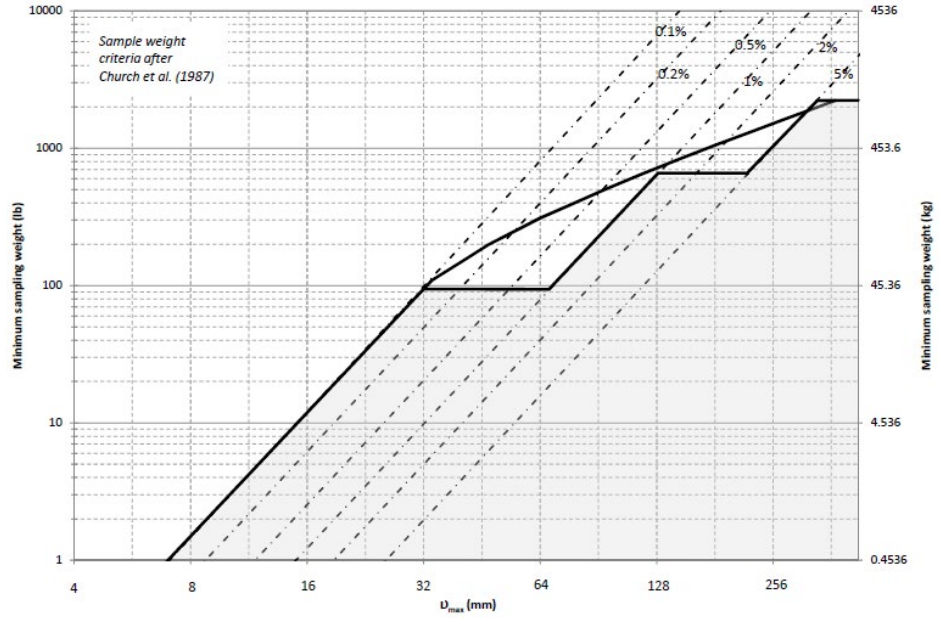
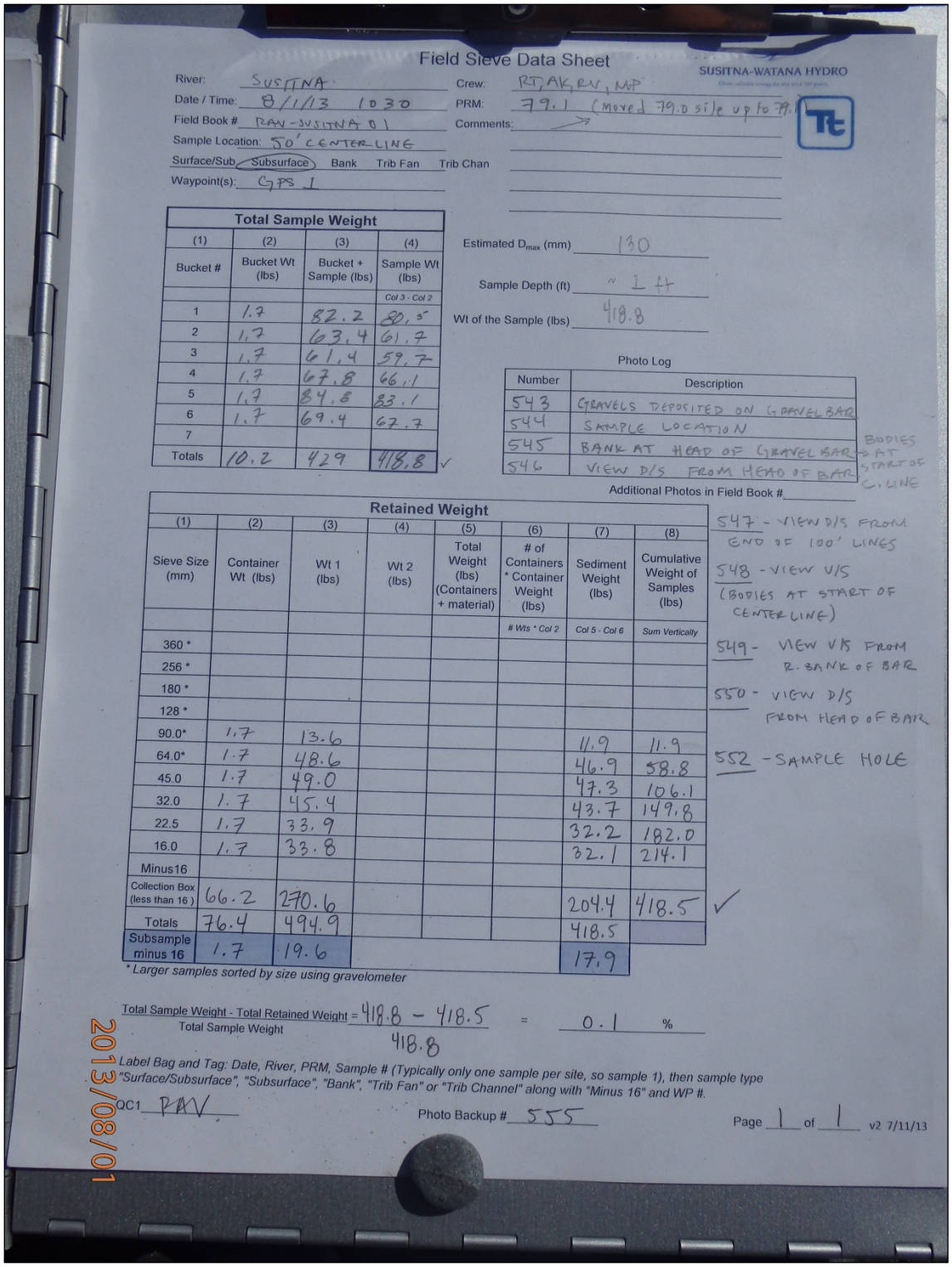


Figure 4.1-4. Minimum sample weight for sediment with different Dmax sizes (Dmax = 0.1% of the sample weight for Dmax < 32mm, Dmax = 1% of the sample weight for Dmax < 128mm and Dmax = 5% of the sample weight for Dmax > 128mm (Modified from Figure 4.20 from Bunte and Abt, 2001)



Field Sieve Data Sheet

SUSITNA-WATANA HYDRO

River: SUSITNA
Date / Time: 8/1/13 1030
Field Book #: PAN-SUSITNA 01
Sample Location: 50' CENTERLINE
Surface/Sub: Subsurface Bank Trib Fan Trib Chan
Waypoint(s): GPS 1

Crew: RT, AK, RV, NP
PRM: 79.1 (moved 79.0 site up to 79.1)
Comments:

Total Sample Weight

(1) Bucket #	(2) Bucket Wt (lbs)	(3) Bucket + Sample (lbs)	(4) Sample Wt (lbs)
			Col 3 - Col 2
1	1.7	82.2	80.5
2	1.7	63.4	61.7
3	1.7	61.4	59.7
4	1.7	67.8	66.1
5	1.7	84.8	83.1
6	1.7	69.4	67.7
7			
Totals	10.2	429	418.8 ✓

Estimated D_{max} (mm): 130
Sample Depth (ft): ~ 1 ft
Wt of the Sample (lbs): 418.8

Photo Log

Number	Description
543	GRAVELS DEPOSITED ON GRAVEL BAR
544	SAMPLE LOCATION
545	BANK AT HEAD OF GRAVEL BAR → BODIES AT START OF C. LINE
546	VIEW D/S FROM HEAD OF BAR

Additional Photos in Field Book #:

547 - VIEW D/S FROM END OF 100' LINES
548 - VIEW U/S (BODIES AT START OF CENTERLINE)
549 - VIEW U/S FROM R. BANK OF BAR
550 - VIEW D/S FROM HEAD OF BAR
552 - SAMPLE HOLE

Retained Weight

(1) Sieve Size (mm)	(2) Container Wt (lbs)	(3) Wt 1 (lbs)	(4) Wt 2 (lbs)	(5) Total Weight (lbs) (Containers + material)	(6) # of Containers * Container Weight (lbs)	(7) Sediment Weight (lbs)	(8) Cumulative Weight of Samples (lbs)
					# Wts * Col 2	Col 5 - Col 6	Sum Vertically
360 *							
256 *							
180 *							
128 *							
90.0*	1.7	13.6				11.9	11.9
64.0*	1.7	48.6				46.9	58.8
45.0	1.7	49.0				47.3	106.1
32.0	1.7	45.4				43.7	149.8
22.5	1.7	33.9				32.2	182.0
16.0	1.7	33.8				32.1	214.1
Minus16							
Collection Box (less than 16)	66.2	270.6				204.4	418.5 ✓
Totals	76.4	494.9				418.5	
Subsample minus 16	1.7	19.6				17.9	

* Larger samples sorted by size using gravelometer

Total Sample Weight - Total Retained Weight / Total Sample Weight = (418.8 − 418.5) / 418.8 = 0.1 %

Label Bag and Tag: Date, River, PRM, Sample # (Typically only one sample per site, so sample 1), then sample type "Surface/Subsurface", "Subsurface", "Bank", "Trib Fan" or "Trib Channel" along with "Minus 16" and WP #.

QC1 PAV

Photo Backup # 555

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Figure 4.1-5: Example of complete field data form for subsurface samples.

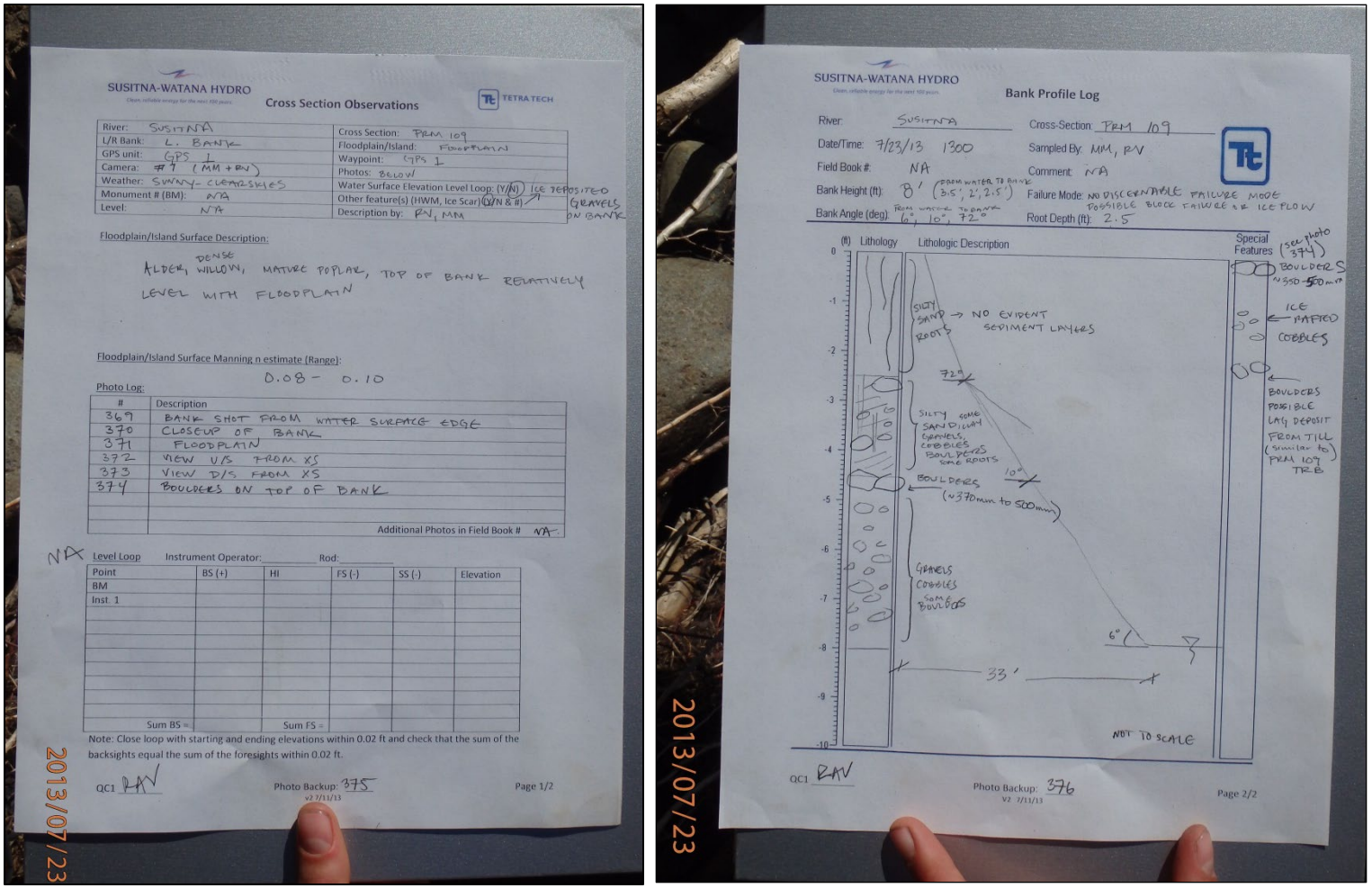

Figure 4.1-6: Example of front and back of 2013 bank observation data sheets.

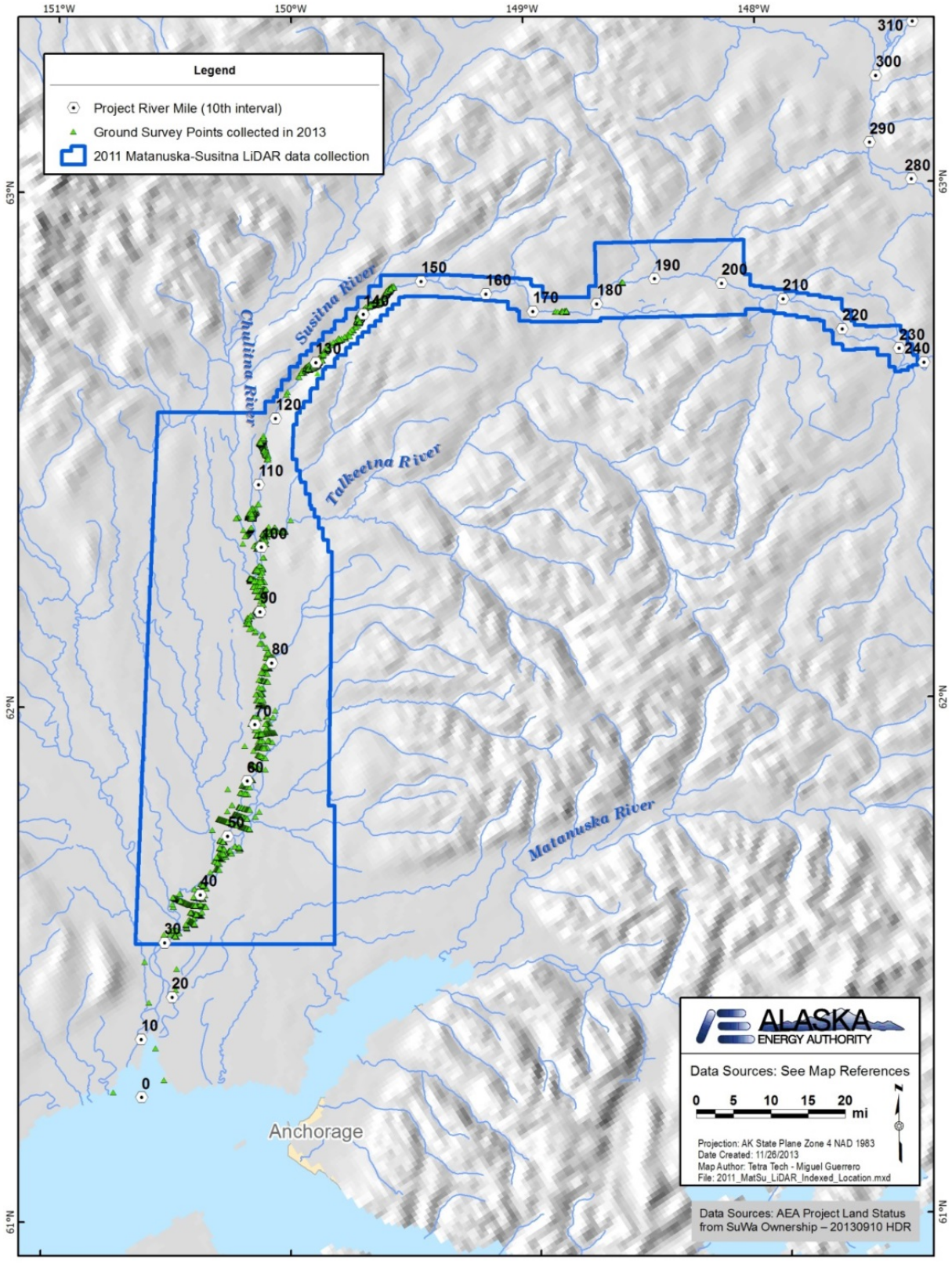

Figure 4.1-7. 2011 Matanuska-Susitna Borough LiDAR collections and 2013 ground survey point locations.

