Susitna-Watana Hydroelectric Project (FERC No. 14241)

Geomorphology Study (6.5)

Figures

Initial Study Report

Prepared for

Alaska Energy Authority

SUSITNA-WATANA HYDRO

Clean, reliable energy for the next 100 years.

Prepared By

Tetra Tech

Watershed GeoDynamics

February 2014 Draft

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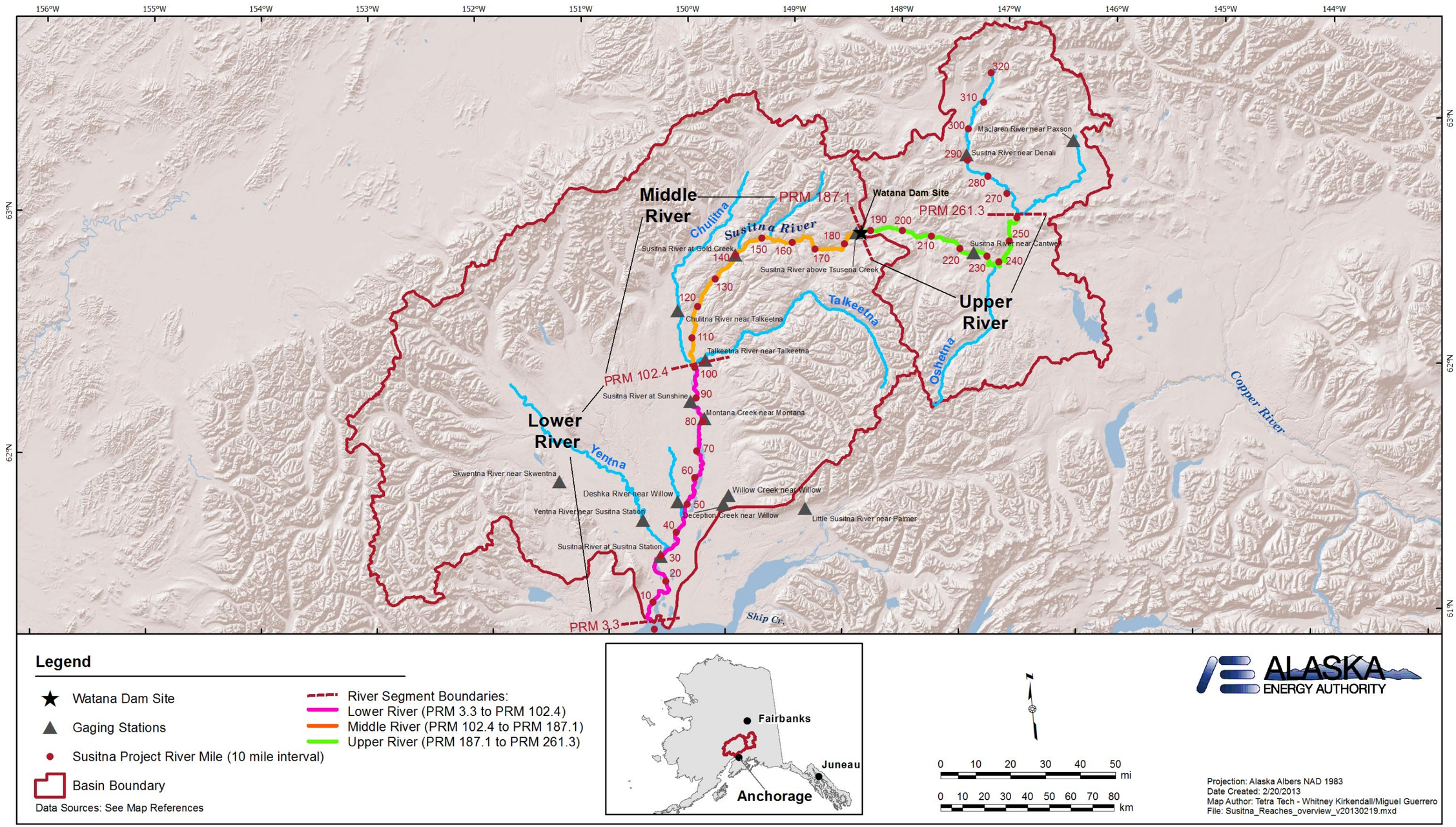

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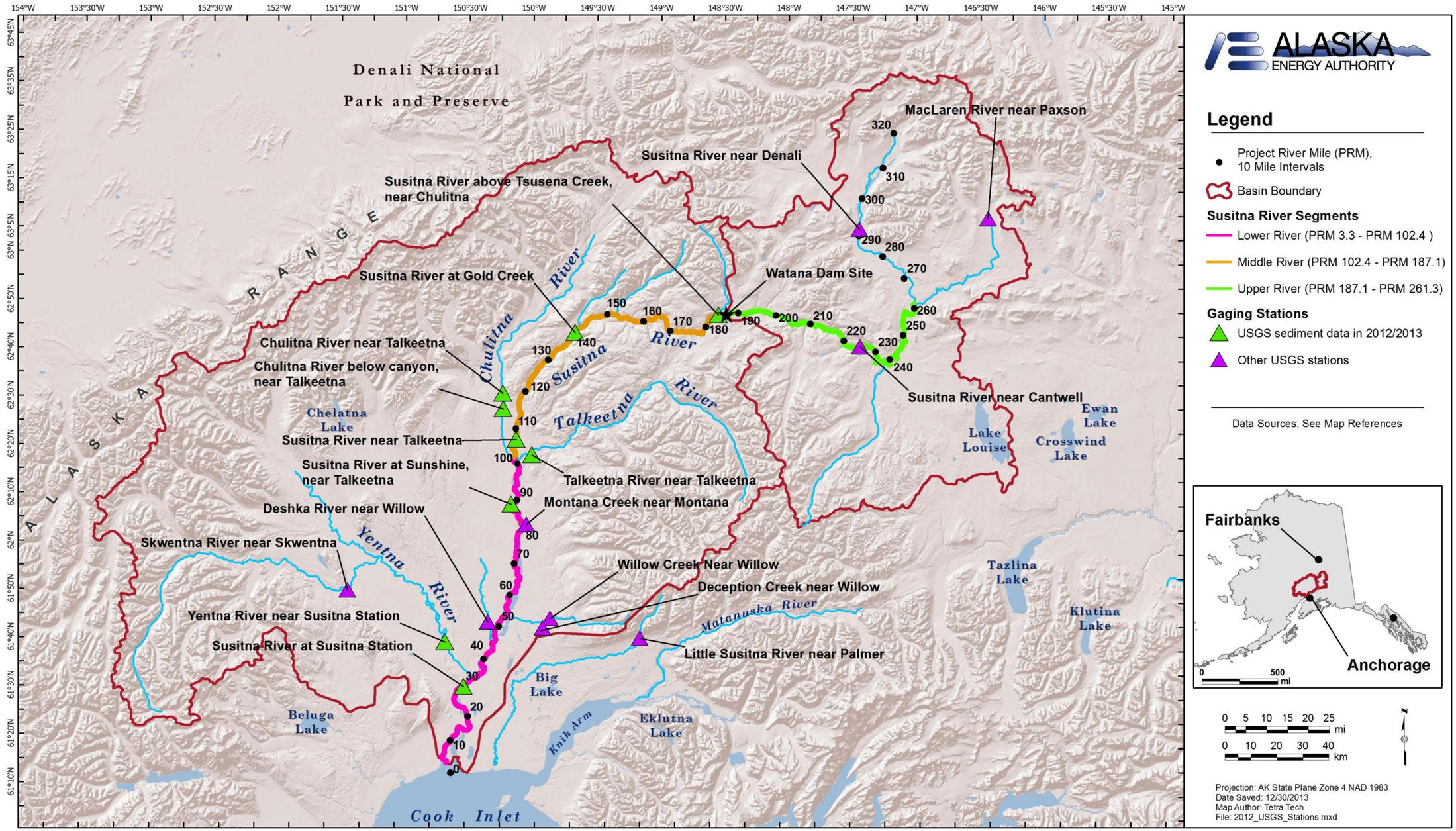

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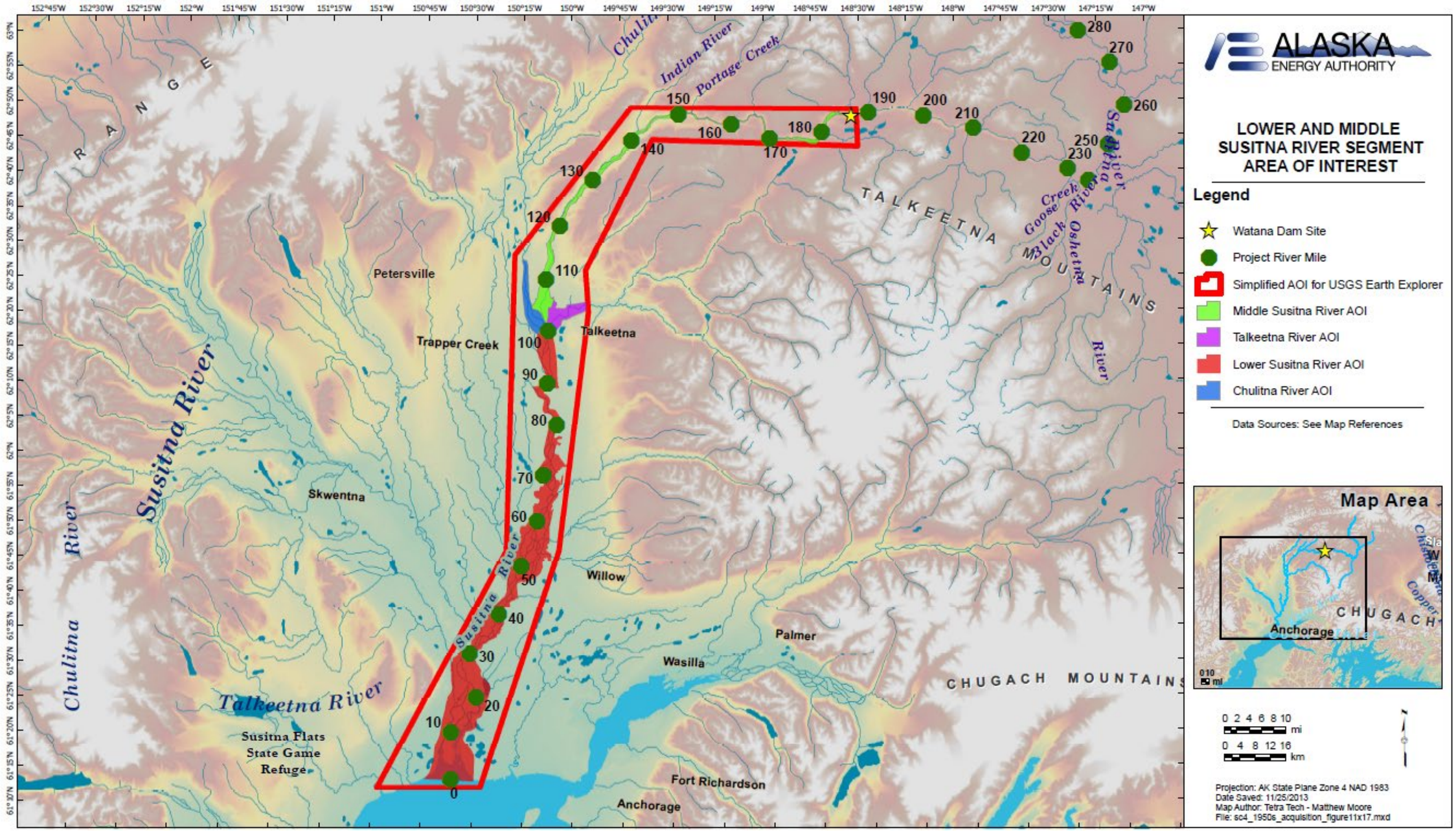

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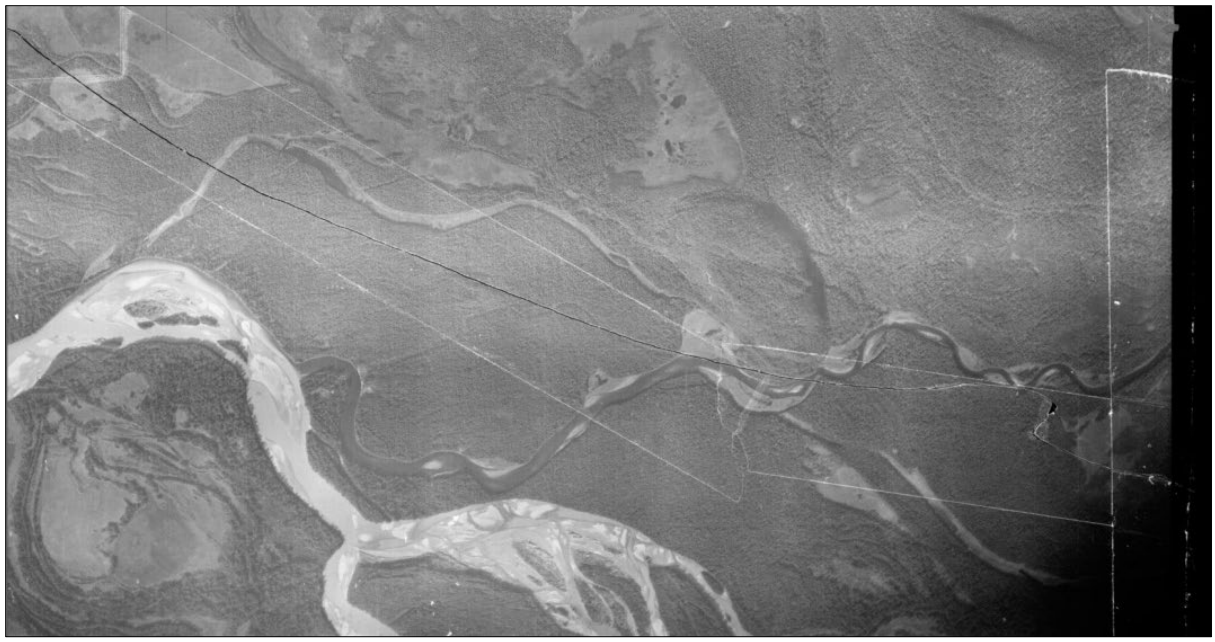

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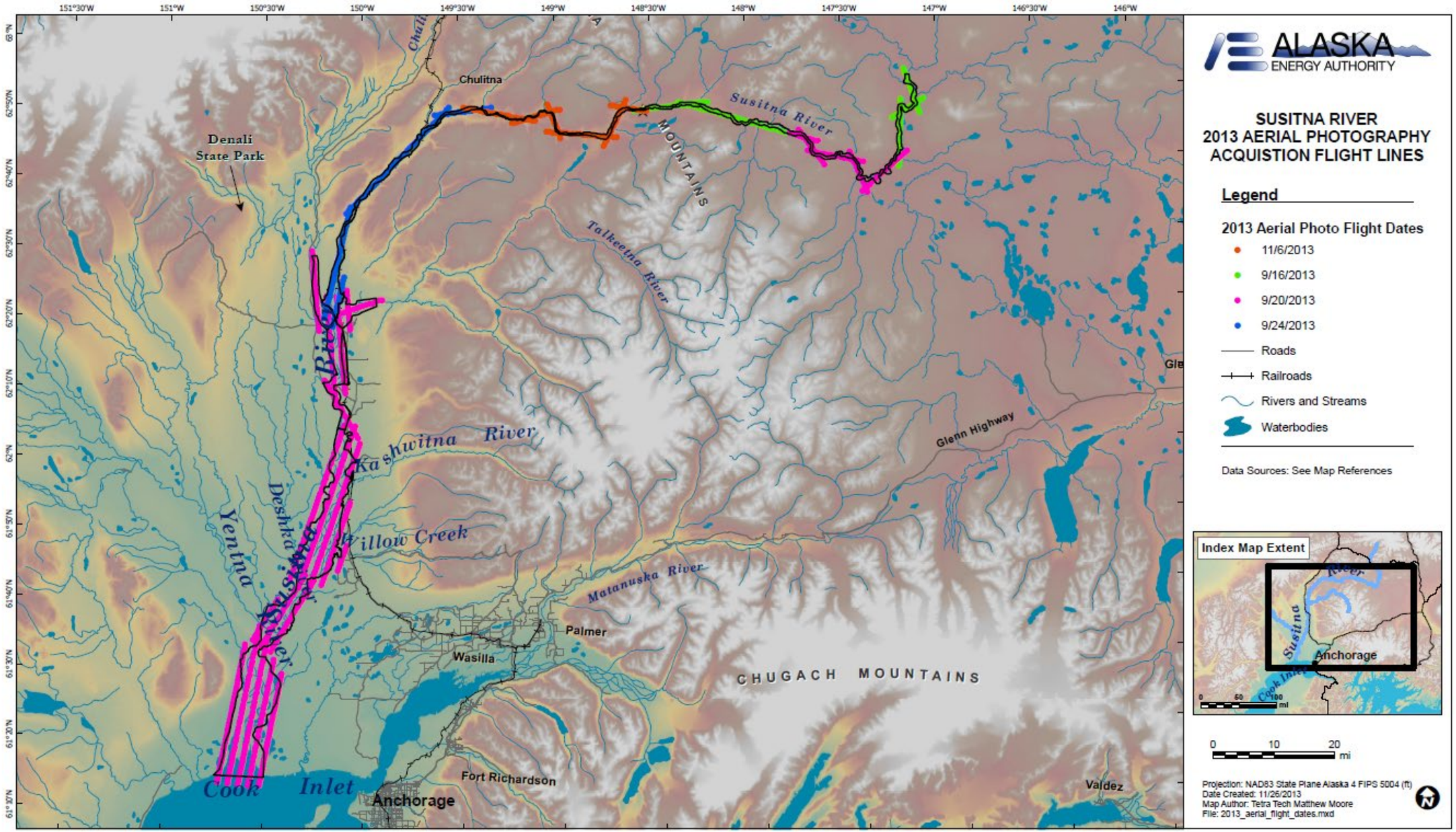

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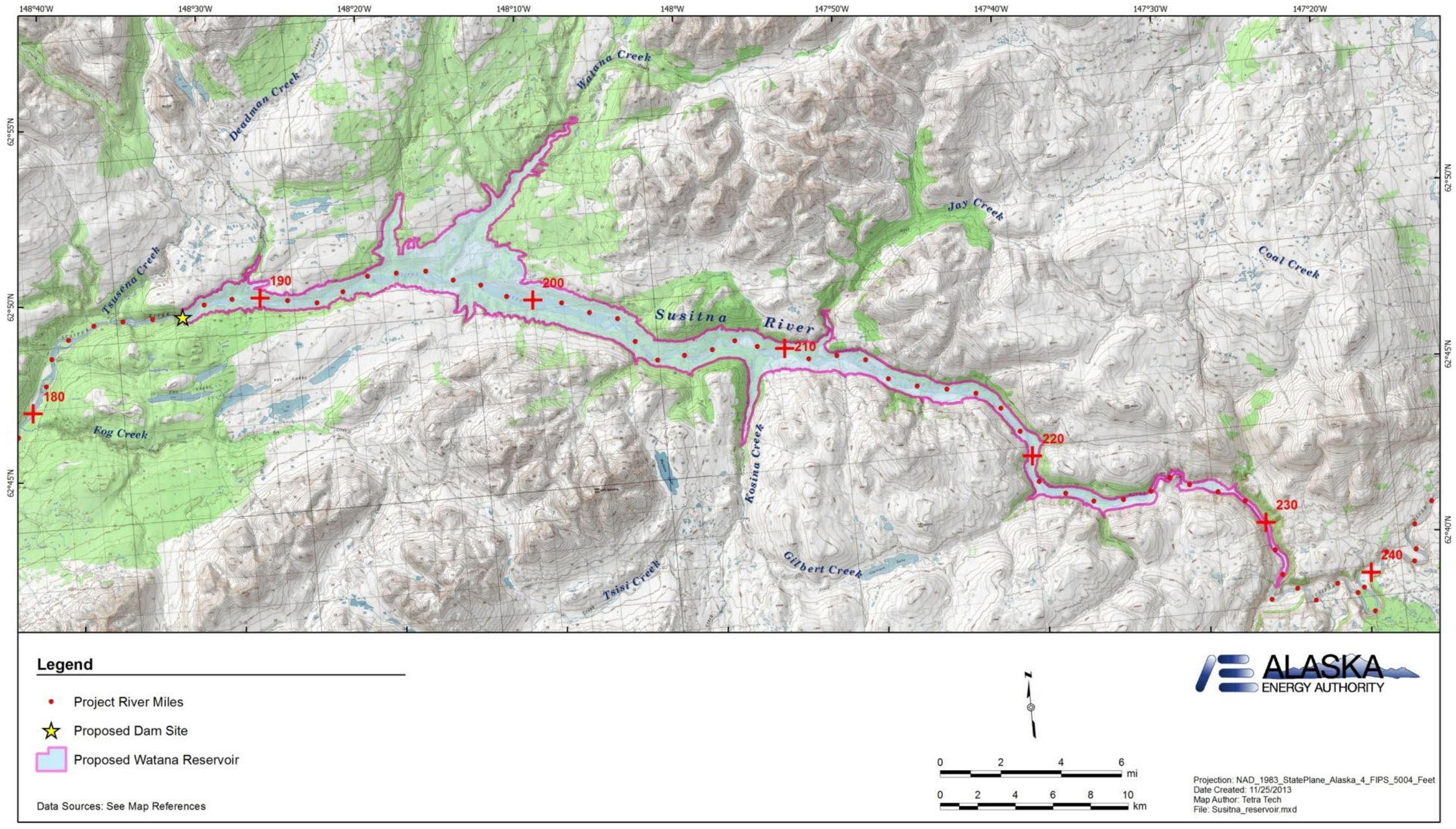

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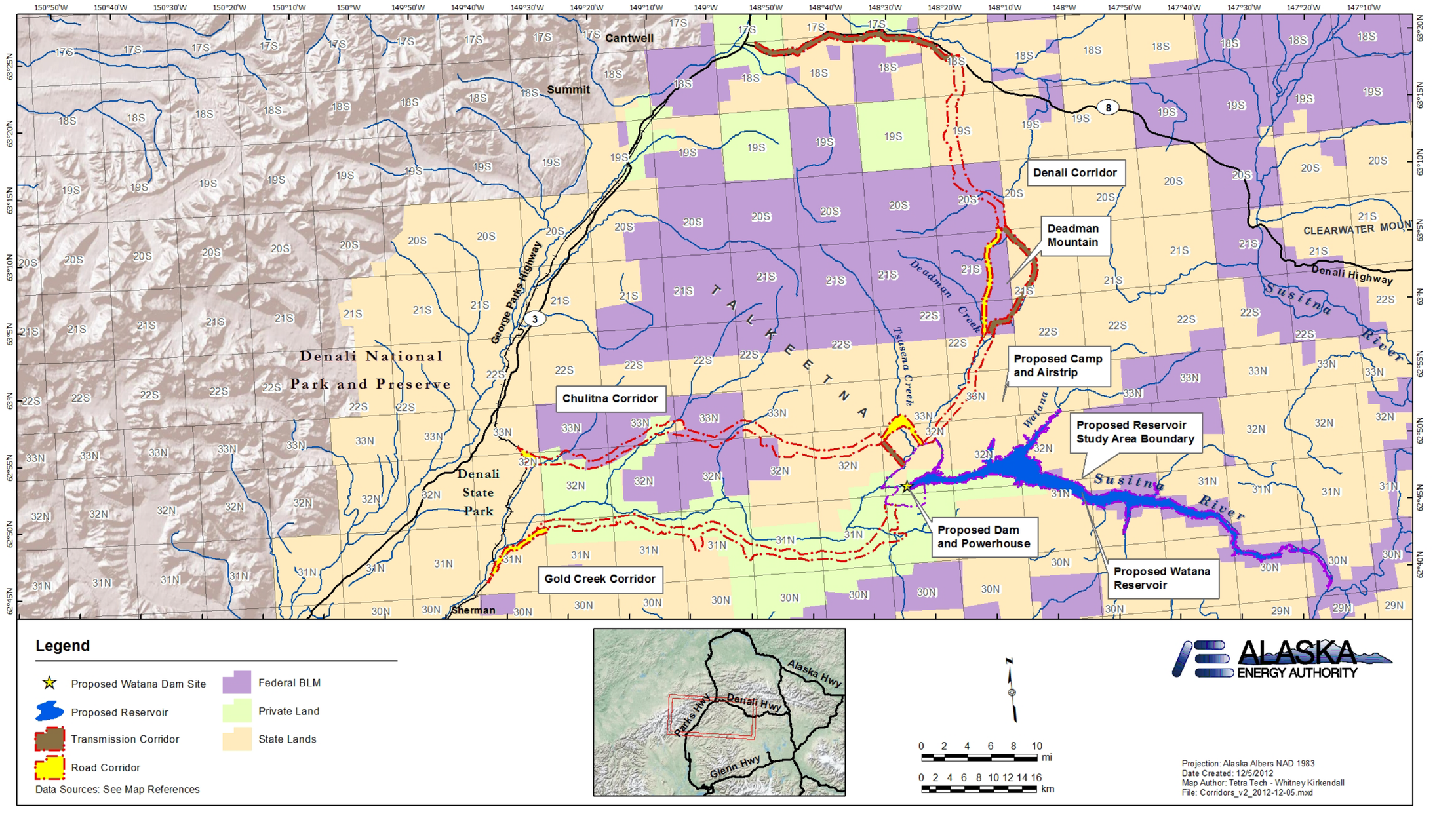

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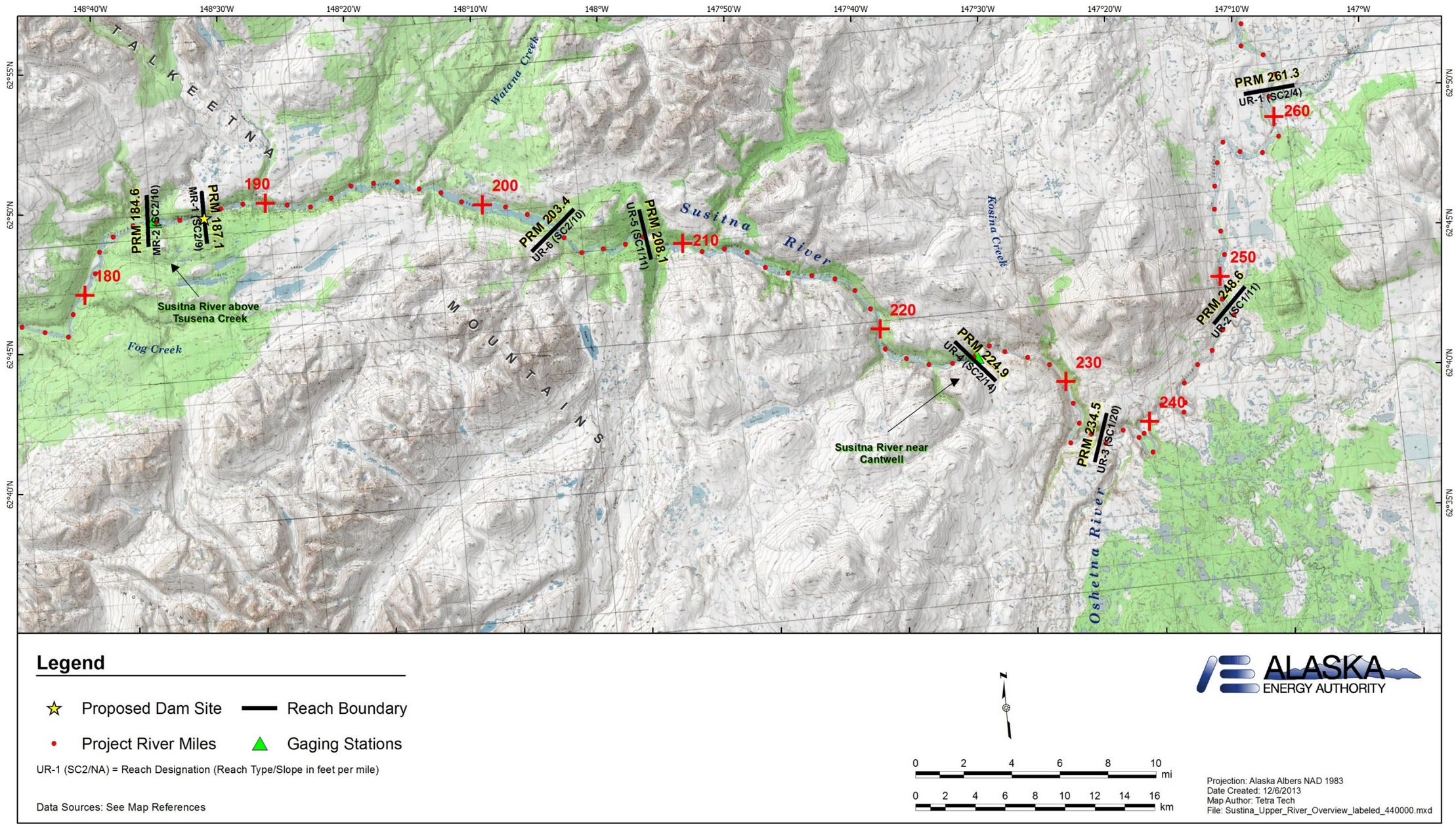

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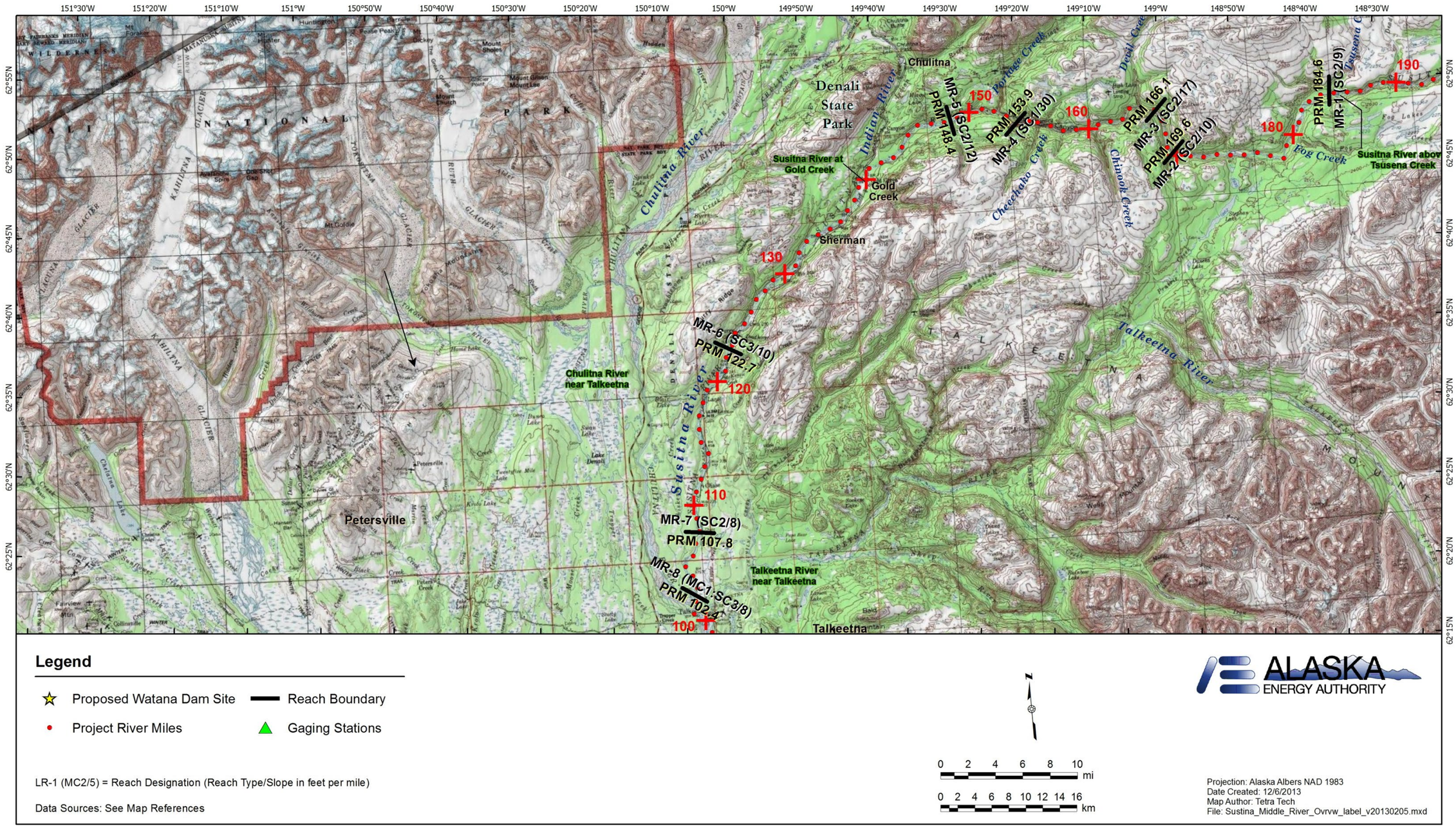

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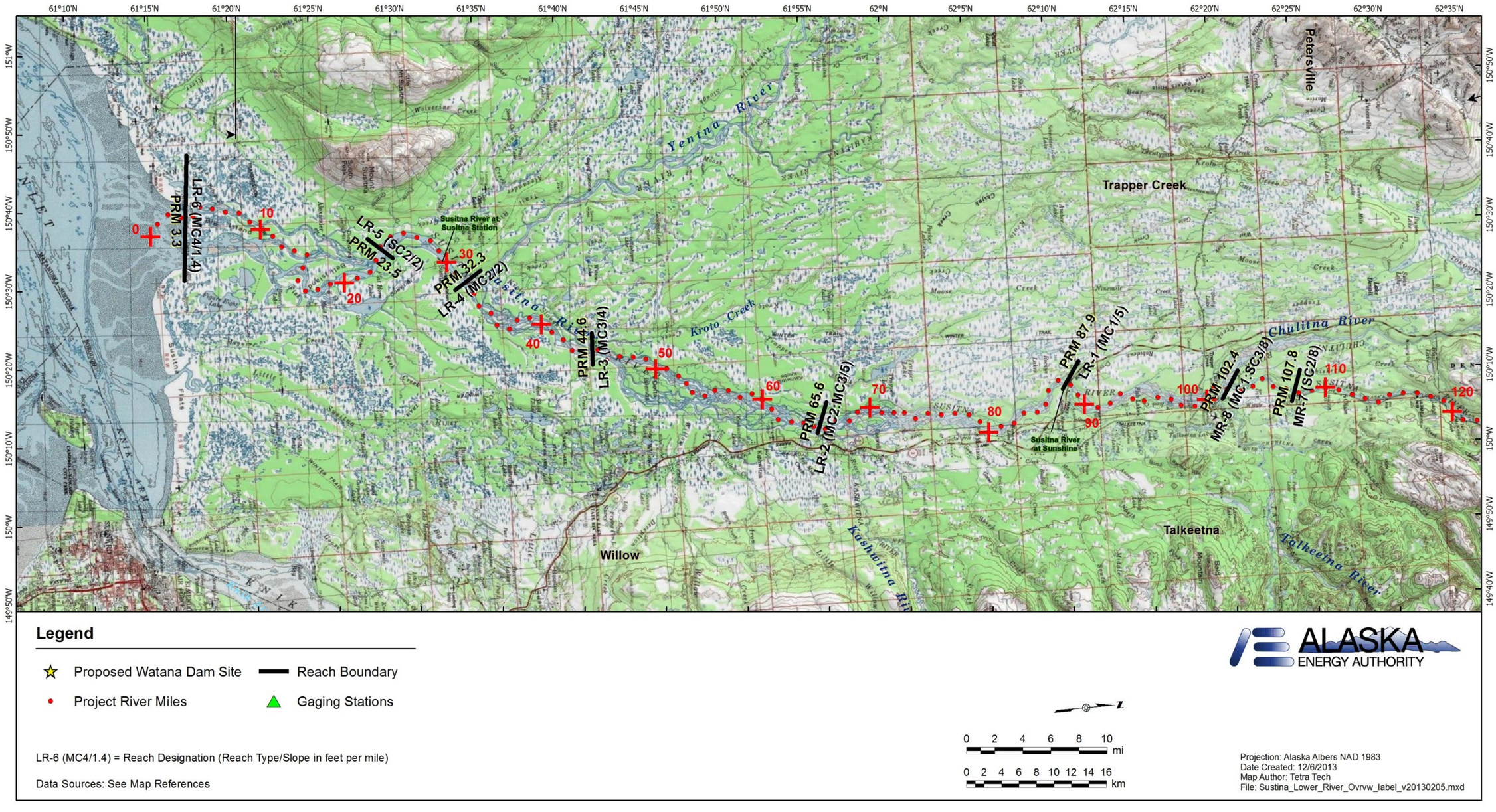

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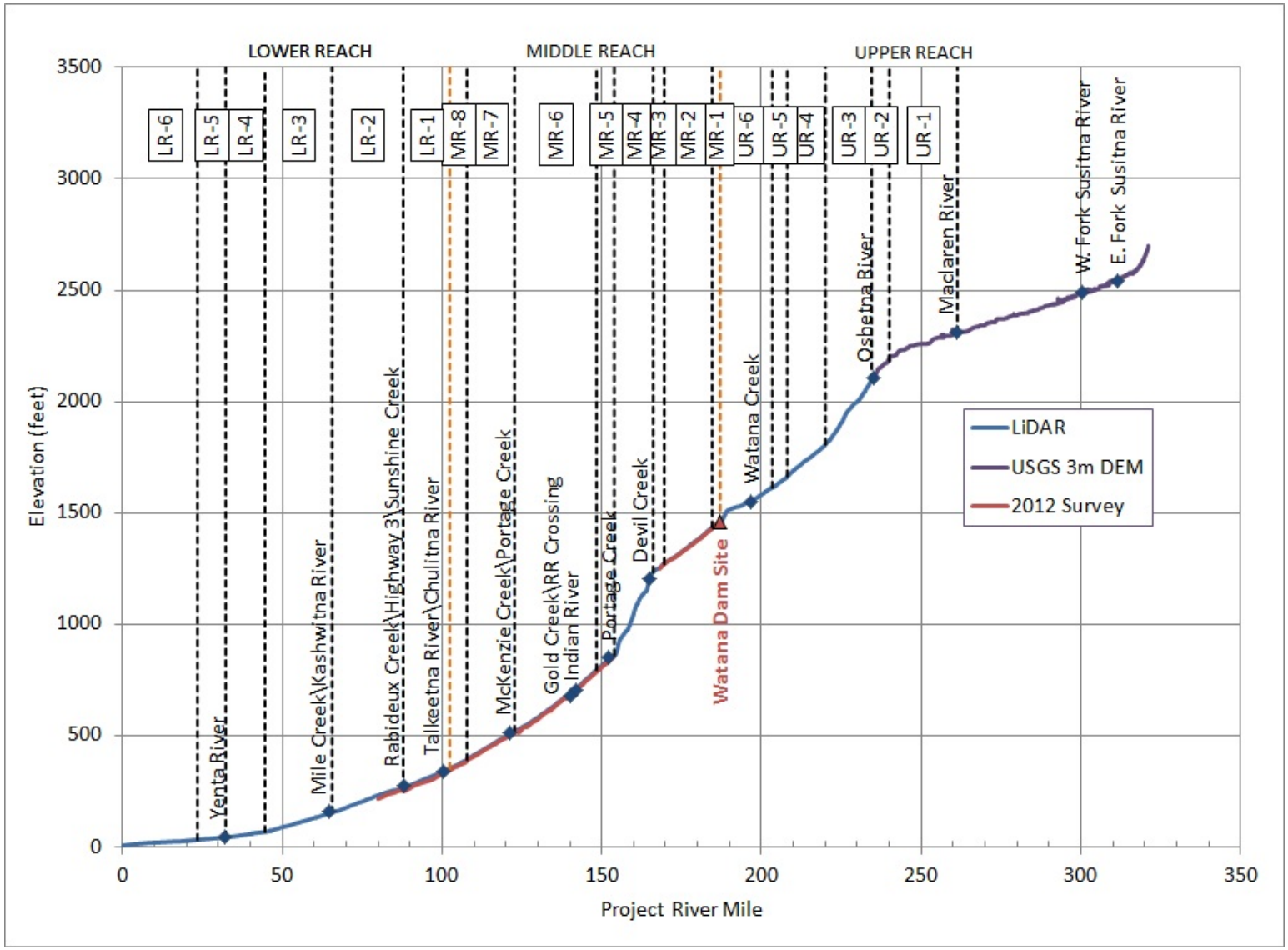