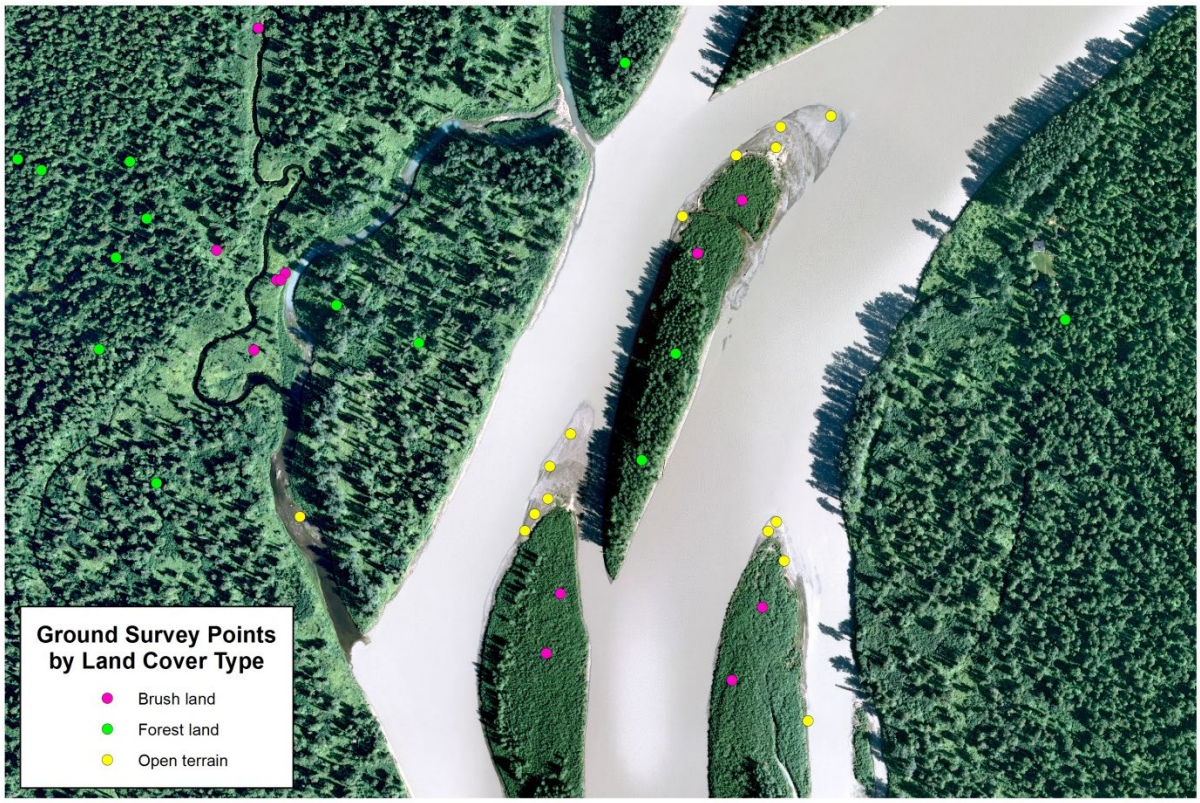

Figure 4.1-8. Example ground survey points displayed over aerial photography

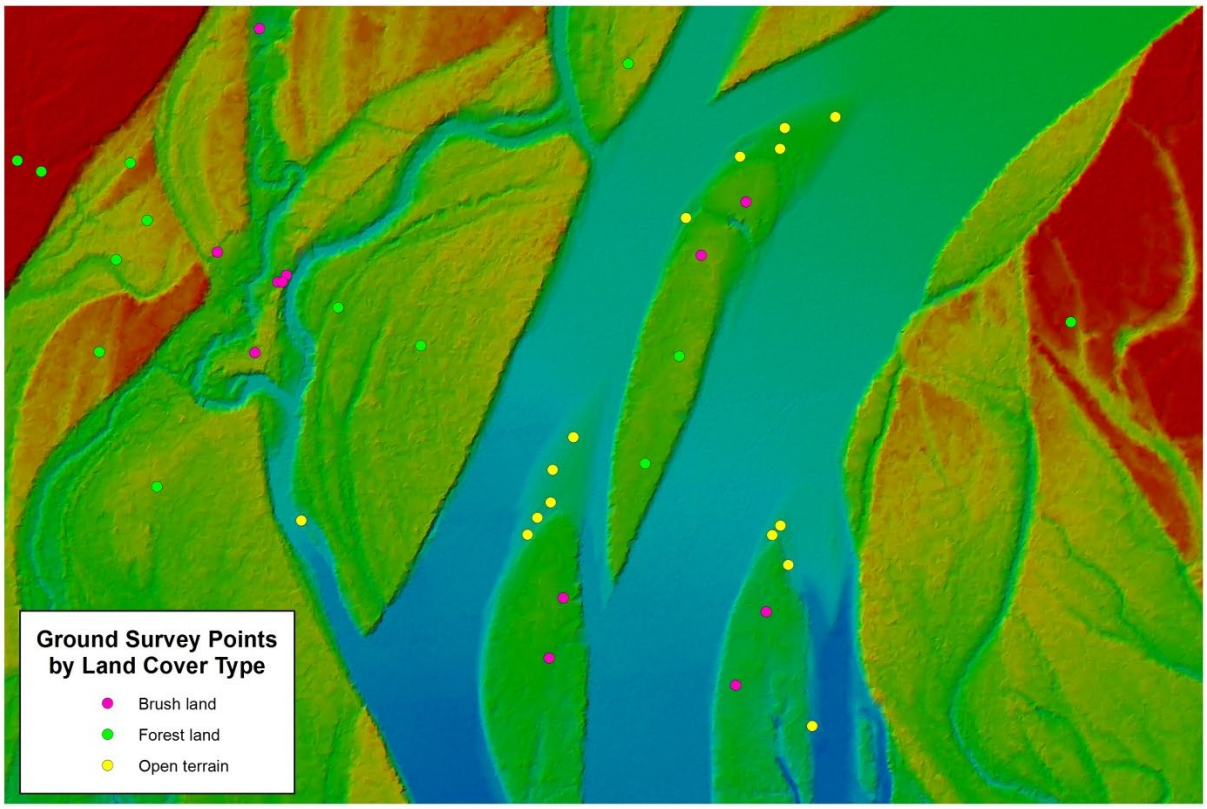

Figure 4.1-9. Example ground survey points displayed over TIN derived from LiDAR point cloud.

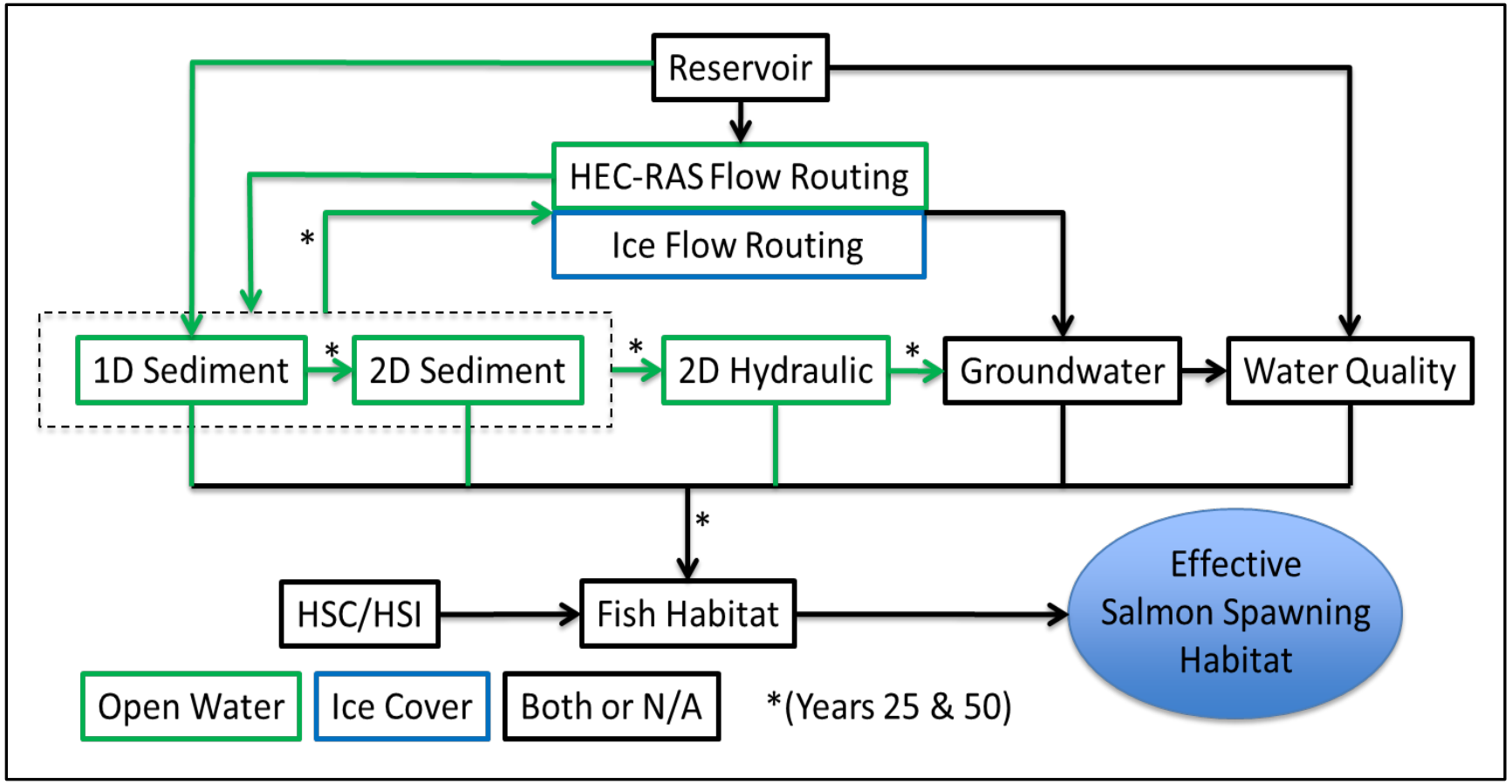

Figure 4.2-1 Fluvial Geomorphology Model Interdependencies.