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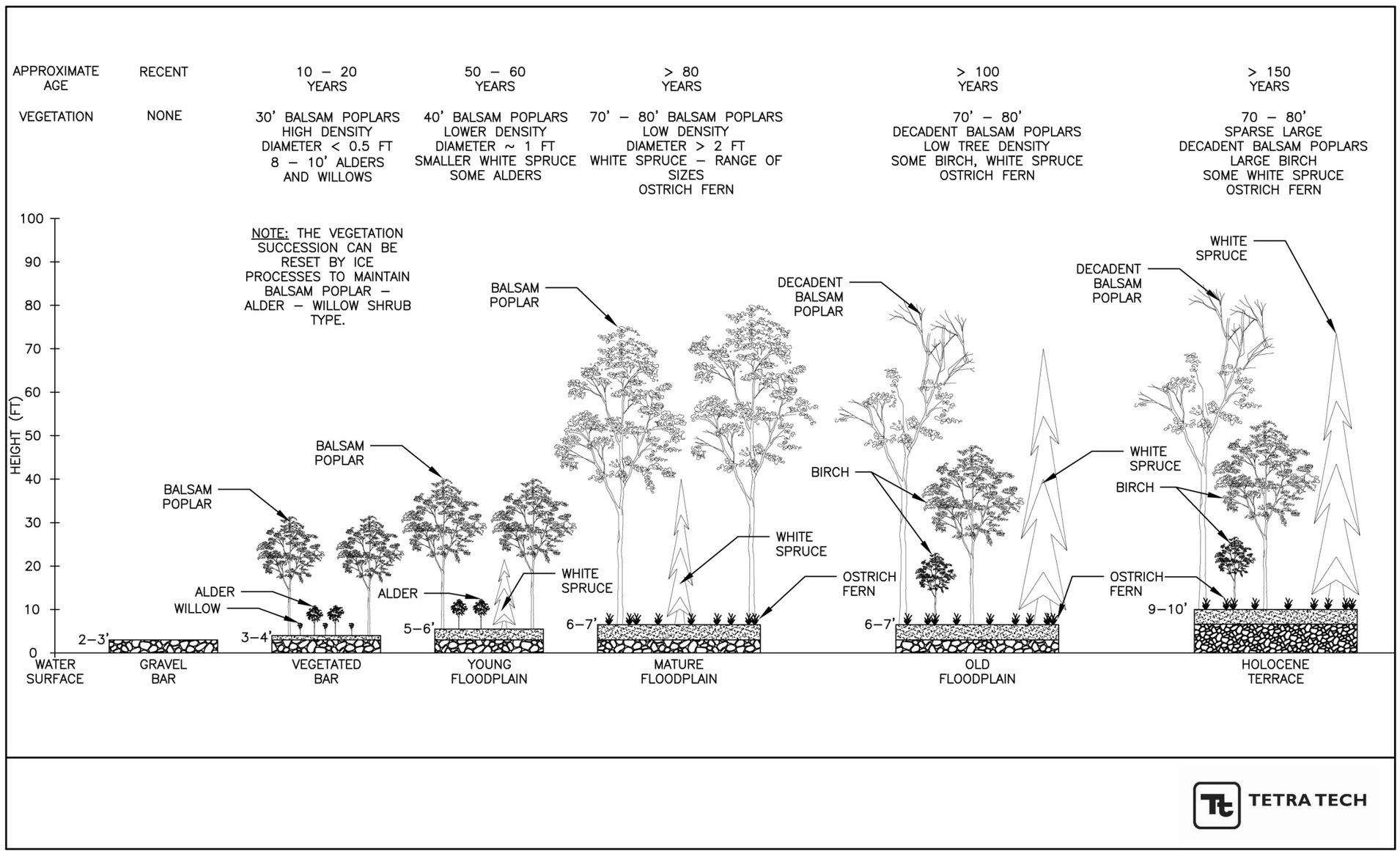
GEOMORPHIC SUCCESSION
MIDDLE SUSITNA RIVER SEGMENT



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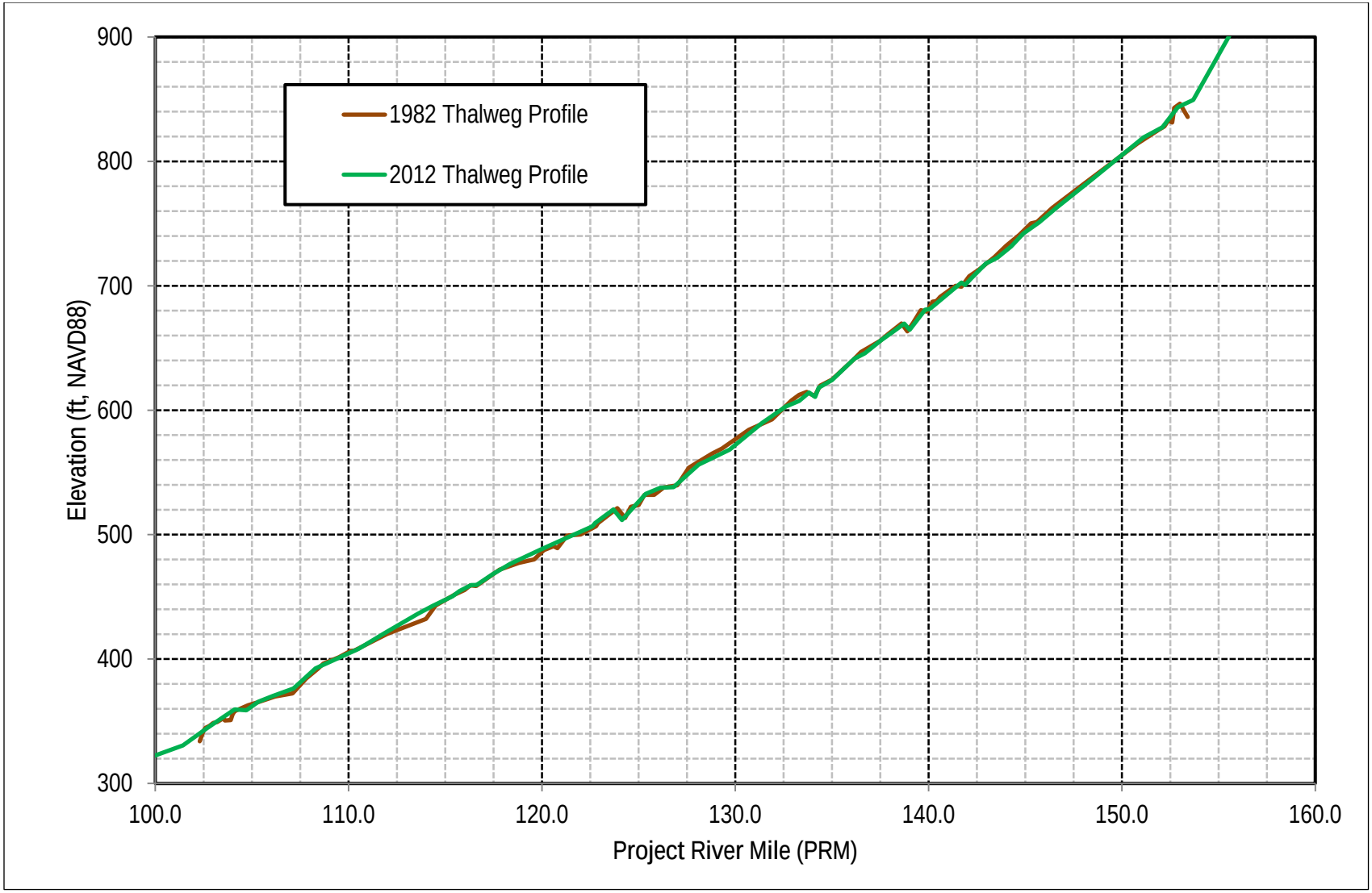

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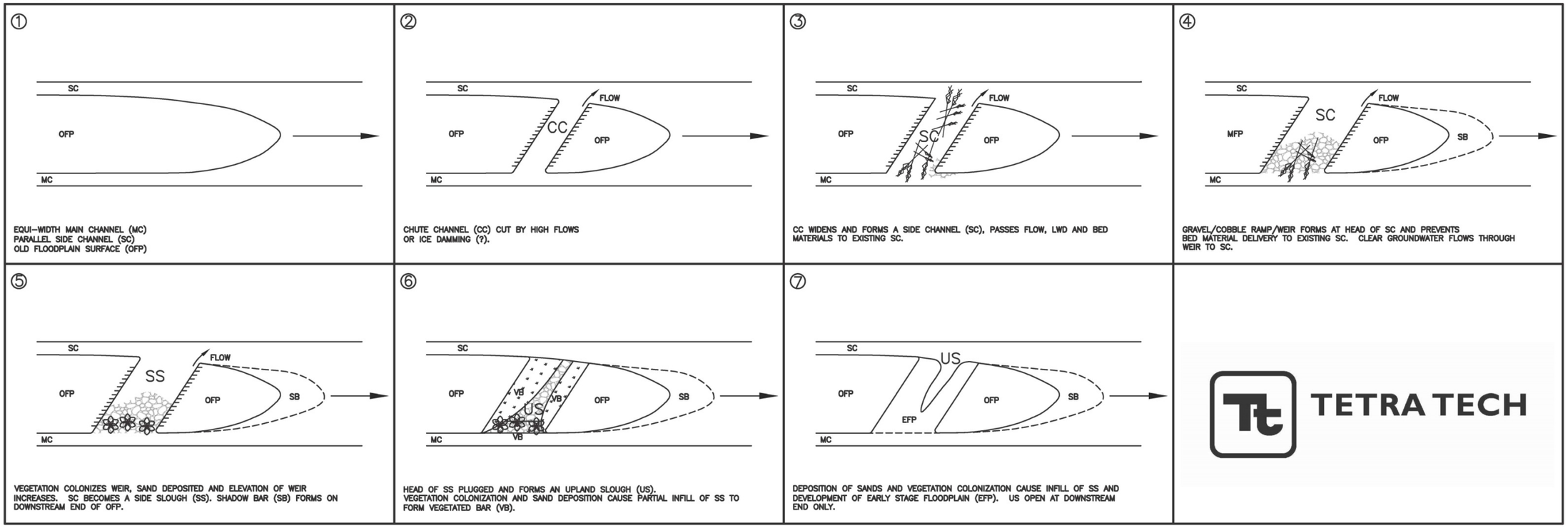

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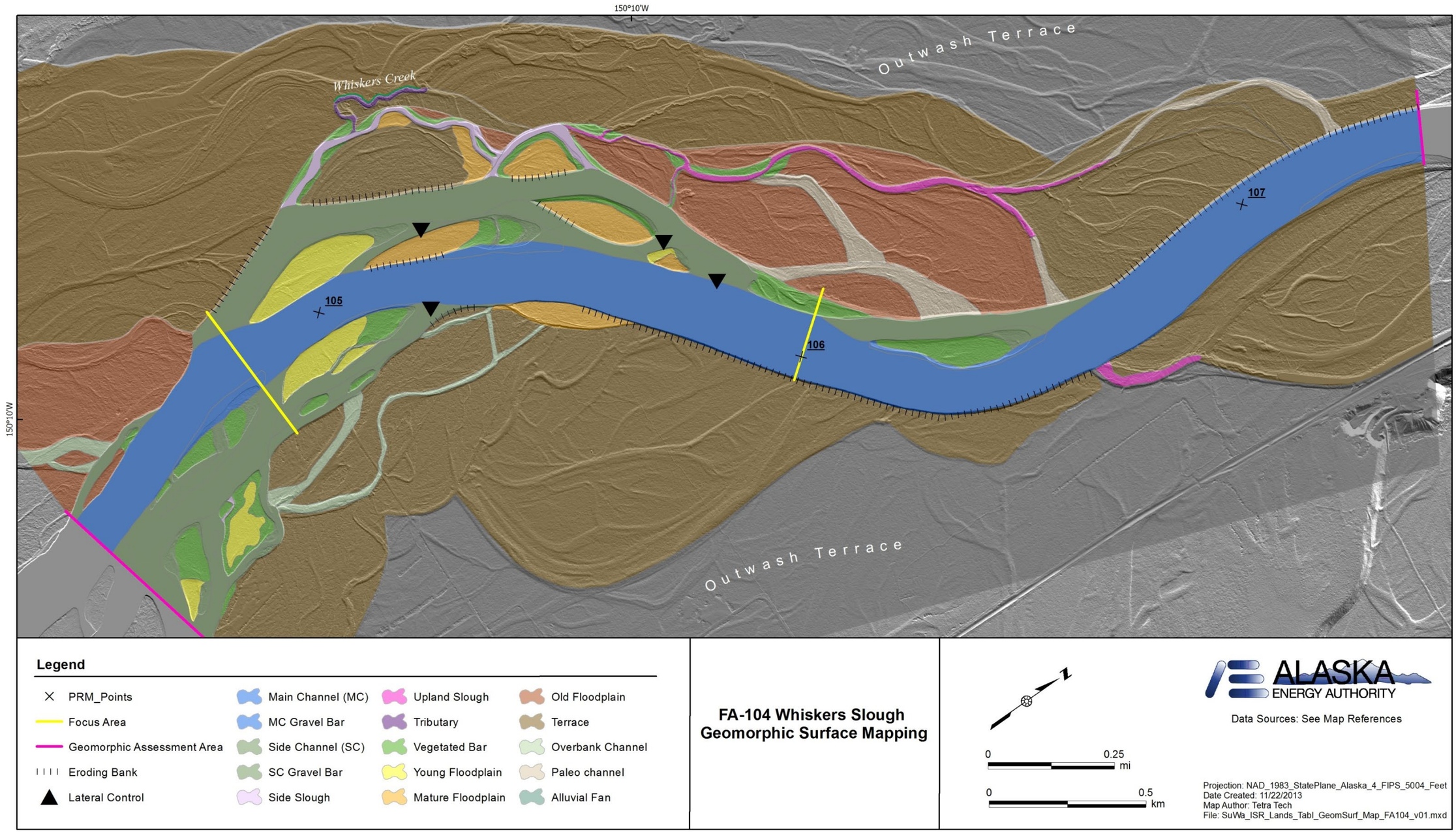

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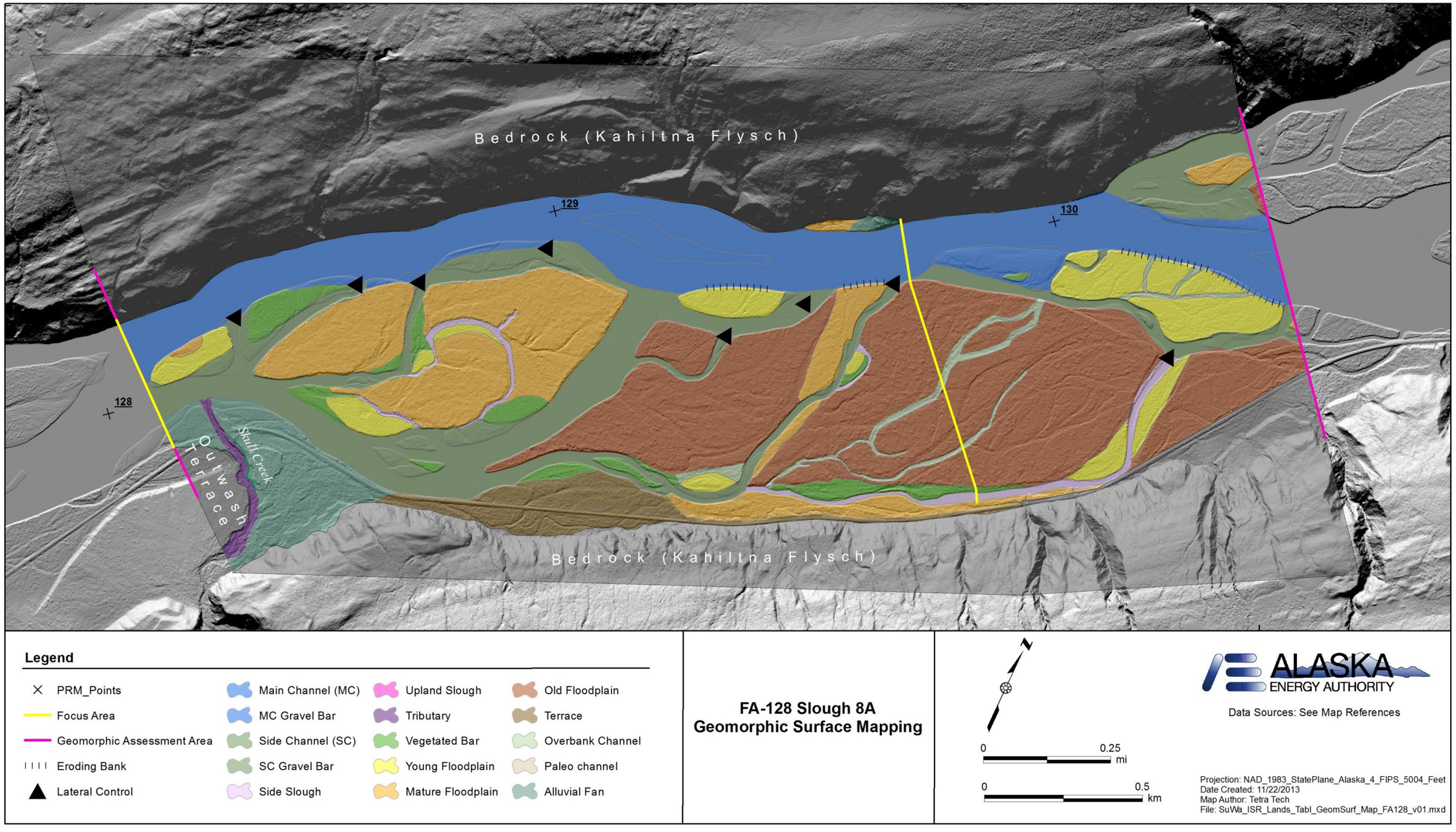

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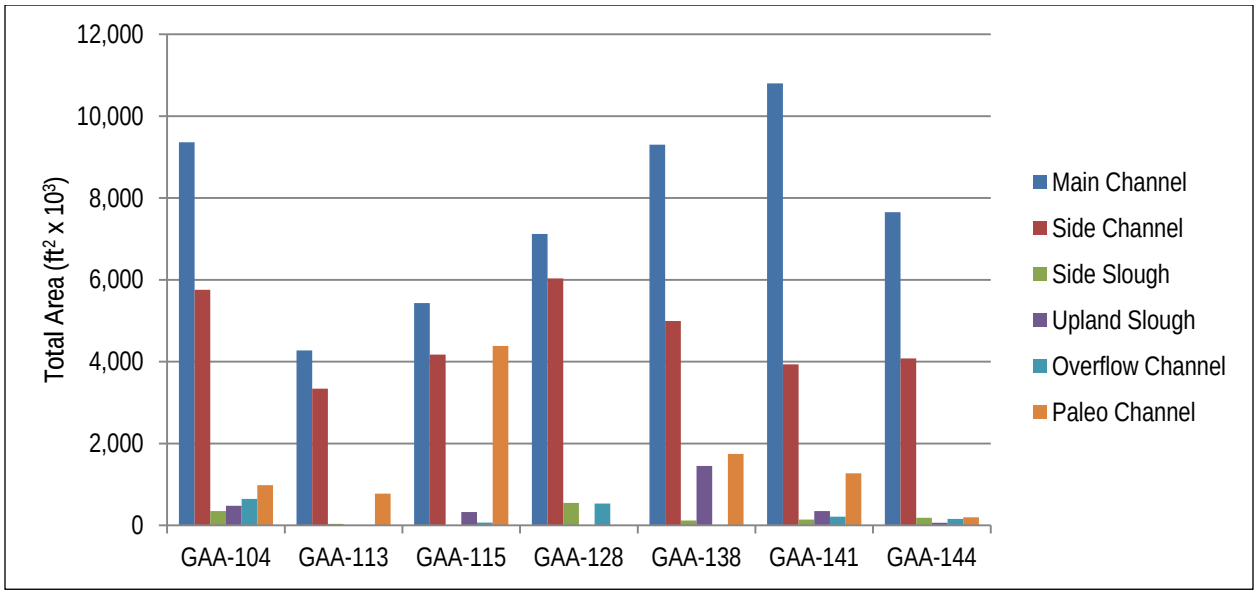

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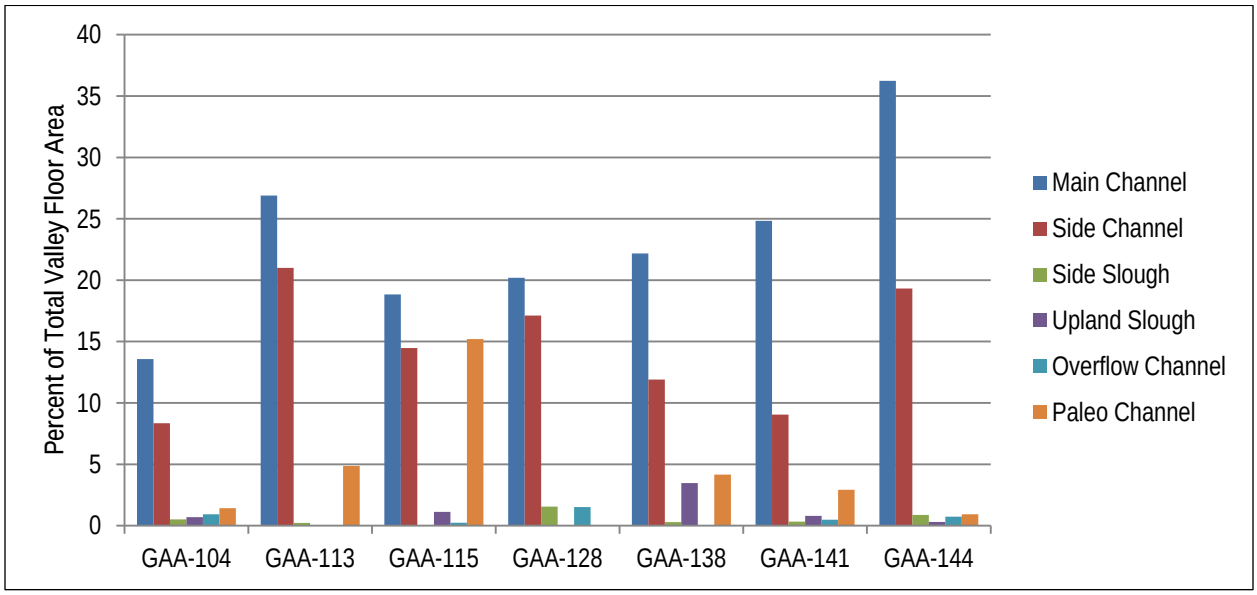

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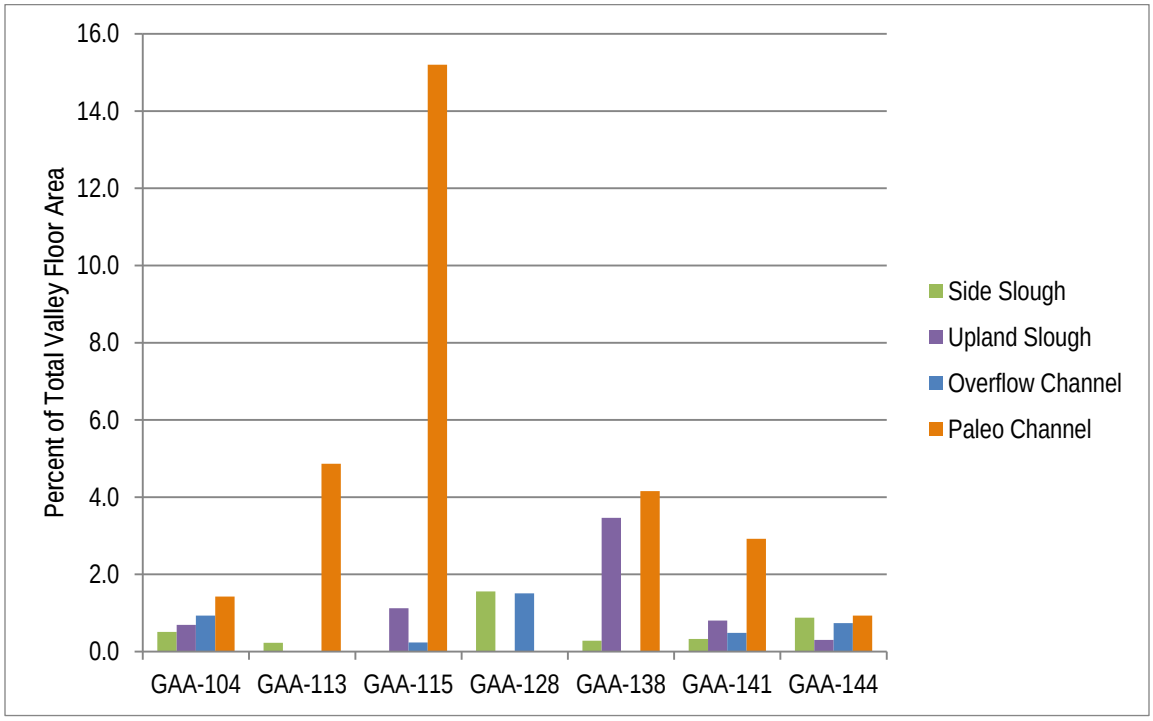

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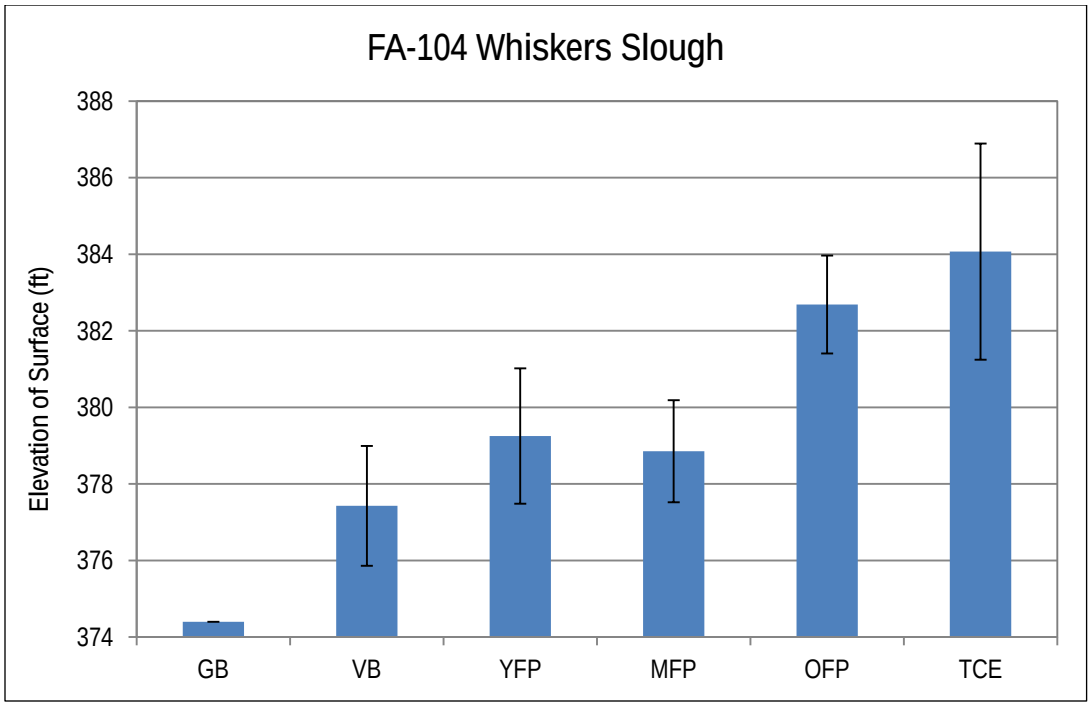

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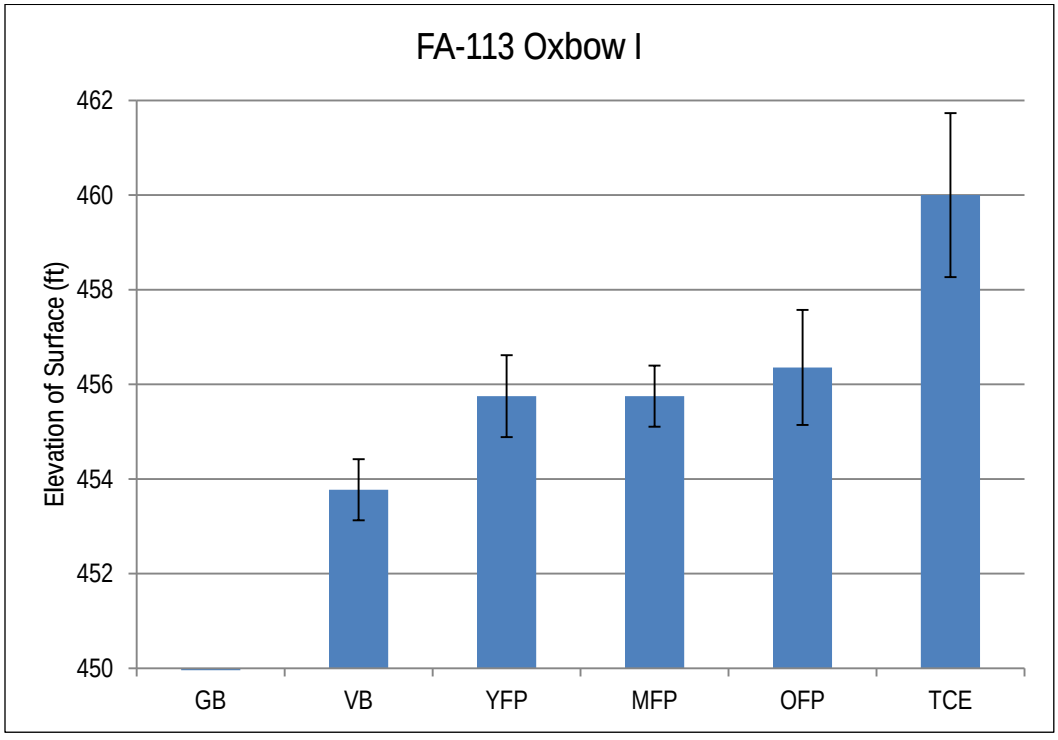

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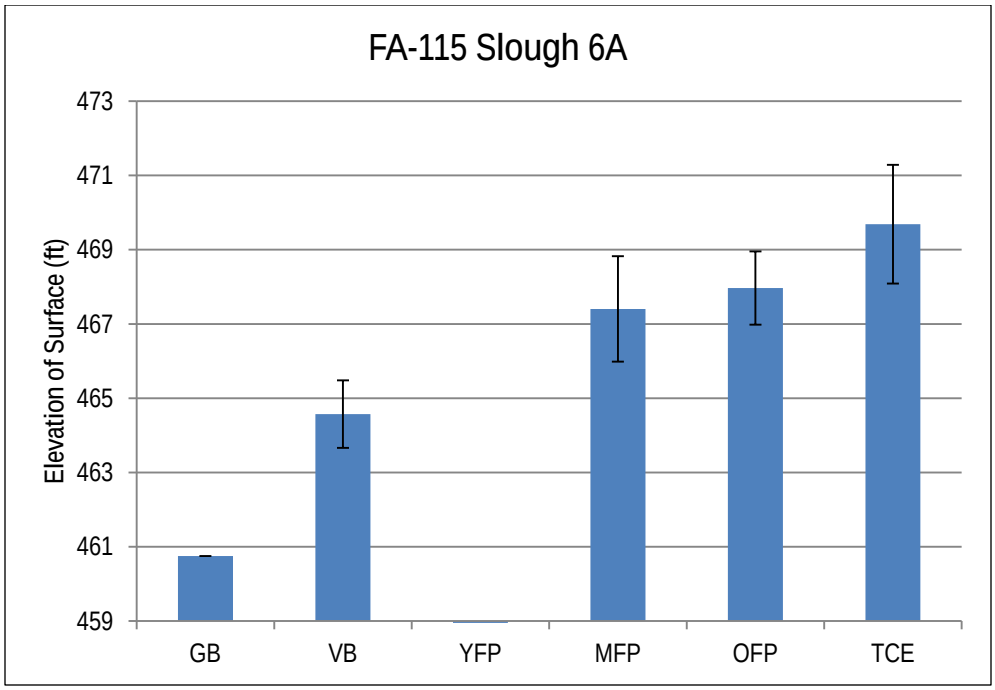

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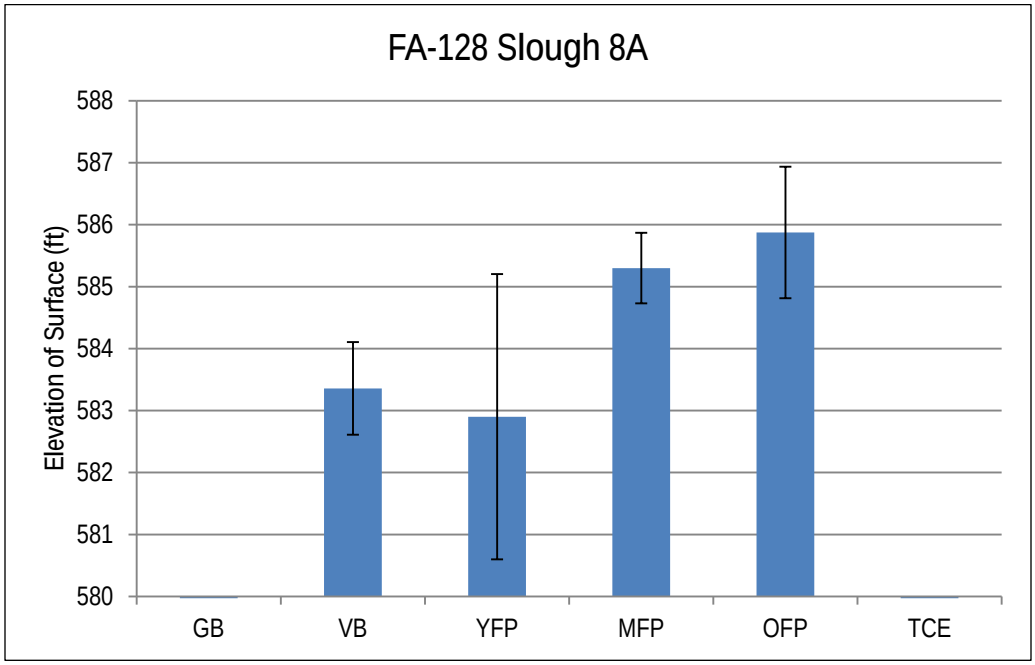

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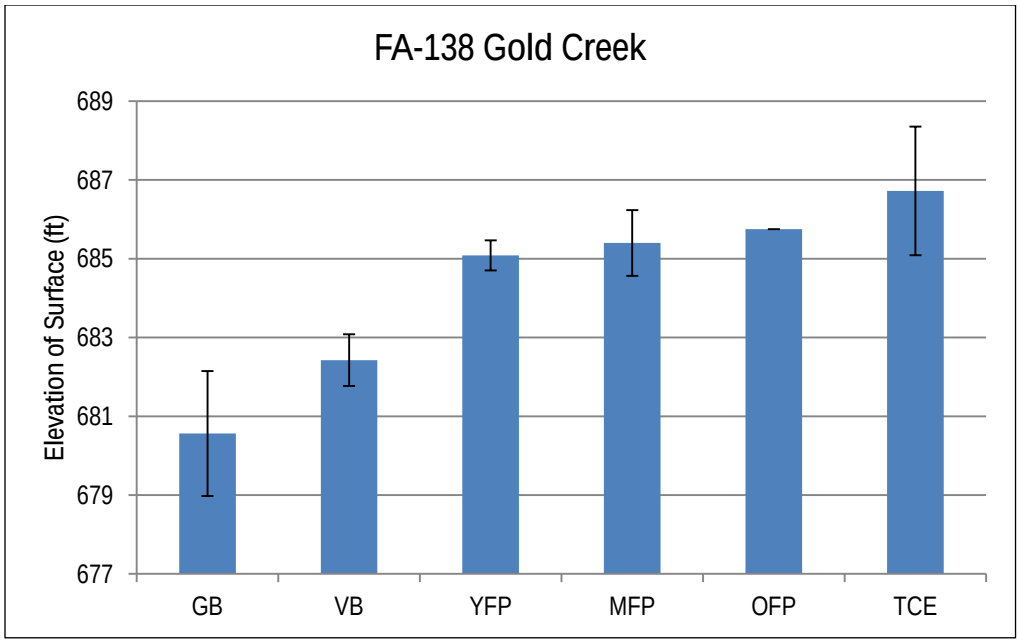

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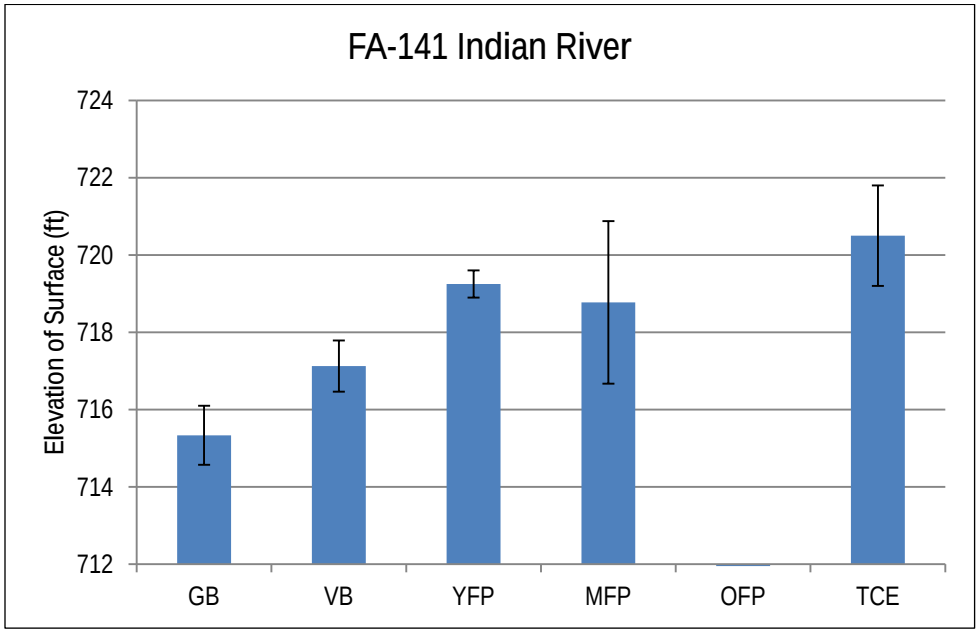

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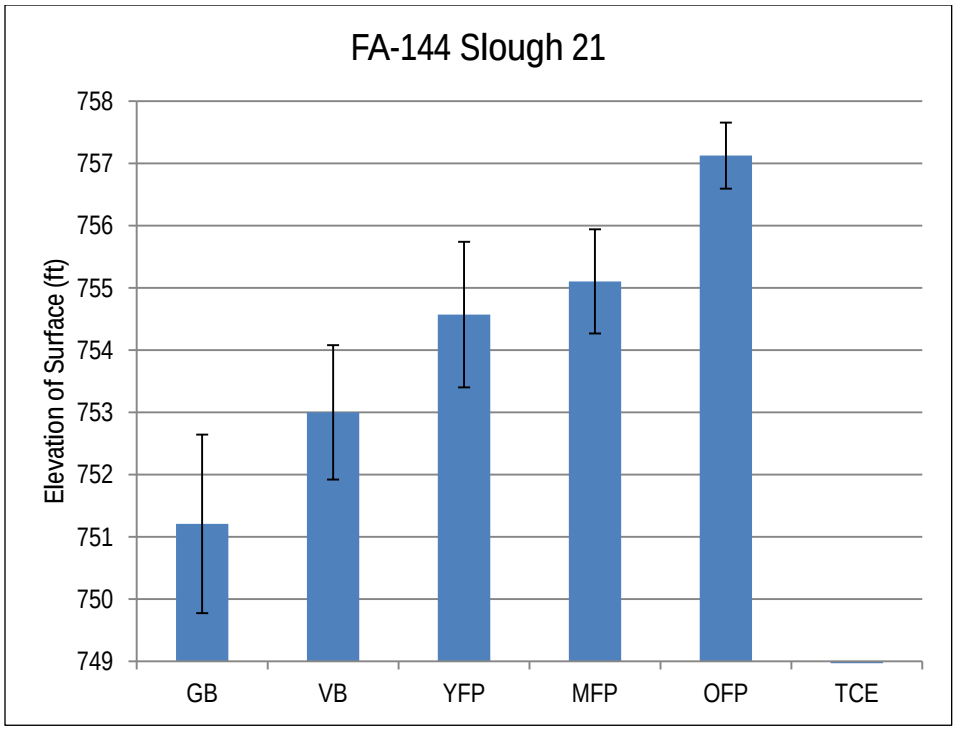

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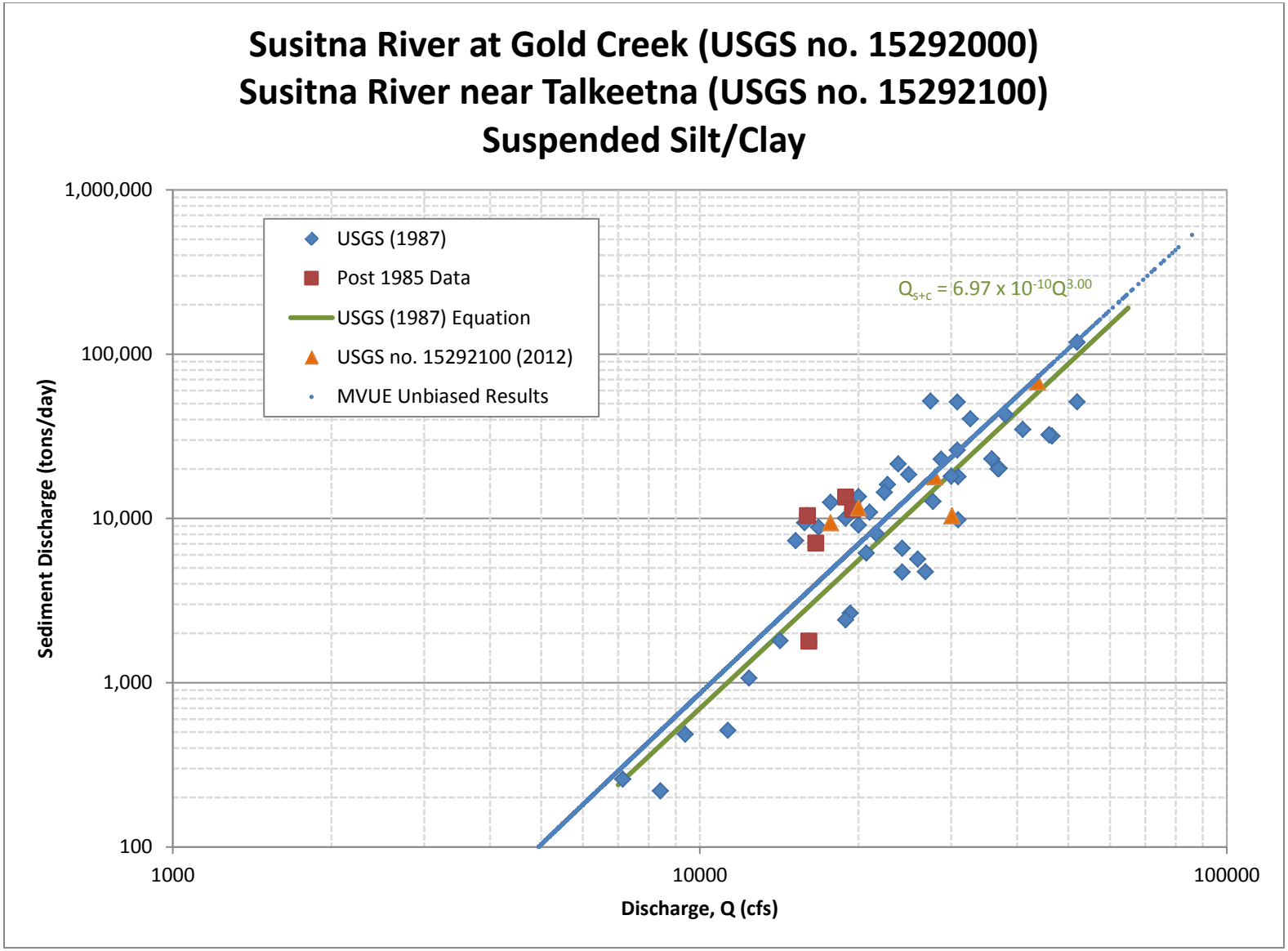

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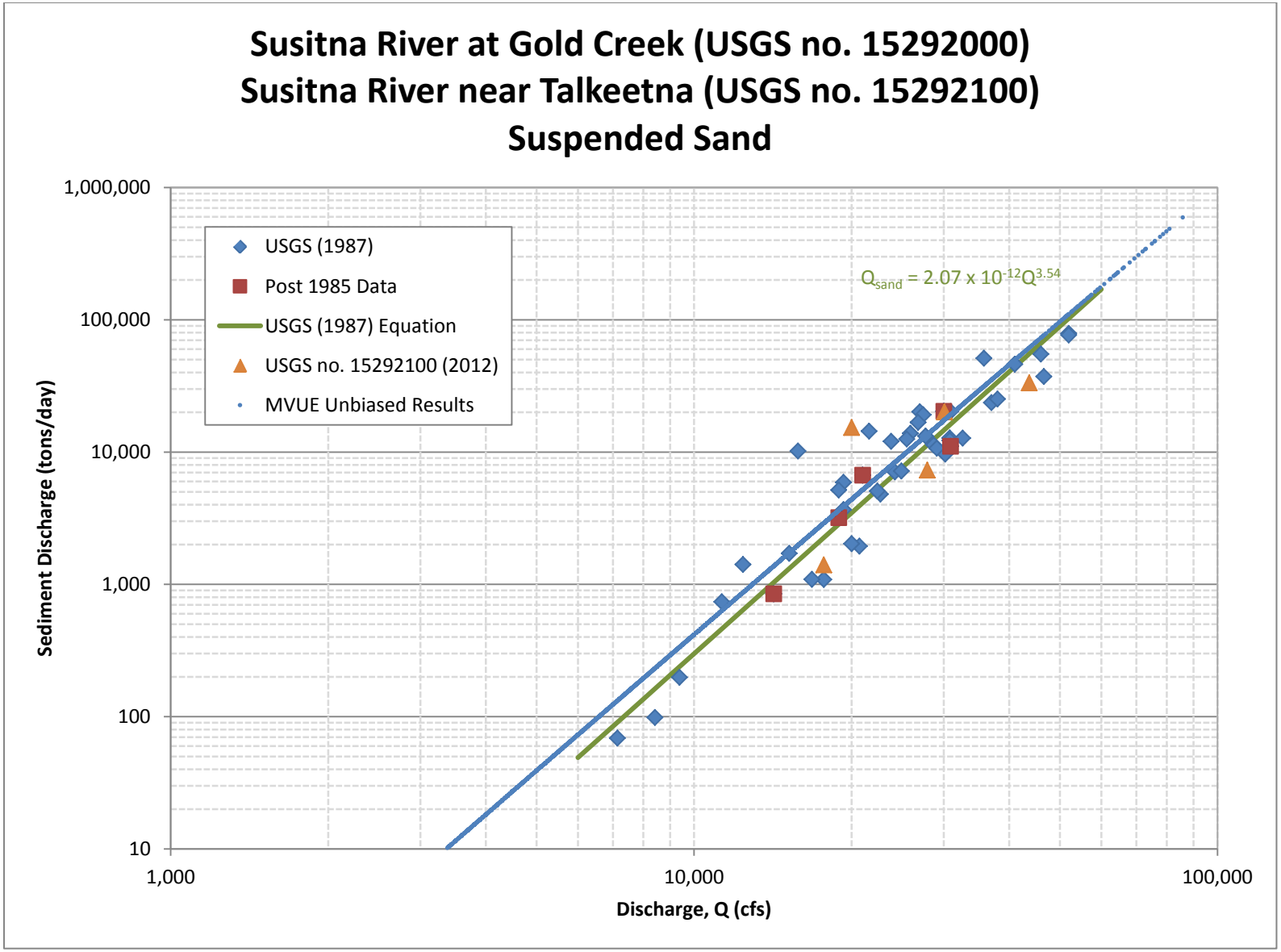

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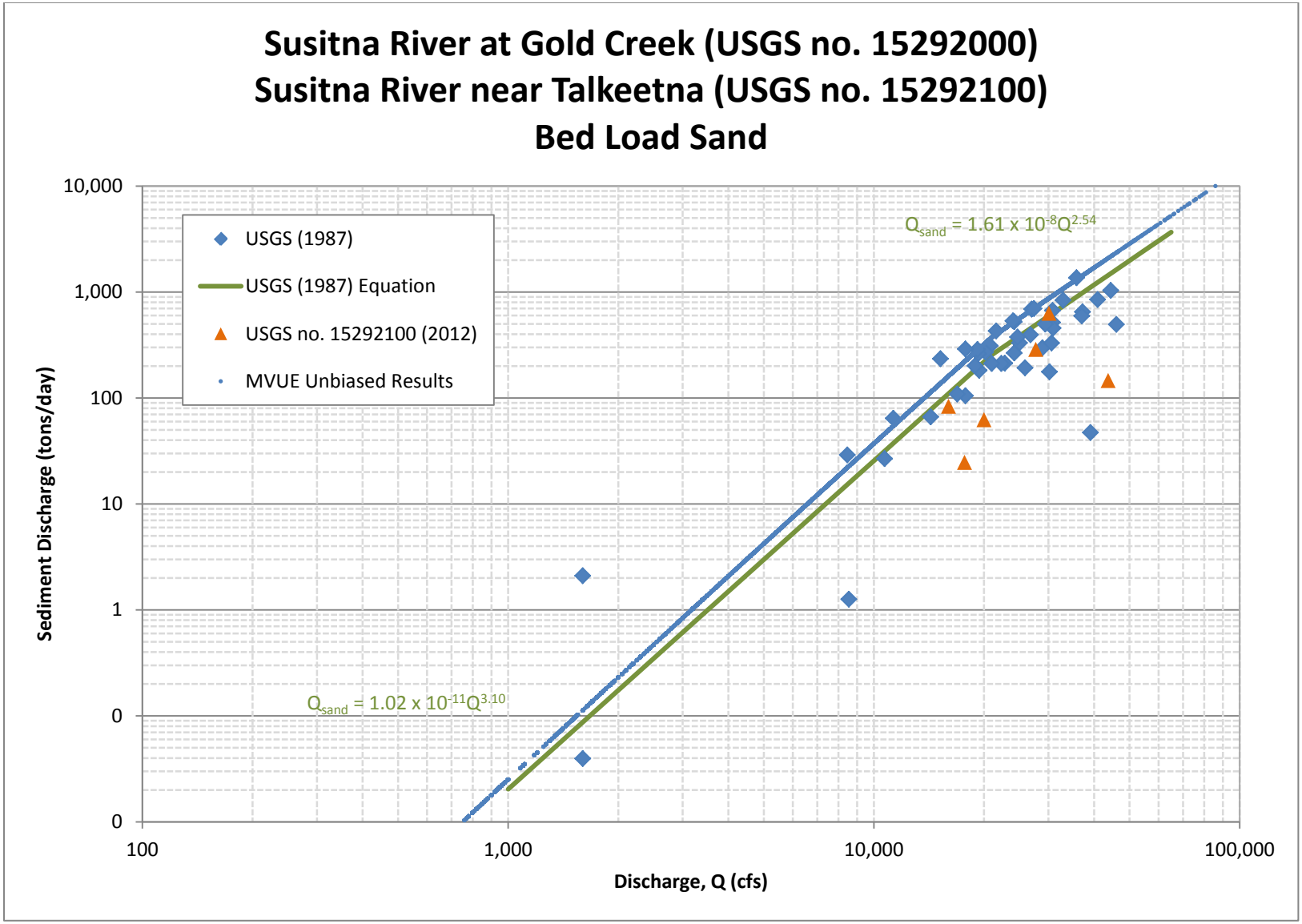

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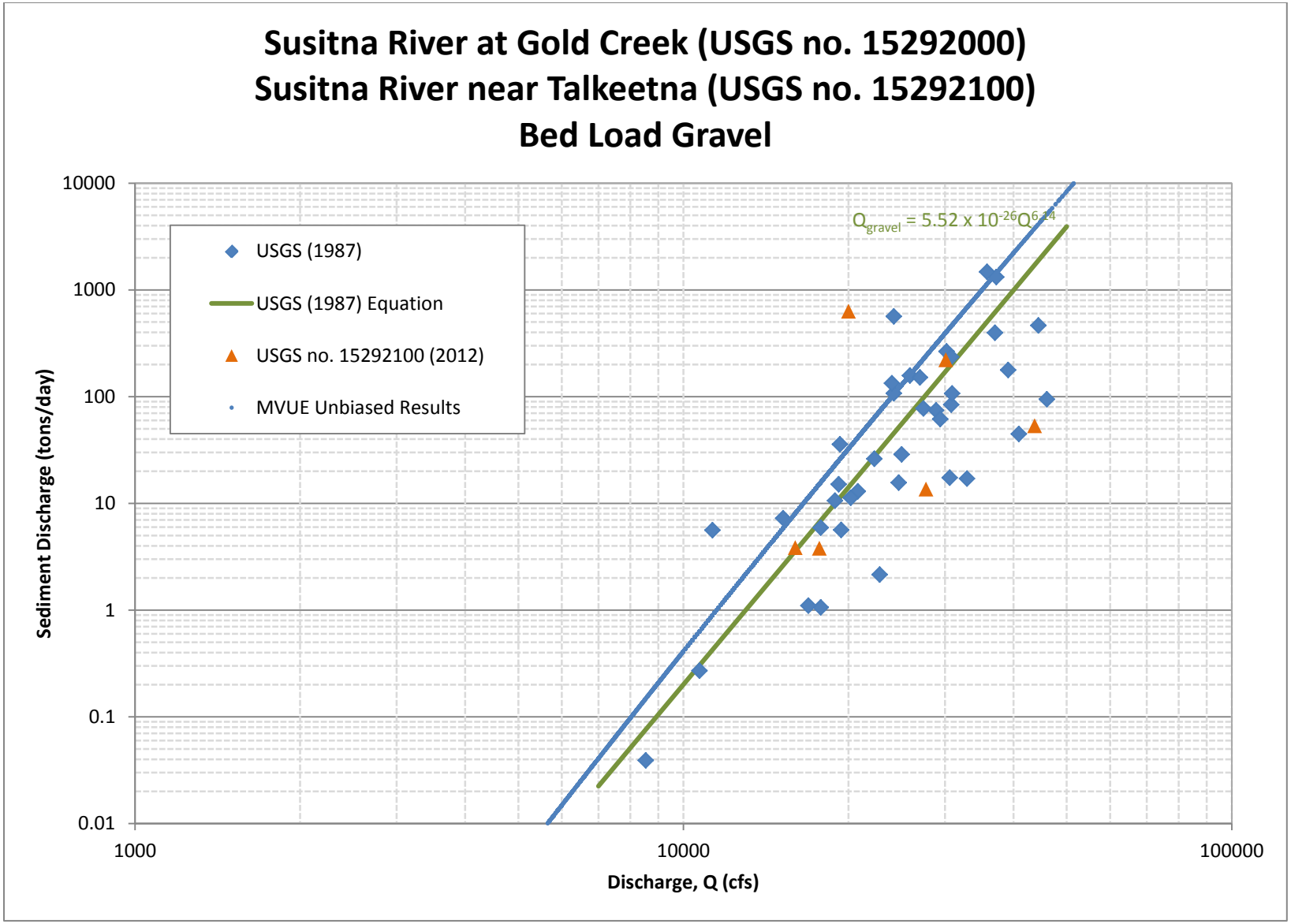

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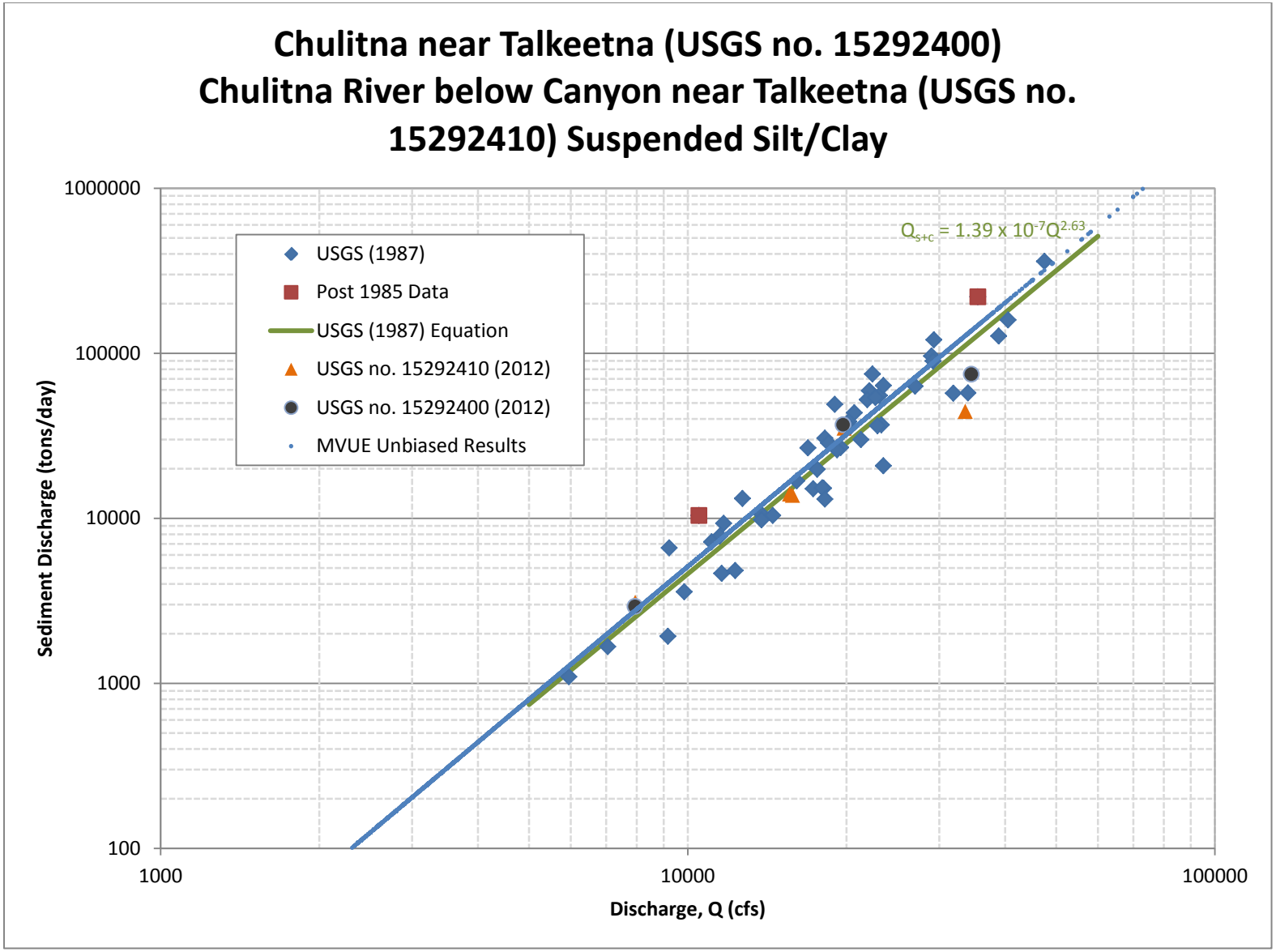

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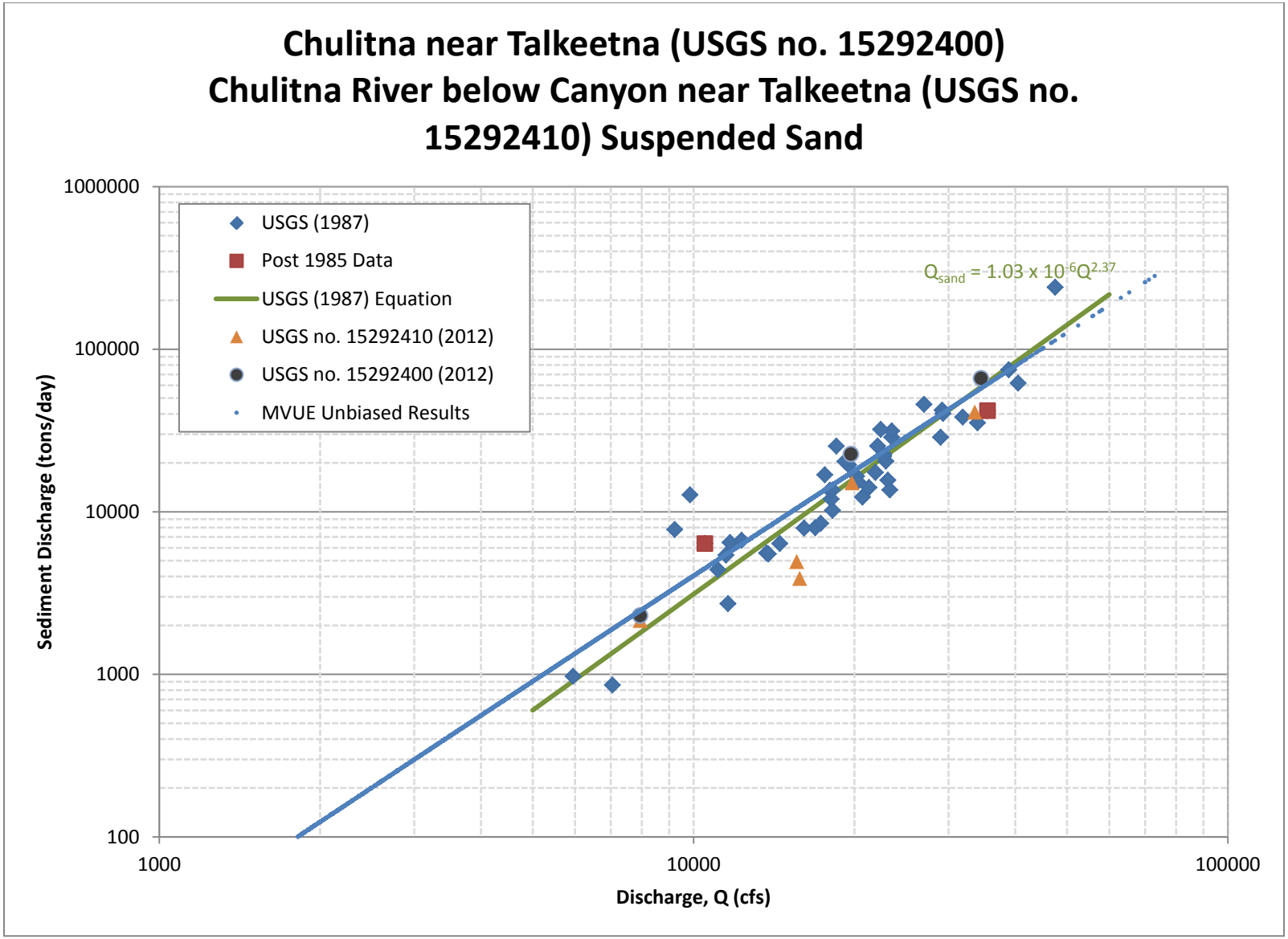

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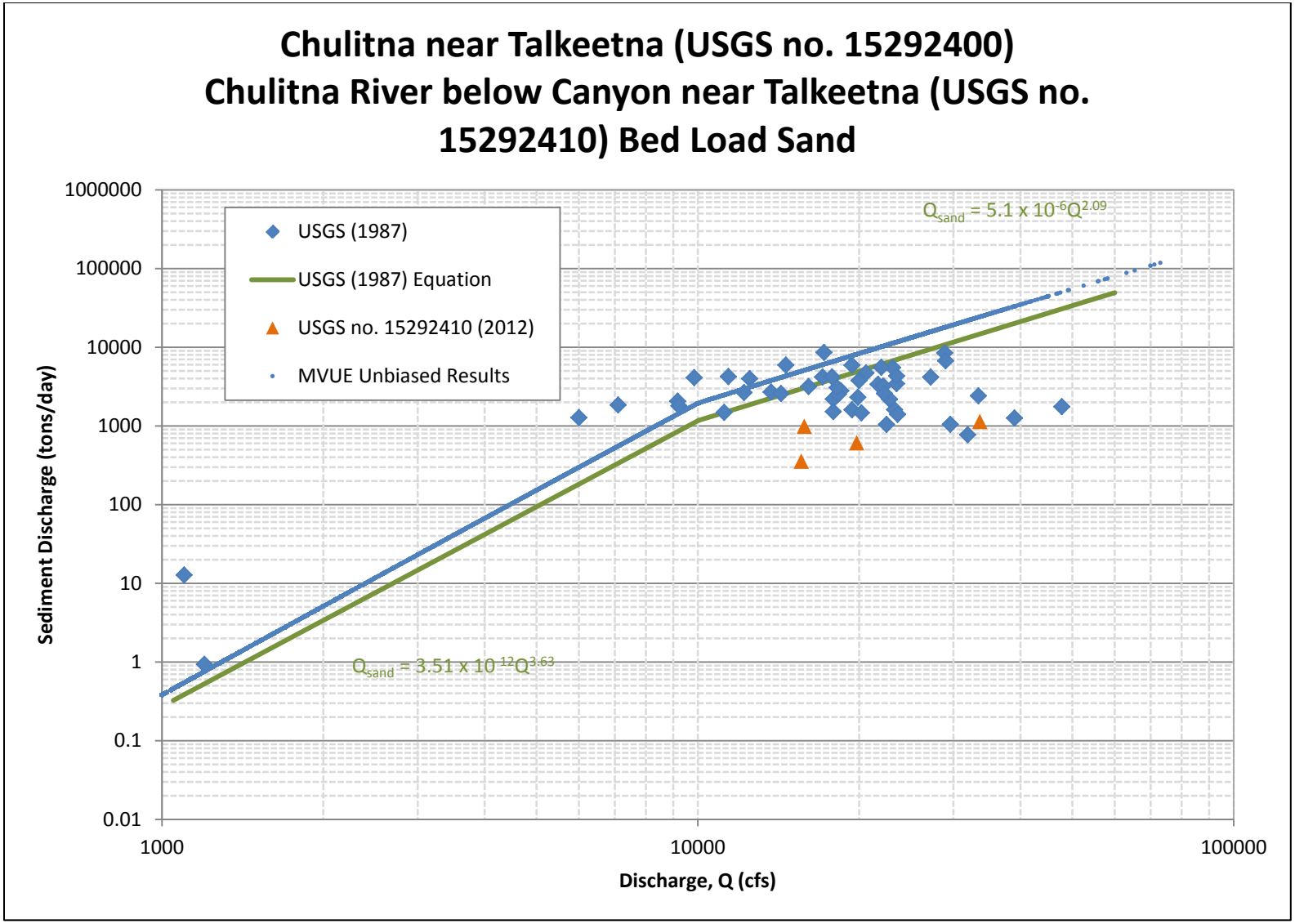

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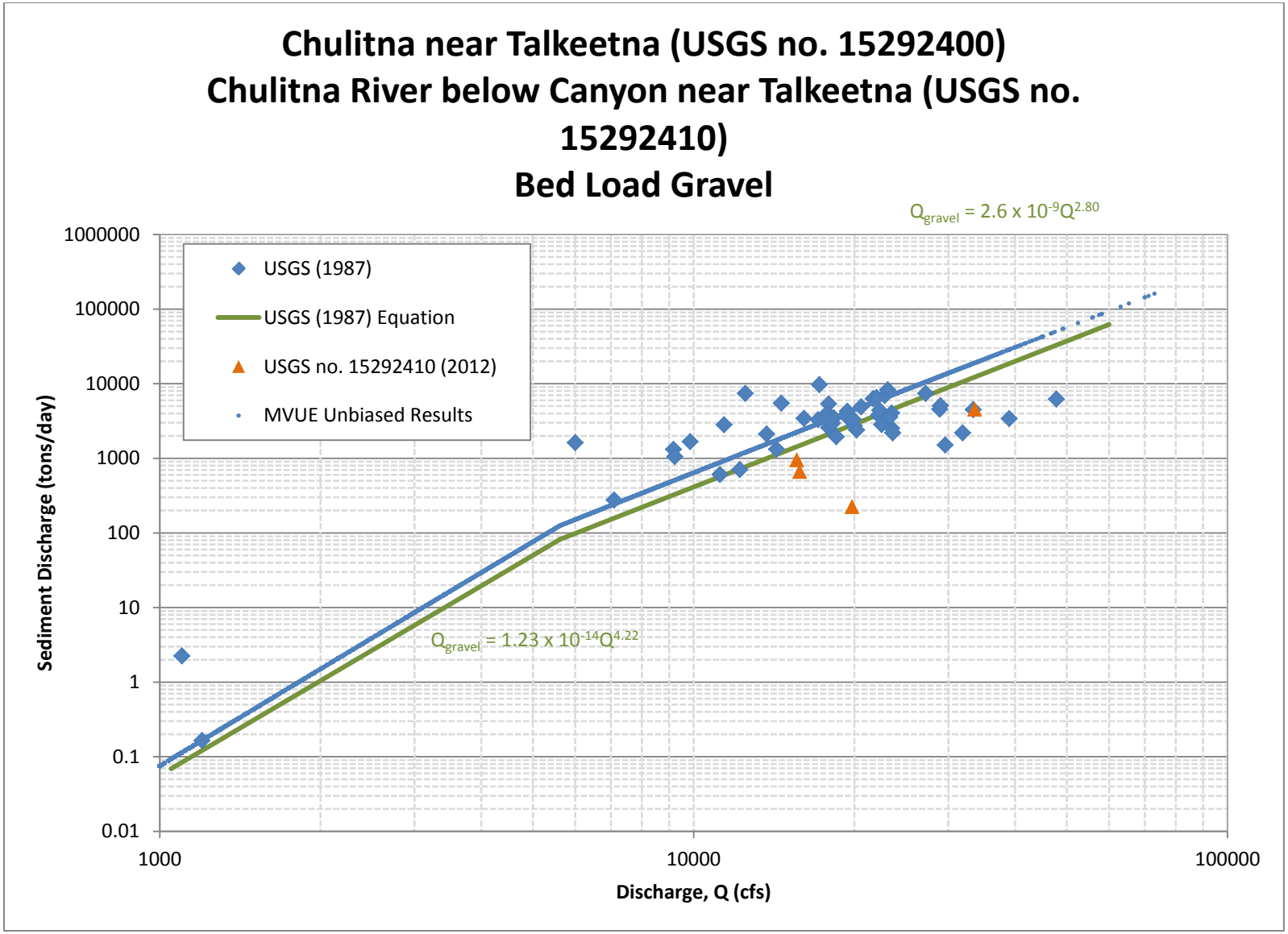

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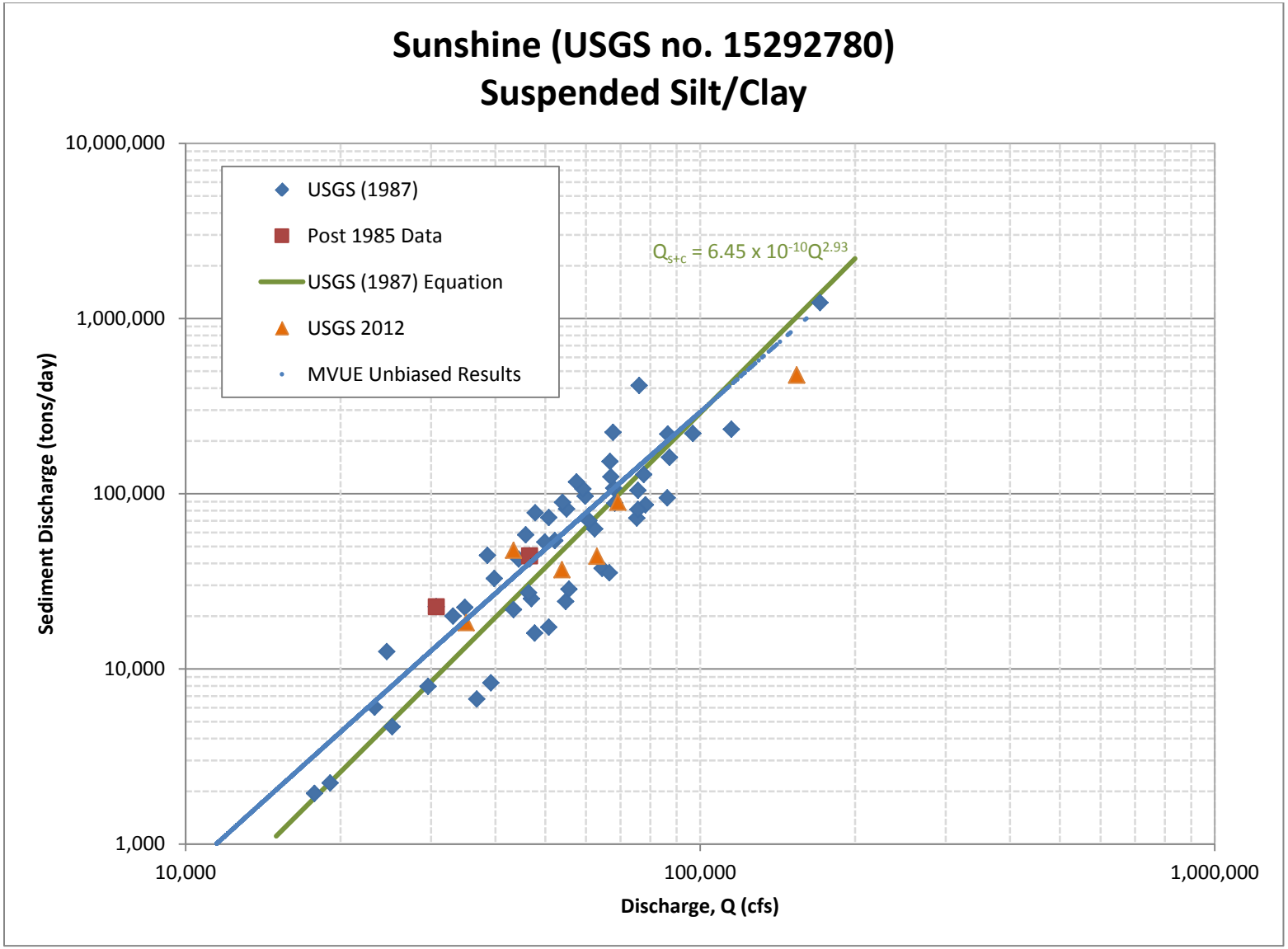

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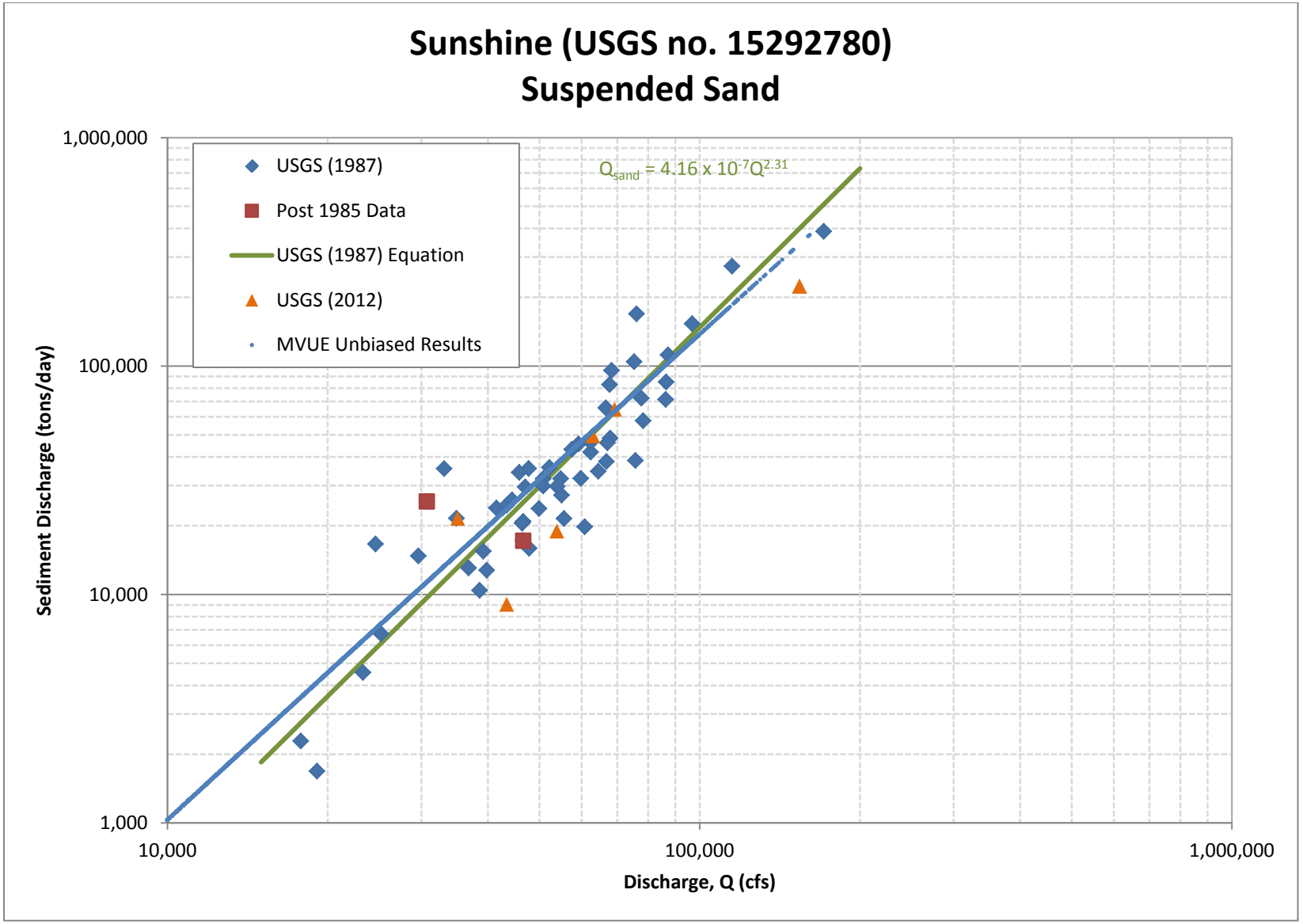