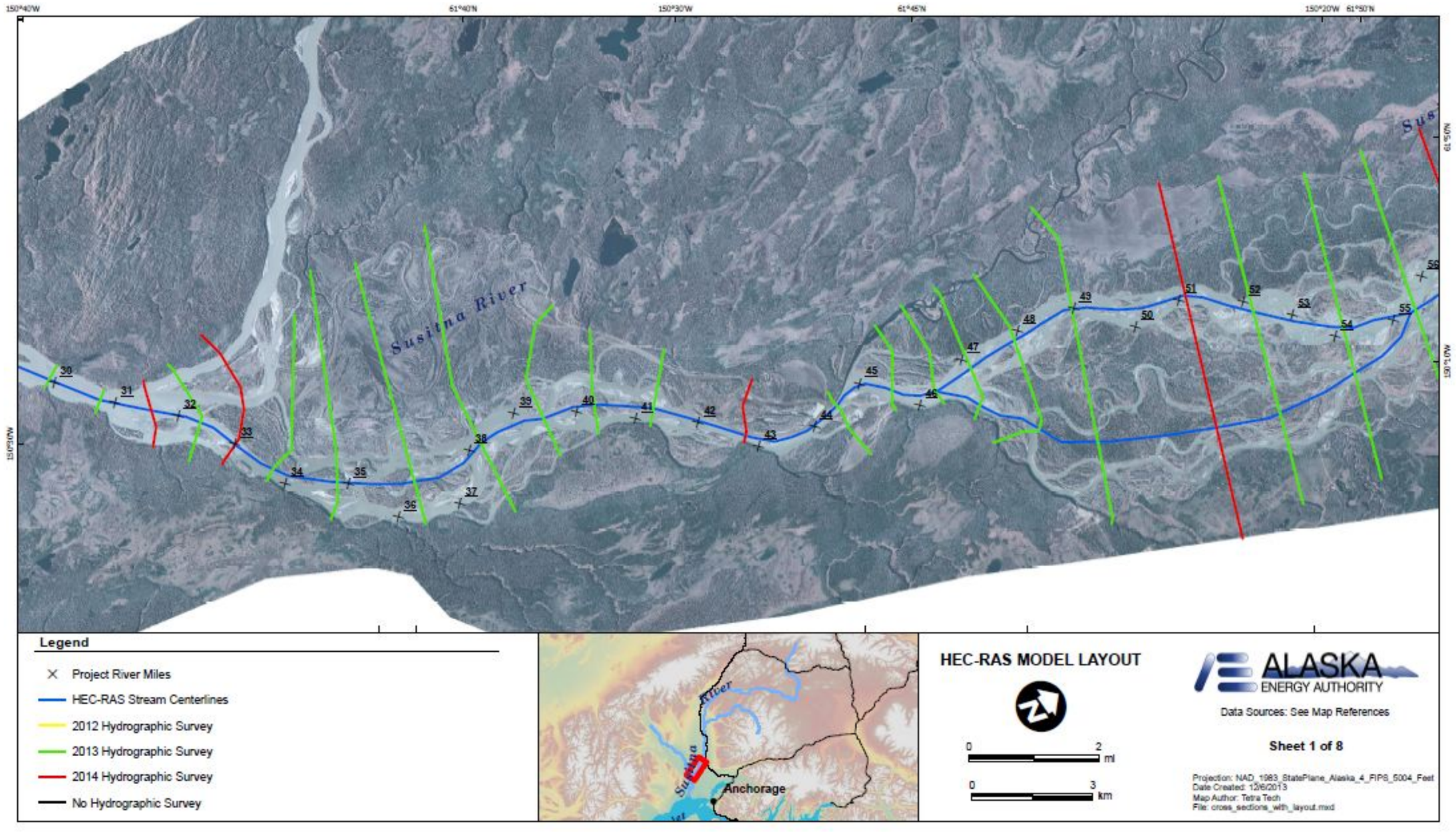

Figure 5.1-1. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

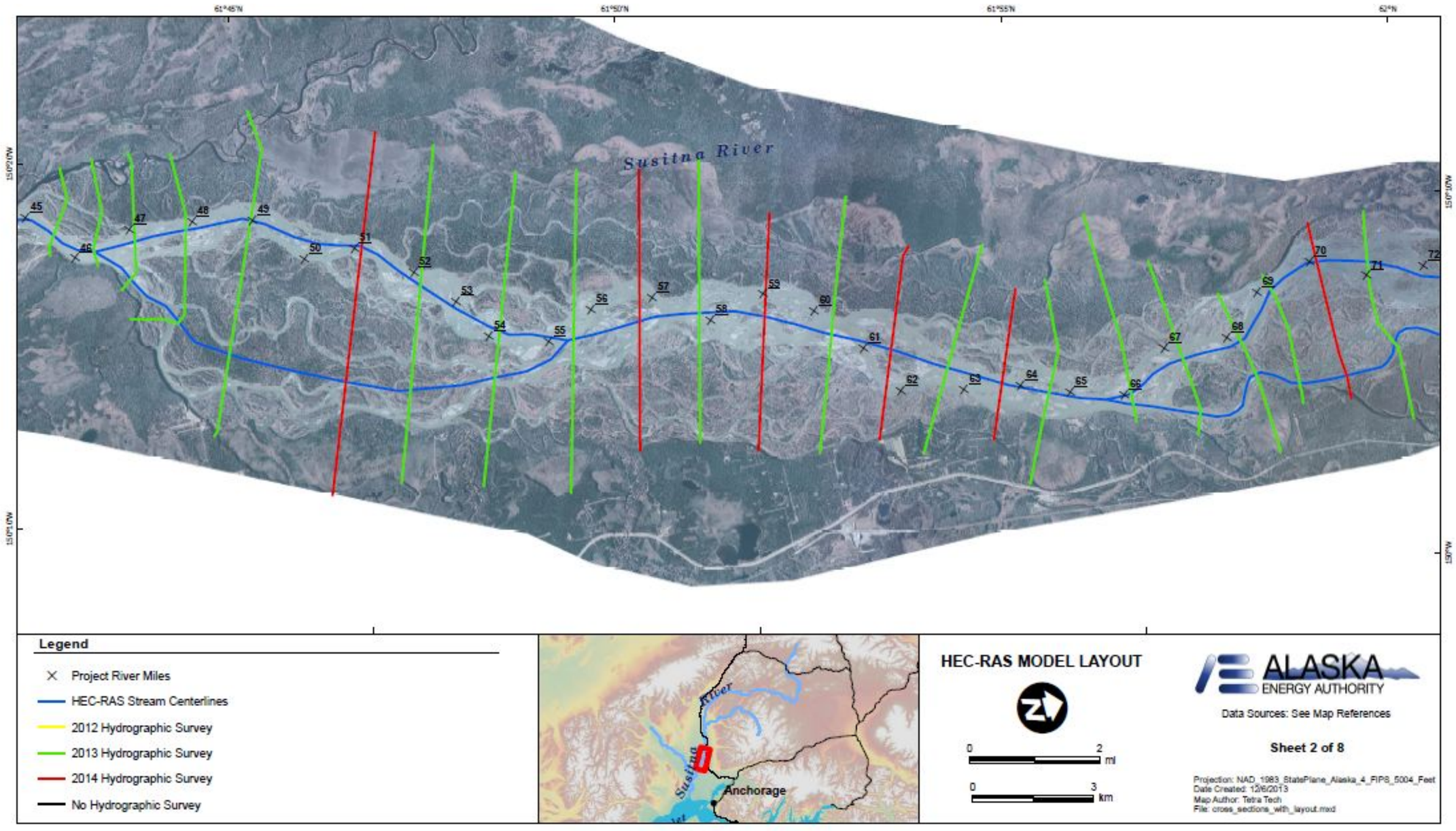

Figure 5.1-2. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

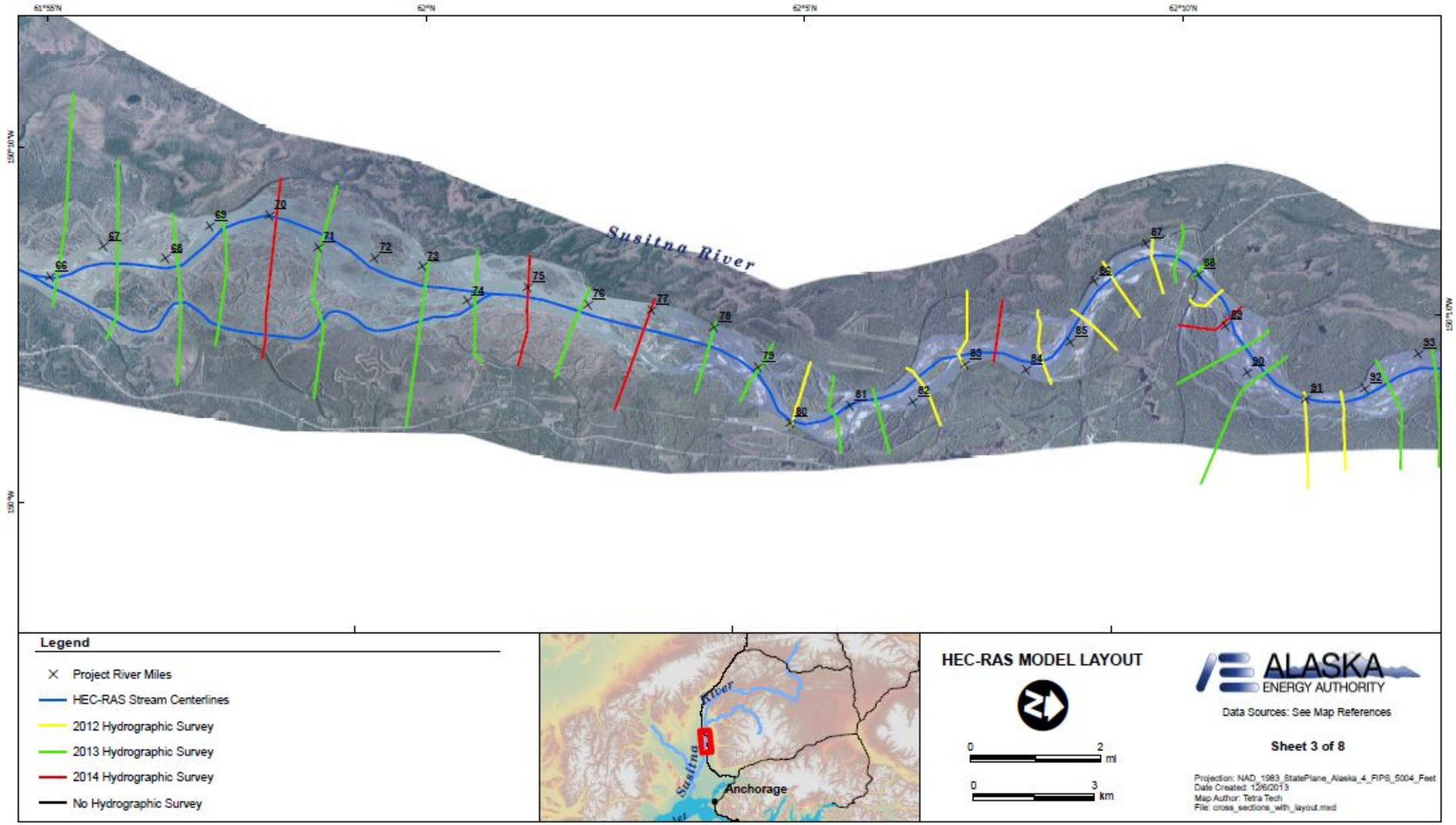

Figure 5.1-3. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

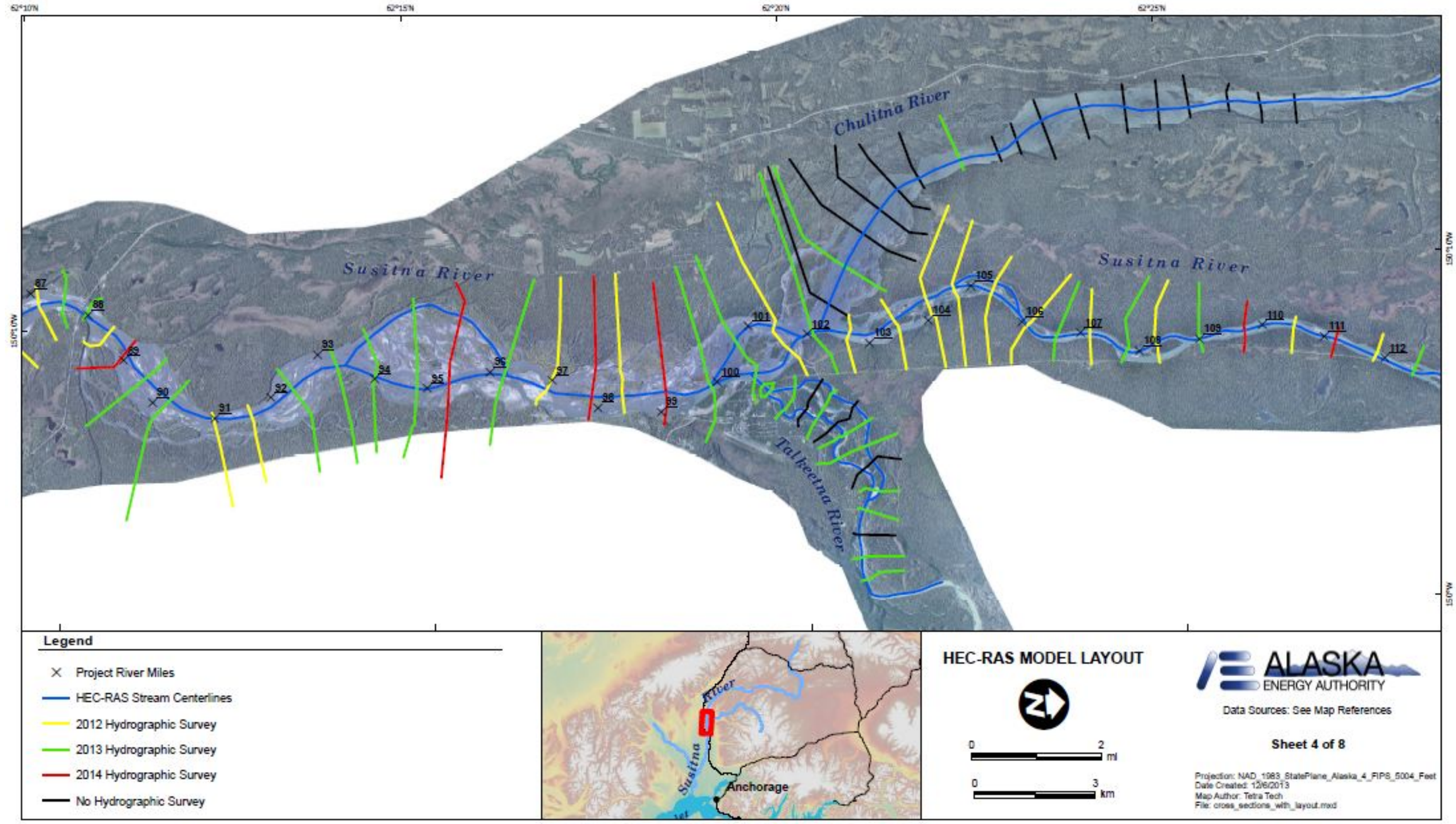

Figure 5.1-4. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

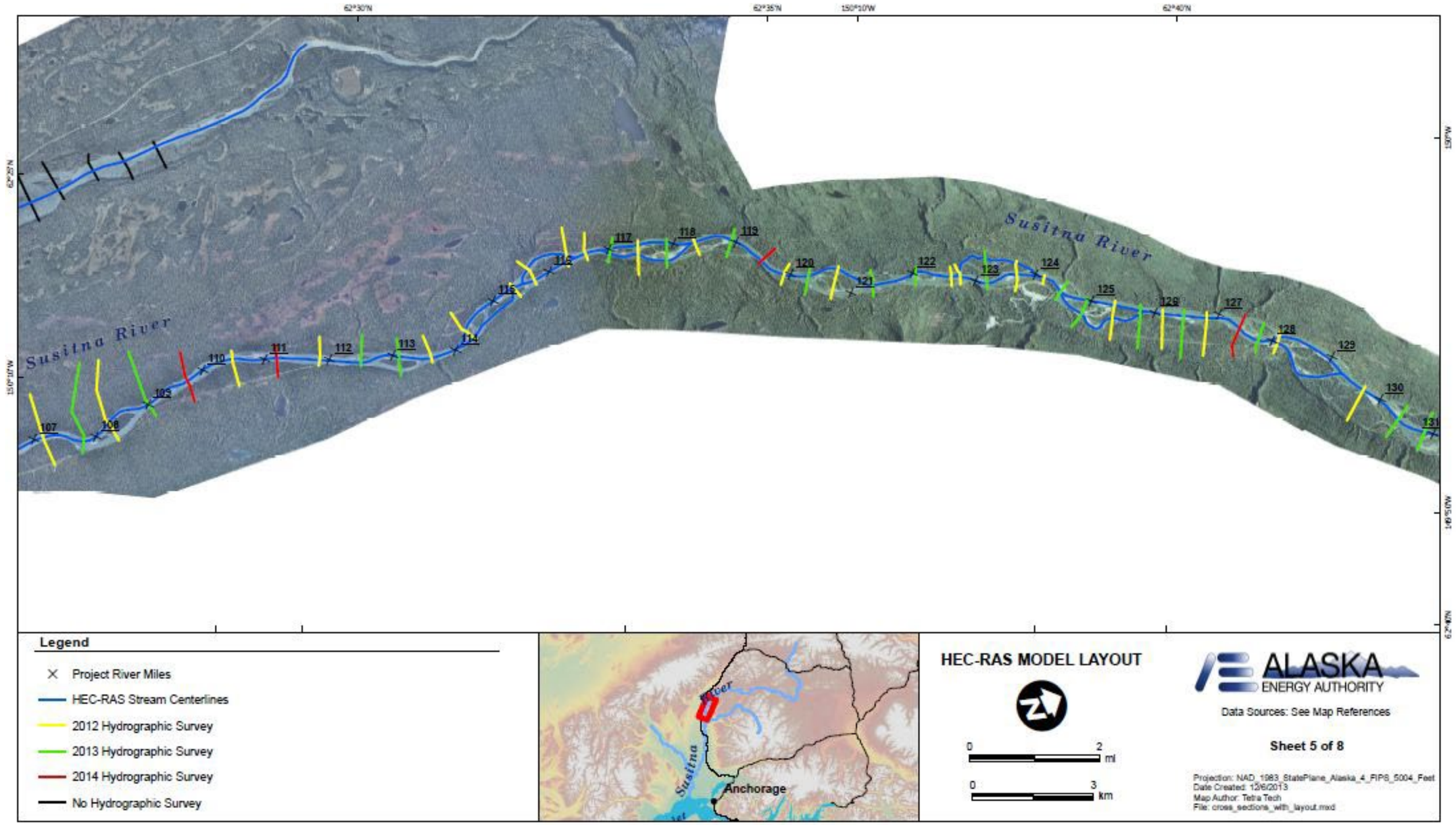

Figure 5.1-5. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

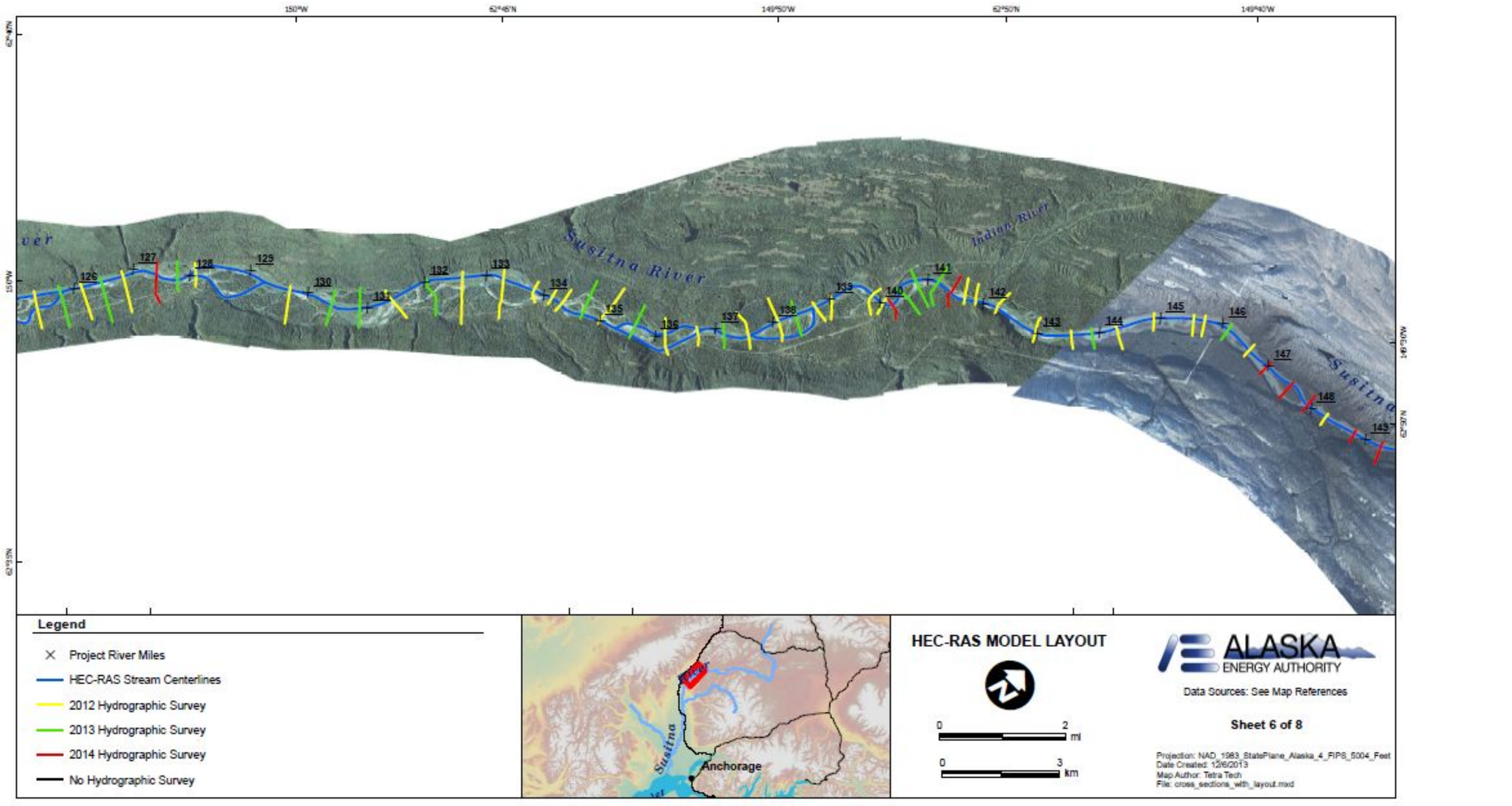

Figure 5.1-6. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

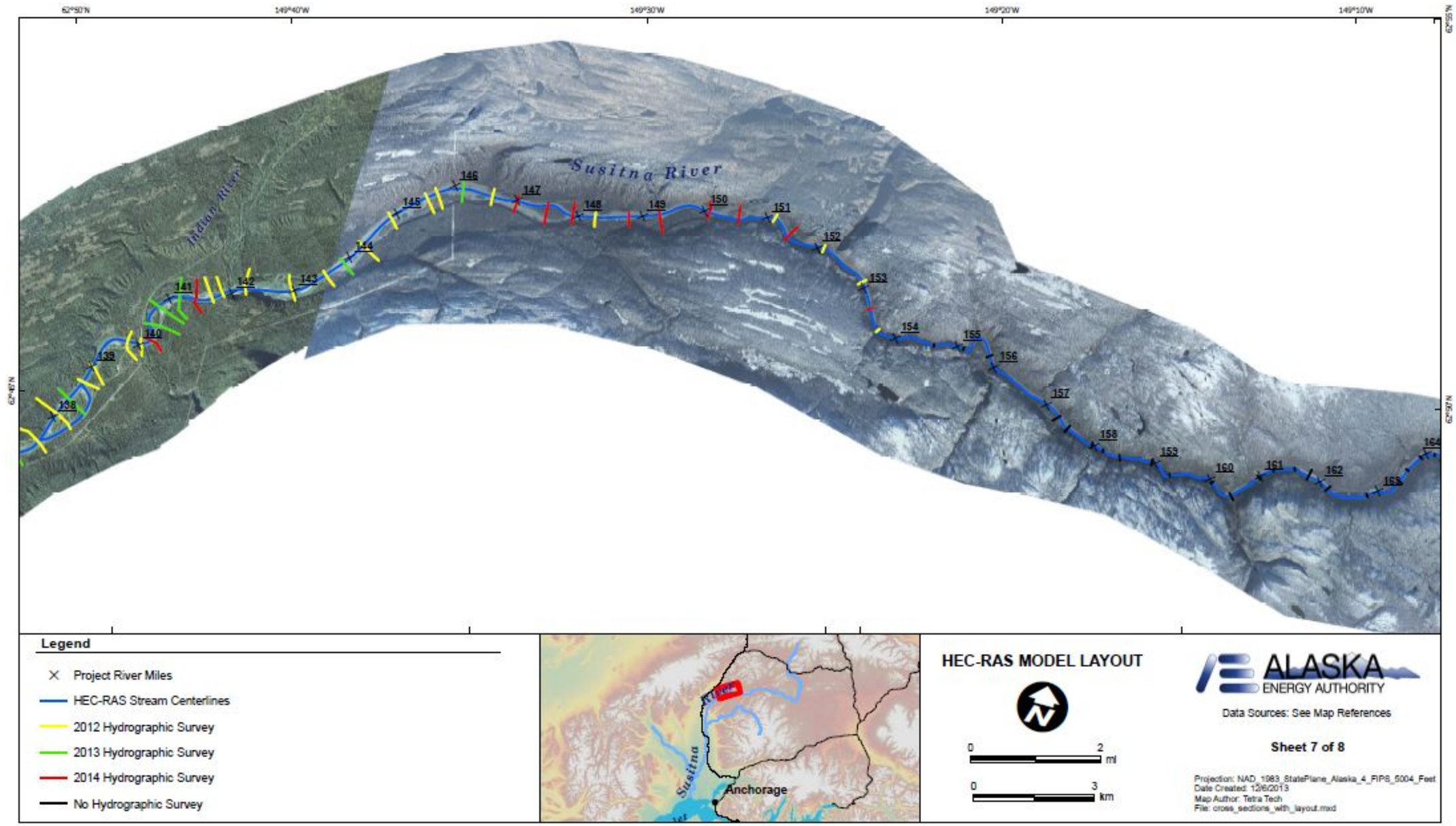

Figure 5.1-7. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model

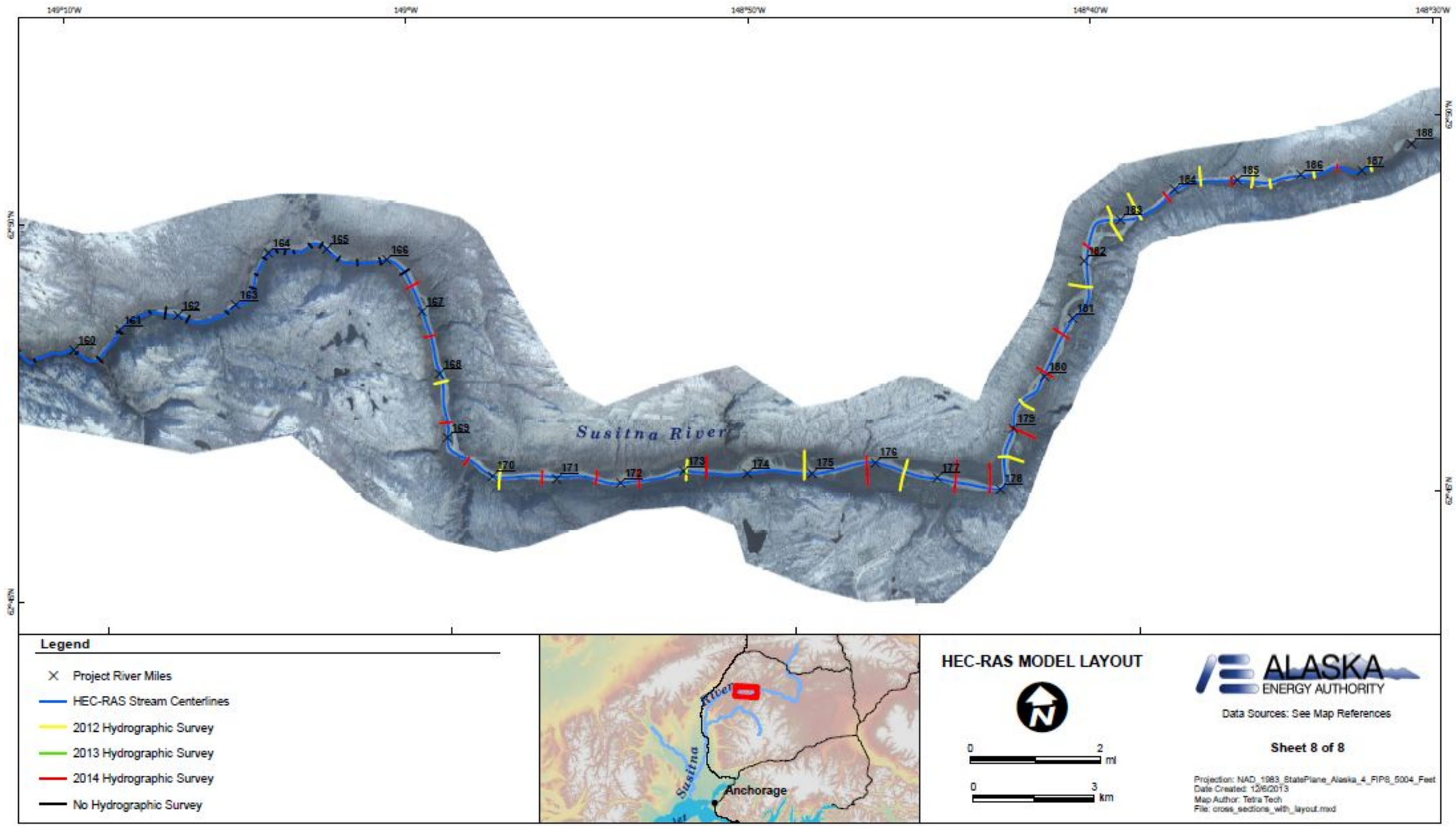

Figure 5.1-8. Cross Section Locations for Reach Scale 1-D Sediment-Transport Model.

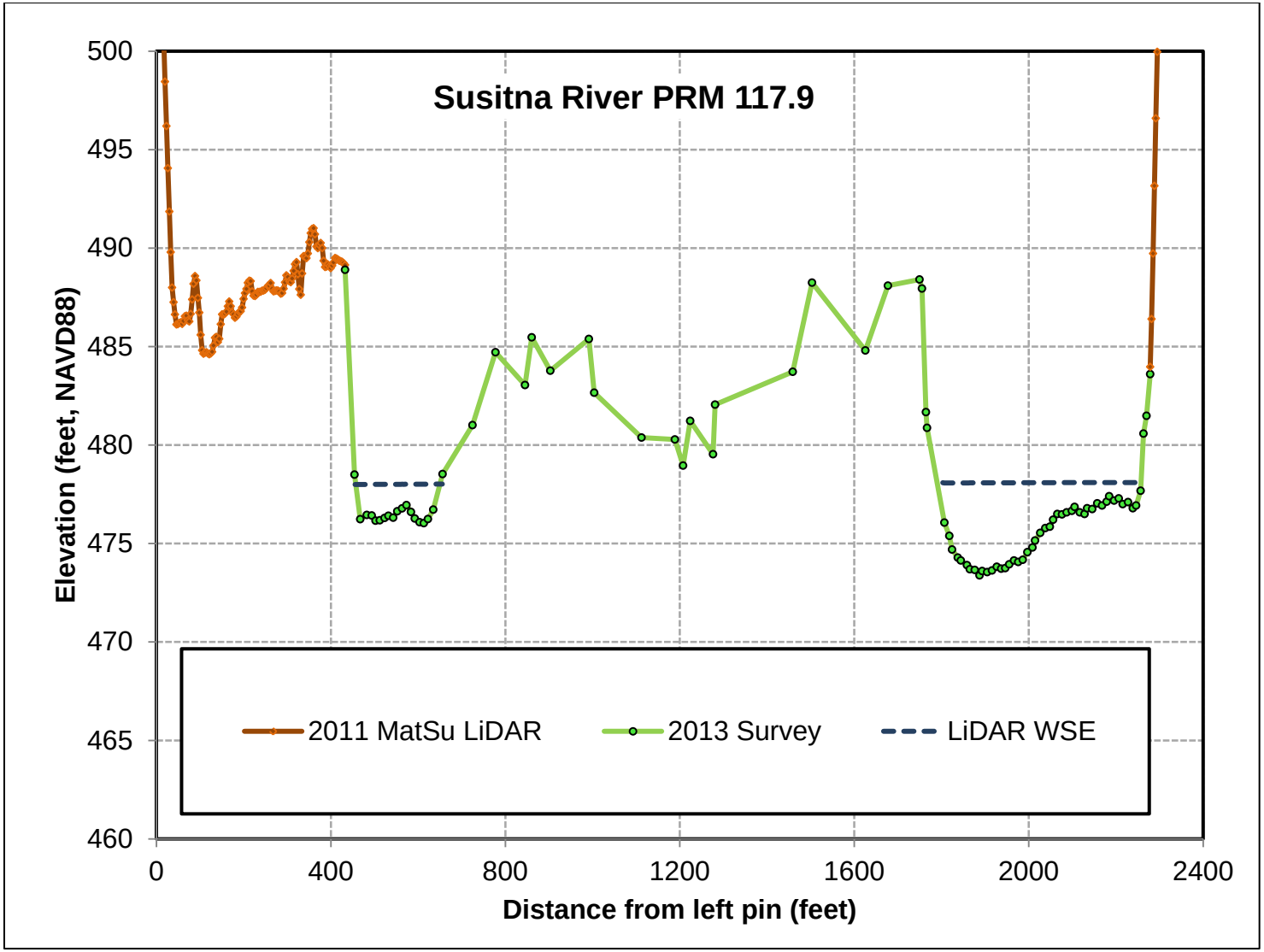

Figure 5.1-9. Merged Hydrographic Survey and LiDAR Survey at PRM 117.9.

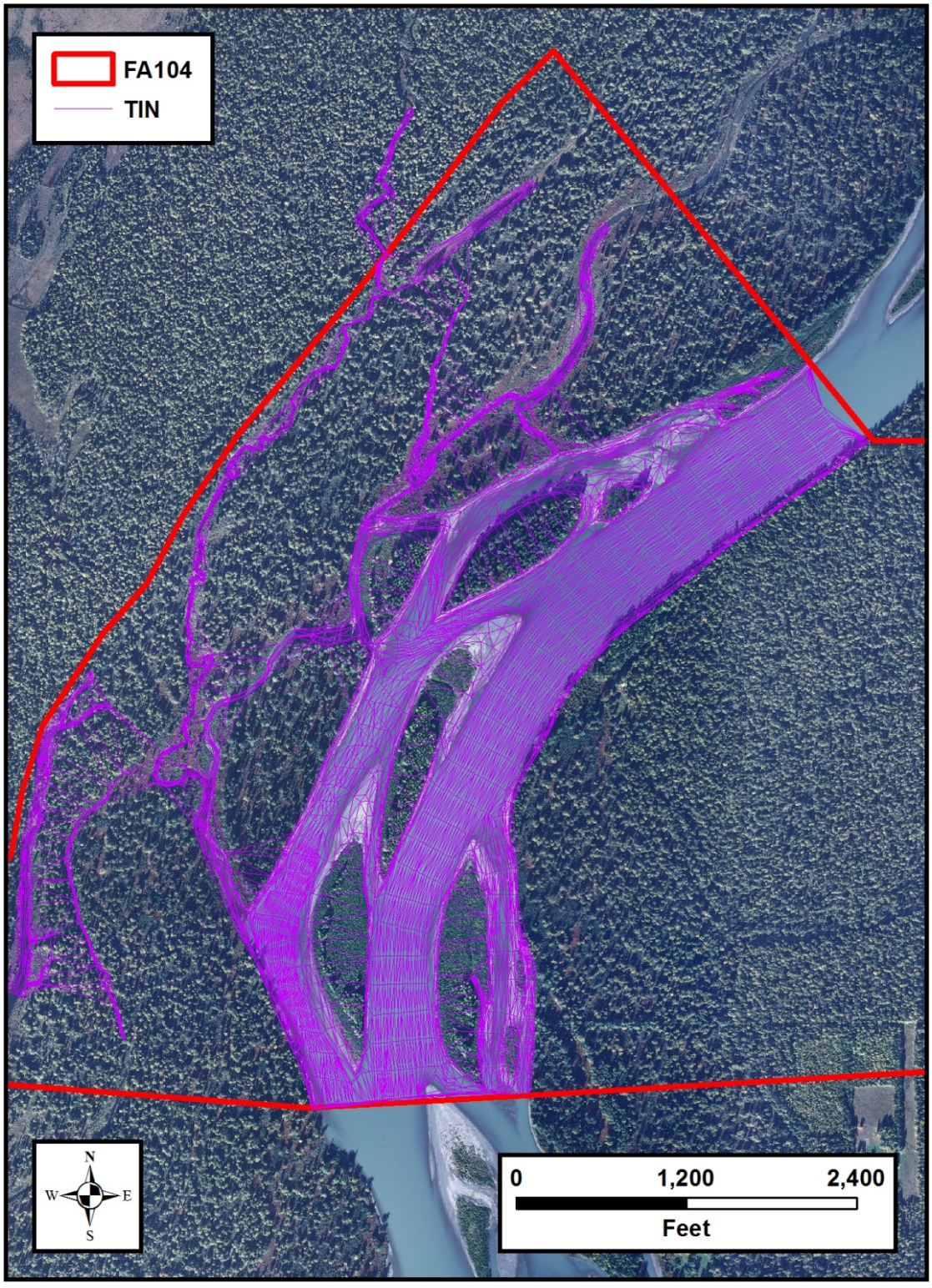

Figure 5.1-10. Triangular Irregular Network (TIN) Developed to Represent the Channel and Portions of the Overbanks at FA-104.

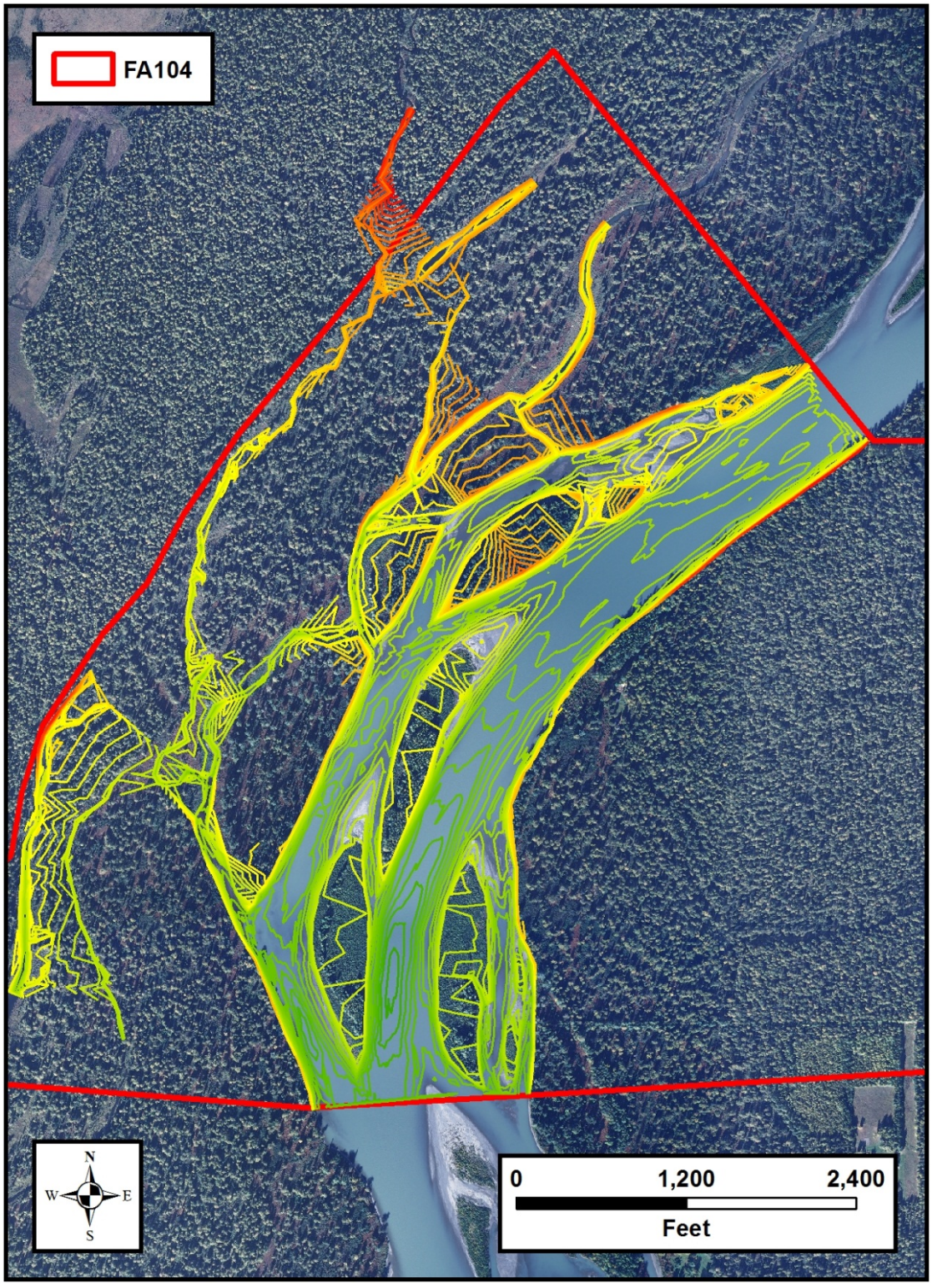

Figure 5.1-11. One-foot Interval Contour Mapping of FA-104 Developed from the TIN (Figure 5.1-10).

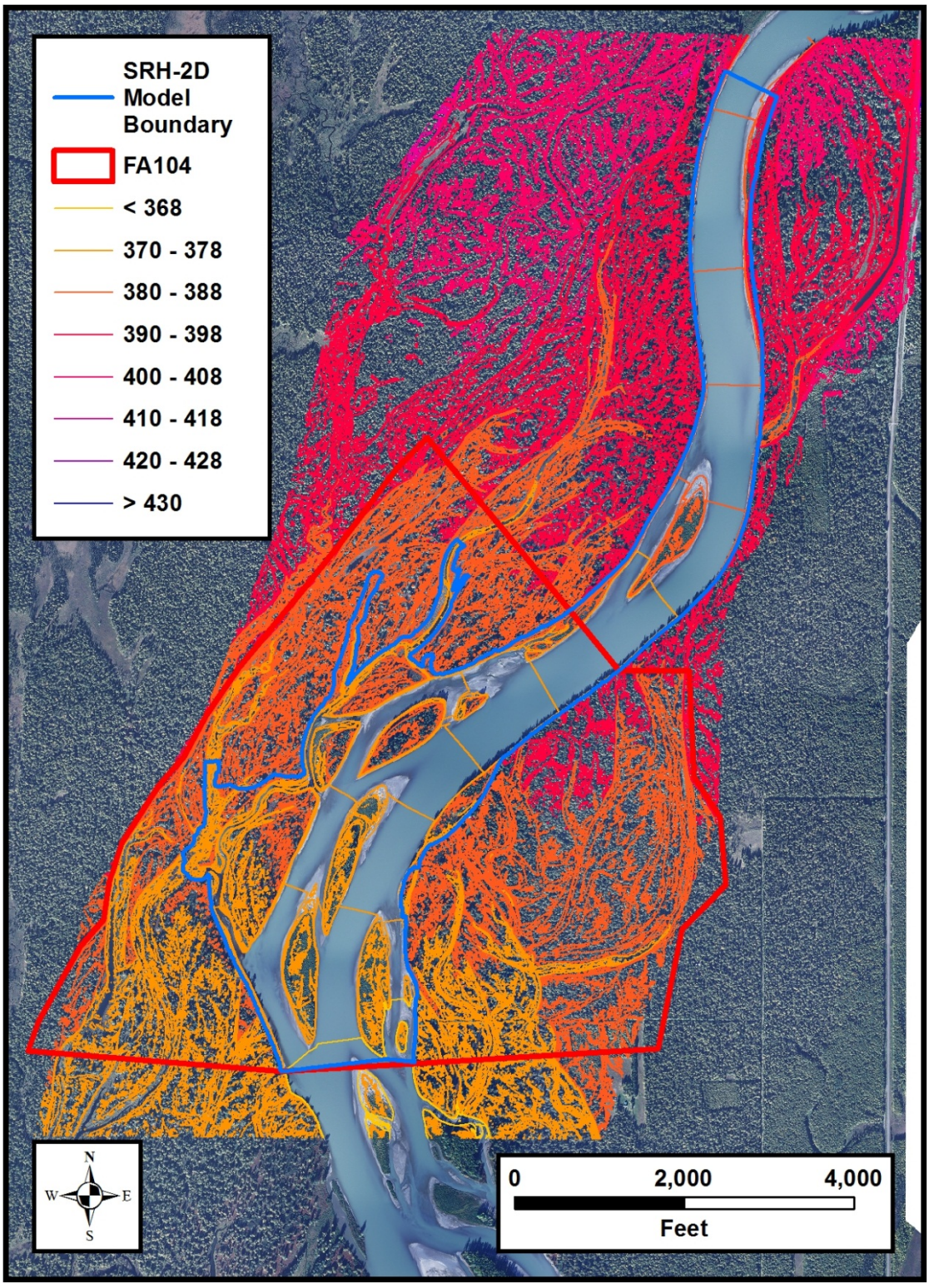

Figure 5.1-12. Two-foot Interval Contour Mapping Developed from the 2013 LiDAR Survey of FA-104.

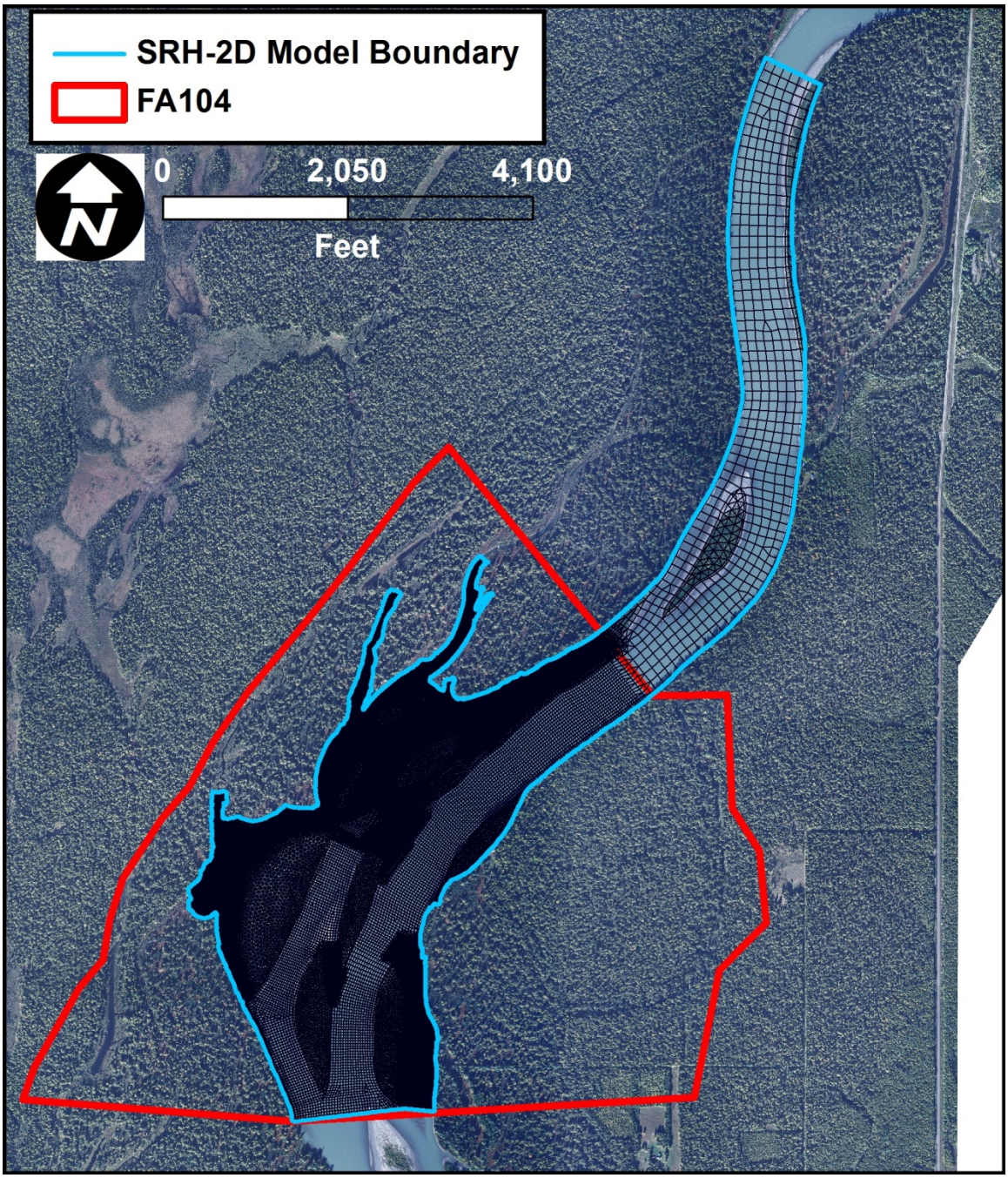

Figure 5.1-13. Extents of the SRH-2D Habitat Mesh. Note: the model contains approximately 164,000 elements and was extended upstream of the focus area to provide better prediction of the hydraulic conditions at the upstream end of the focus area and to evaluate the potential for overbank flows.