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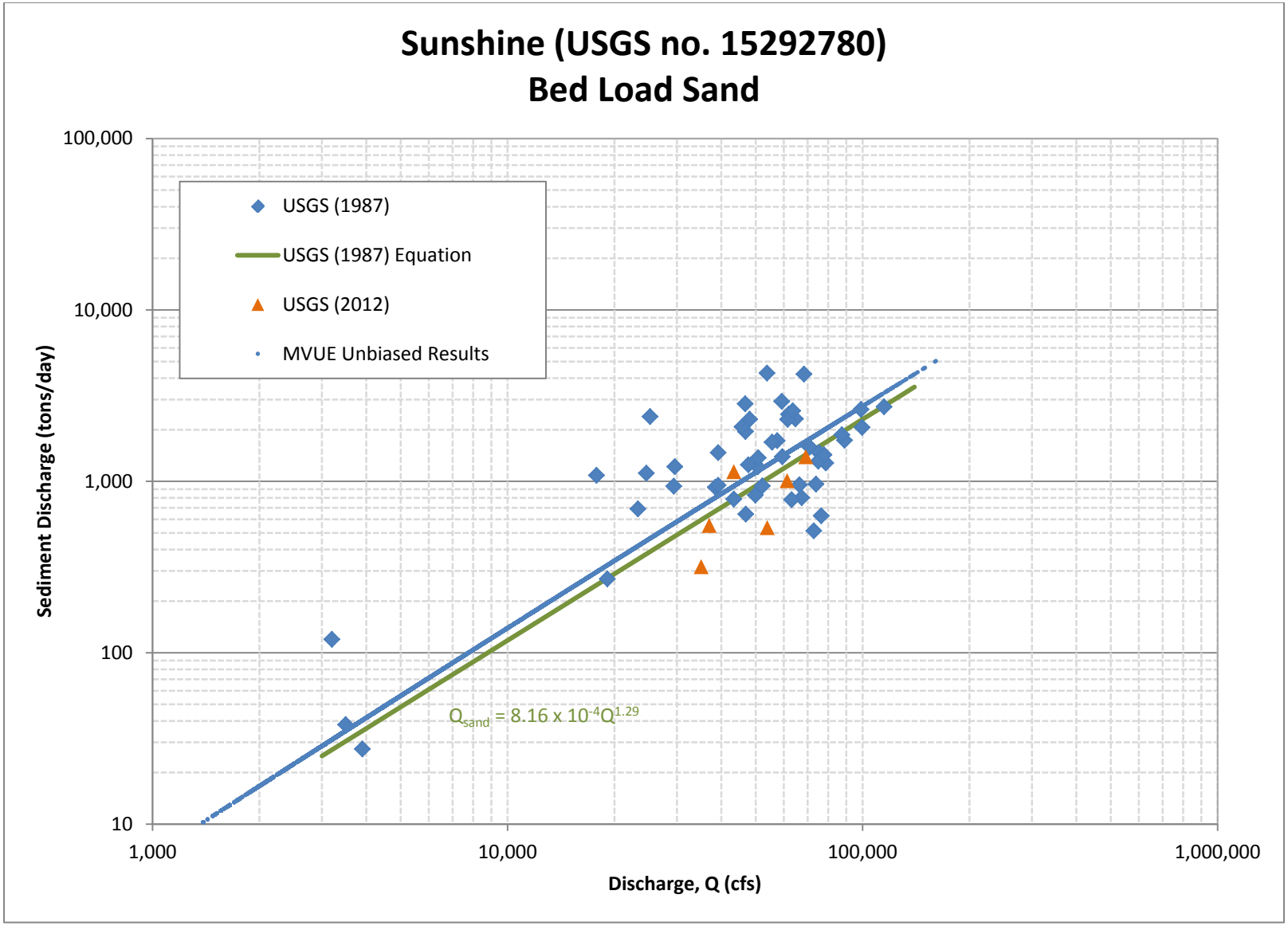

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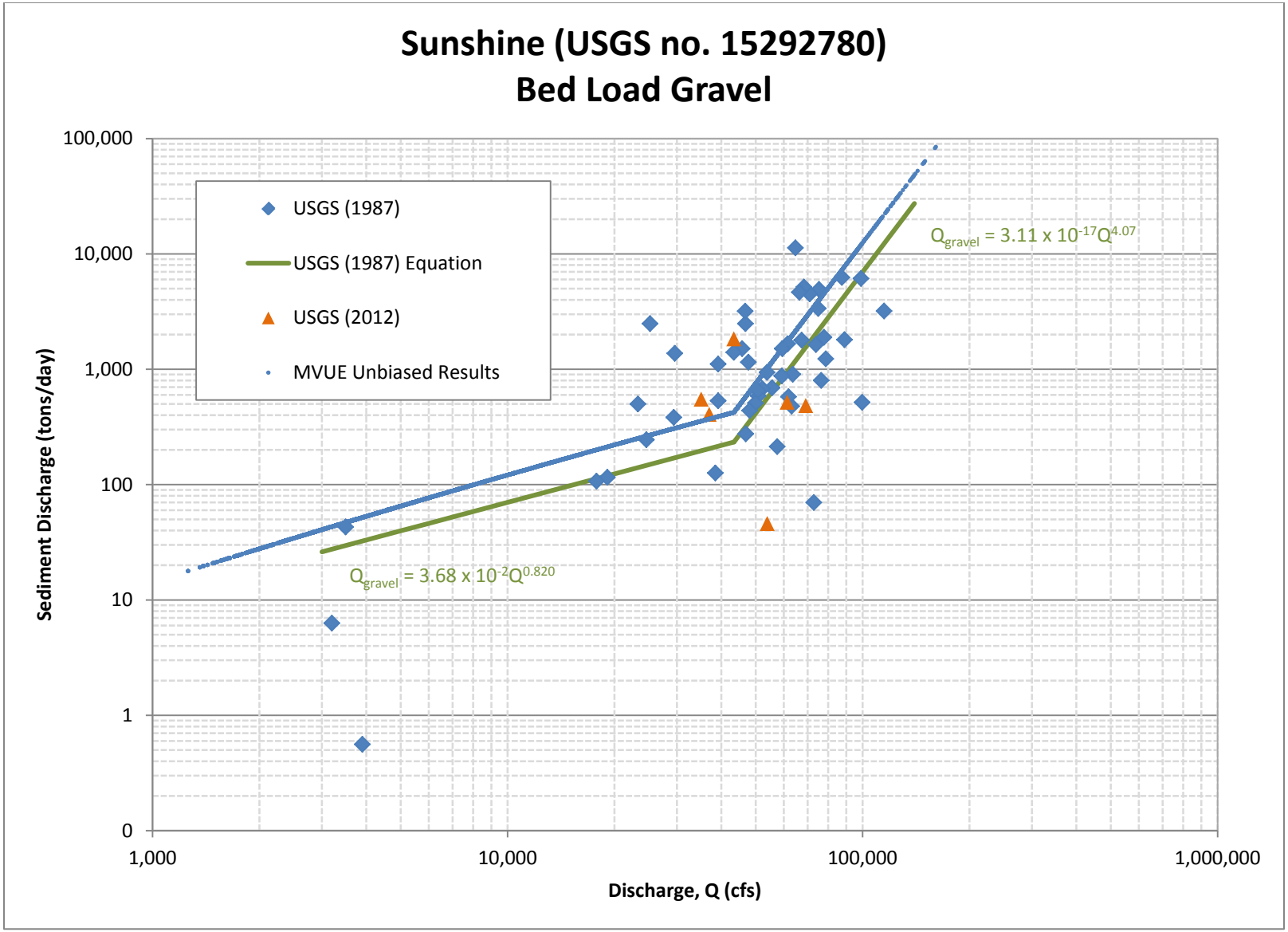

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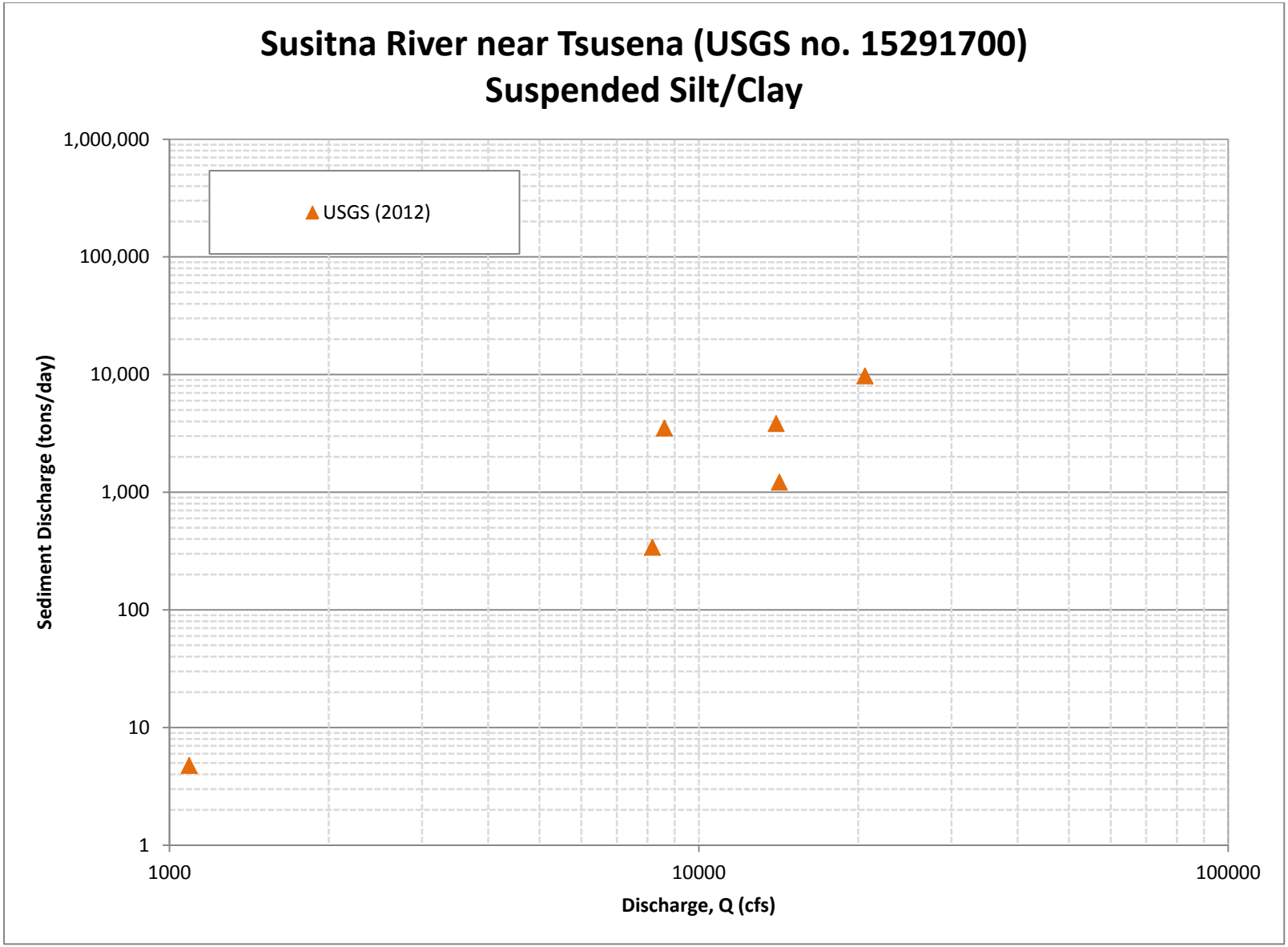

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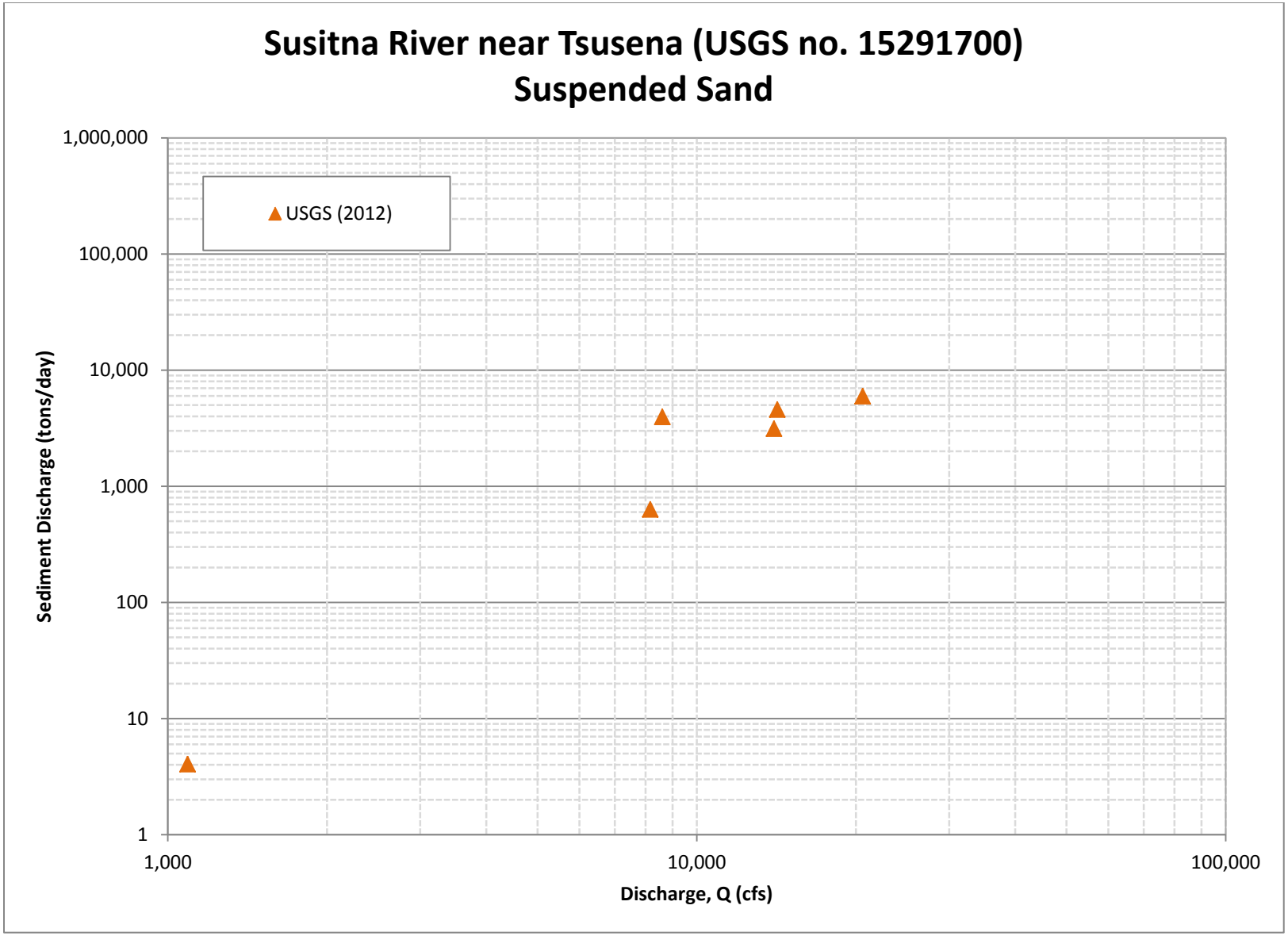

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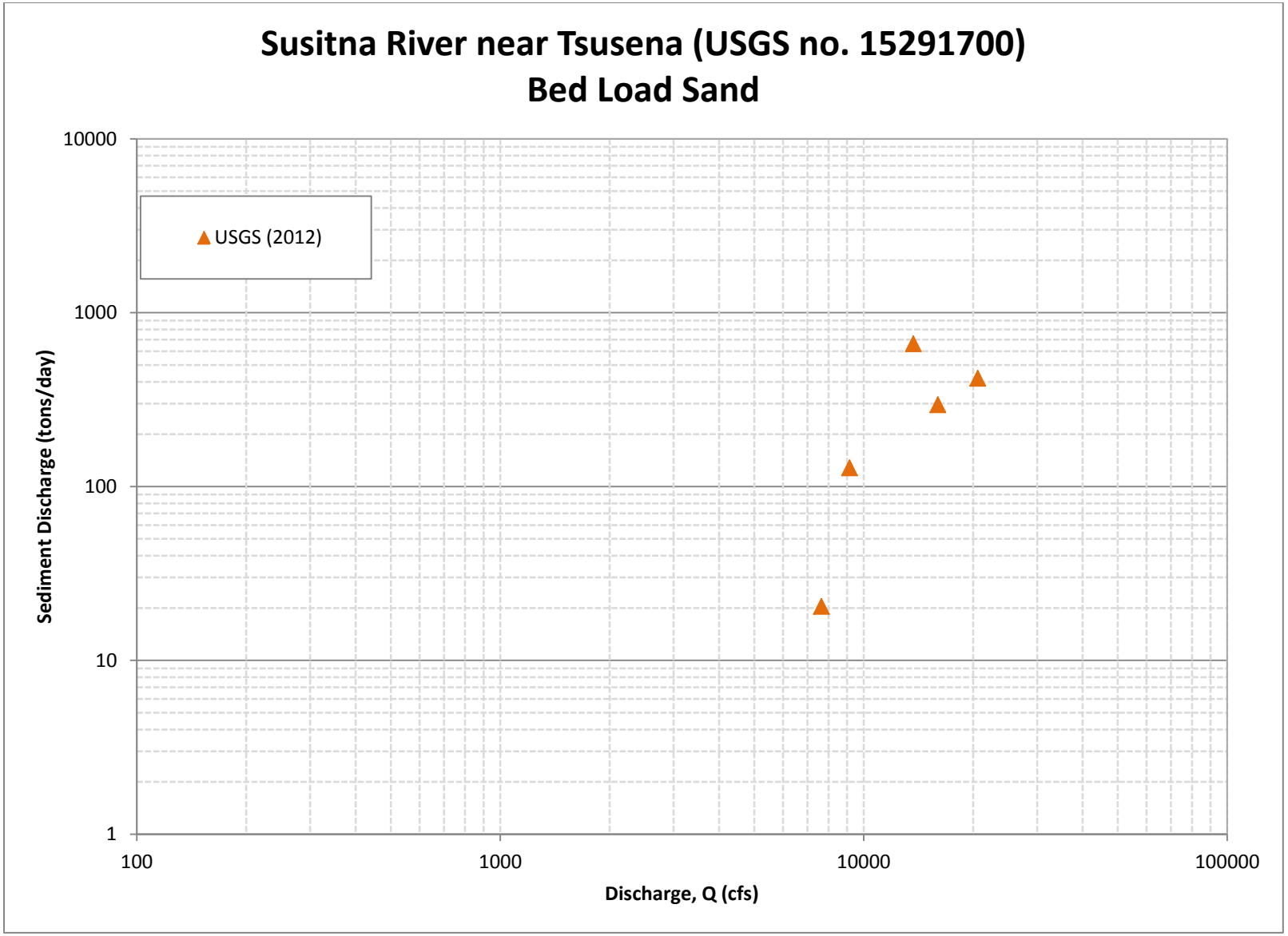

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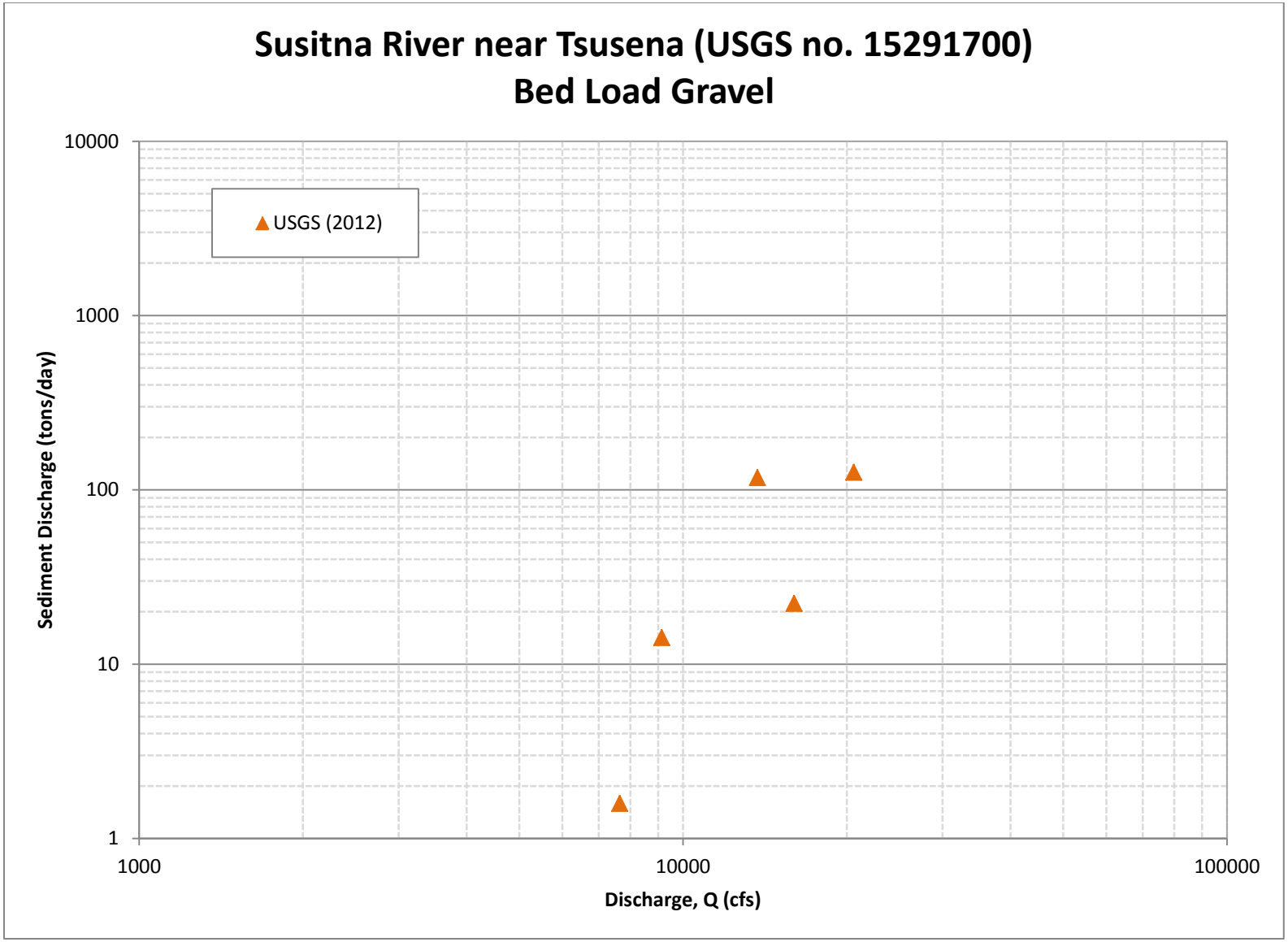

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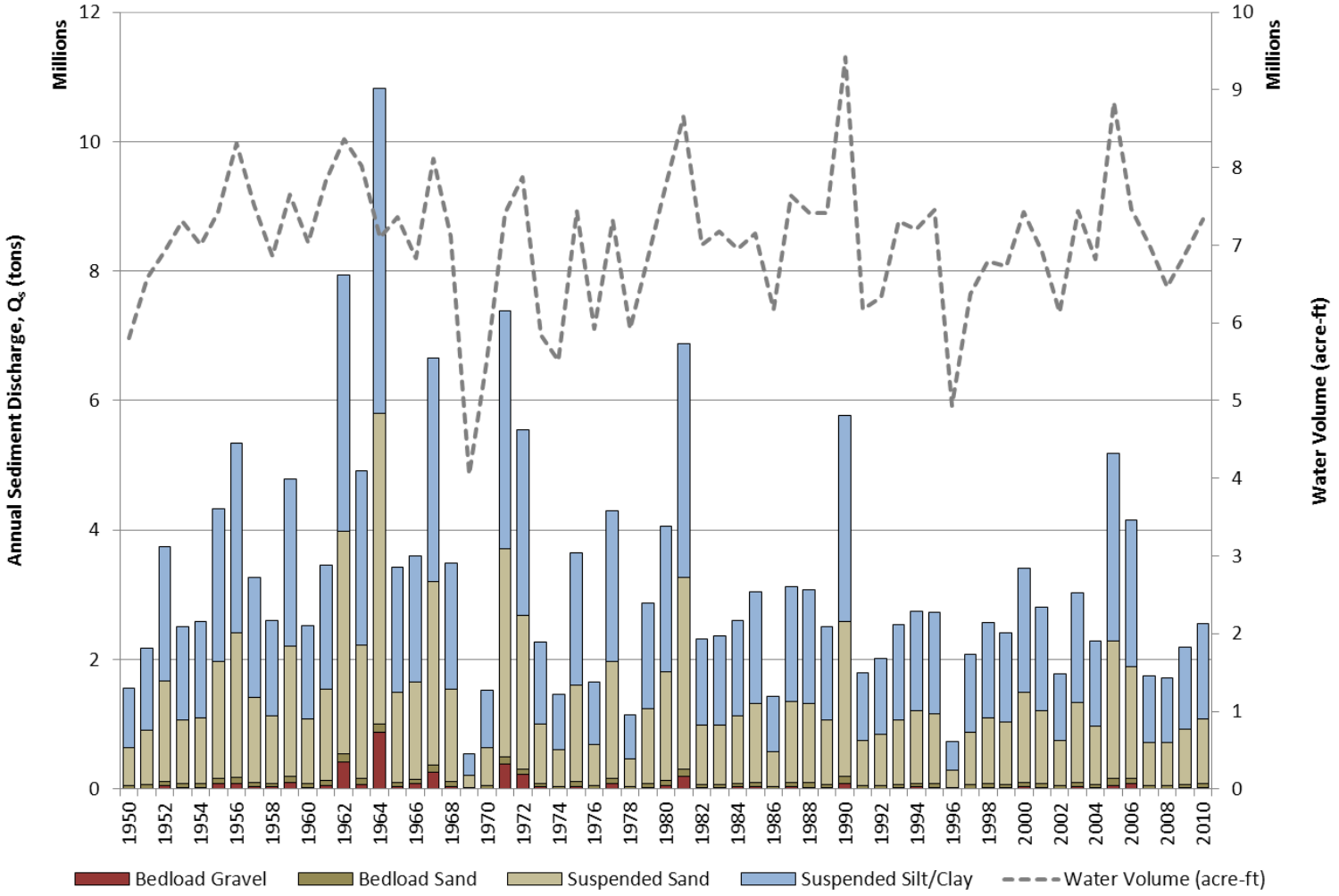
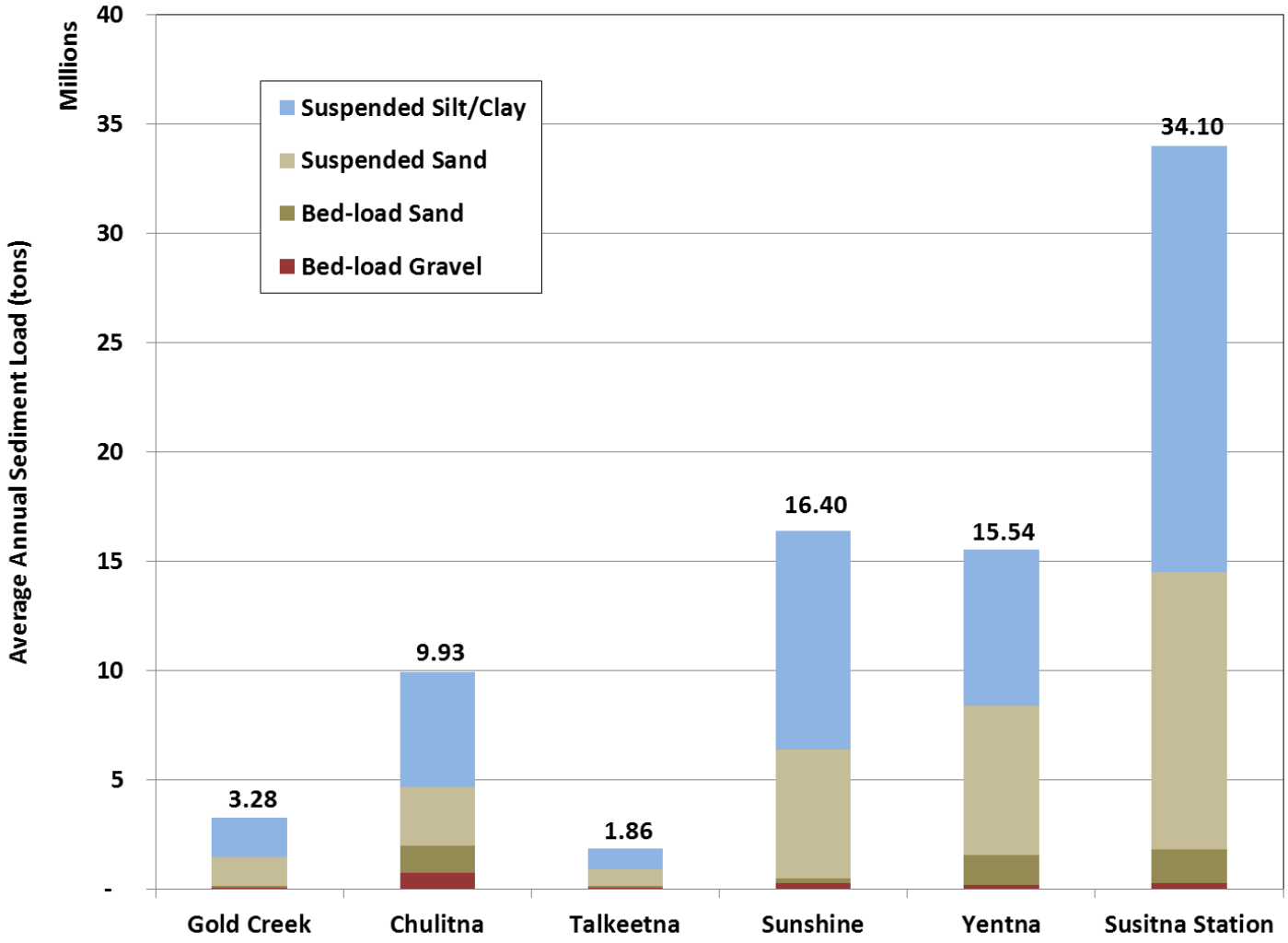


Figure 5.3-1. Estimated annual silt/clay, sand and gravel loads at the Gold Creek (Gage No. 15292000)/Susitna River near Talkeetna (Gage No. 15292100) gage over the 61-year period of flows under pre-Project conditions. Also shown is the annual flow volume for each of the years.



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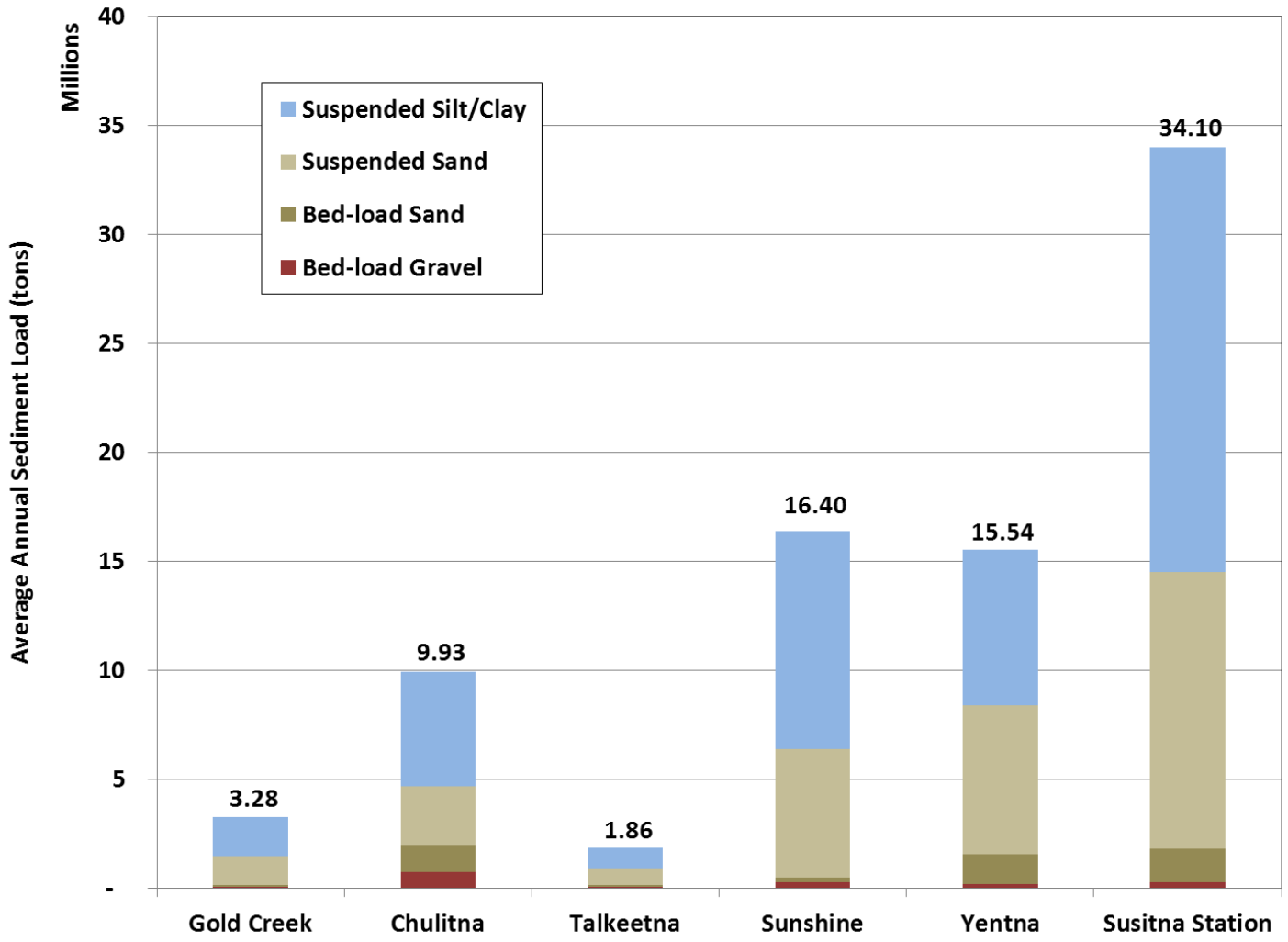

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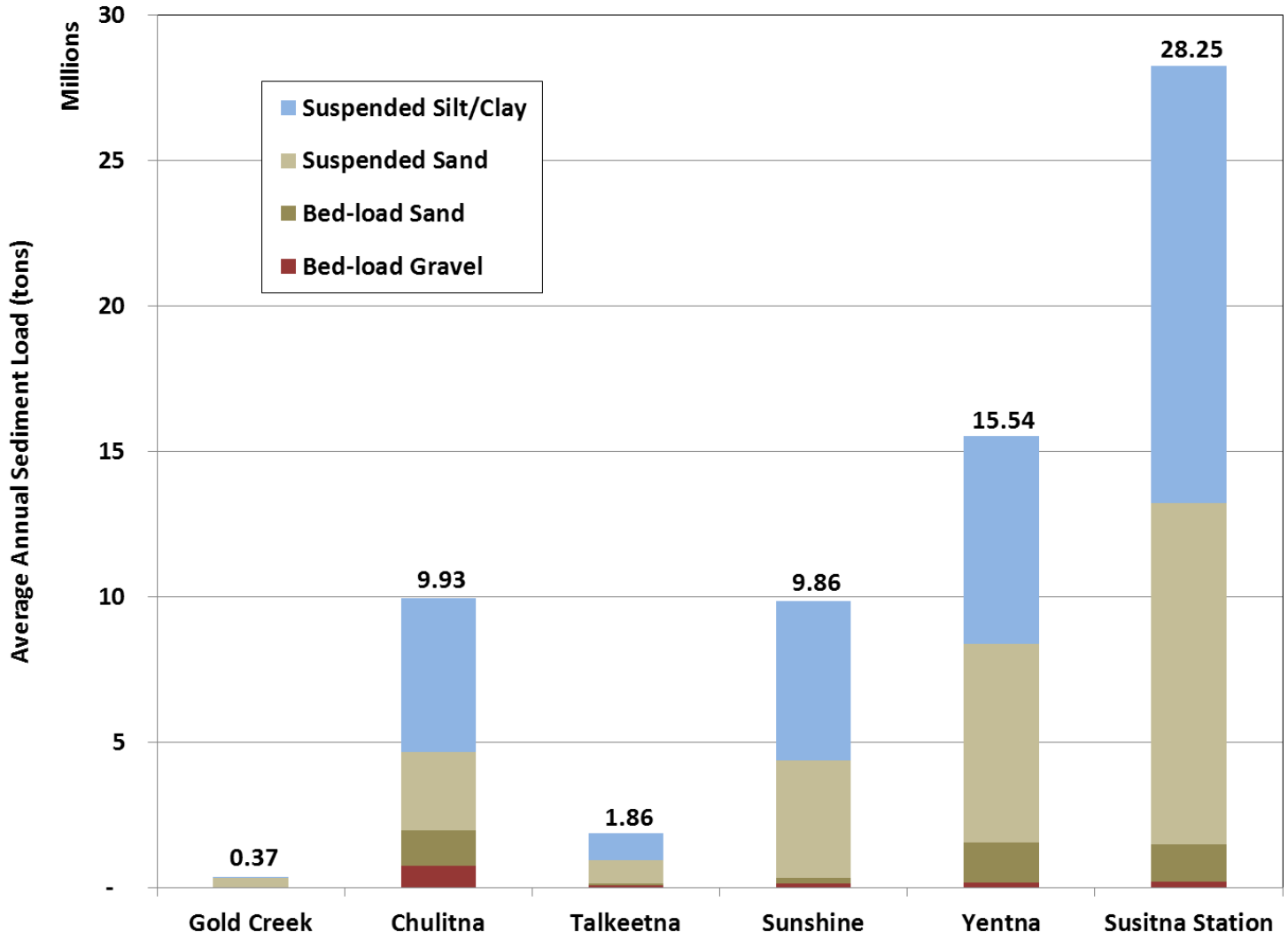

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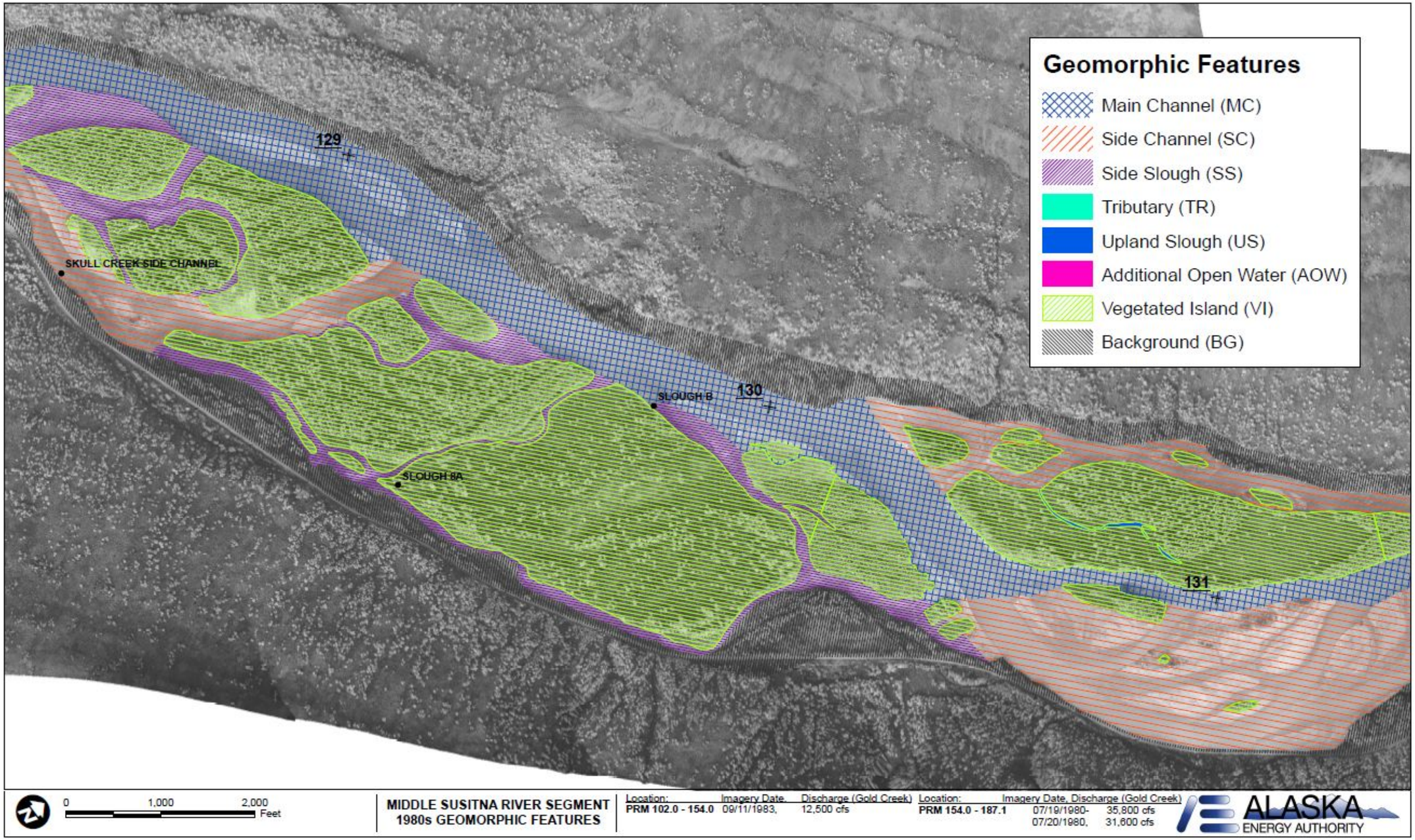
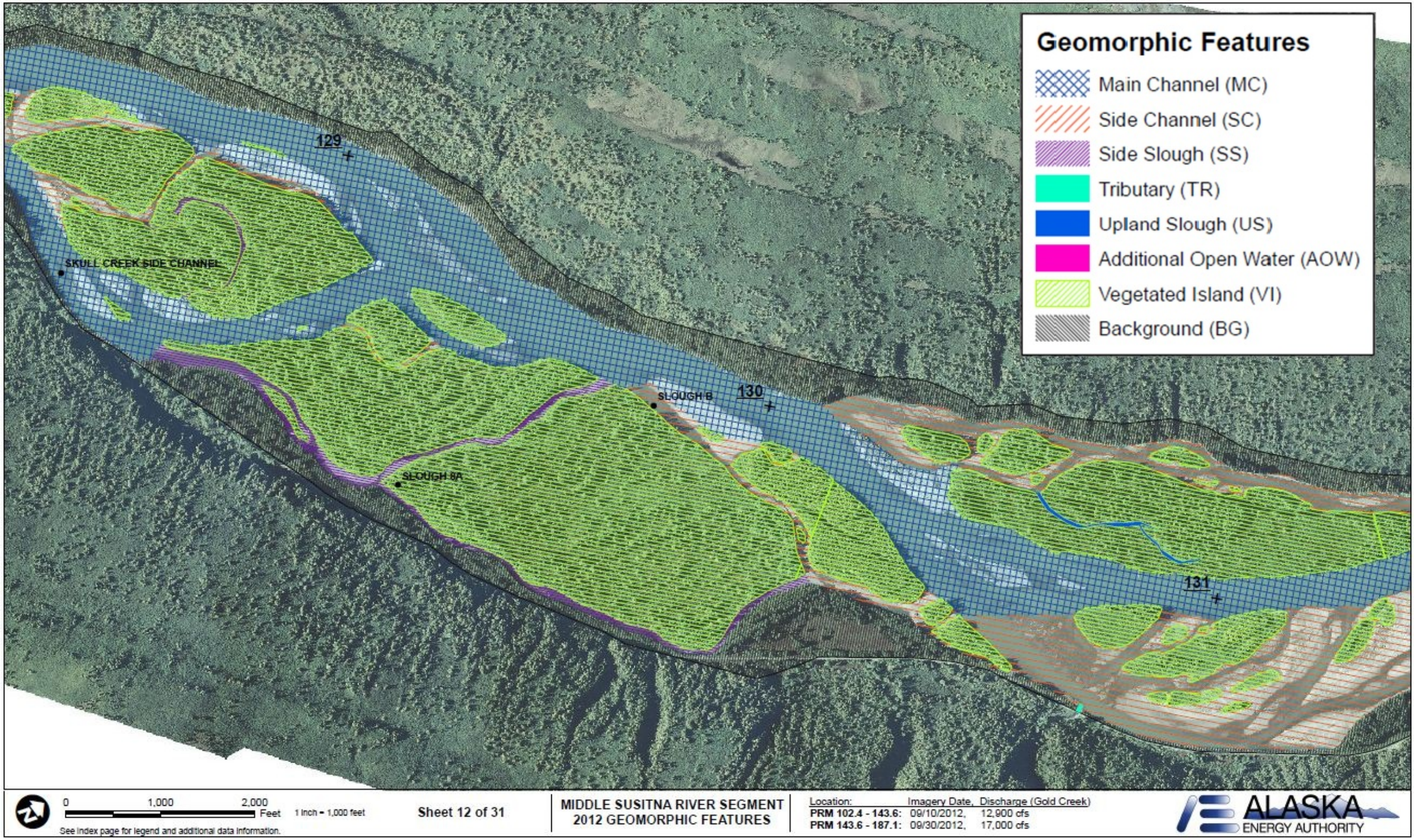


Figure 5.4-1: Example of 1980s Geomorphic Feature Mapping of the Middle River.



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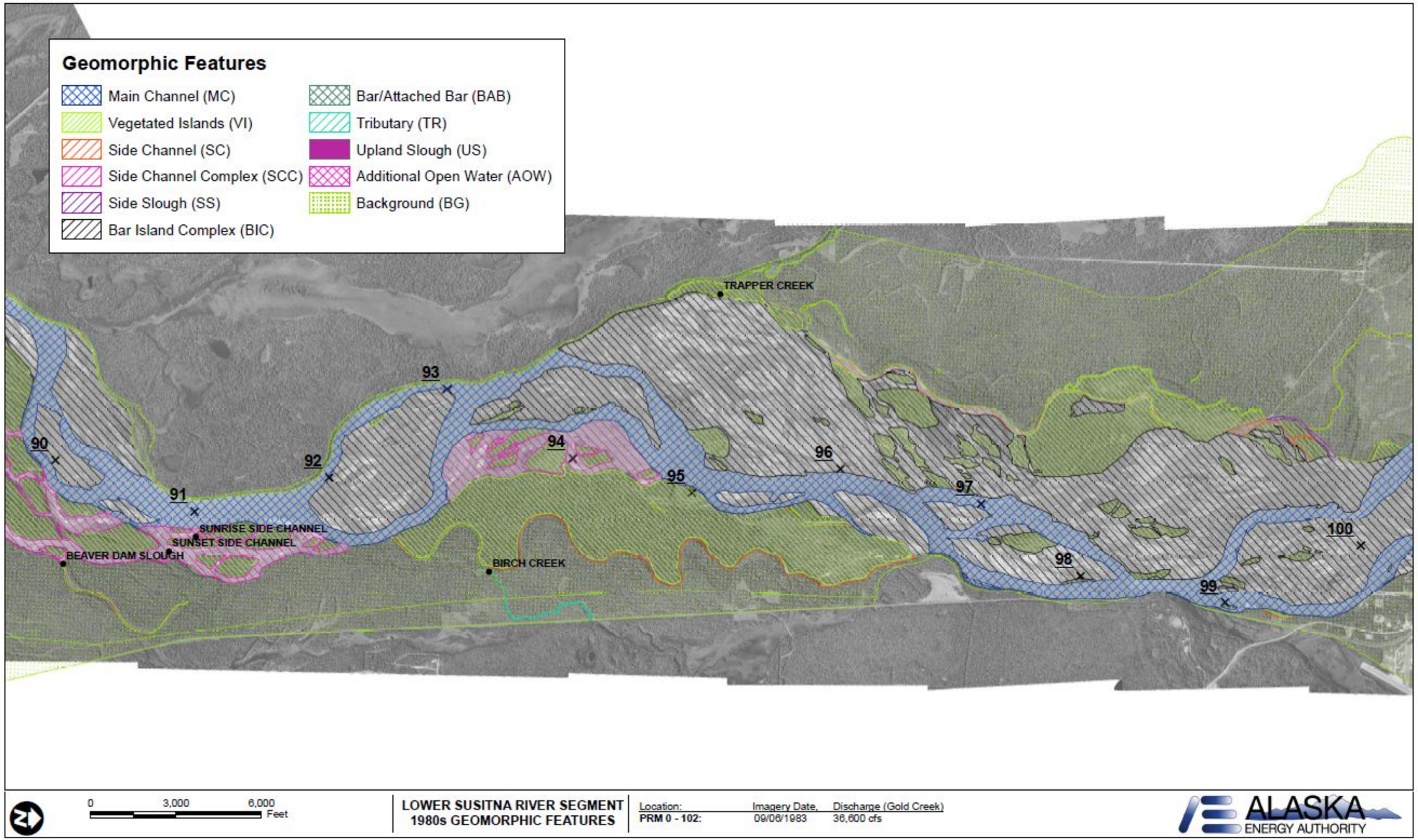

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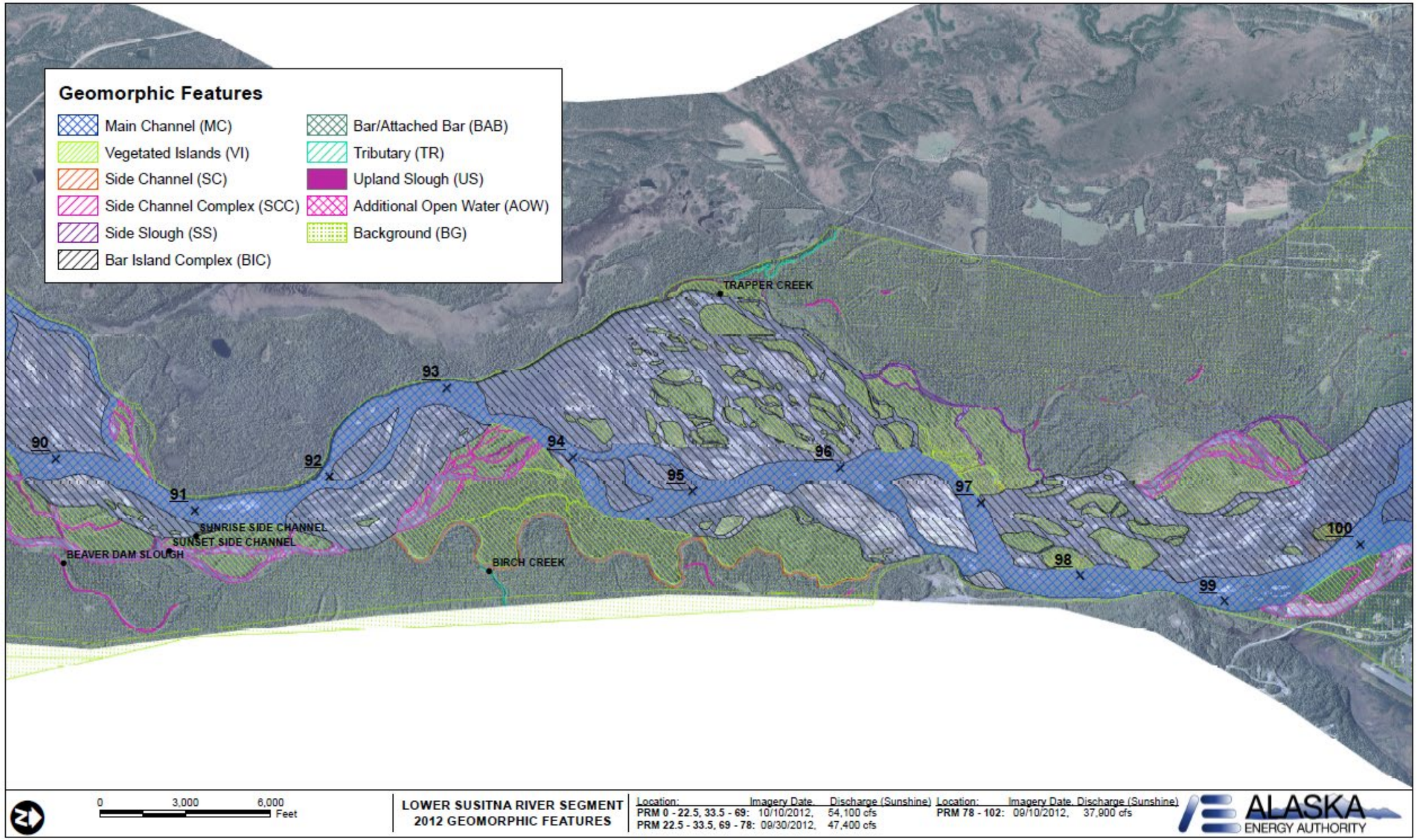

Figure 5.4-4: Example of 2012 Geomorphic Feature Mapping of the Lower River.

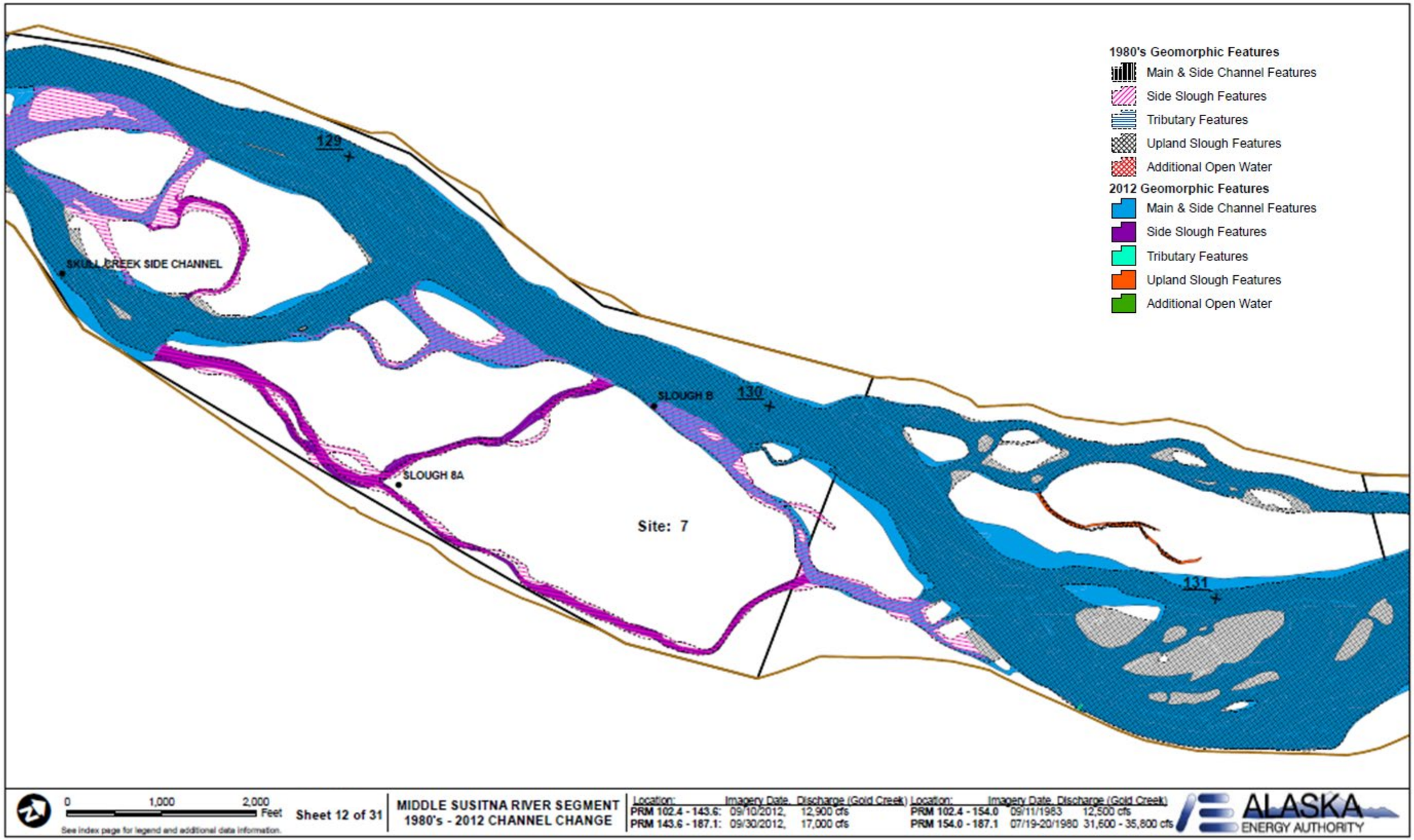

Figure 5.4-5: Example of 1980s Geomorphic Feature Overlay Mapping of the Middle River.

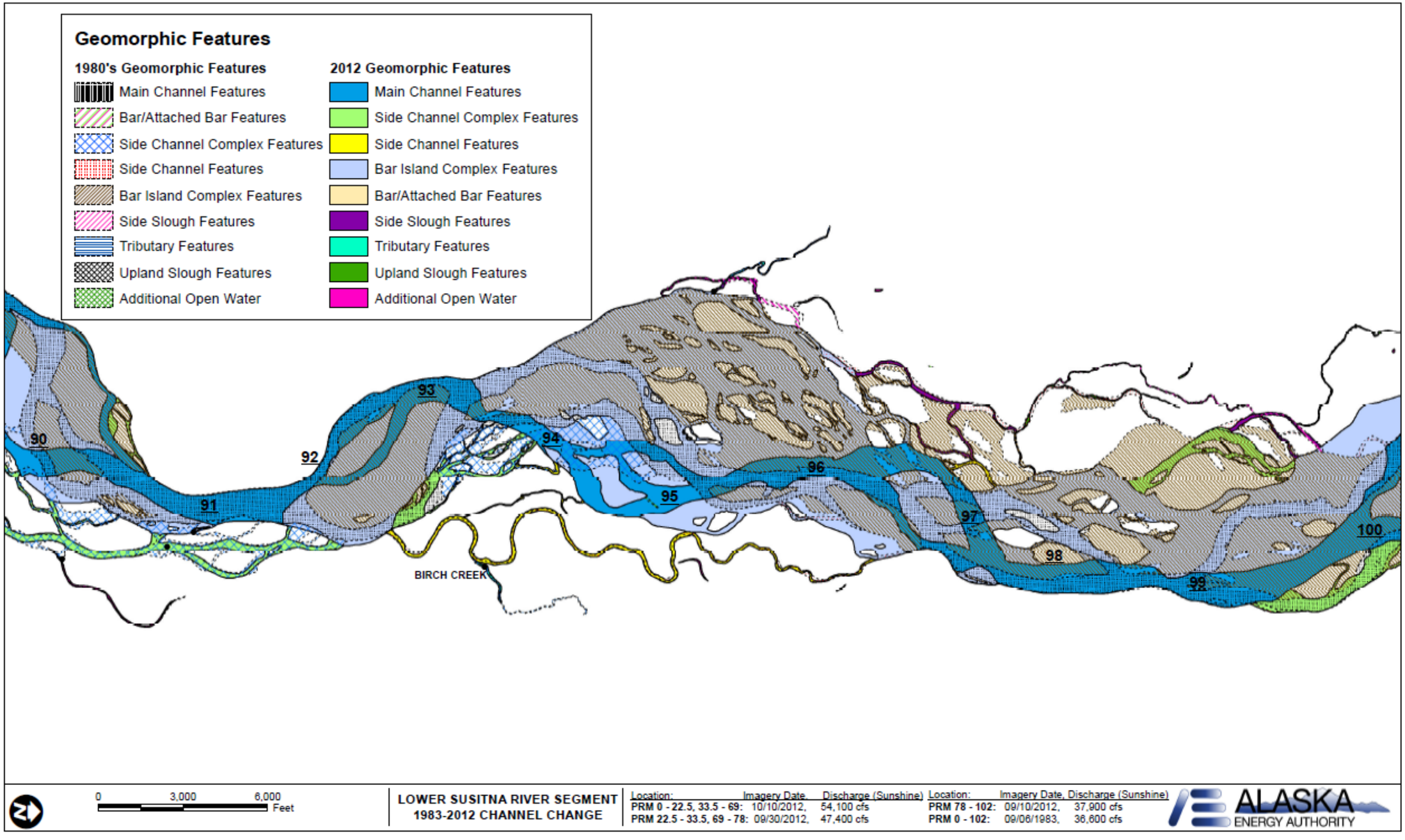

Figure 5.4-6: Example of 1980s Geomorphic Feature Overlay Mapping of the Lower River.

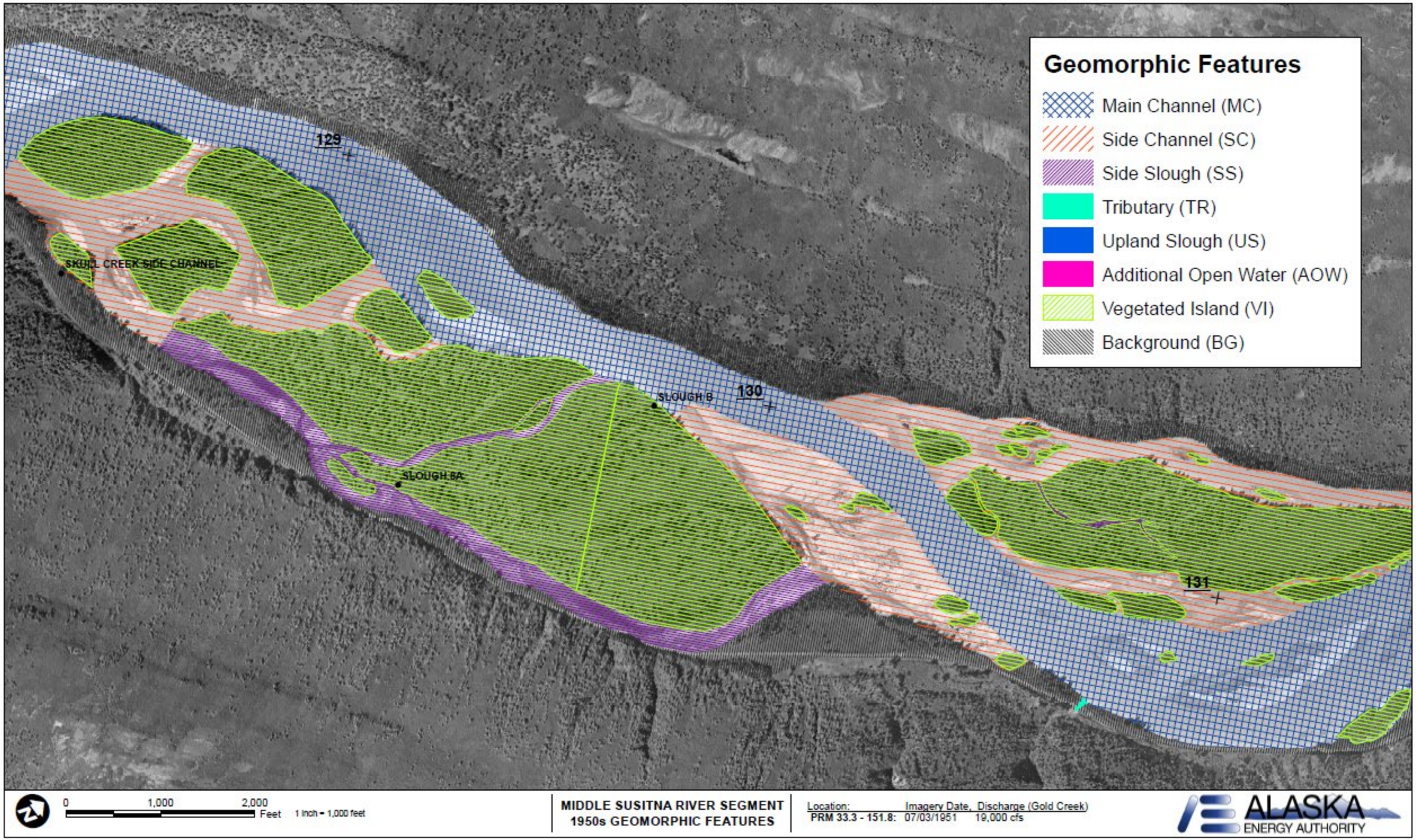

Figure 5.4-7: Example of 1950s Geomorphic Feature Mapping of the Middle River.

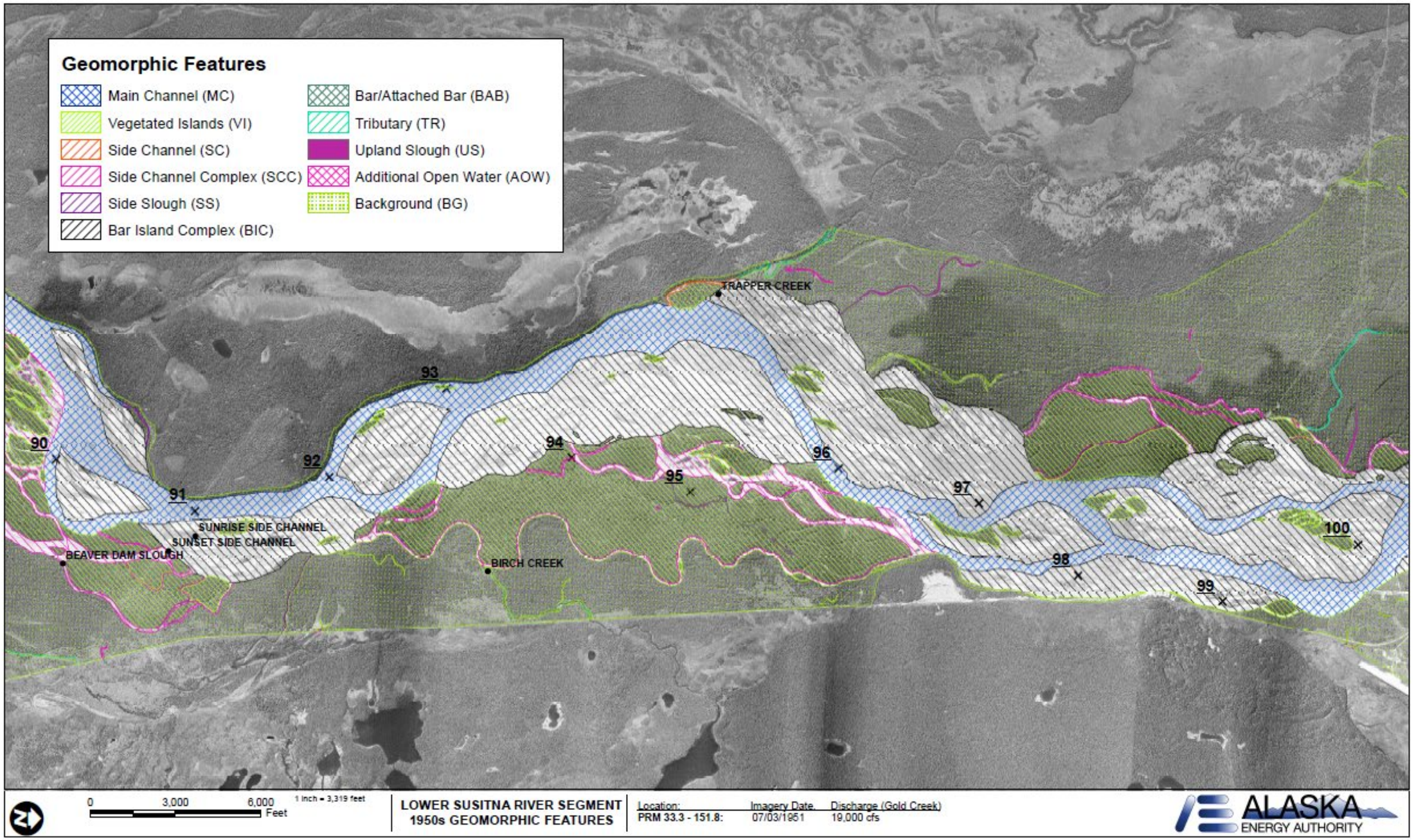

Figure 5.4-8: Example of 1950s Geomorphic Feature Mapping of the Lower River.

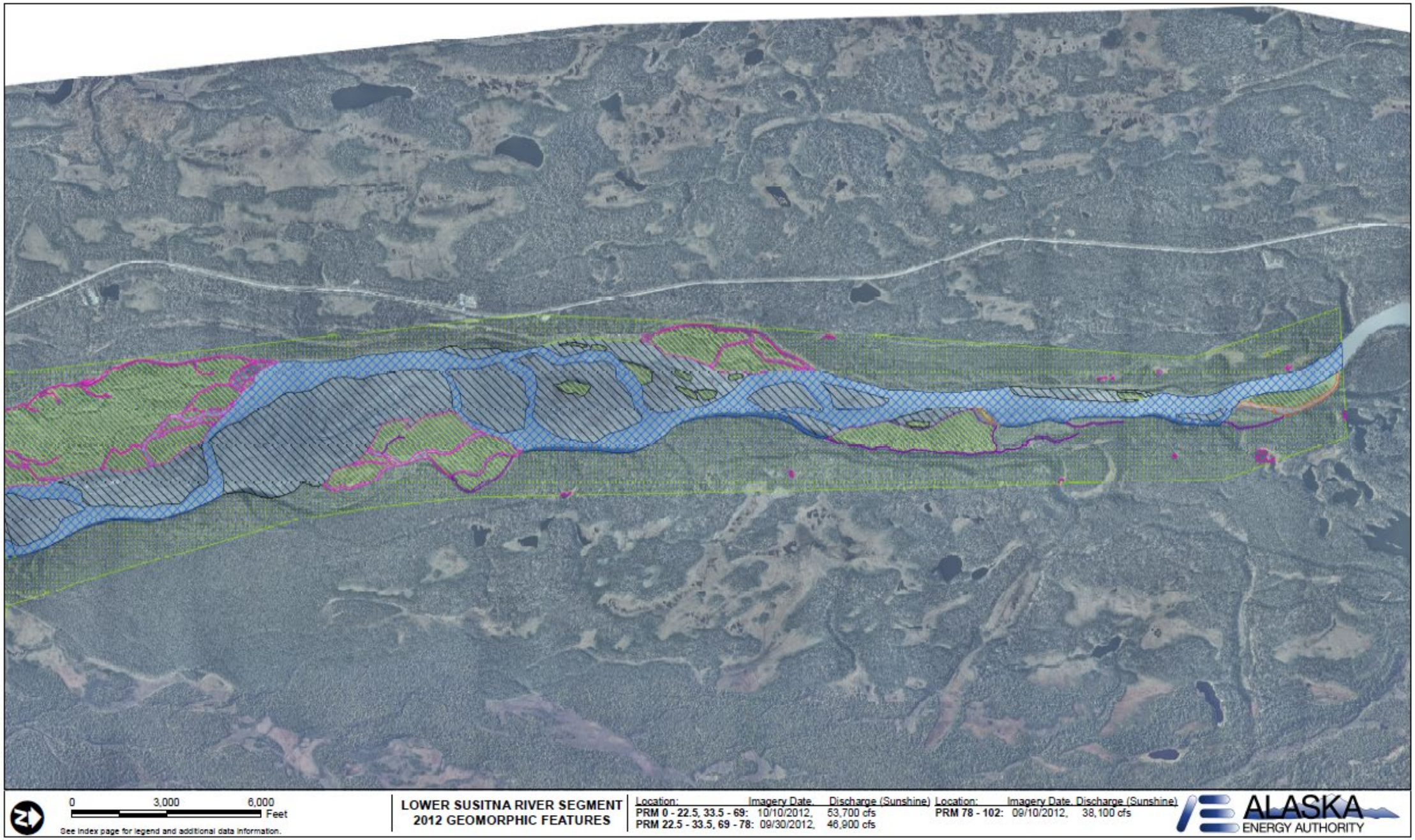

Figure 5.4-9: Extended 2012 Geomorphic Feature Mapping of the Chulitna River.

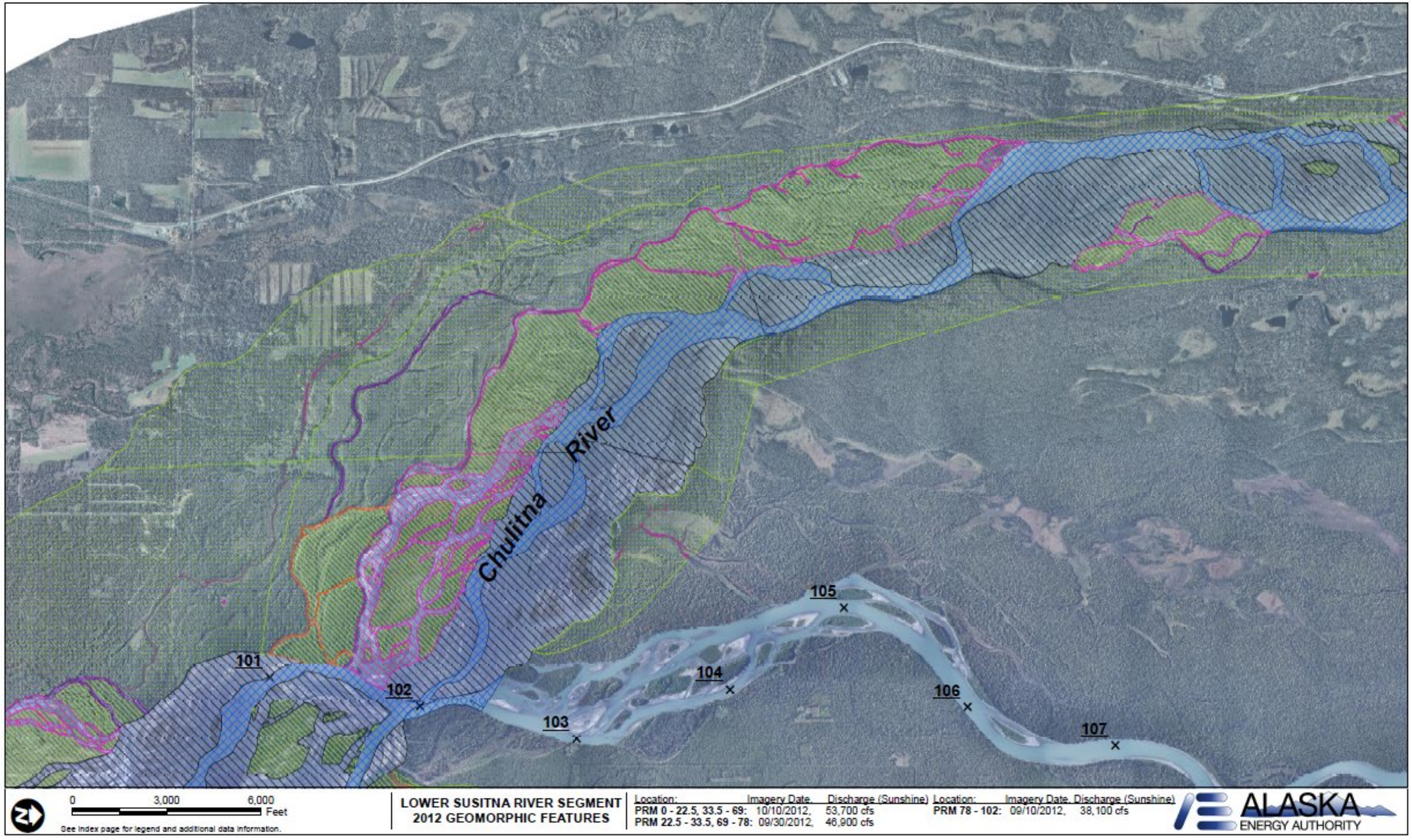

Figure 5.4-10: Extended 2012 Geomorphic Feature Mapping of the Chulitna River.

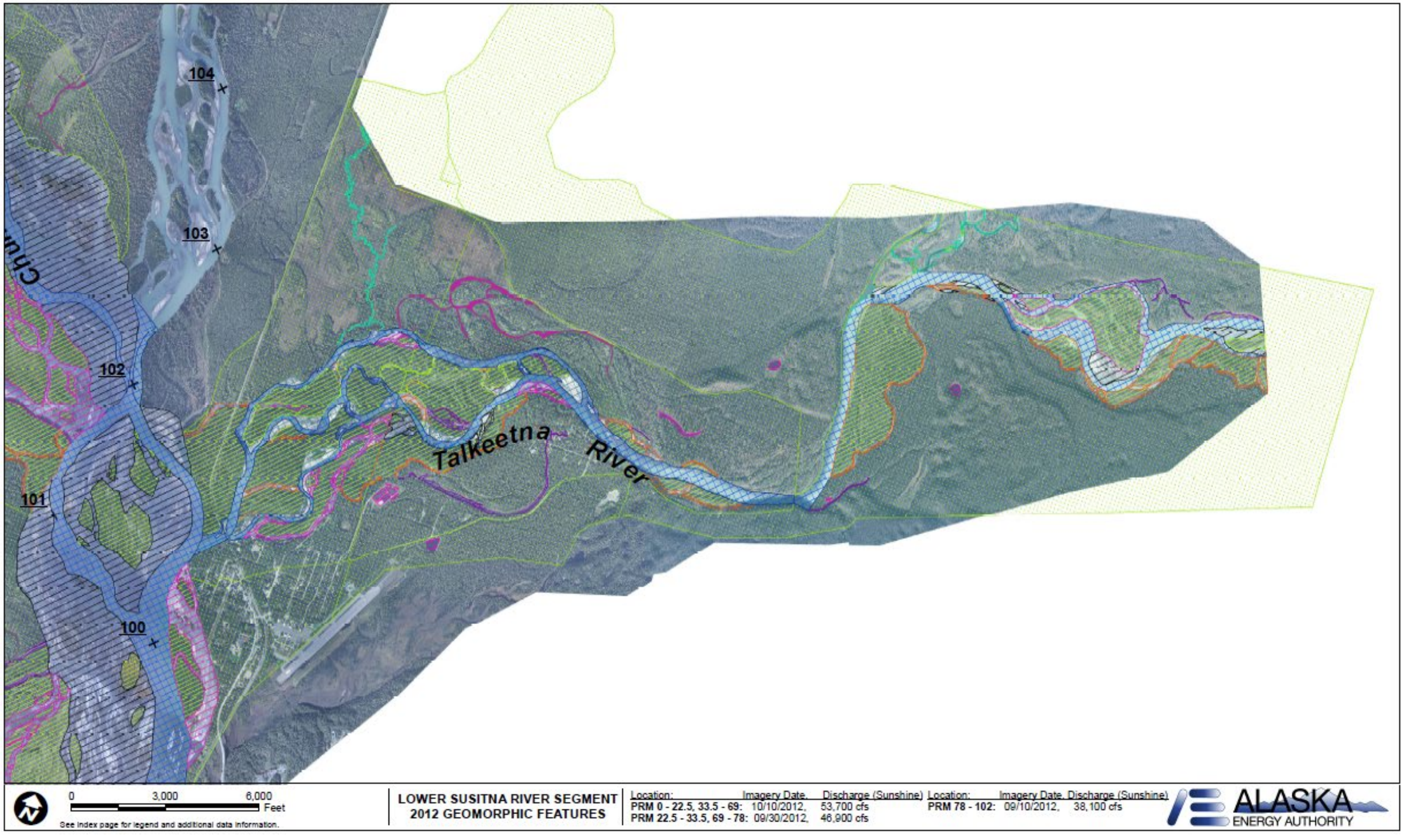

Figure 5.4-11: Extended 2012 Geomorphic Feature Mapping of the Talkeetna River.