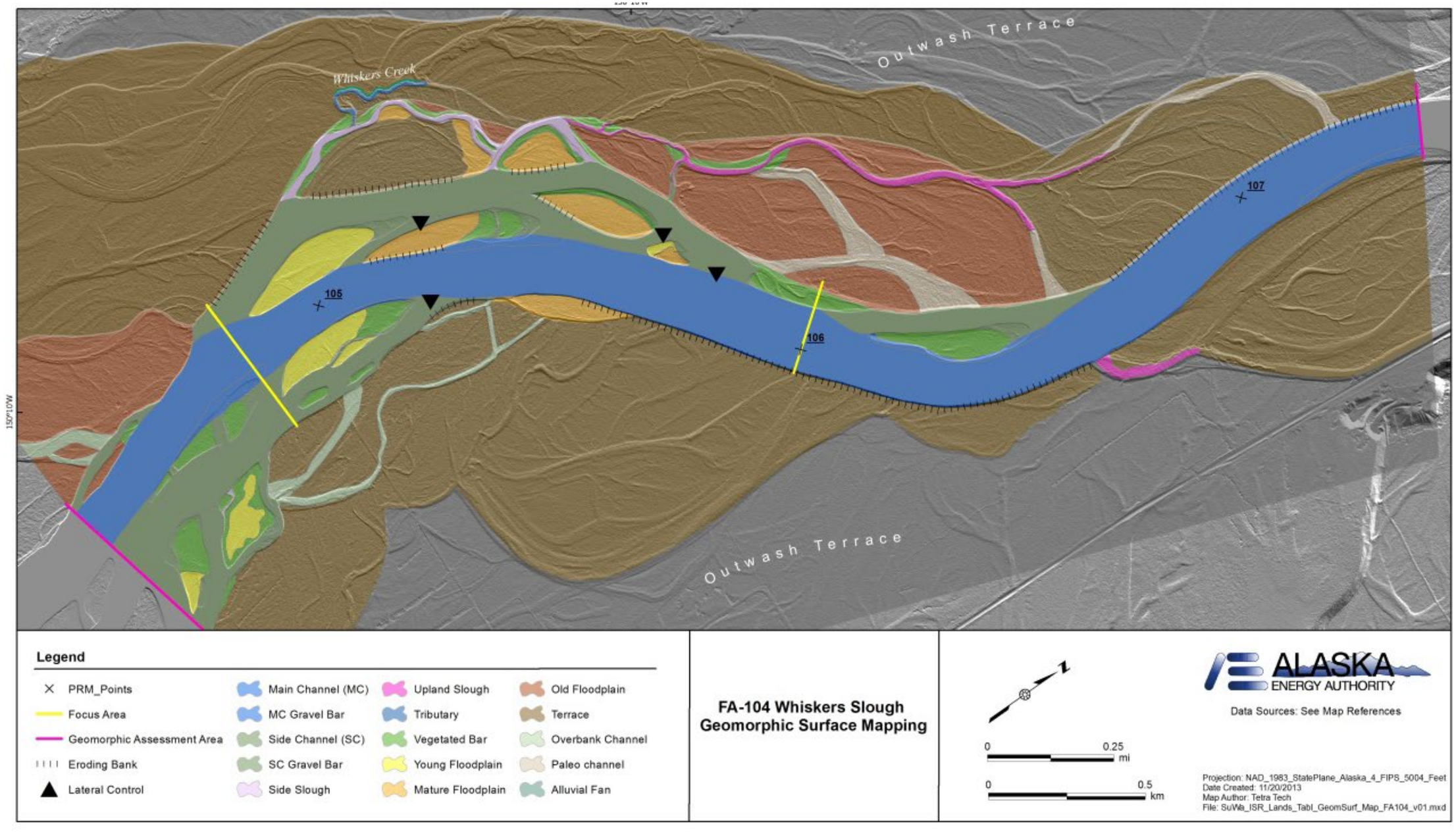

Figure 5.1-14. Geomorphic surface mapping of FA-104 Whiskers Slough.

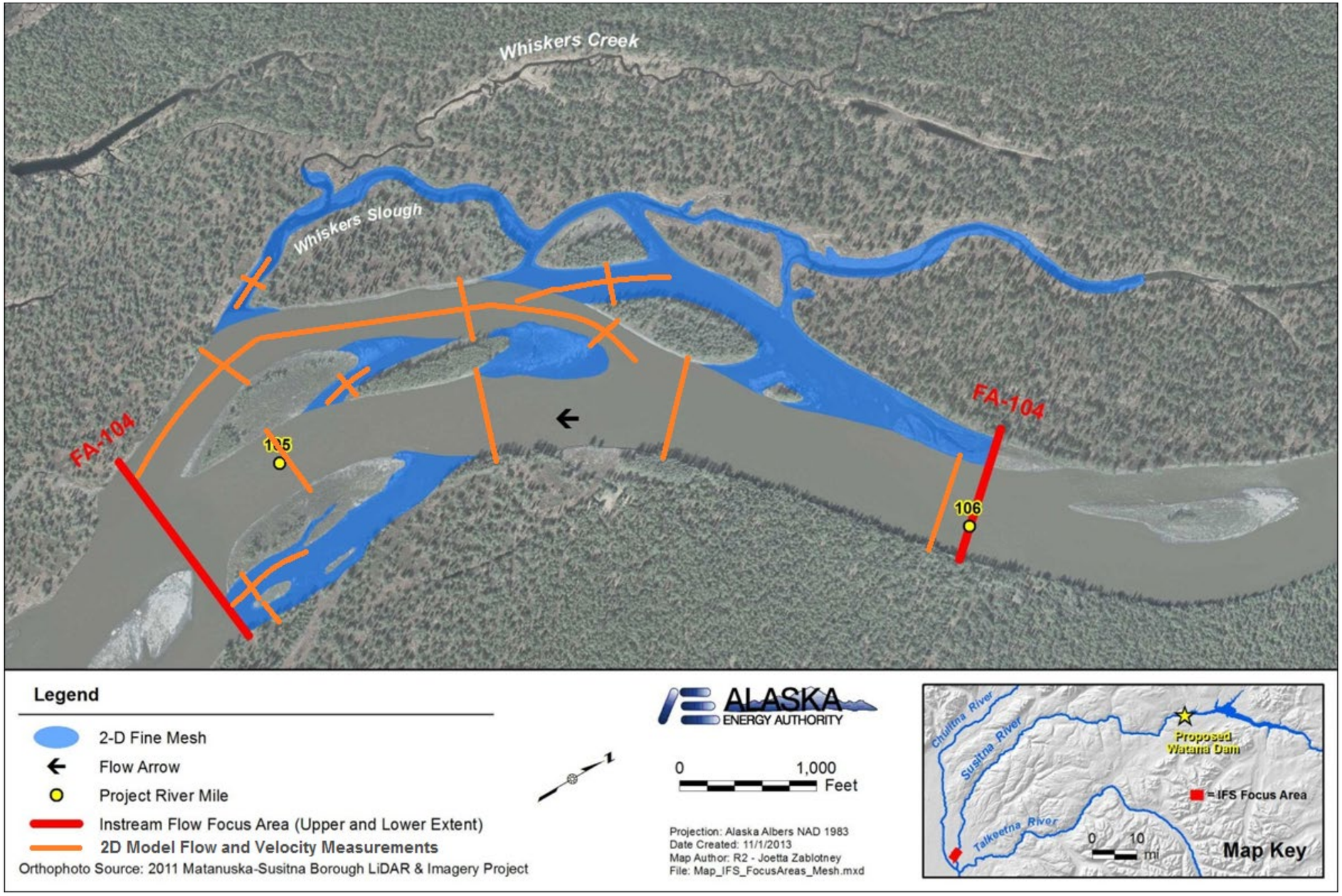

Figure 5.1-15. Example of Habitat Areas at FA-104 Selected to Have a Fine Mesh Size (6.5 feet, 2 m). The Habitat Areas Were Identified by the Aquatic Habitat Team.

Figure 5.1-16. Example of SRH-2D Mesh in Habitat Area at the Mouth of Whiskers Creek (in FA-104) Selected to Have a Fine Mesh Size (2 meters).

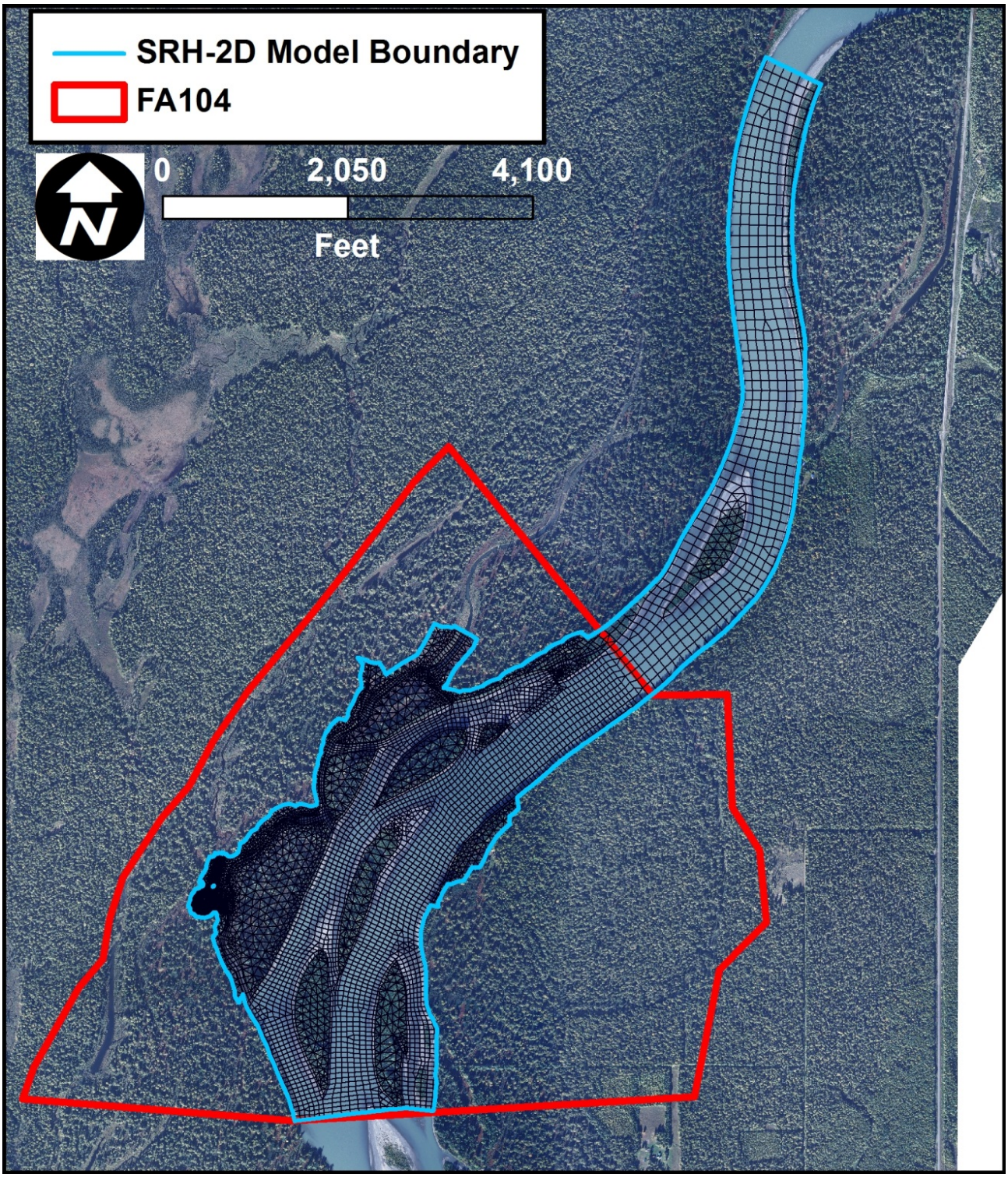

Figure 5.1-17. SRH-2D Bed Evolution Mesh. The Mesh Contains Approximately 10,000 Elements.

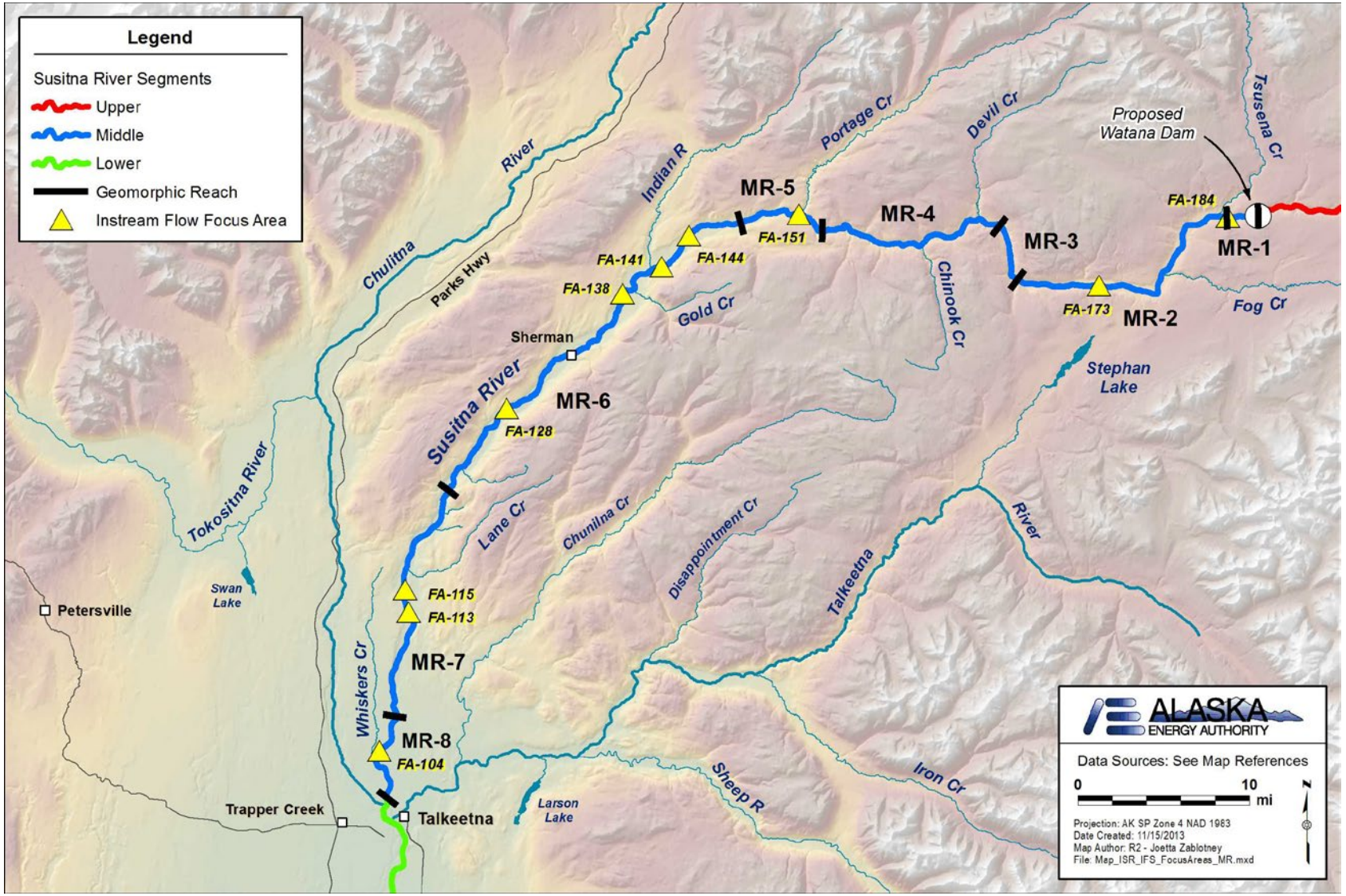

Figure 5.1-18: Locations of Middle Susitna River Segment Focus Areas.