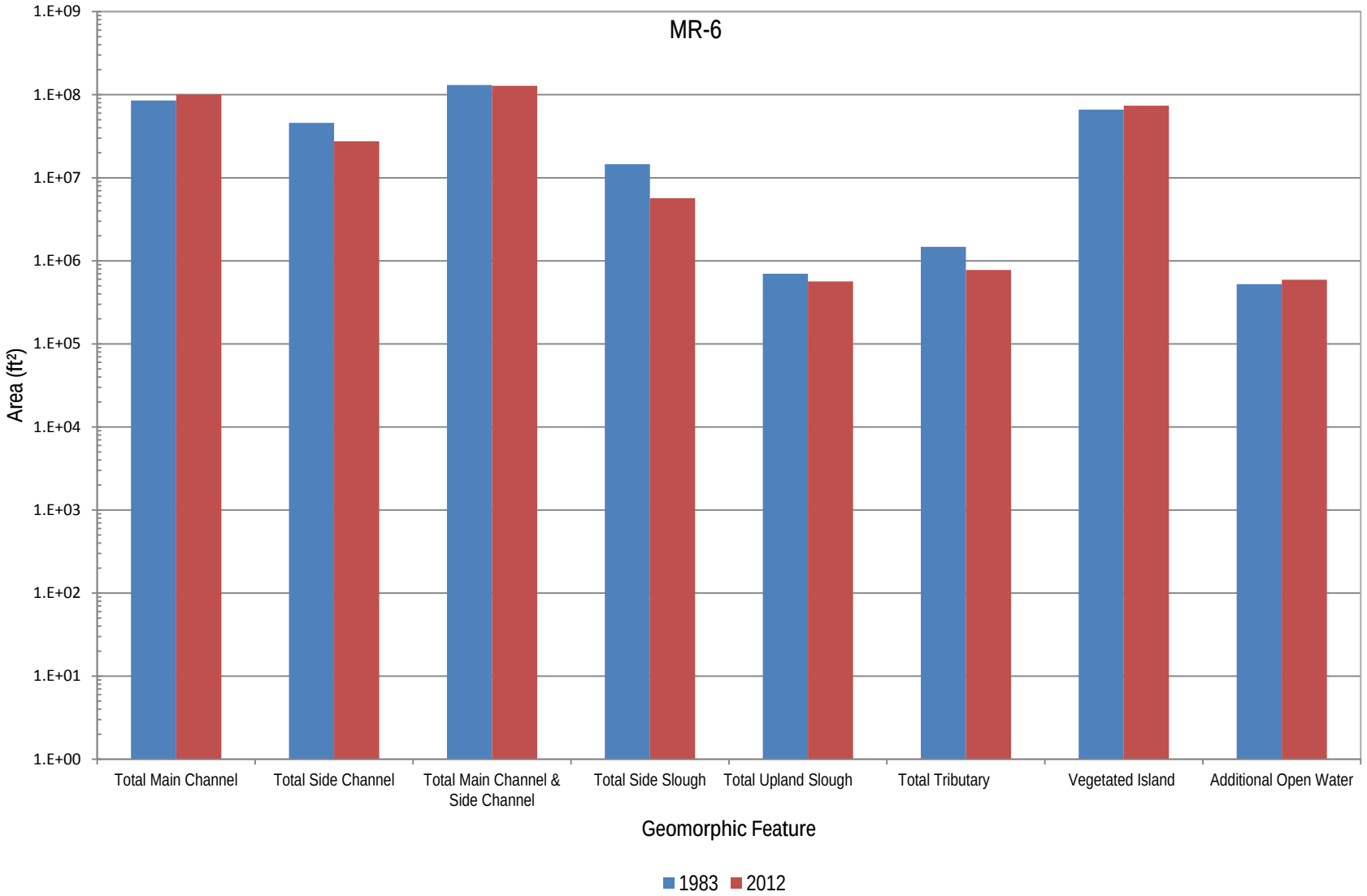

Figure 5.4-12: Middle River Geomorphic Reach 6 comparison of 1980s and 2012 mapped geomorphic feature areas (sq. ft.) on a logarithmic axis.

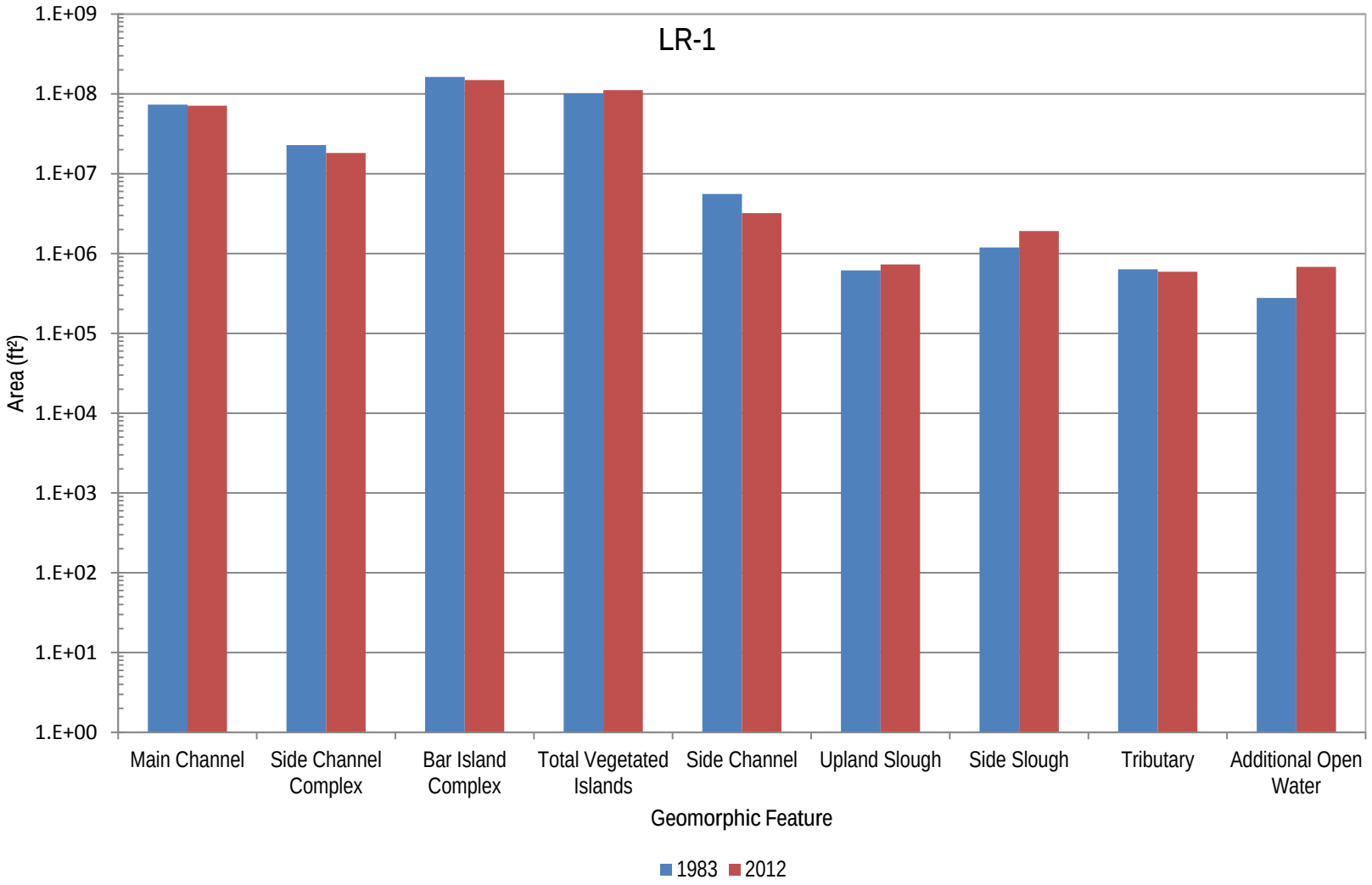

Figure 5.4-13: Lower River Geomorphic Reach 1 comparison of 1980s and 2012 mapped geomorphic feature areas (sq. ft.) on a logarithmic axis.

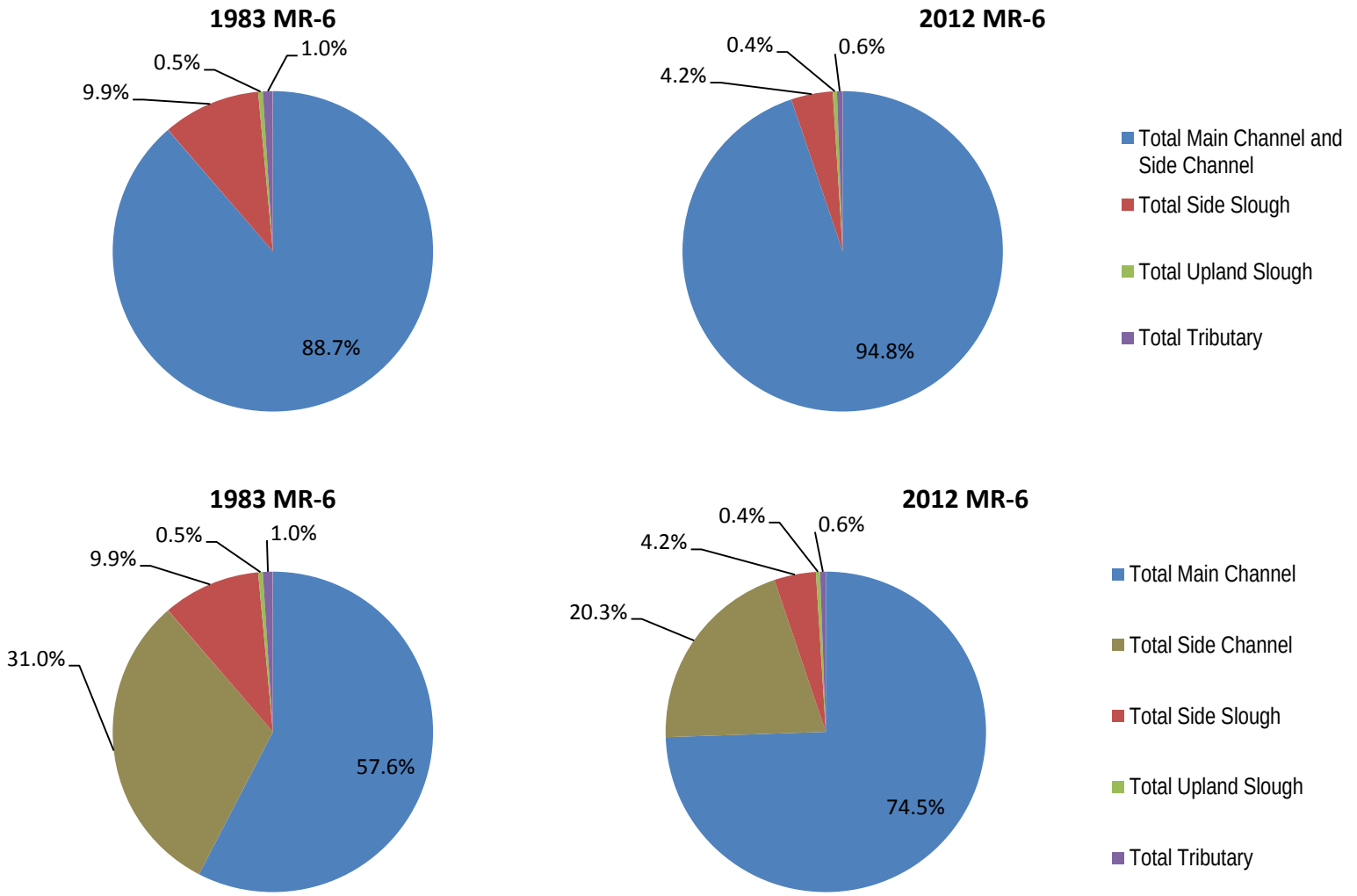

Figure 5.4-14: Relative proportion of geomorphic features in MR-6 of the Middle Susitna River Segment for 1983 and 2012 (top charts main channels and side channels combined / bottom charts main channels and side channels tracked separately).

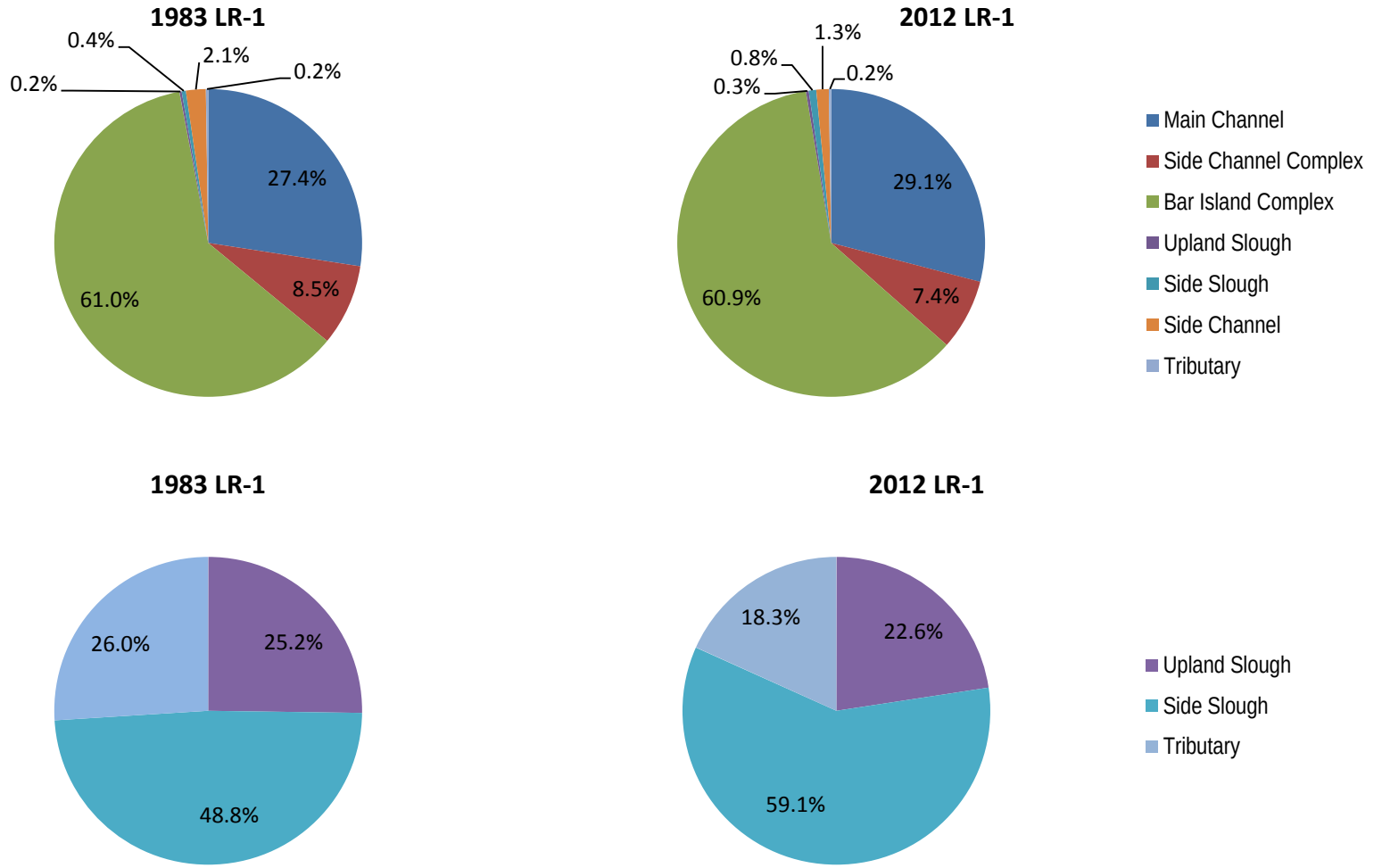

Figure 5.4-15: Relative proportion of geomorphic features in LR-1 of the Lower Susitna River Segment for 1983 and 2012 (top charts are geomorphic features with wetted and exposed regions / bottom charts are geomorphic features with primary aquatic habitat).

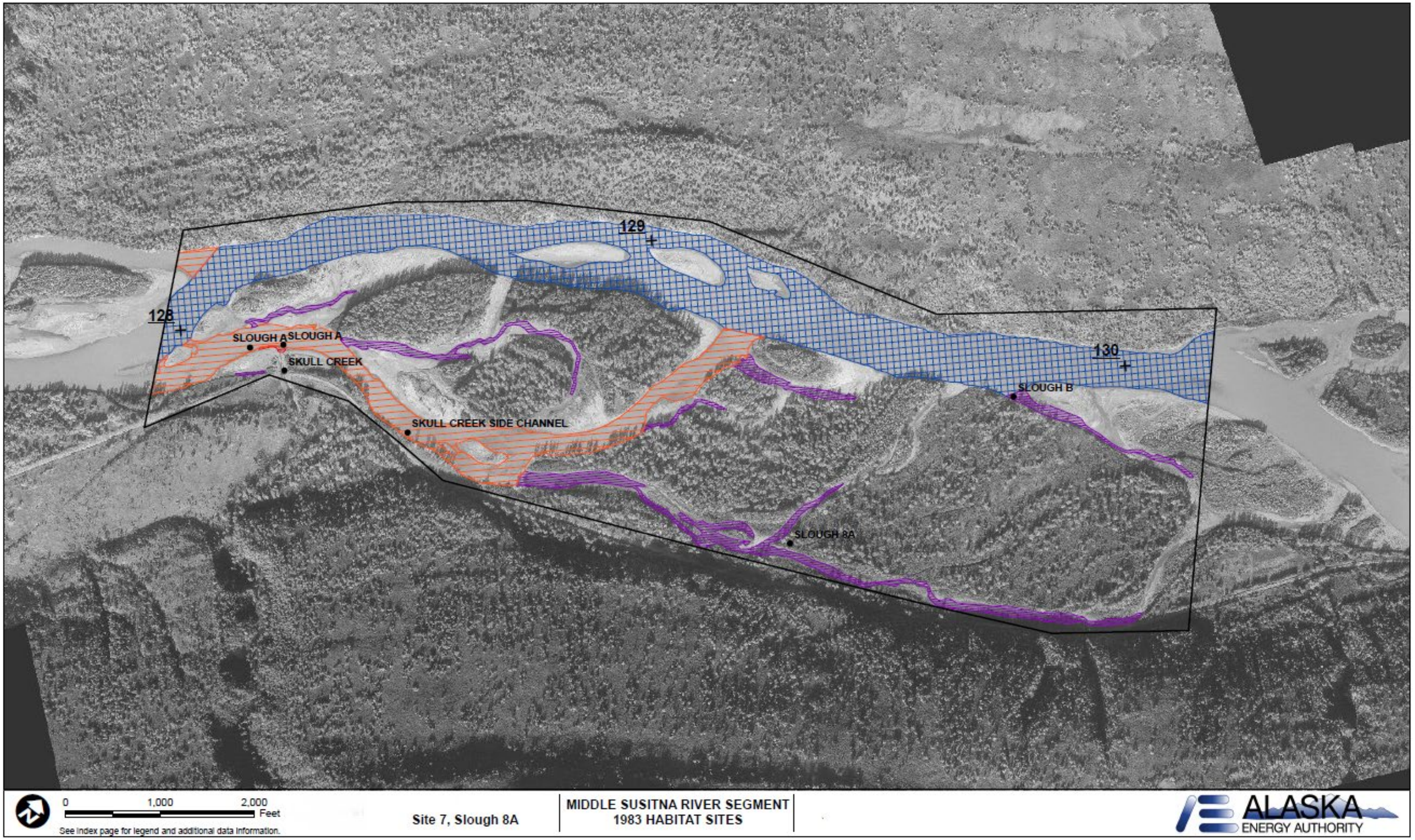

Figure 5.5-1. 1980s aquatic macrohabitat types at the Slough 8A habitat site

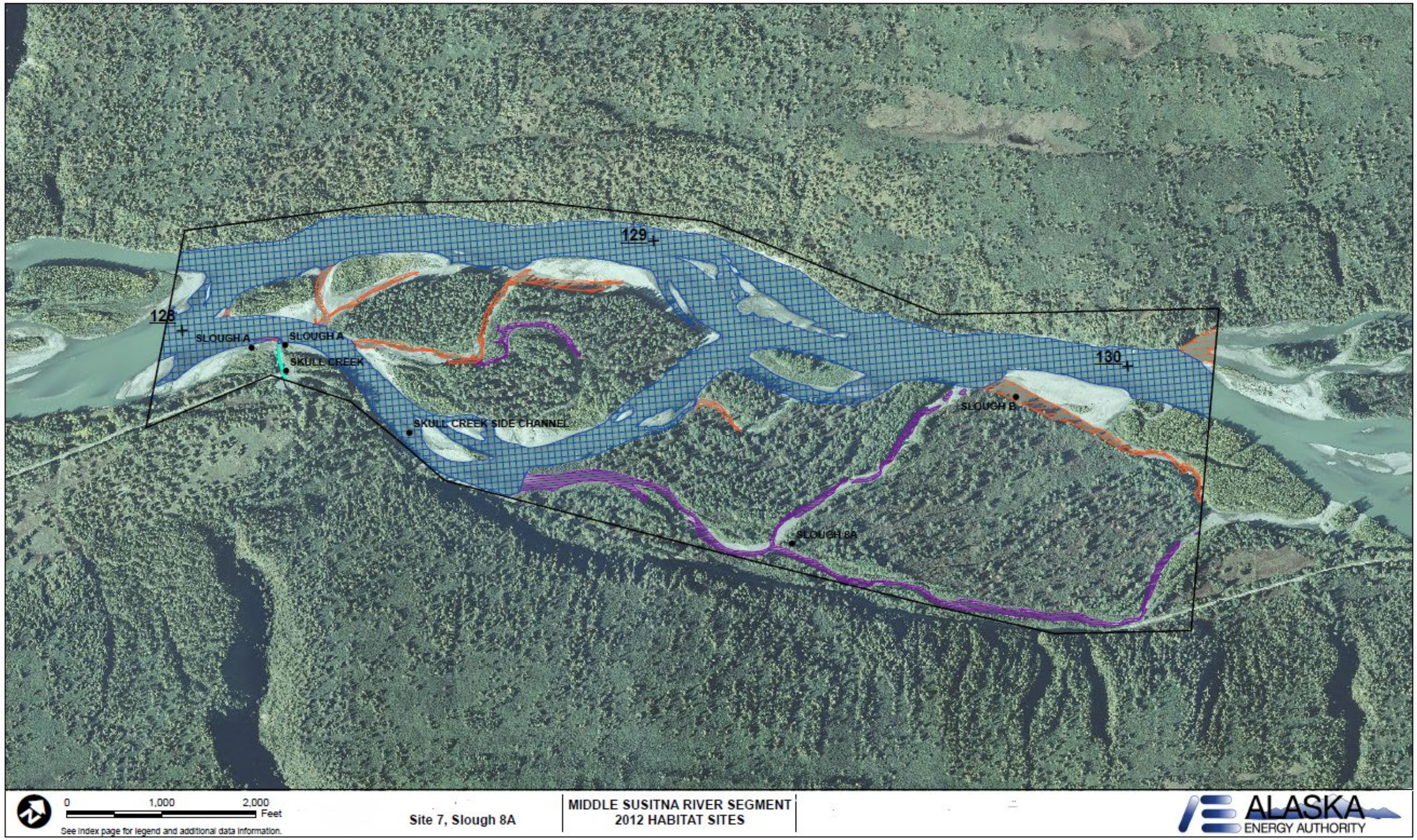

Figure 5.5-2. 2012 aquatic macrohabitat types at the Slough 8A habitat site

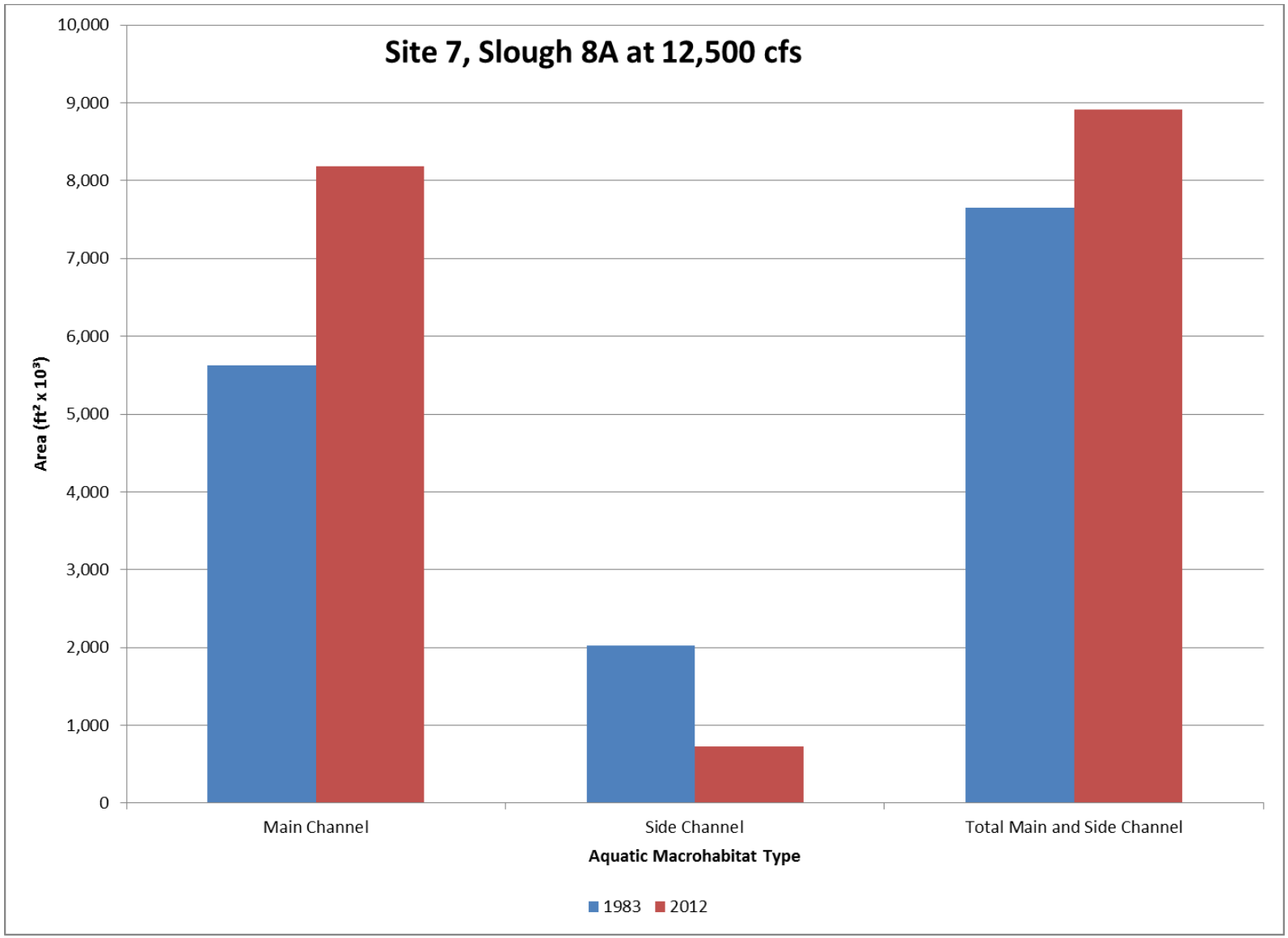

Figure 5.5-3. Comparison of mapped areas of main and side channel aquatic macrohabitat types from 1983 to 2012 at Slough 8A.

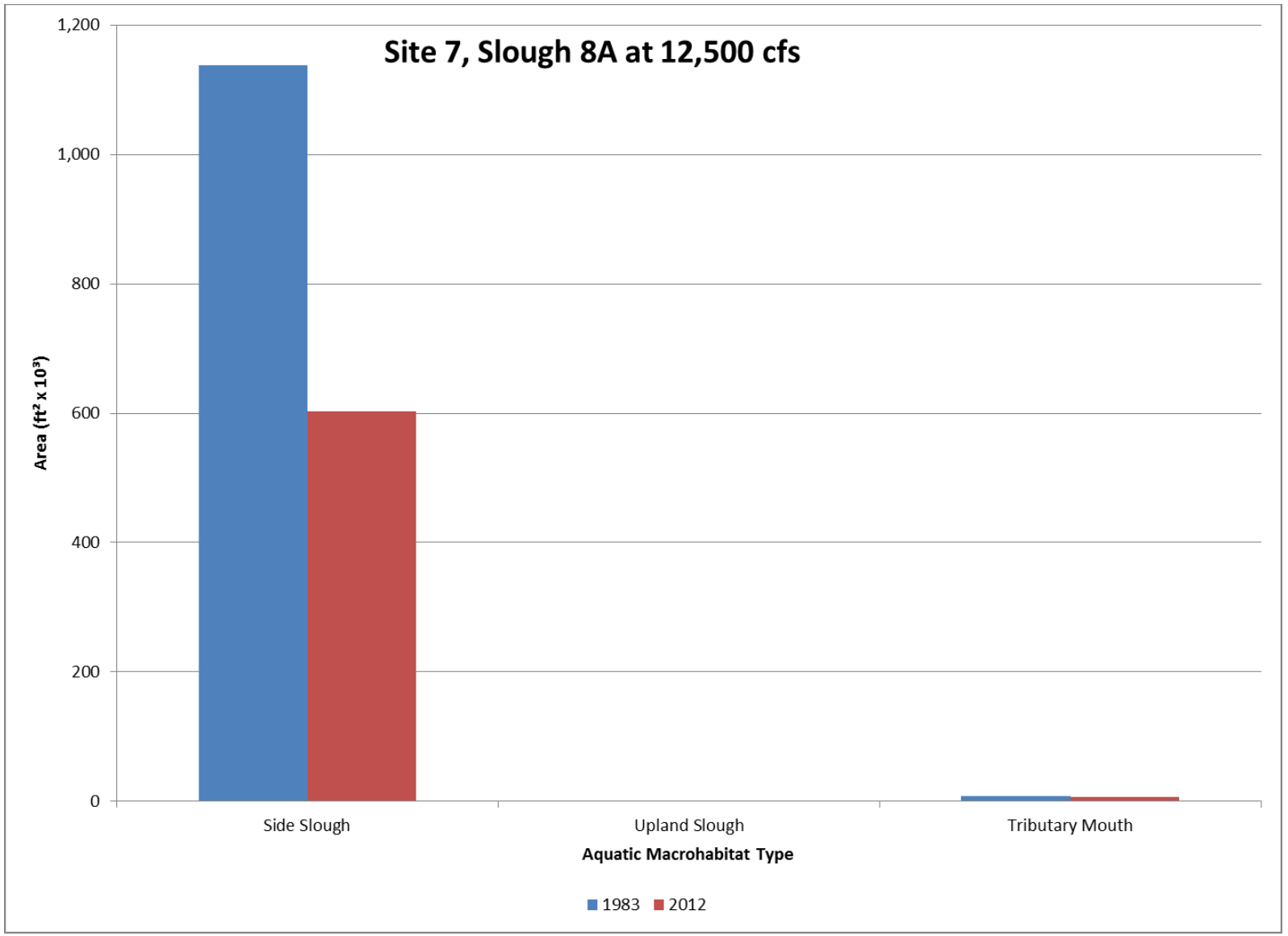

Figure 5.5-4. Comparison of mapped areas for side slough, upland slough and tributary mouth aquatic macrohabitat types from 1983 to 2012 at Slough 8A.

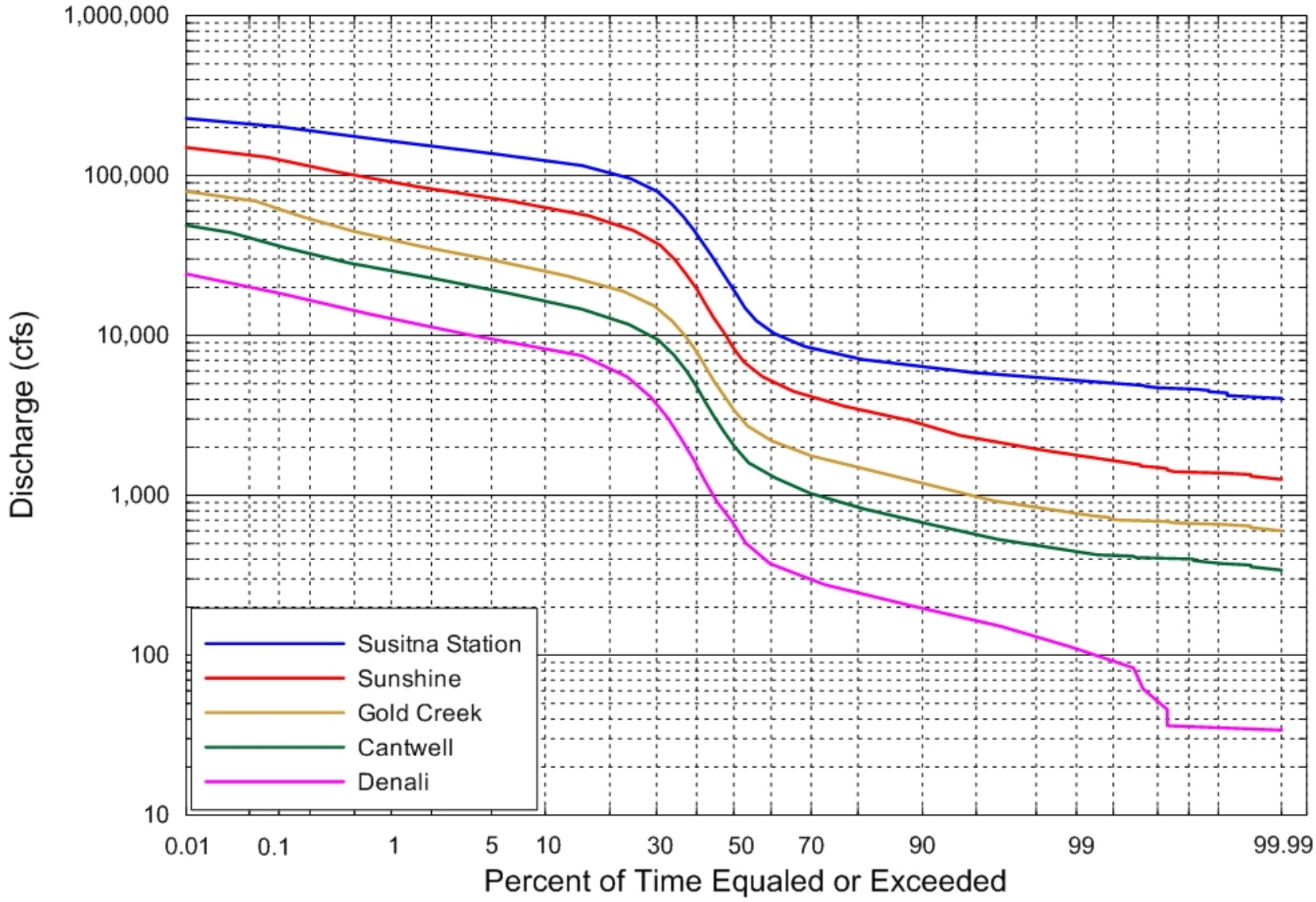

Figure 5.6.1. Annual flow-duration curves for mainstem gages for pre-Project conditions based on the USGS extended record (Tetra Tech 2013d)

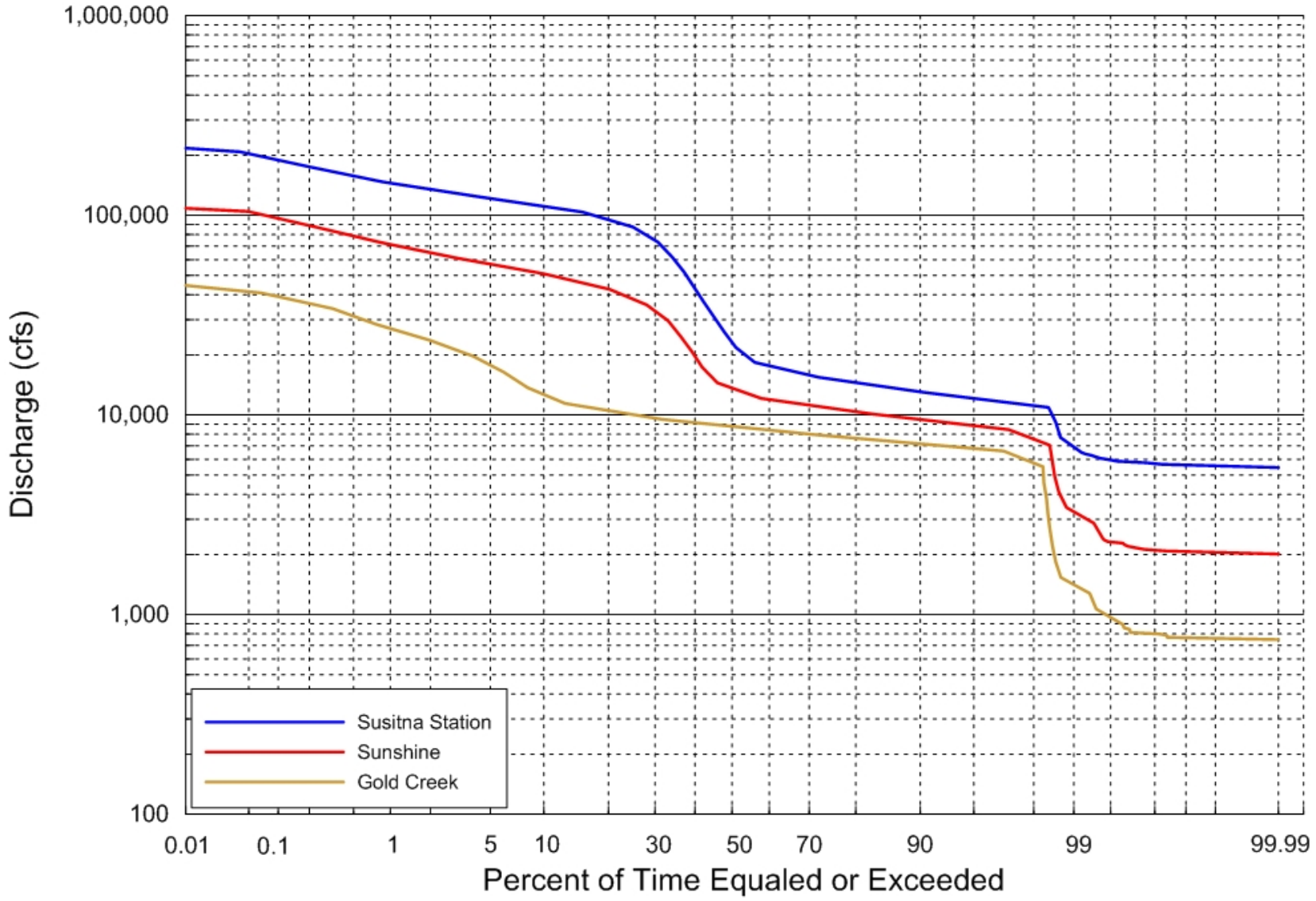

Figure 5.6-2. Annual flow-duration curves for three mainstem gages for Maximum Load Following OS-1 Conditions based on HEC-ResSim model. (Tetra Tech 2013d)

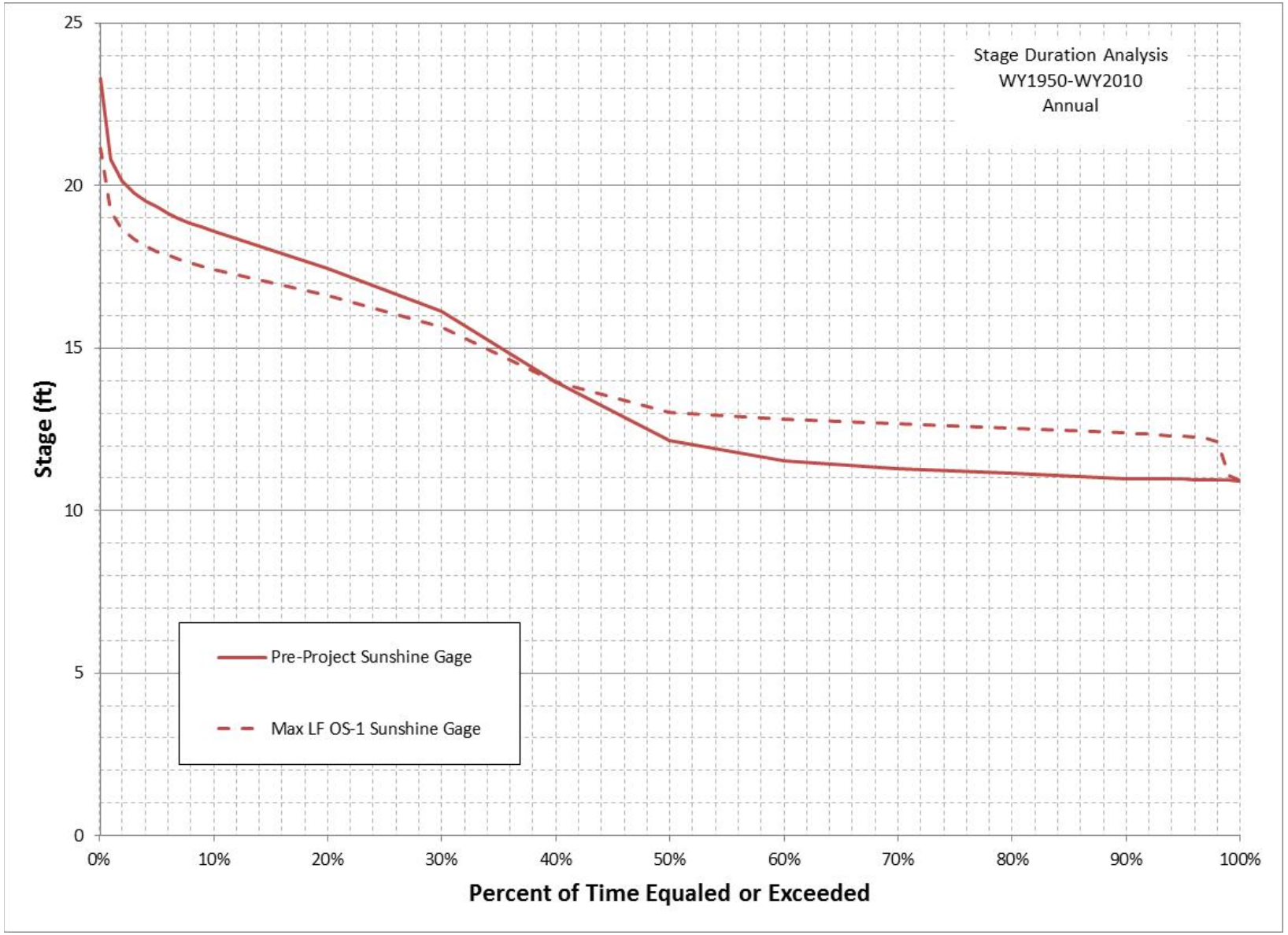

Figure 5.7-1. Annual Stage-Exceedance Relationships for pre-Project and Max LF OS-1 Conditions, Sunshine Gage (Tetra Tech, Inc. 2013d).

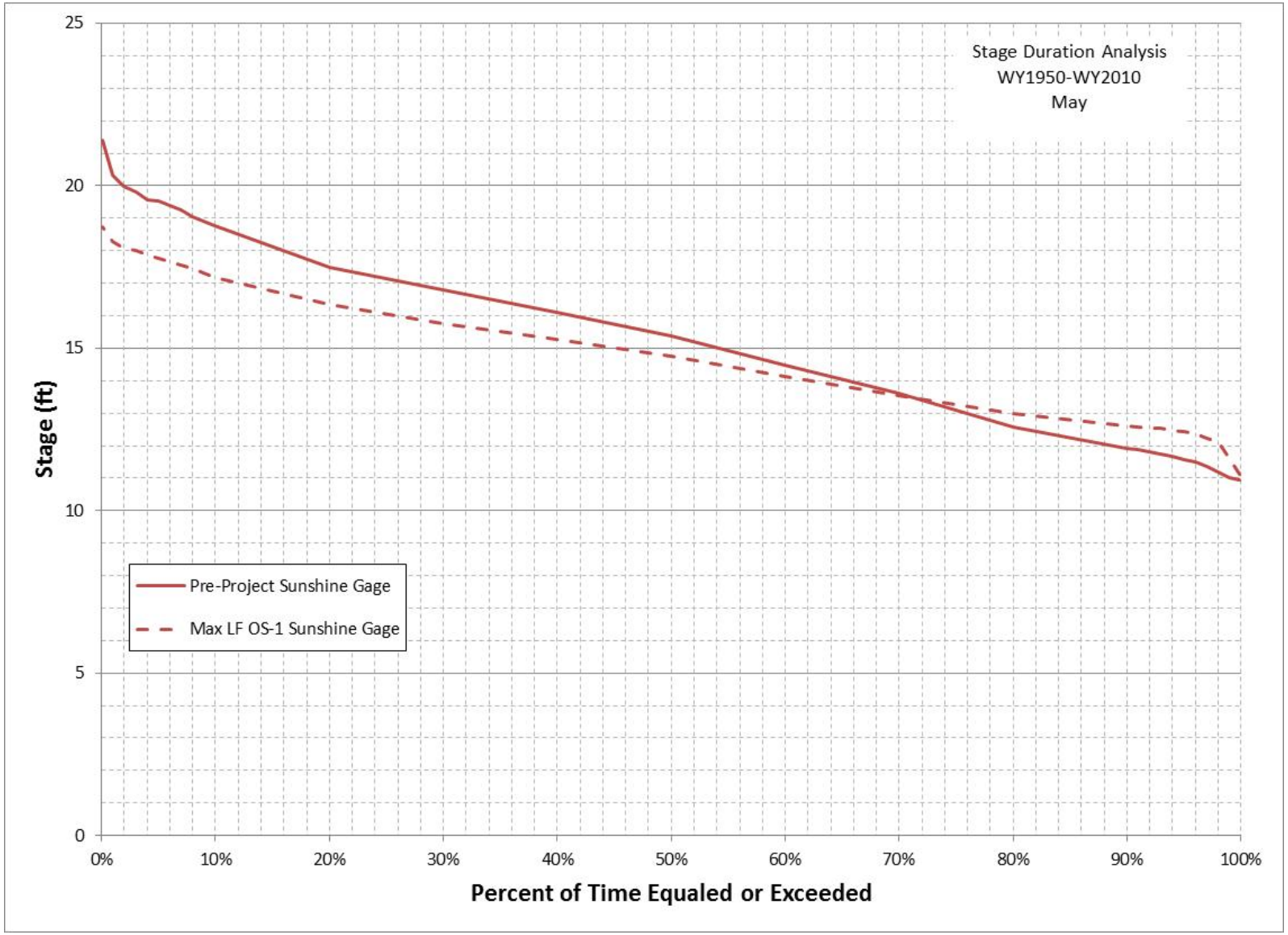

Figure 5.7-2. Monthly Stage-Exceedance Relationships for May for pre-Project and Max LF OS-1 Conditions, Sunshine Gage (Tetra Tech, Inc. 2013d).

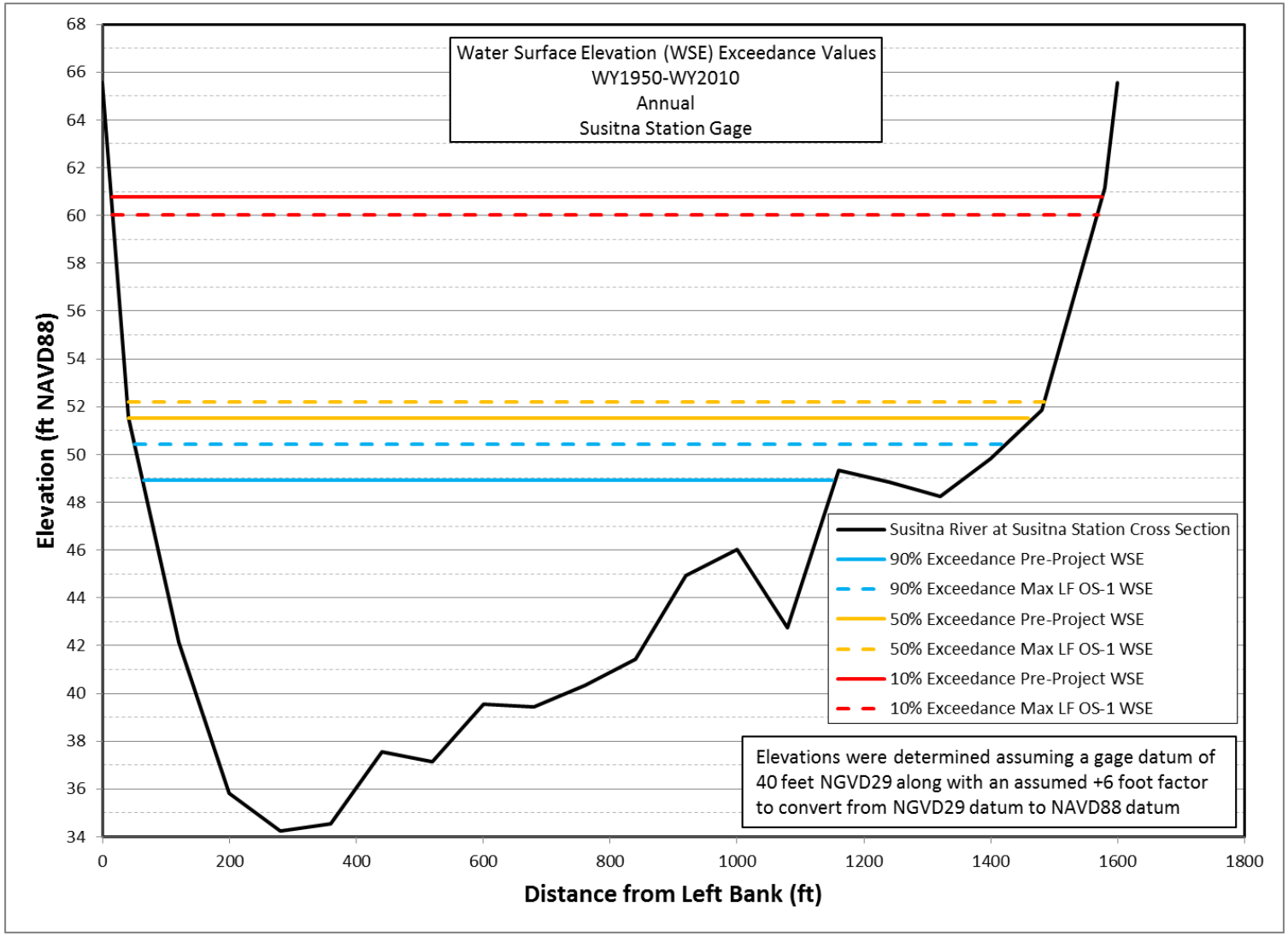

Figure 5.7-3. Select Annual Water-Surface Elevation Exceedance Values for pre-Project and Max LF OS-1 Conditions, Susitna Station Gage(Tetra Tech, Inc. 2013d).

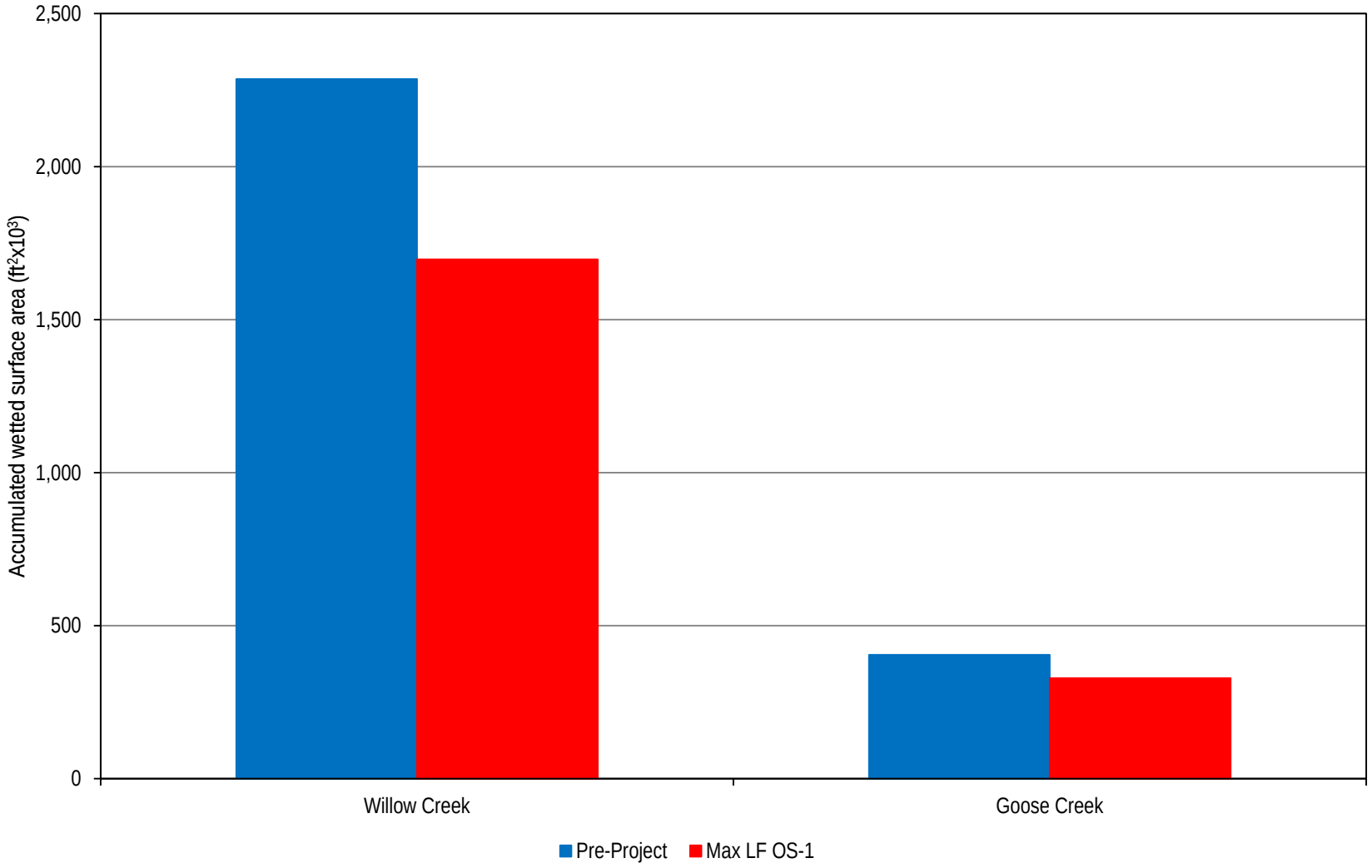

Figure 5.7-4. Accumulated wetted surface area (ft2x103) computed over June-September for the median monthly discharge at Sunshine gage presented for the tributary mouth habitat (Tetra Tech, Inc 2013e)

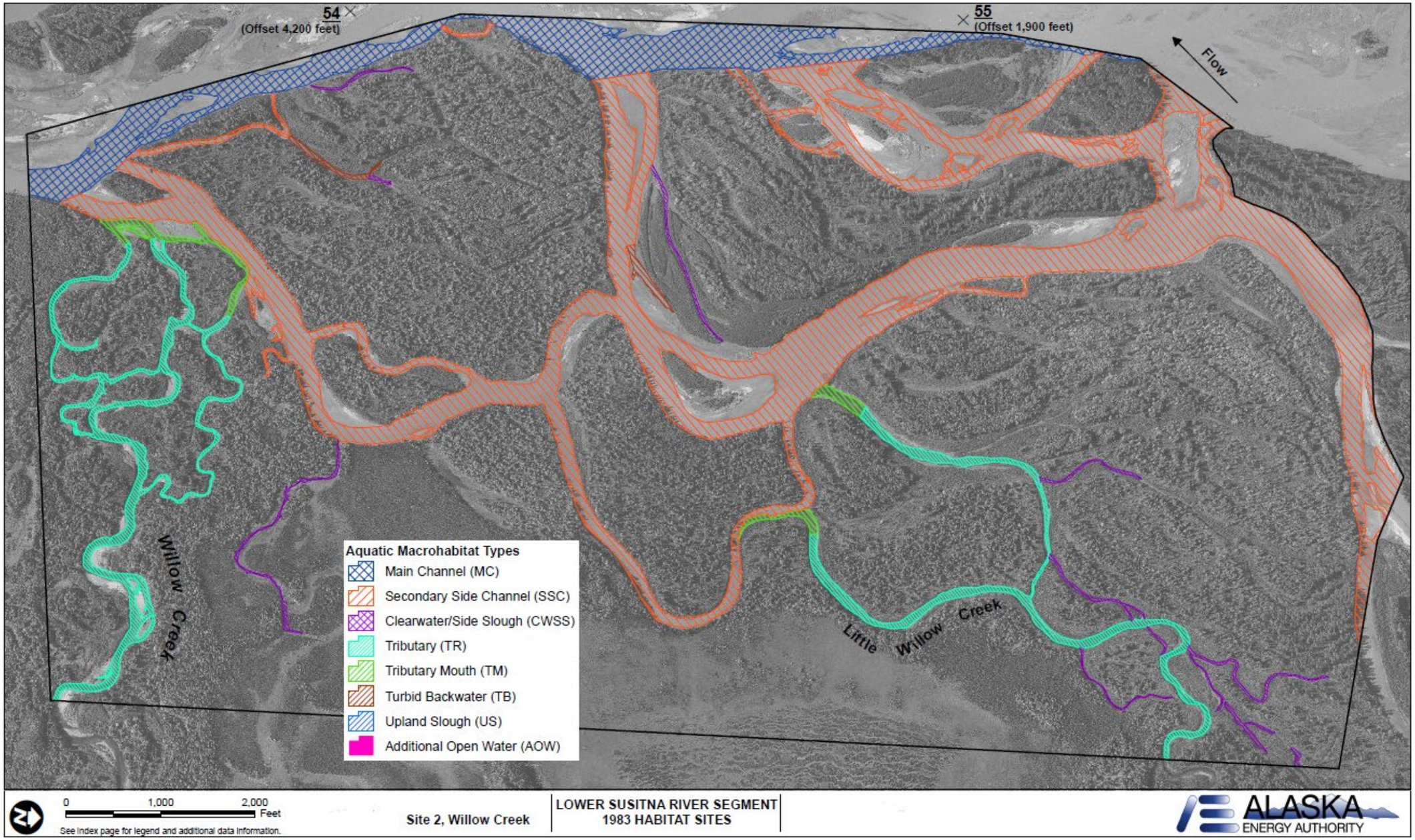

Figure 5.7-5. 1980s Aquatic macrohabitat types in the Willow Creek habitat site (Tetra Tech, Inc. 2013f).

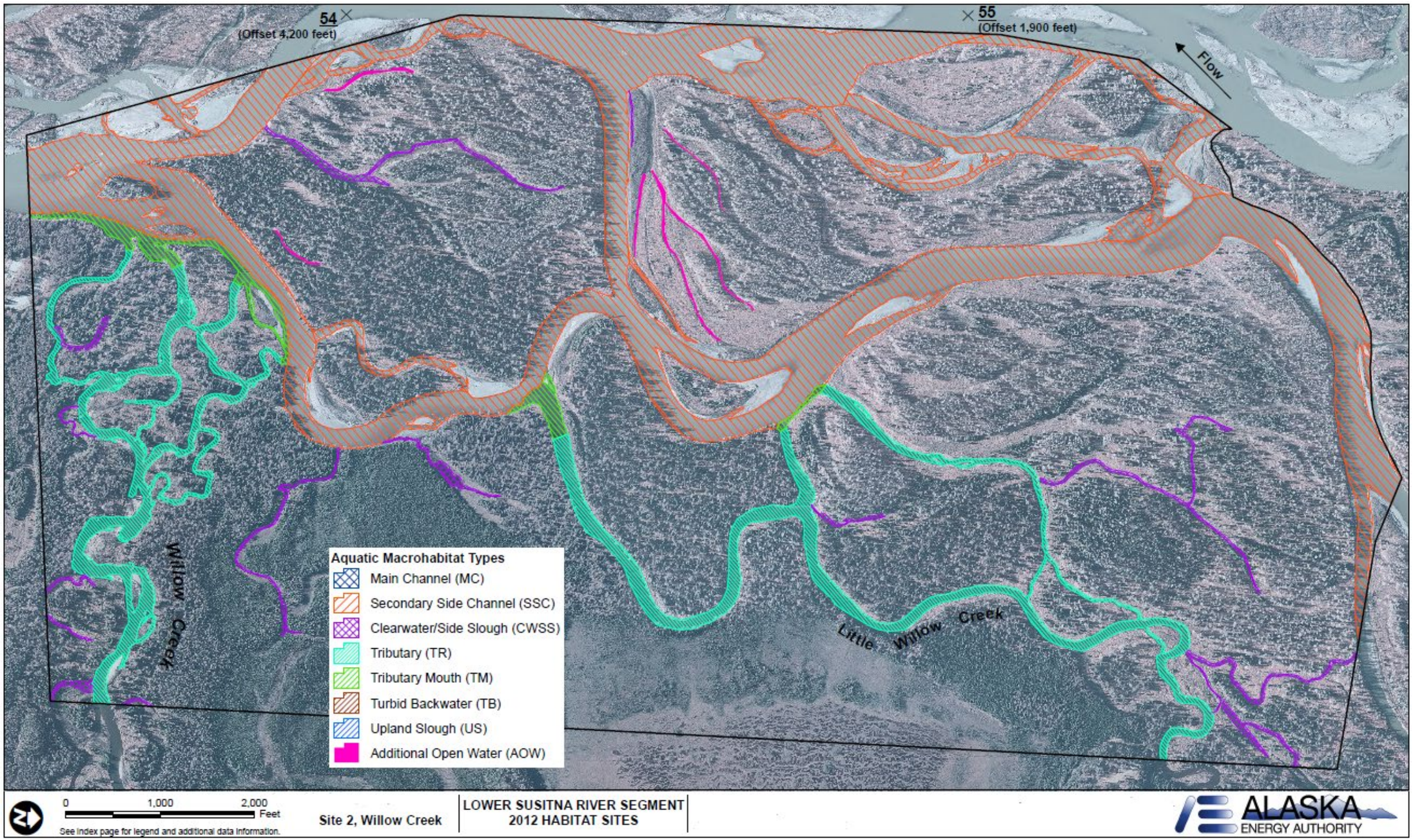

Figure 5.7-6. 2012 Aquatic macrohabitat types in the Willow Creek habitat site (Tetra Tech, Inc. 2013f).

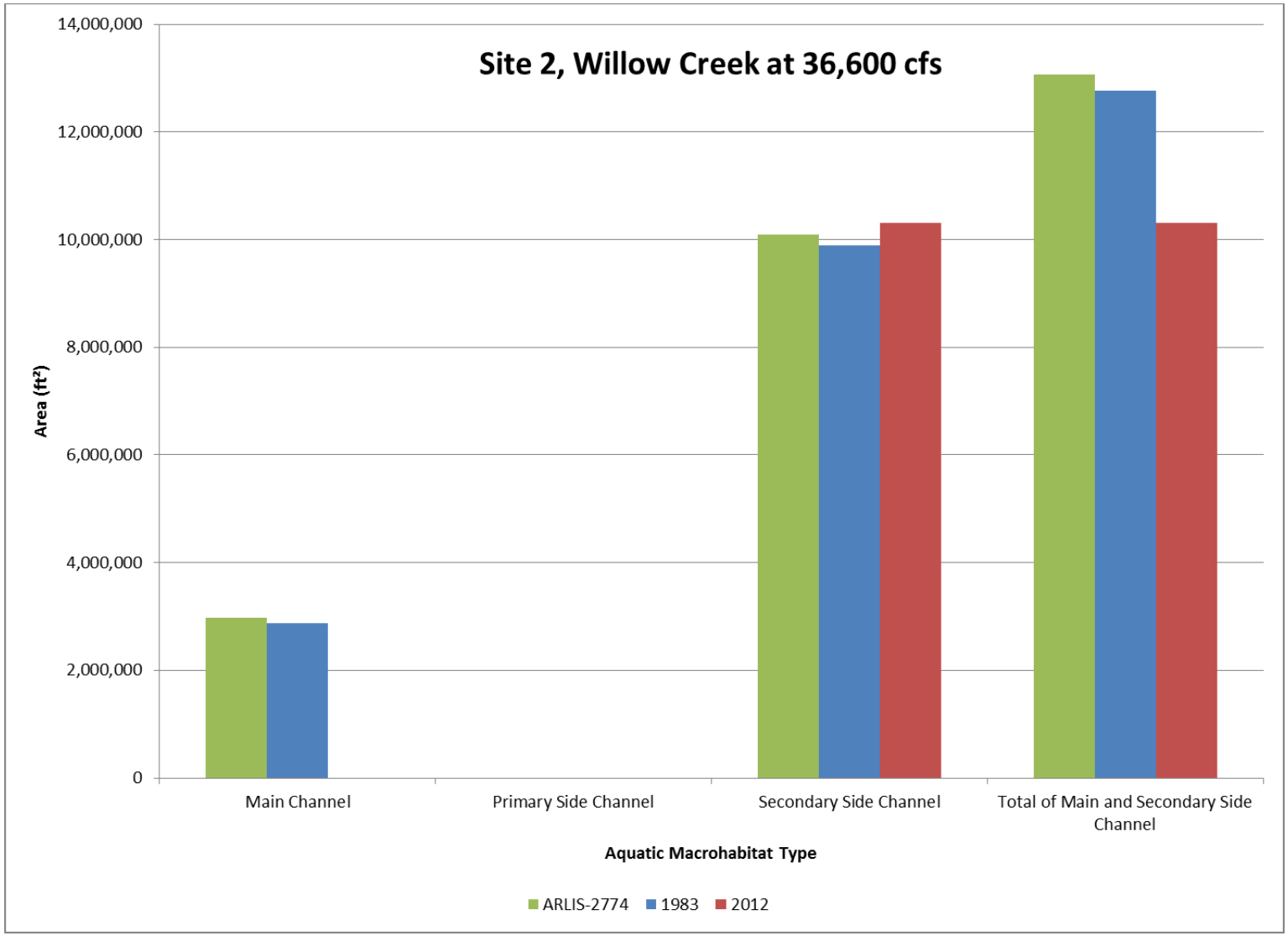

Figure 5.7-7. Comparison of aquatic macrohabitat types from 1983 to 2012 at Willow Creek, main channel and side channel habitats (Tetra Tech, Inc. 2013f).

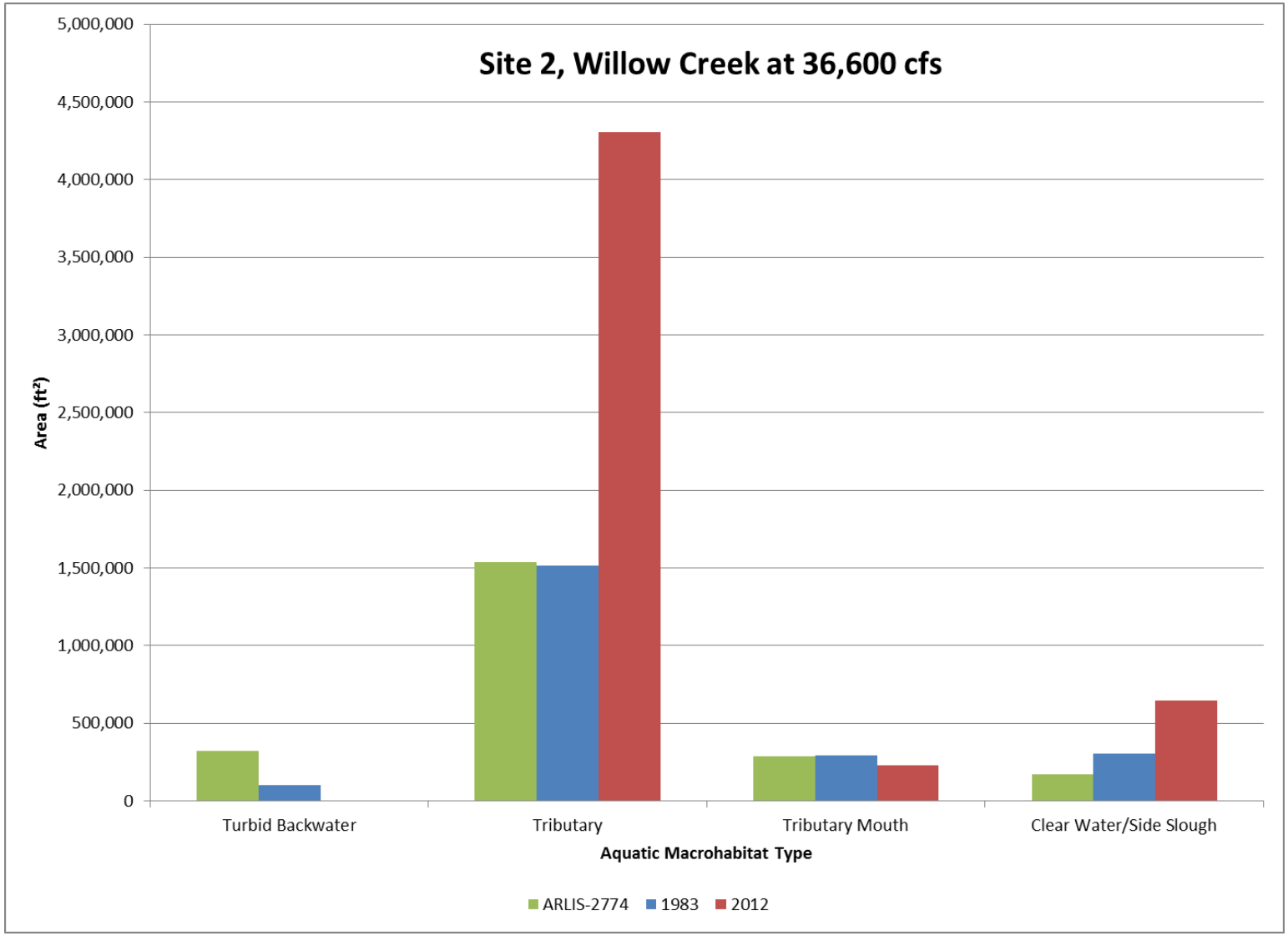

Figure 5.7-8. Comparison of aquatic macrohabitat types from 1983 to 2012 at Willow Creek, tributary and side slough habitats (Tetra Tech, Inc. 2013f).

Figure 5.8-2: Typical bank profile with armored toe and mid-bank, FA-104. Flow in the river was approximately 24,000 cfs.

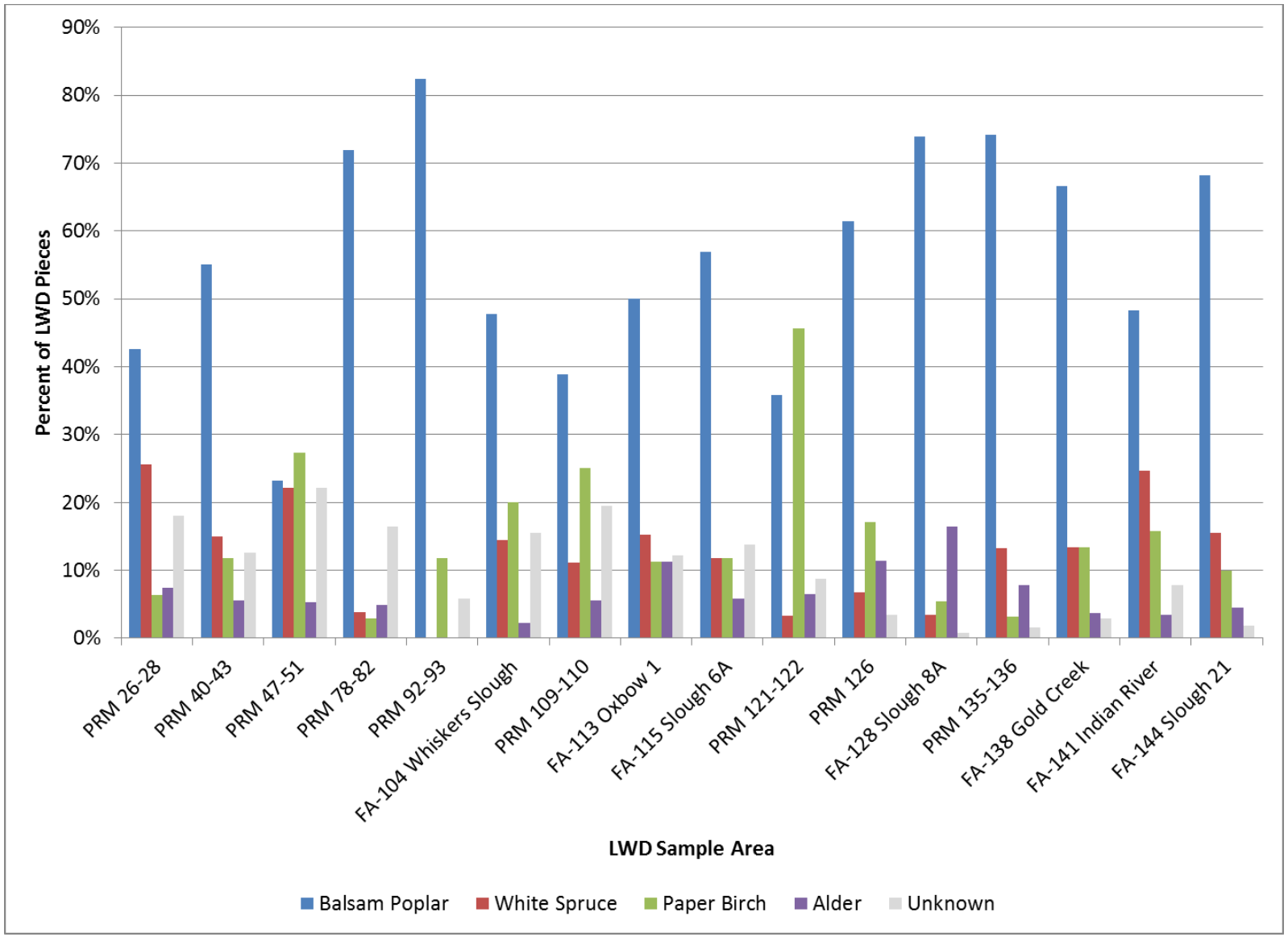

Figure 5.9-1. Large Woody Debris (LWD) by Species, 2013 Field Inventory.

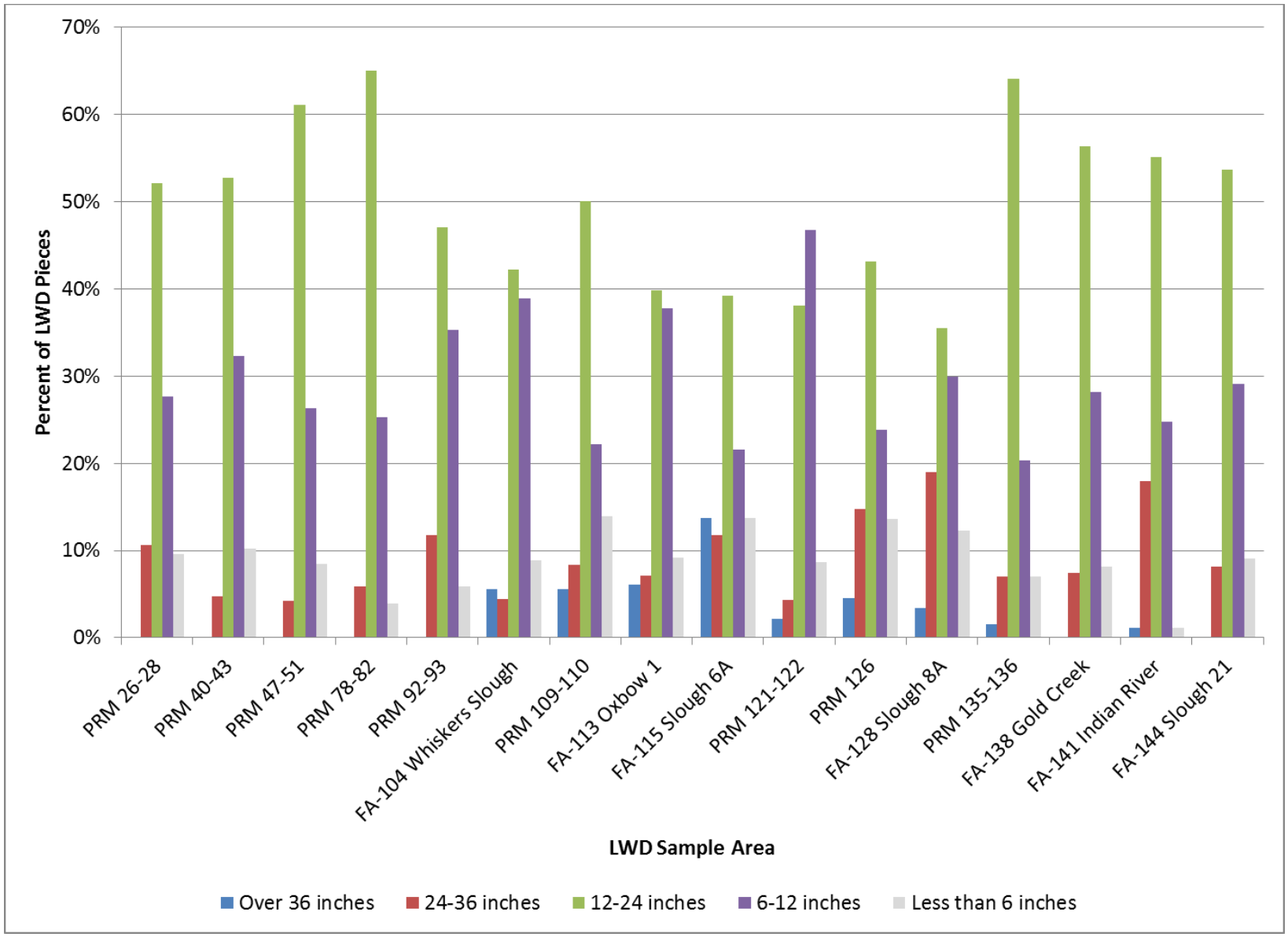

Figure 5.9-2. Large Woody Debris (LWD) by Diameter, 2013 Field Inventory

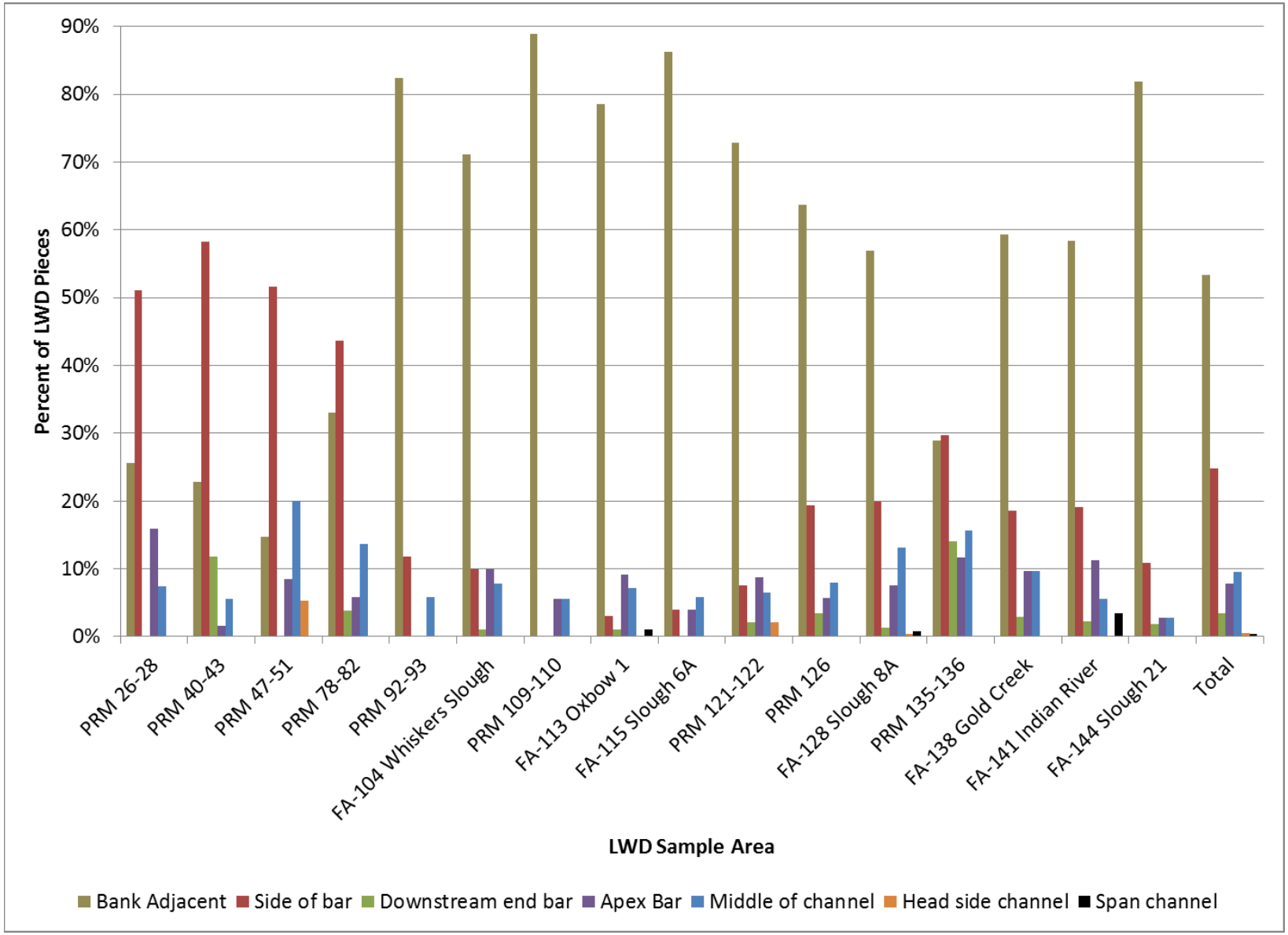

Figure 5.9-3. Large Woody Debris (LWD) by Channel Position, 2013 Field Inventory.