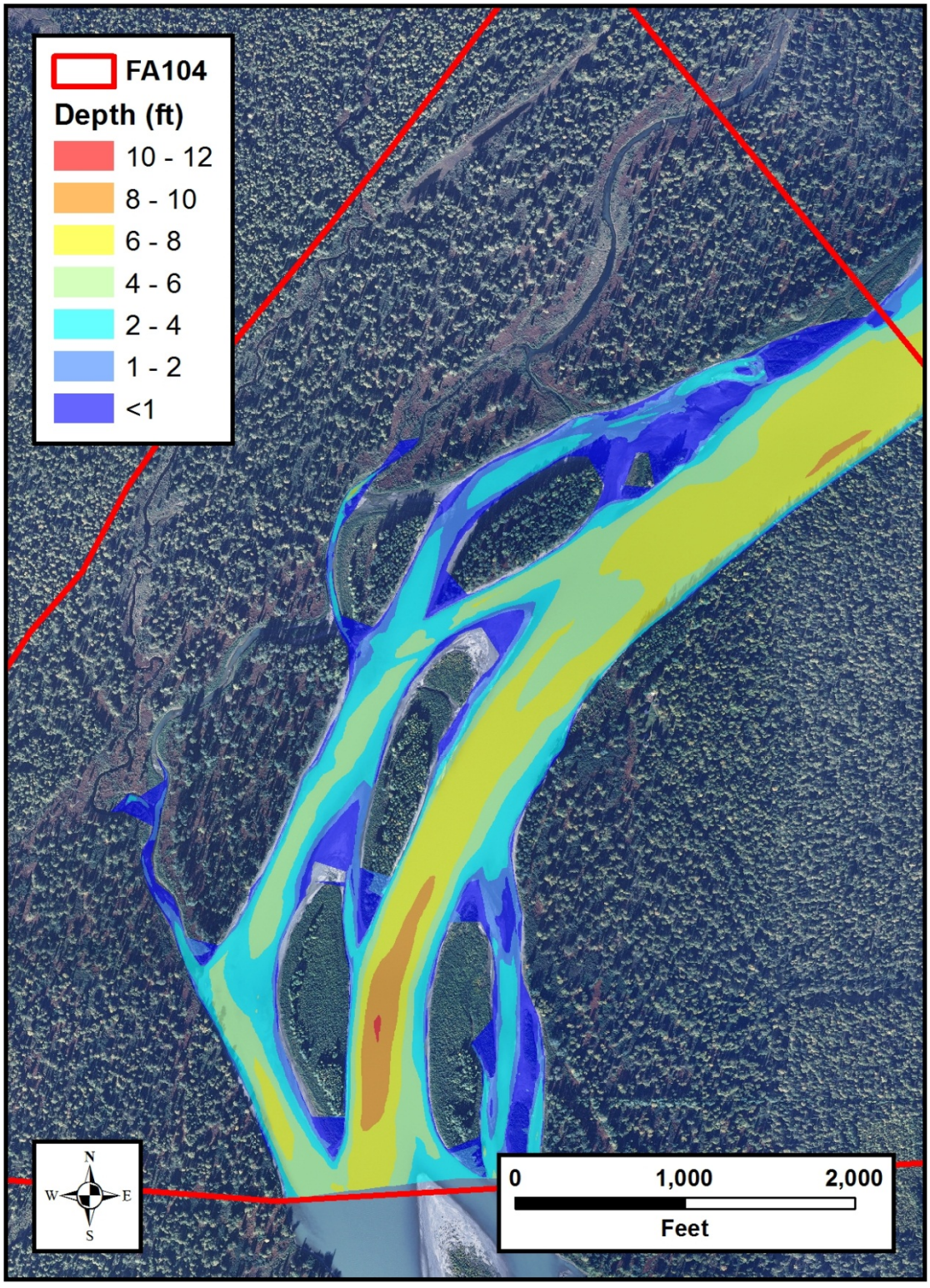

Figure 5.1-19. Predicted Depth Distribution at FA-104 for 24,000 cfs.

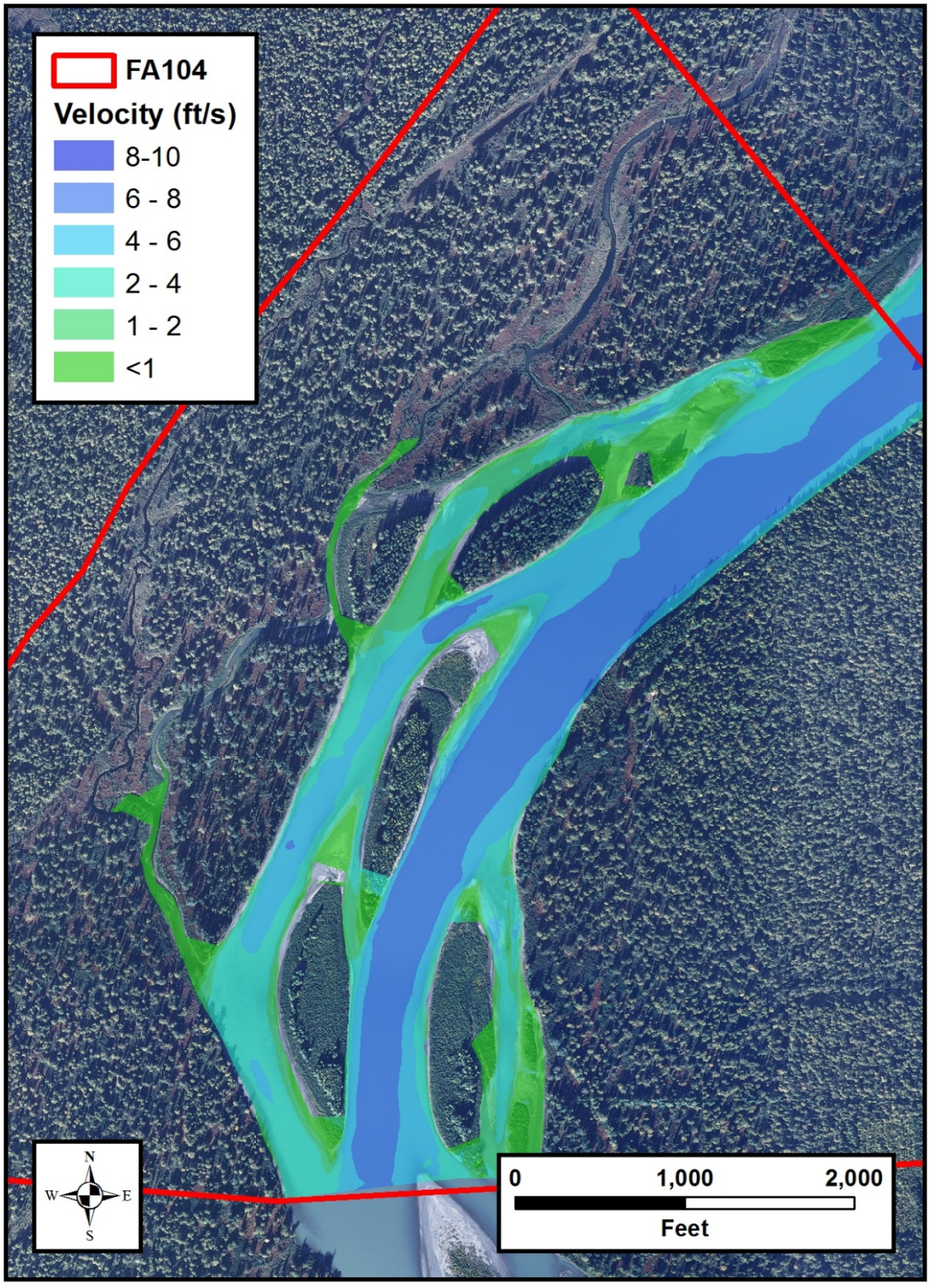

Figure 5.1-20. Predicted Velocity Distribution at FA-104 for 24,000 cfs.

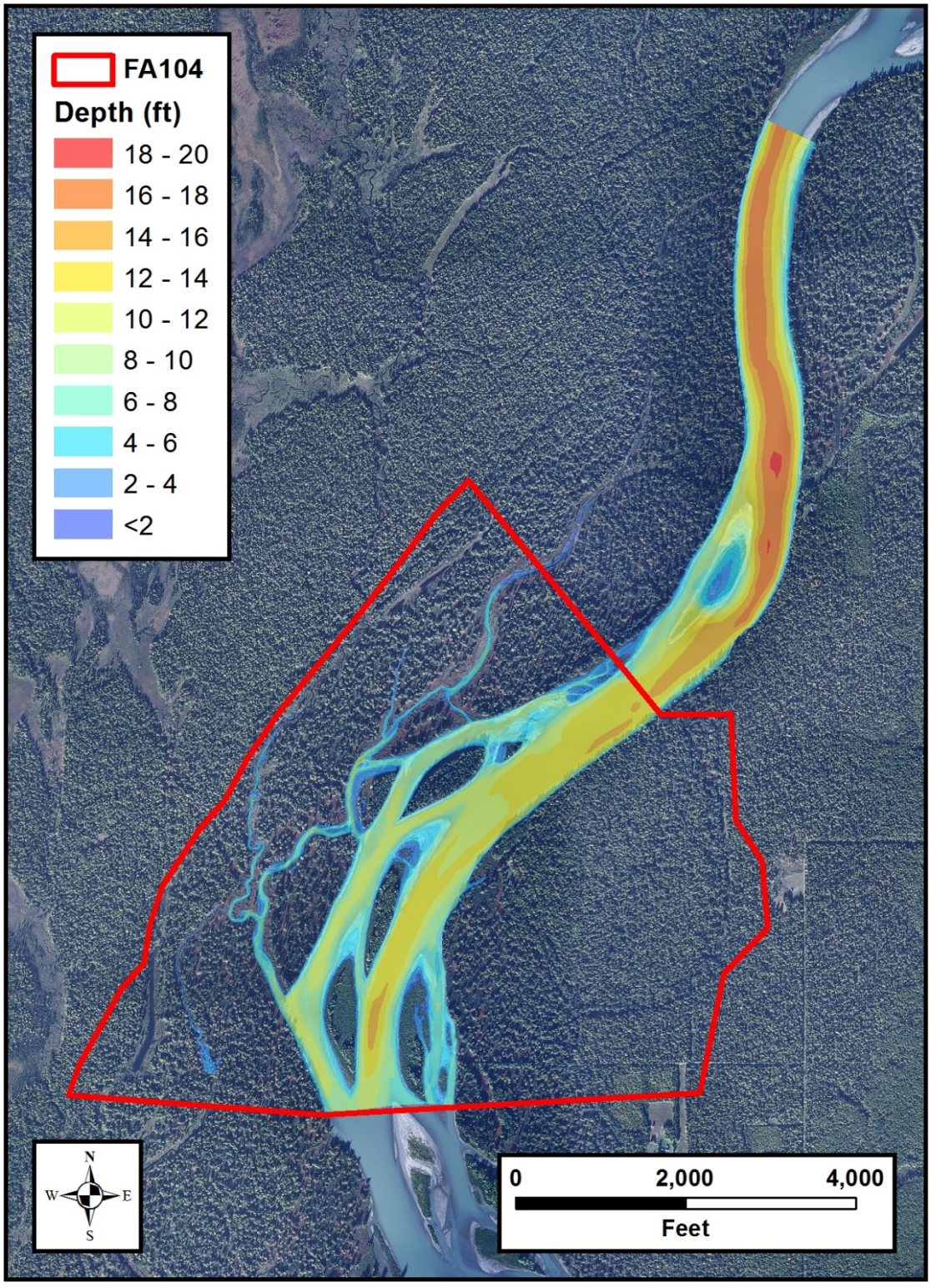

Figure 5.1-21. Predicted Depth Distribution at FA-104 for 100,000 cfs.

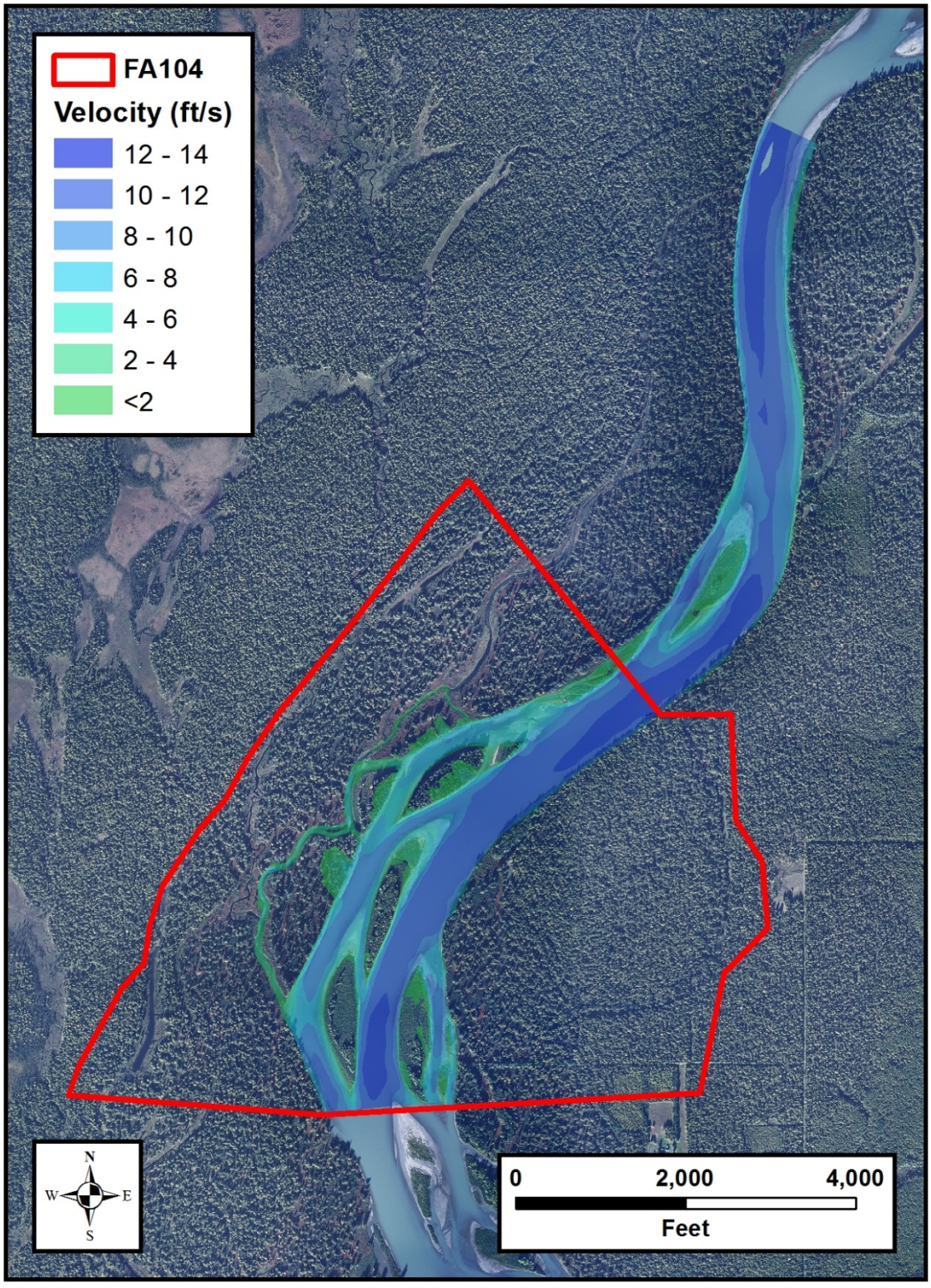

Figure 5.1-22. Predicted Velocity Distribution at FA-104 for 100,000 cfs.

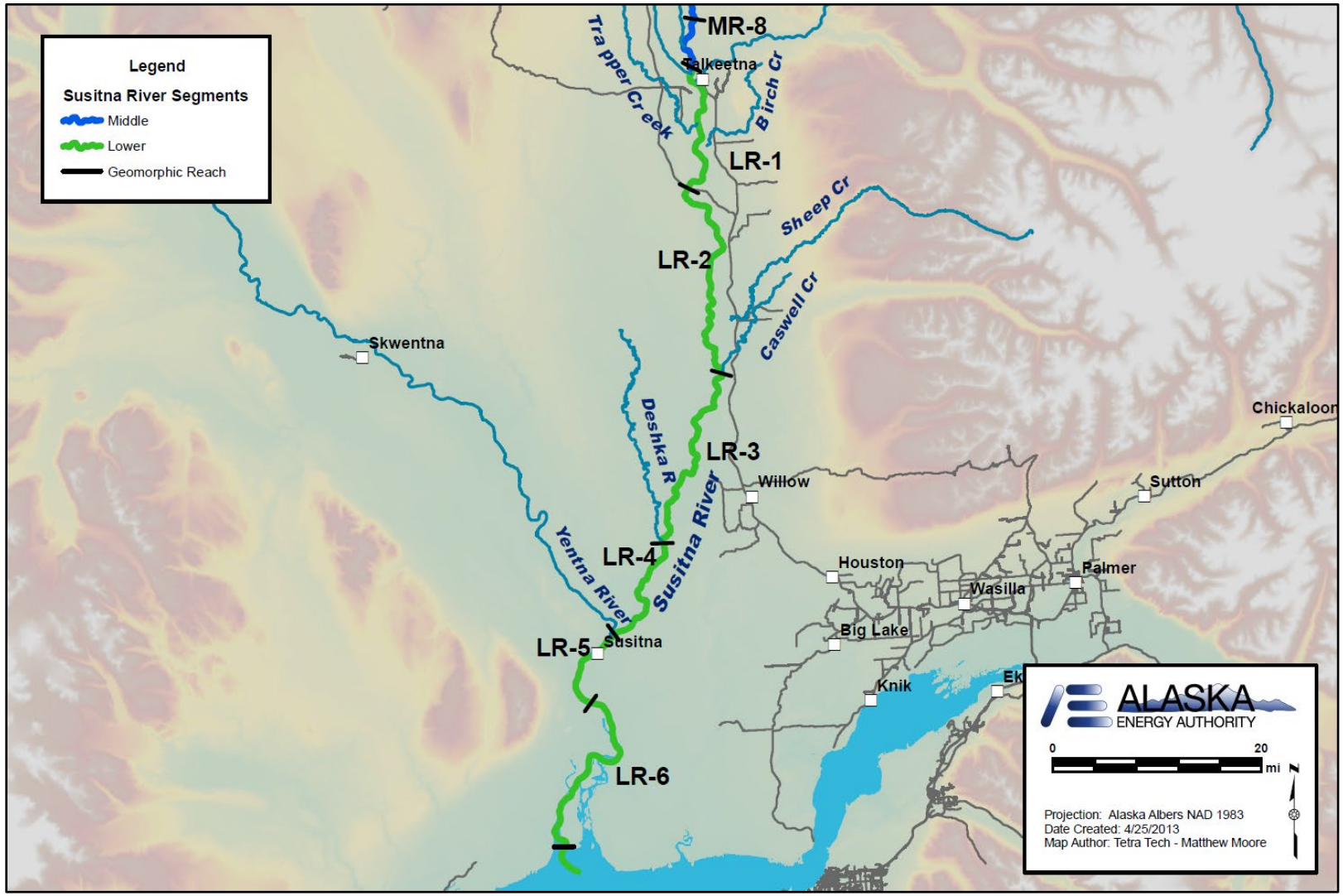

Figure 5.1-23. Lower Susitna River Segment Tributary Locations Relative to Geomorphic Reaches.

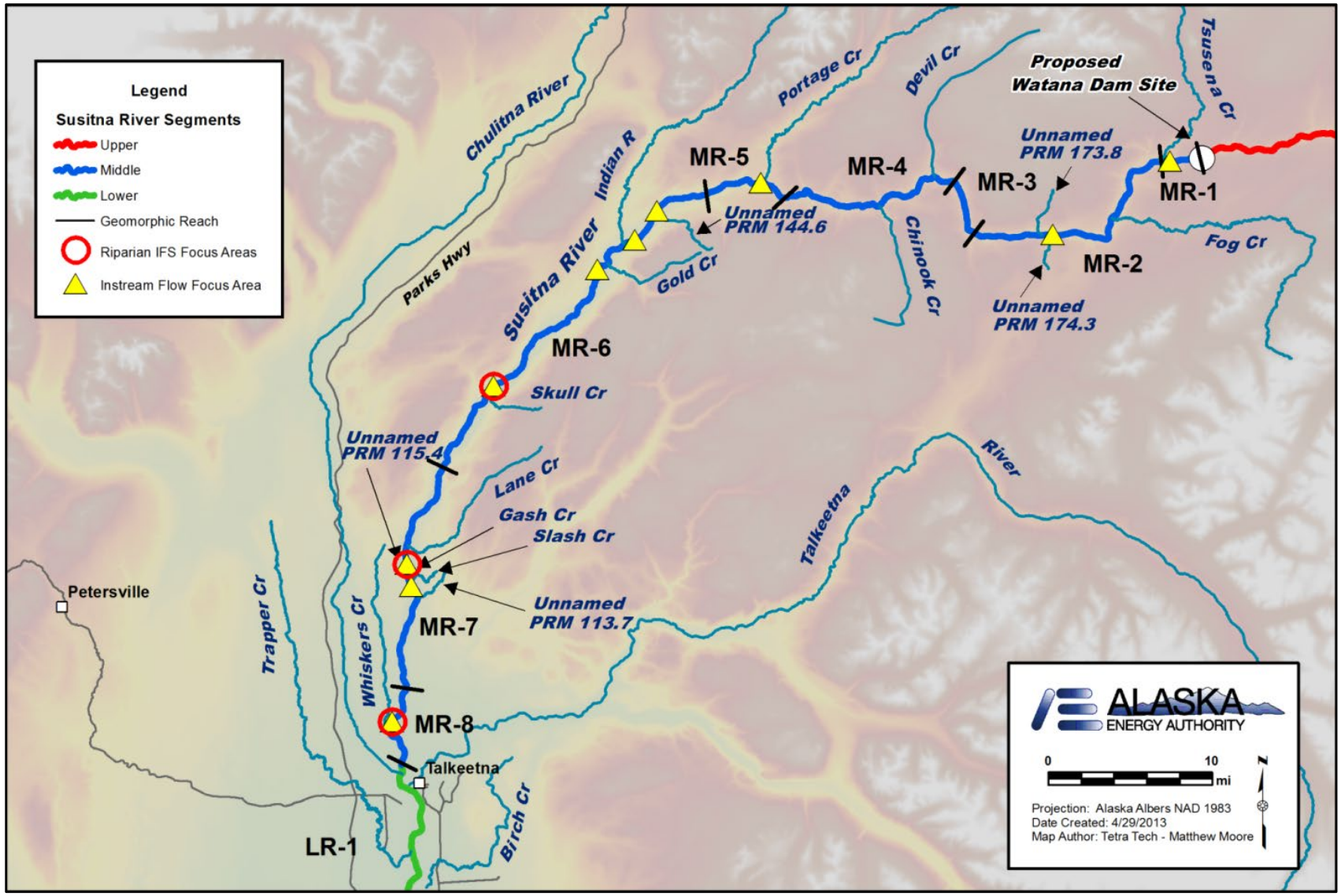

Figure 5.1-24. Middle Susitna River Segment Tributary Locations Relative to Geomorphic Reaches and Focus Areas.

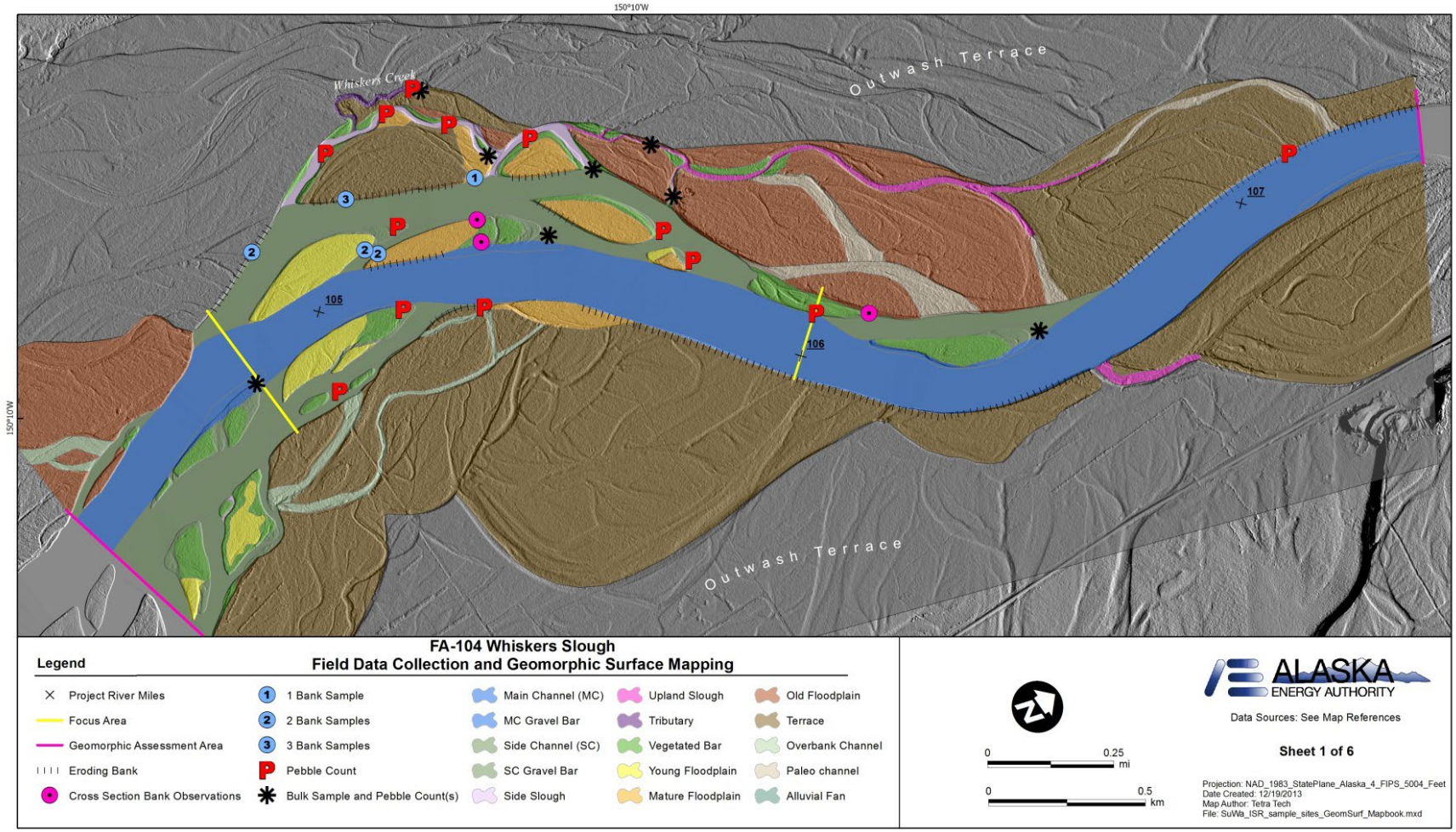

Figure 5.1-25: Sediment samples and bank observations collected at FA-104 (Whiskers Slough).

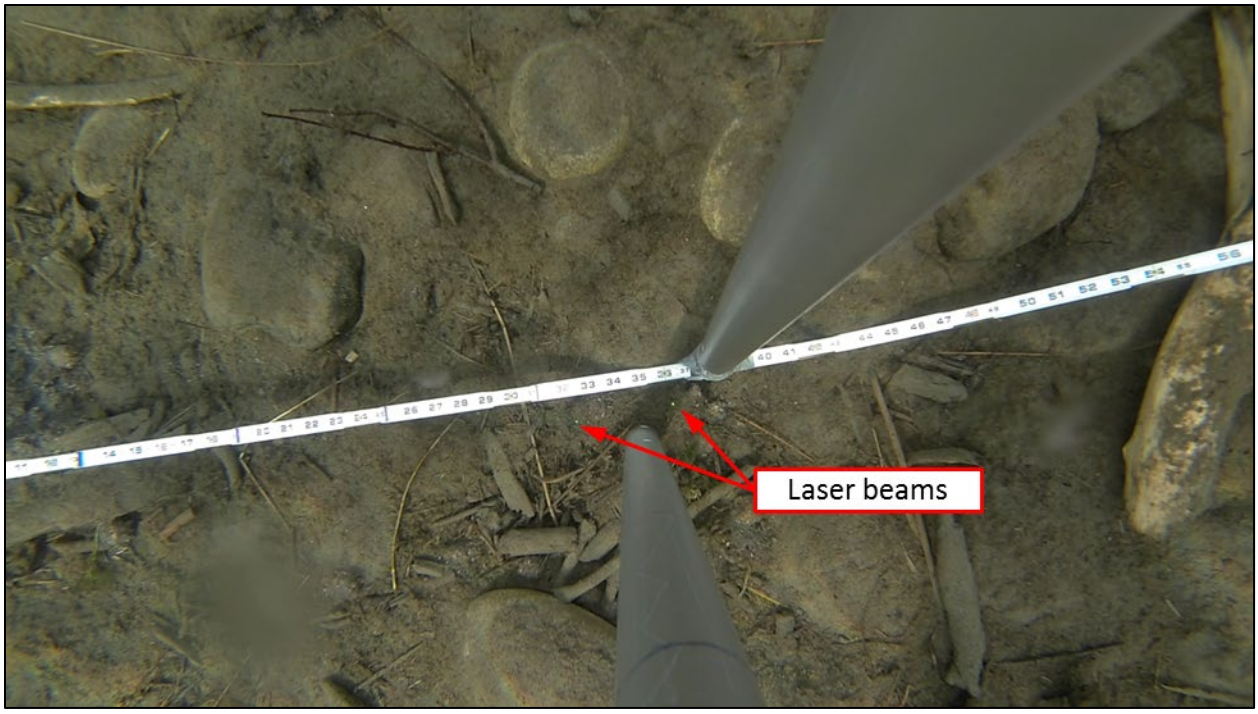

Figure 5.1-26. GoPro image from Whiskers Slough with lights, lasers, and scale in video mode.

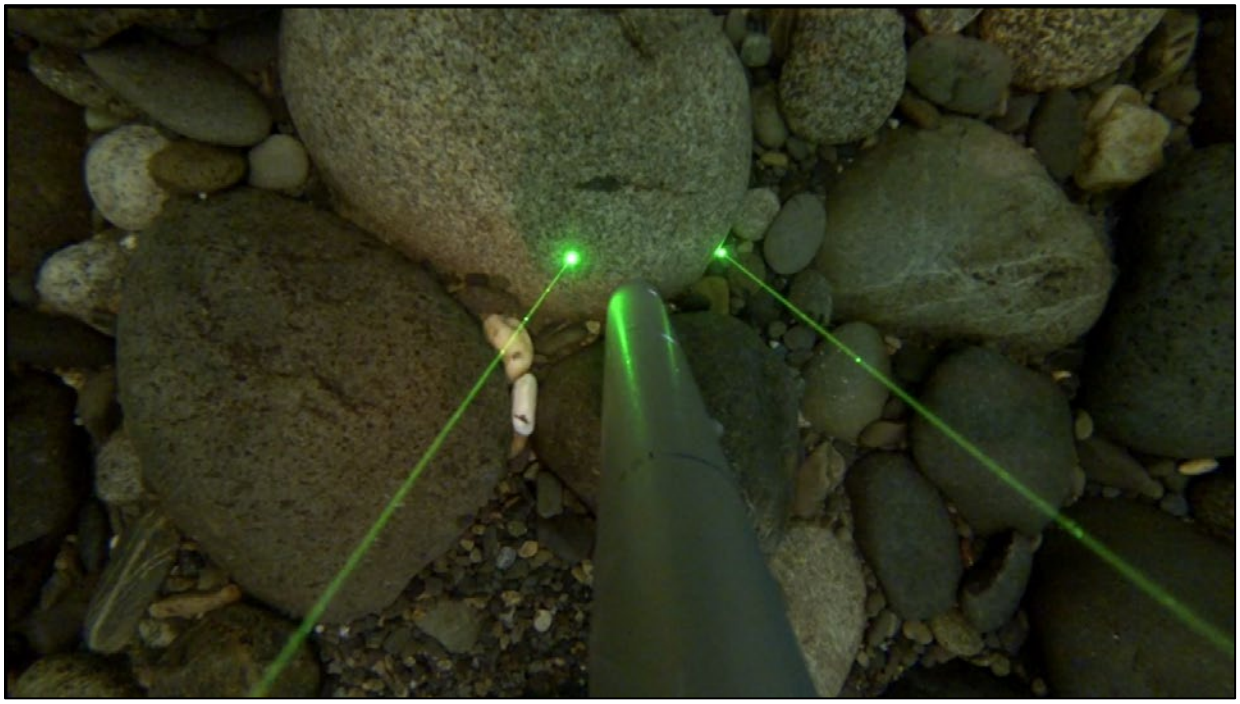

Figure 5.1-27. GoPro image from ESS40 with lasers and the Brinkman Q-Beam Starfire II underwater fishing light.

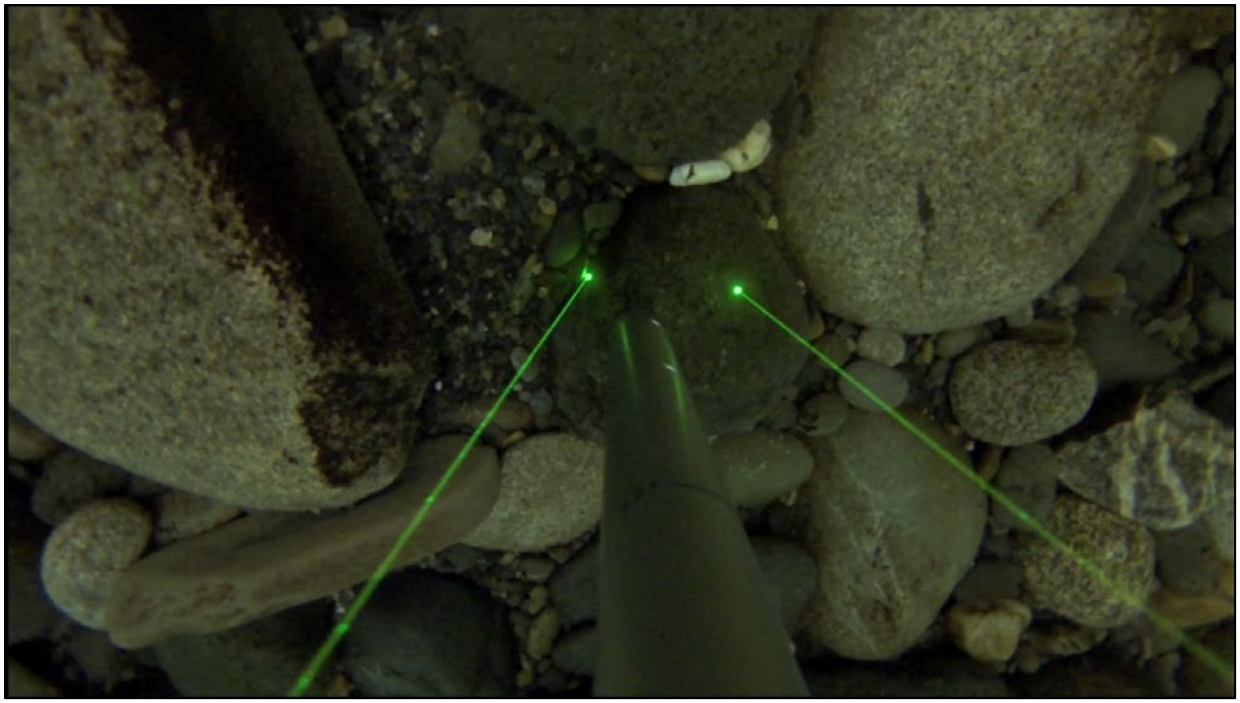

Figure 5.1-28. GoPro image from ESS40 with lasers and without lights

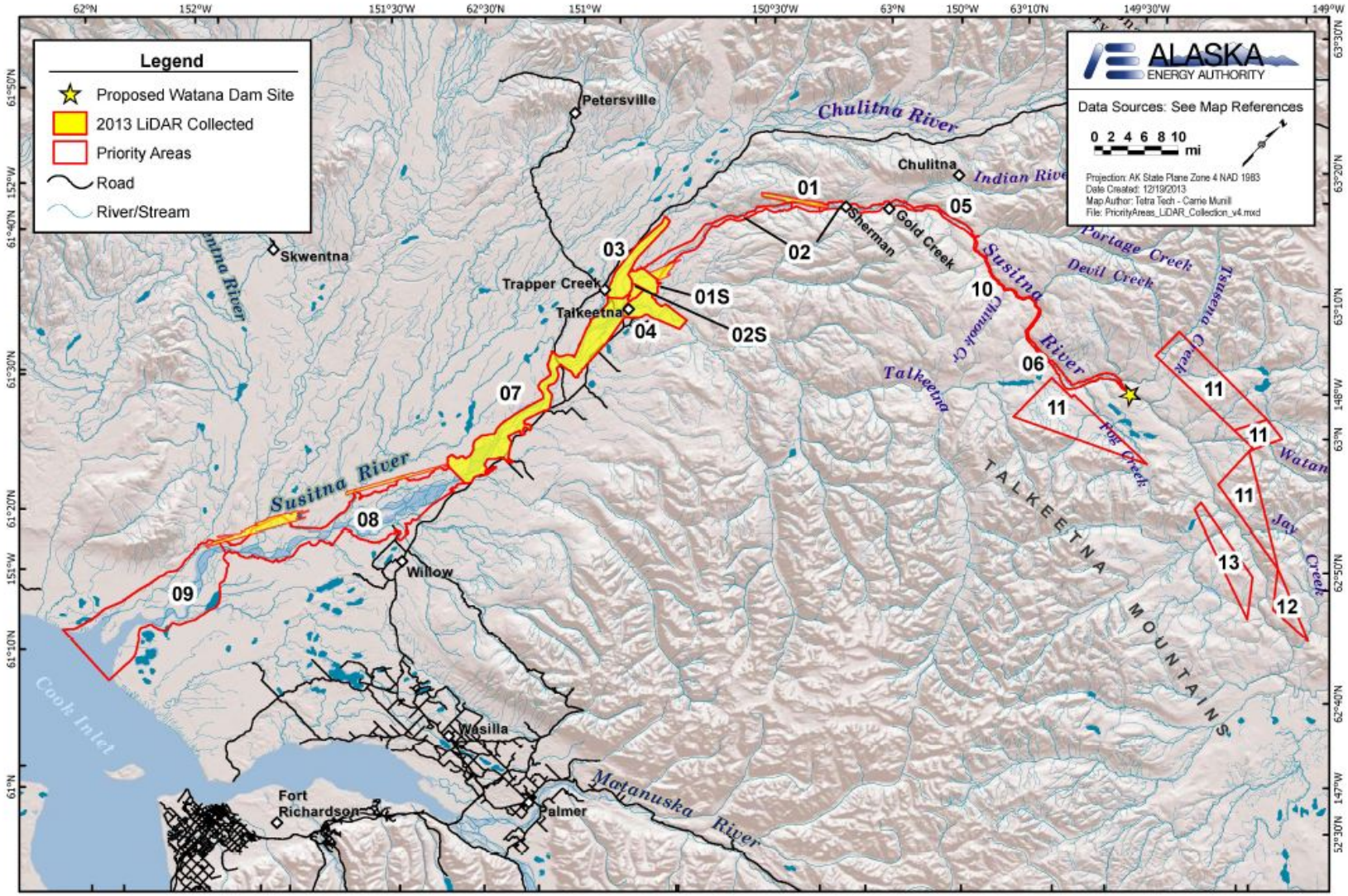

Figure 5.1-29. 2013 LiDAR priority areas and collection.

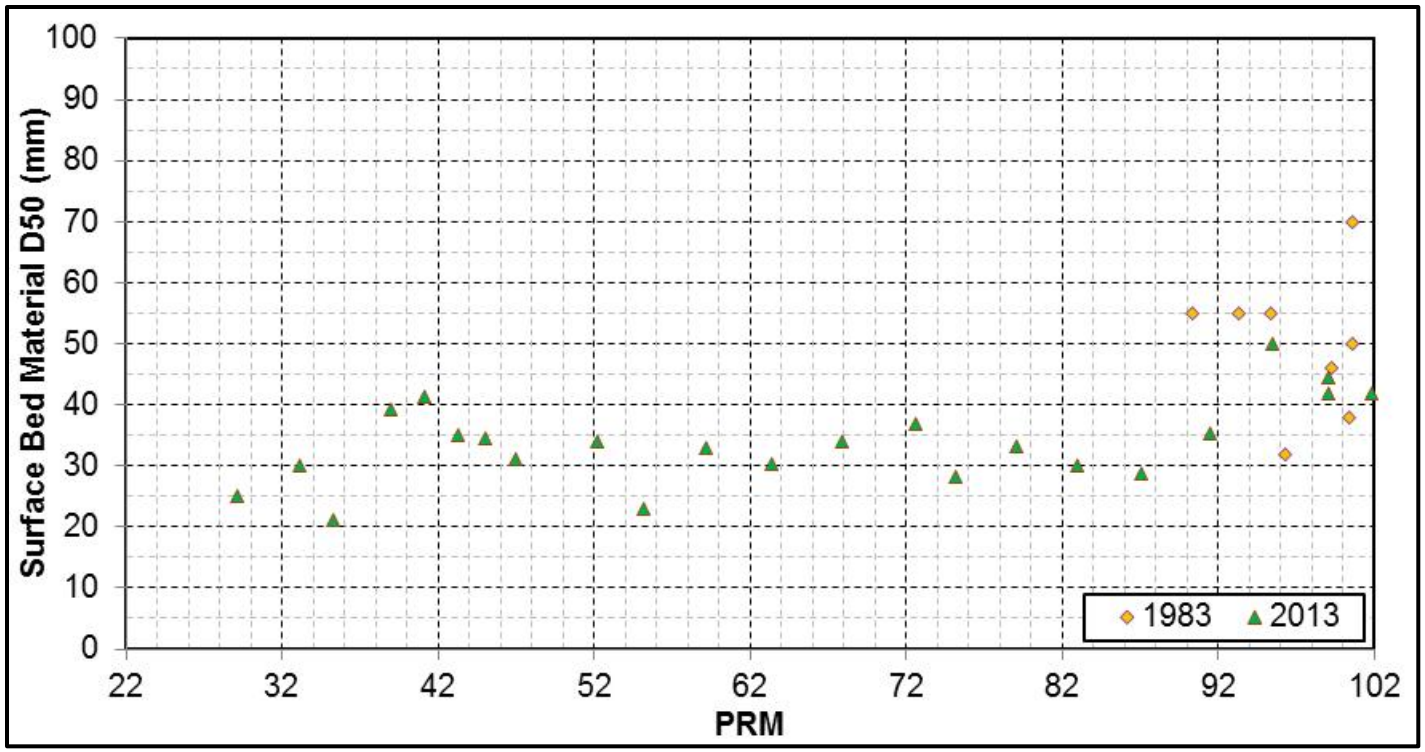

Figure 6.1-1. Lower Susitna River Segment Bed Material Comparison.

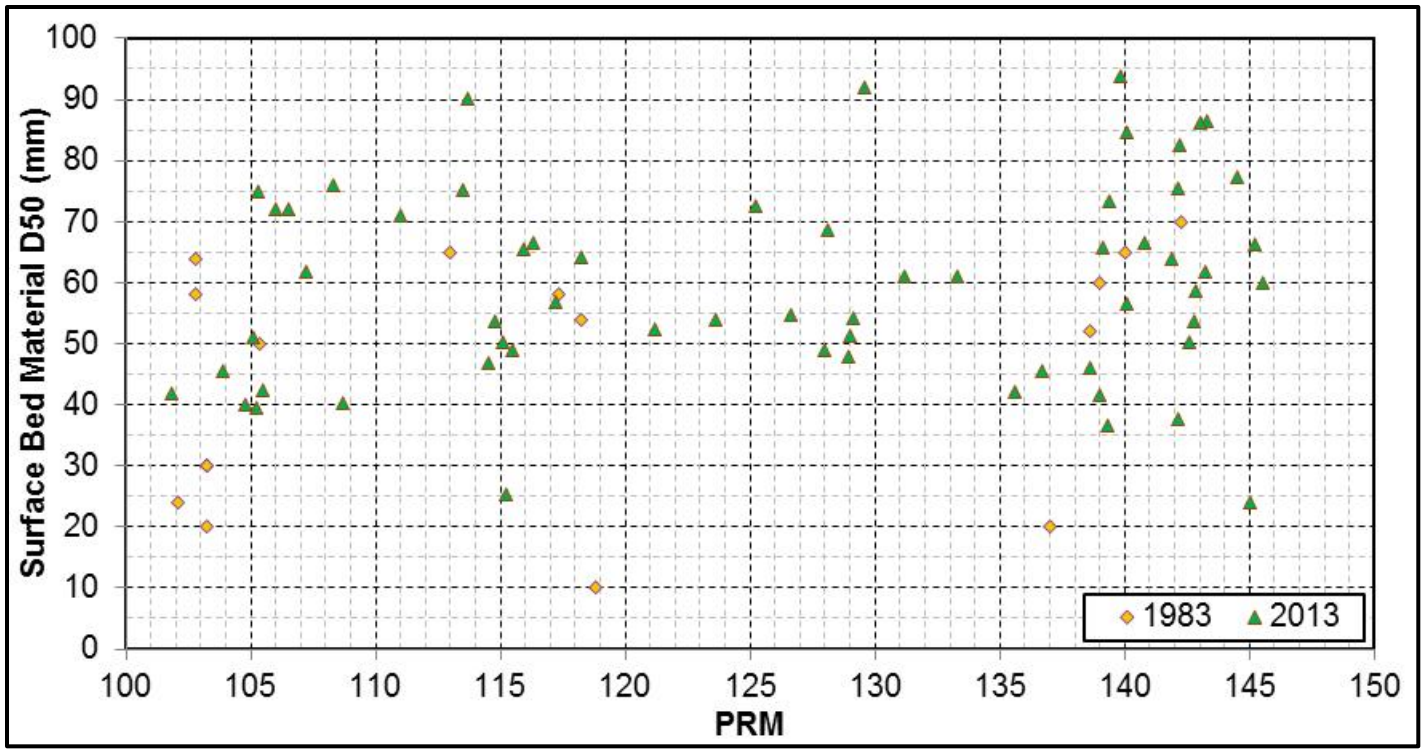

Figure 6.1-2. Middle Susitna River Segment Bed Material Comparison.

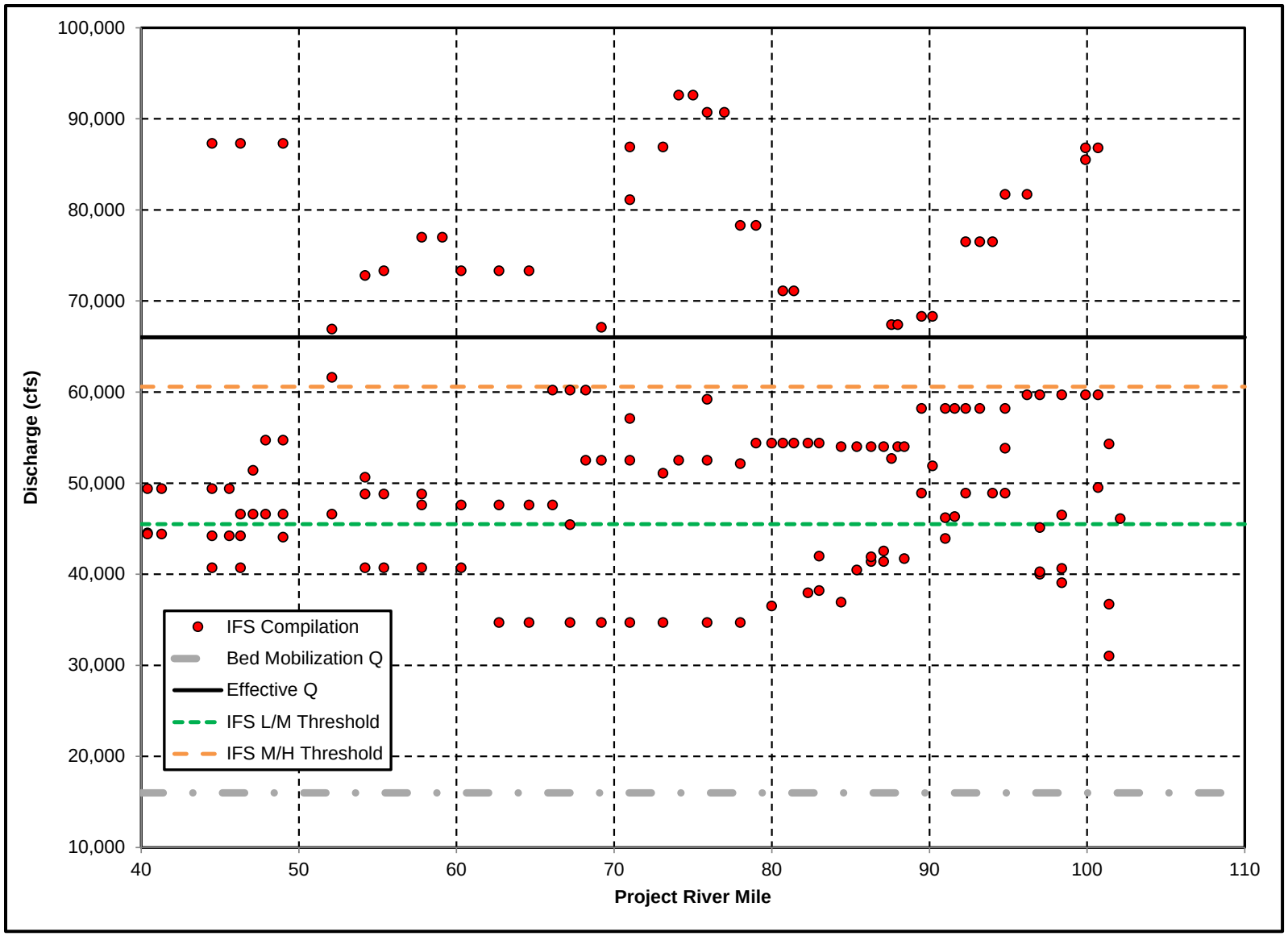

Figure 6.1-3. Lower Susitna River Segment Screening of Coupled WSE and Flow Measurements.

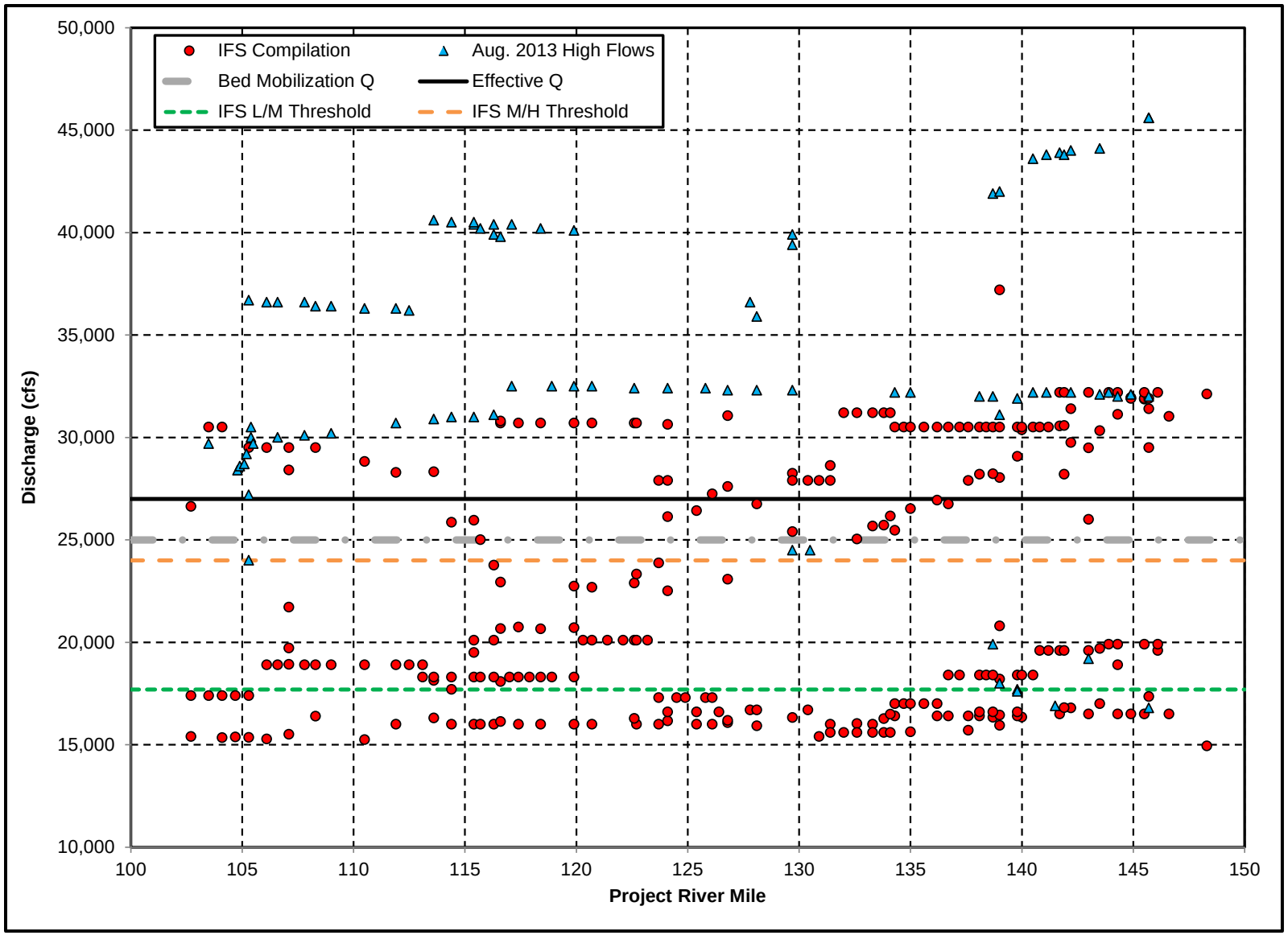

Figure 6.1-4. Middle Susitna River Segment Screening of Coupled WSE and Flow Measurements.

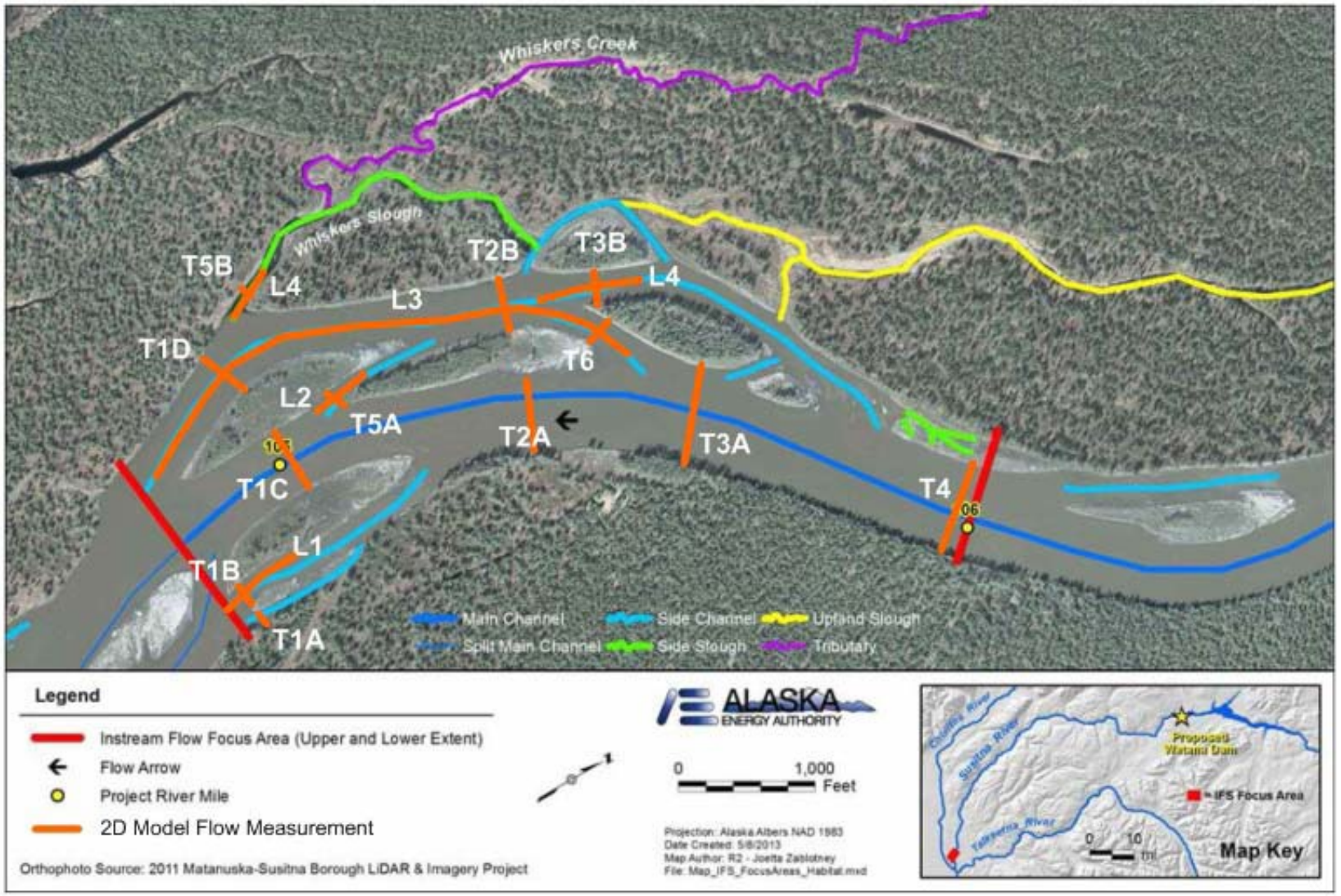

Figure 6.1-5. ADCP Flow Measurement Locations at Whiskers Slough (FA-104).