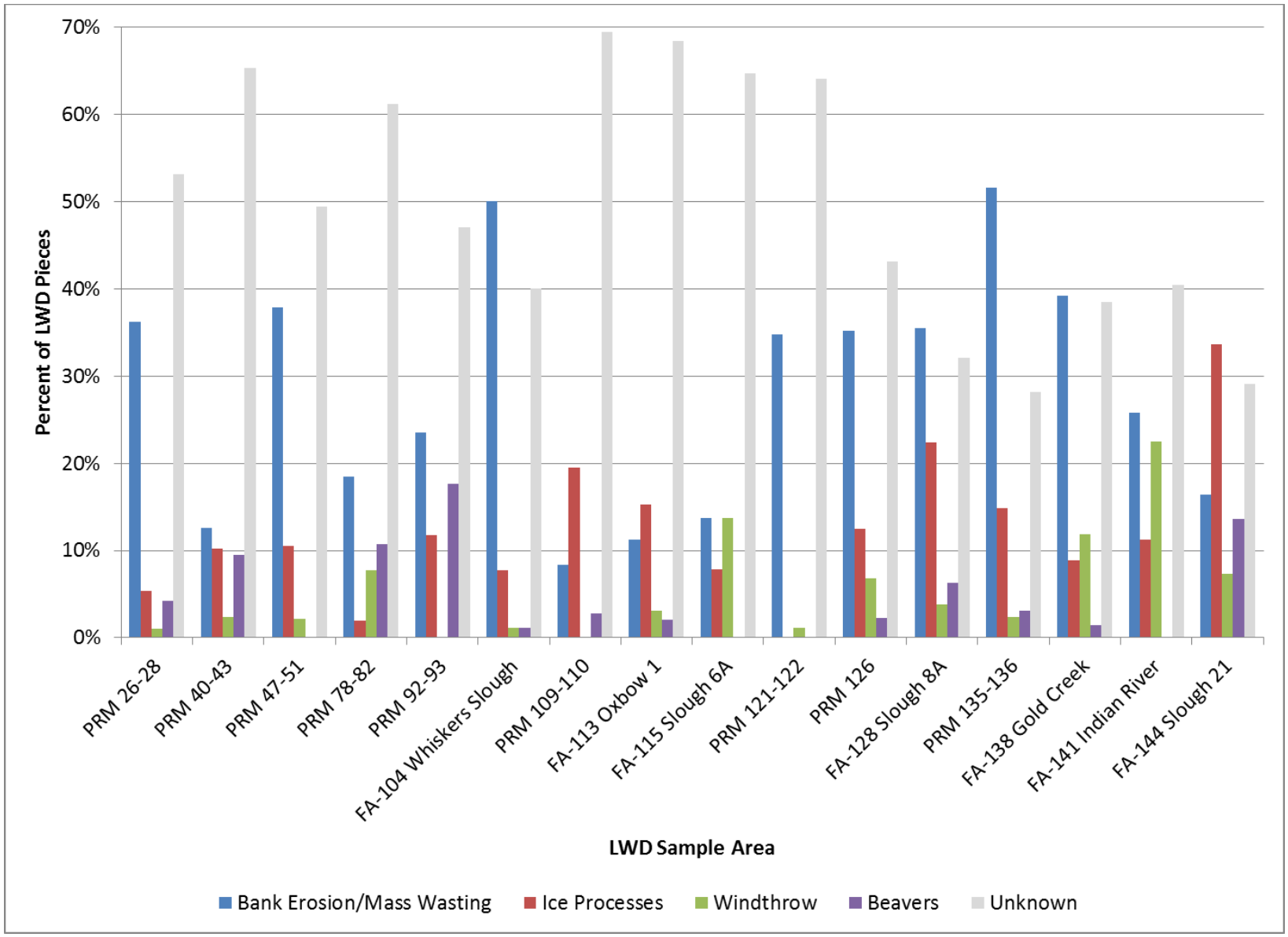

Figure 5.9-4. Large Woody Debris (LWD) by Input Process, 2013 Field Inventory.

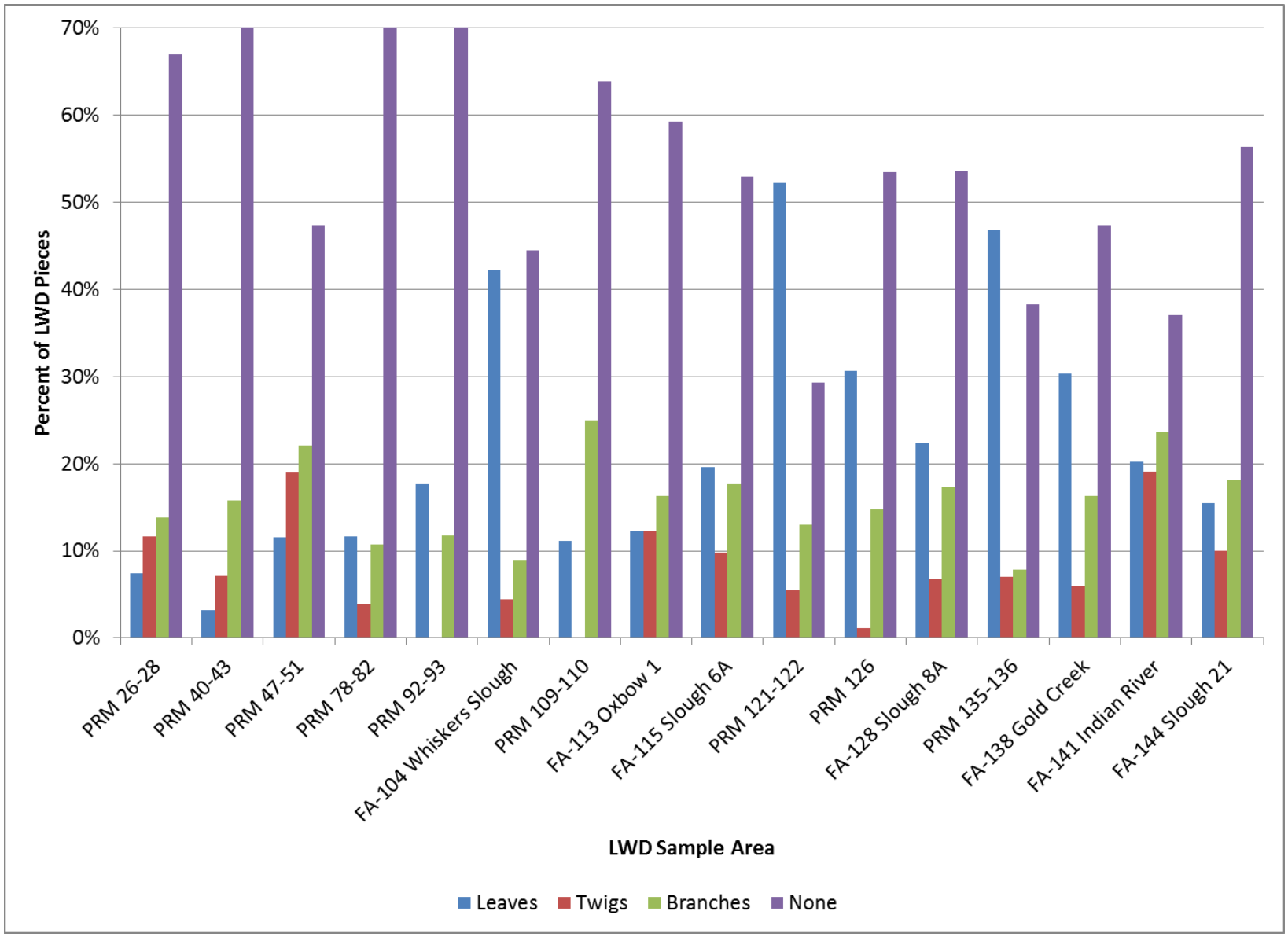

Figure 5.9-5. Large Woody Debris (LWD) by Freshness of Wood, 2013 Field Inventory.

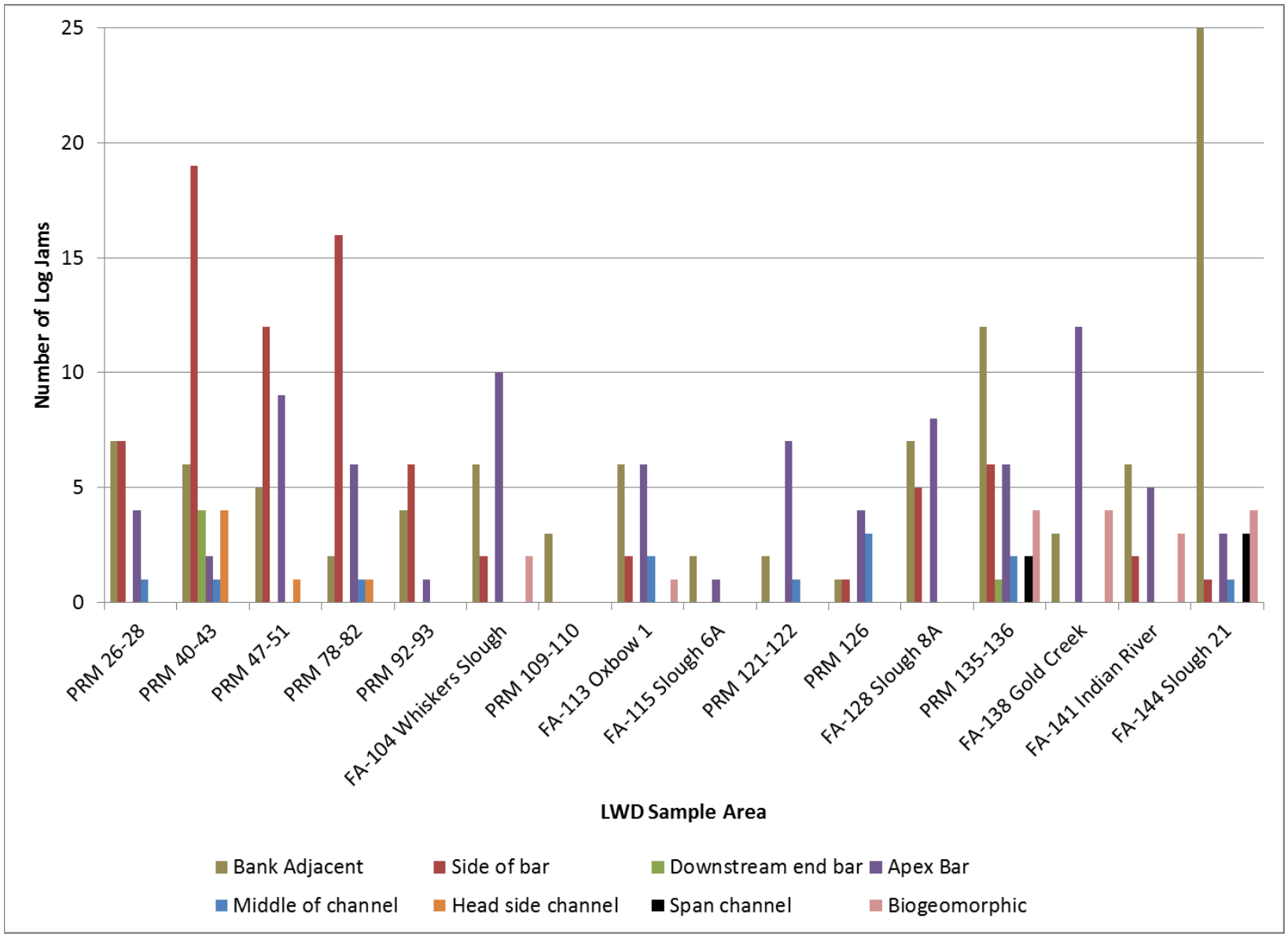

Figure 5.9-6. Log Jams by Channel Position, 2013 Field Inventory.

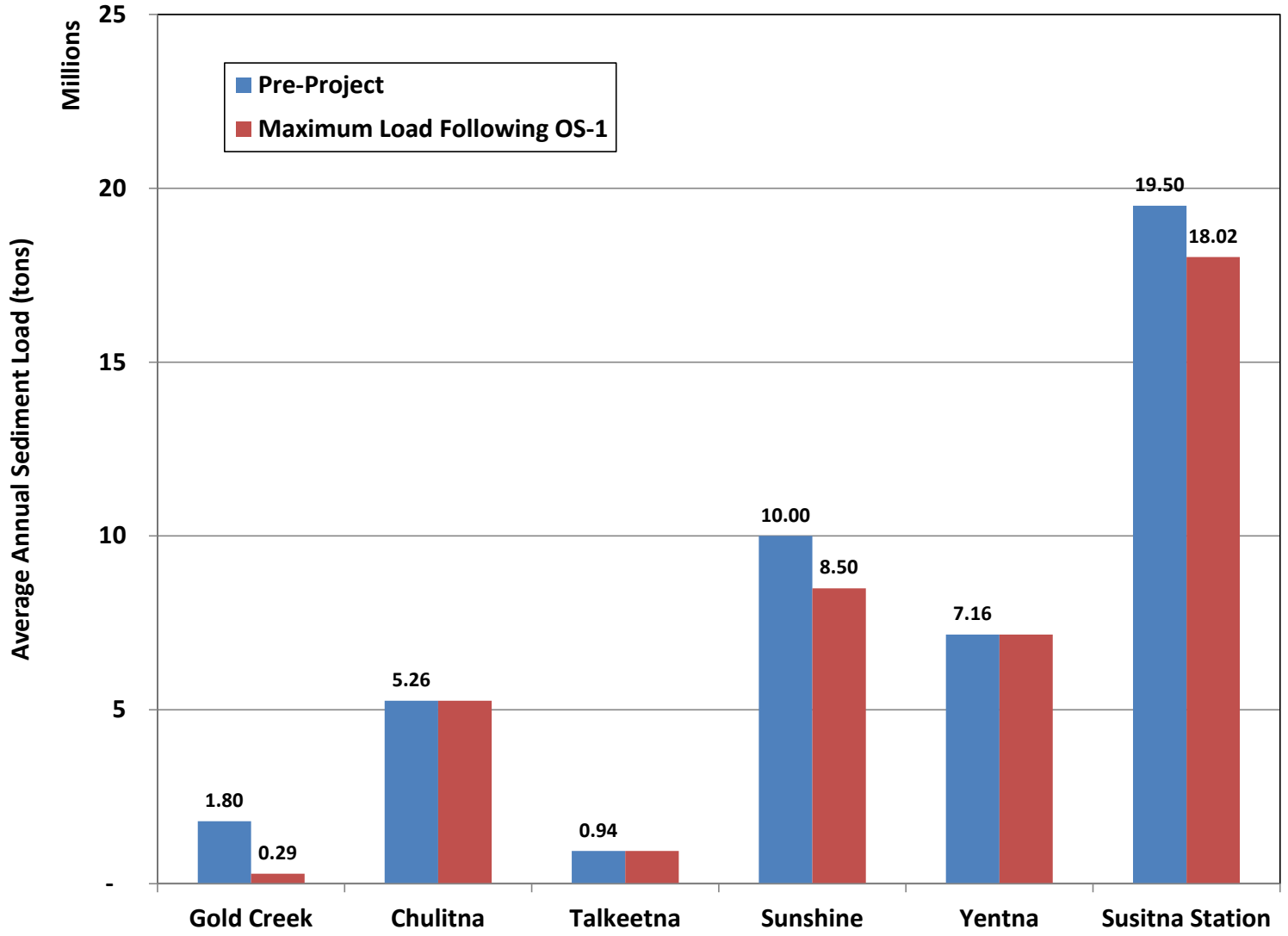

Figure 6.3-1. Average annual silt/clay loads at the three mainstem gages and the three primary tributary gages under pre-Project and Maximum Load Following OS-1 conditions.

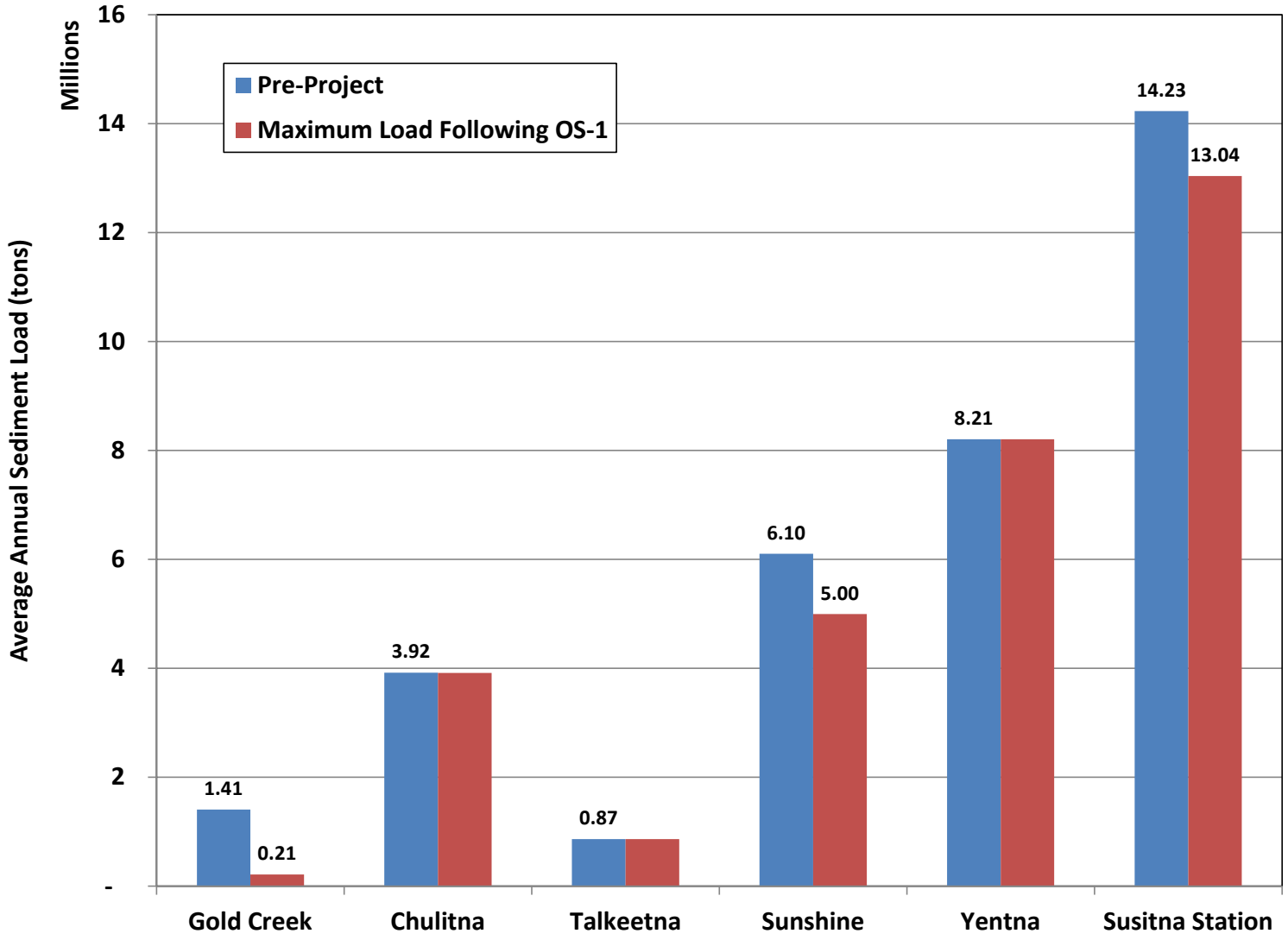

Figure 6.3-2. Average annual sand loads at the three mainstem gages and the three primary tributary gages under pre-Project and Maximum Load Following OS-1 conditions.

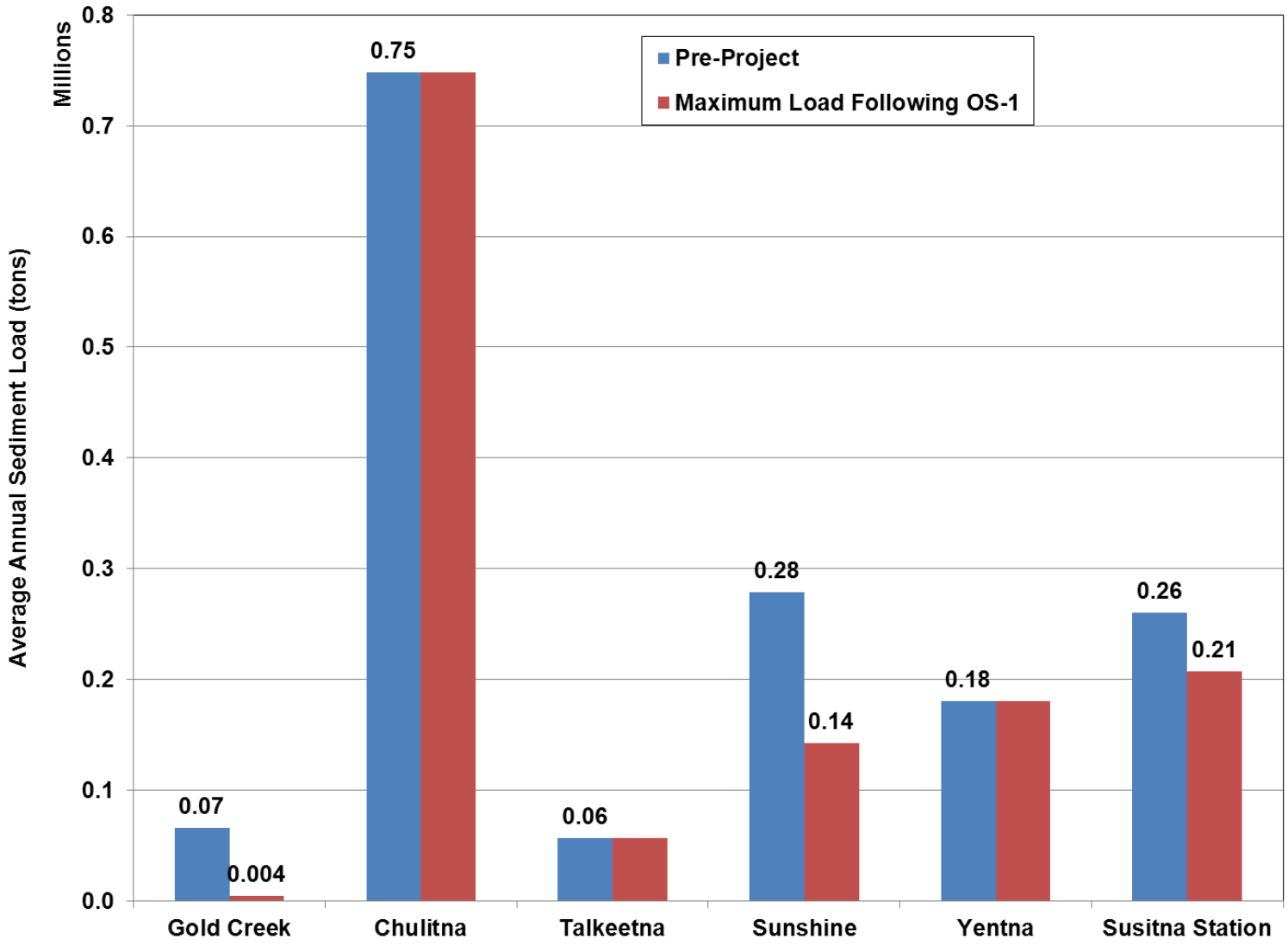

Figure 6.3-3. Average annual gravel loads at the three mainstem gages and the three primary tributary gages under pre-Project and Maximum Load Following OS-1 conditions.

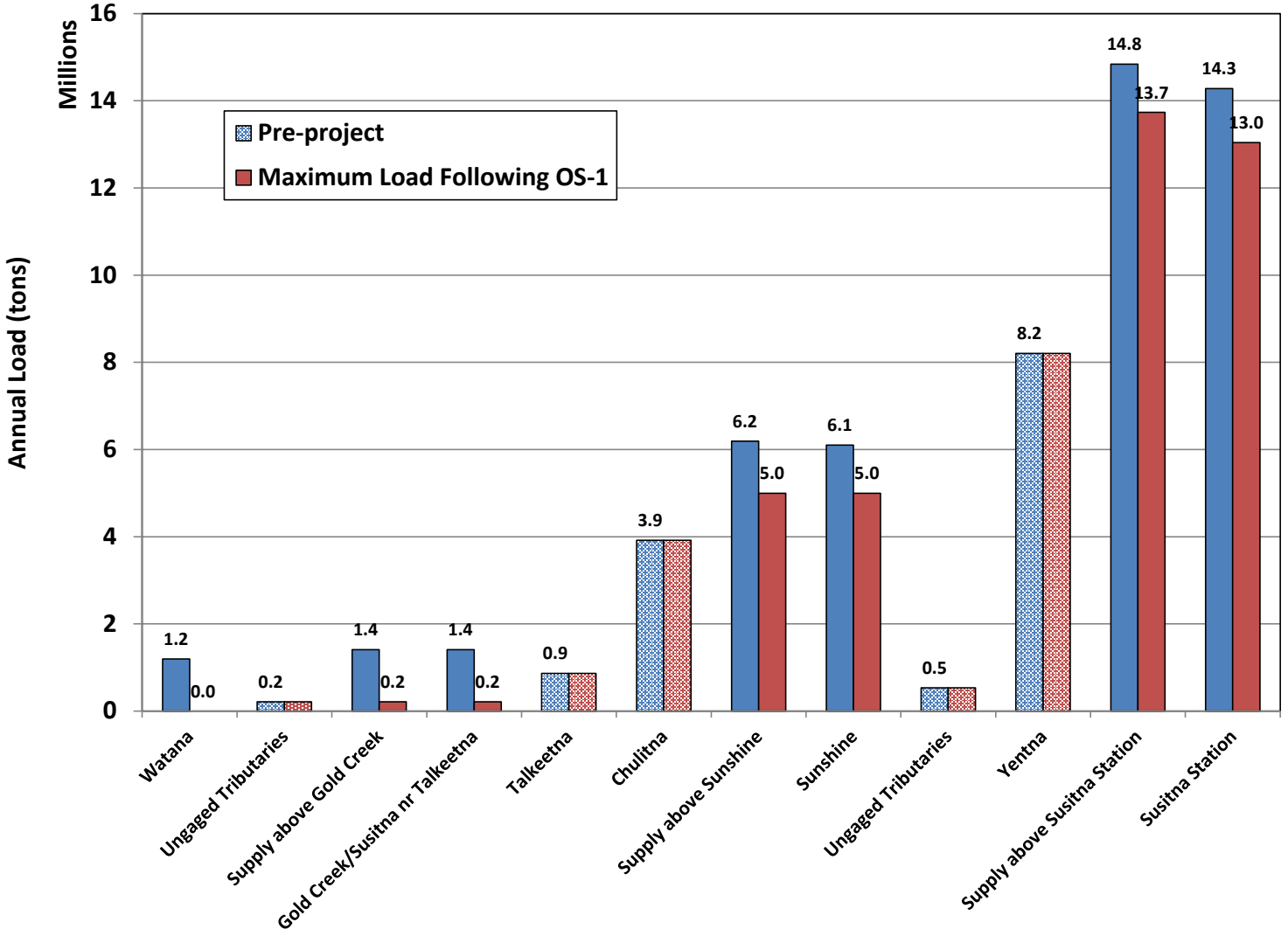

Figure 6.3-4. Average annual sand loads at the mainstem and tributary gages, along with the estimated annual sand load from ungaged tributaries, under pre-Project and Maximum Load Following OS-1 conditions. Also shown is the accumulated sediment supply to key points along the reach based on the gaged and ungaged sand loads.

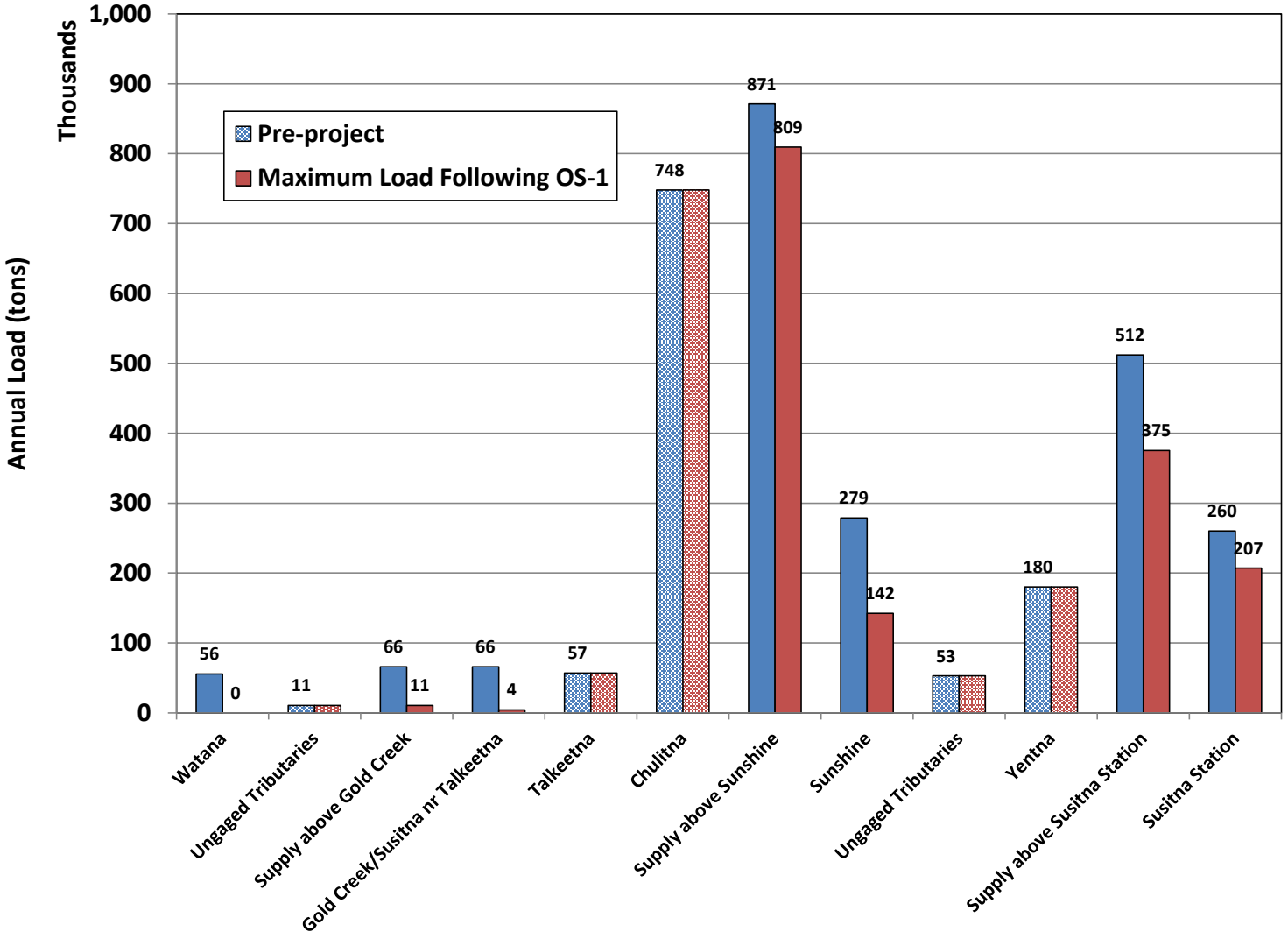

Figure 6.3-5. Average annual gravel loads at the mainstem and tributary gages, along with the estimated annual gravel load from ungaged tributaries, under pre-Project and Maximum Load Following OS-1 conditions. Also shown is the accumulated sediment supply to key points along the reach based on the gaged and ungaged gravel loads.

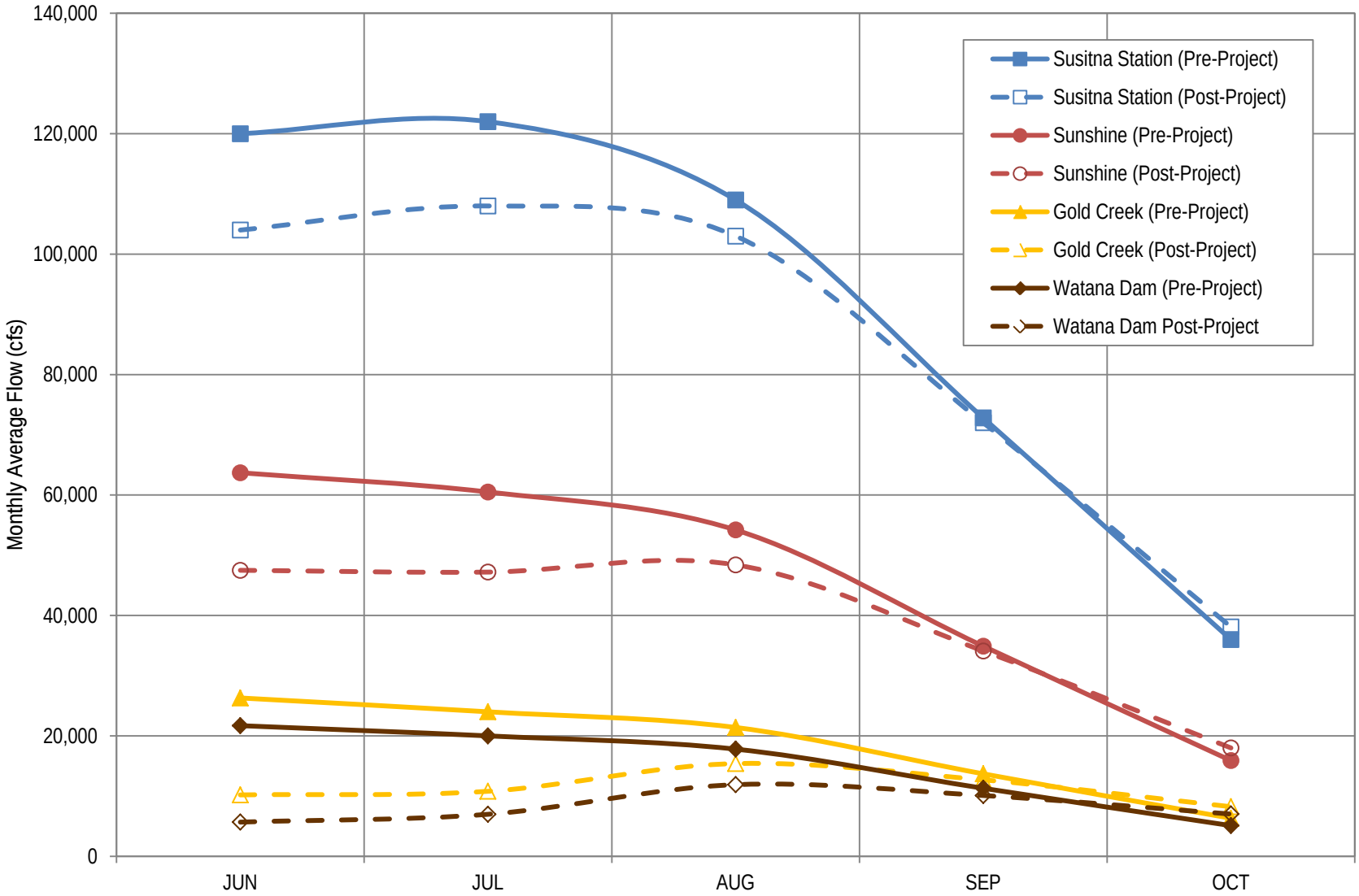

Figure 6.6.1. Average monthly flows (cfs) during the open-water period in the Susitna River watershed for pre-Project and Maximum Load Following OS-1 conditions. (Tetra Tech 2013d).

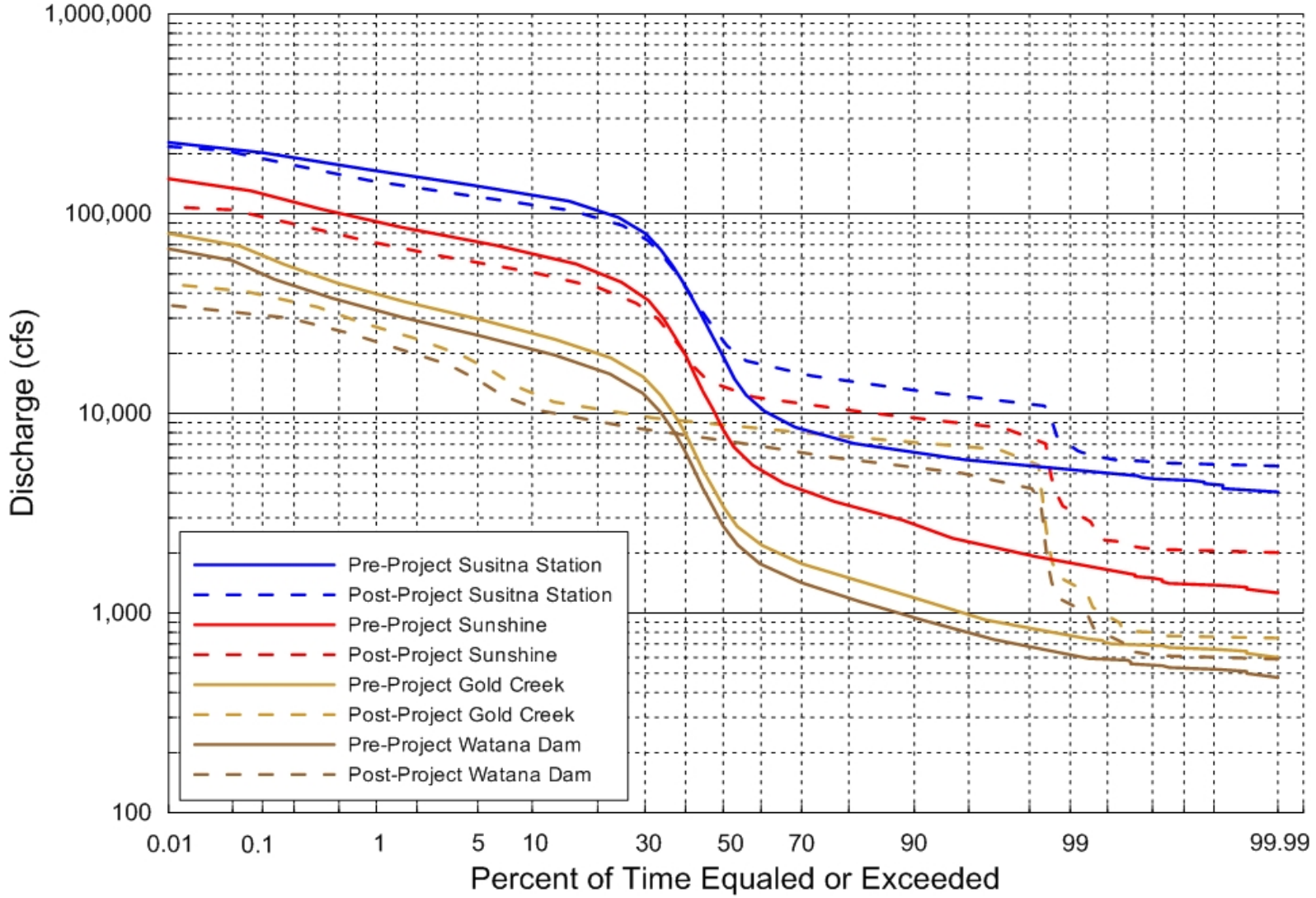

Figure 6.6.2. Annual flow-duration curve comparison for Pre-Project and Maximum Load Following OS-1 conditions.

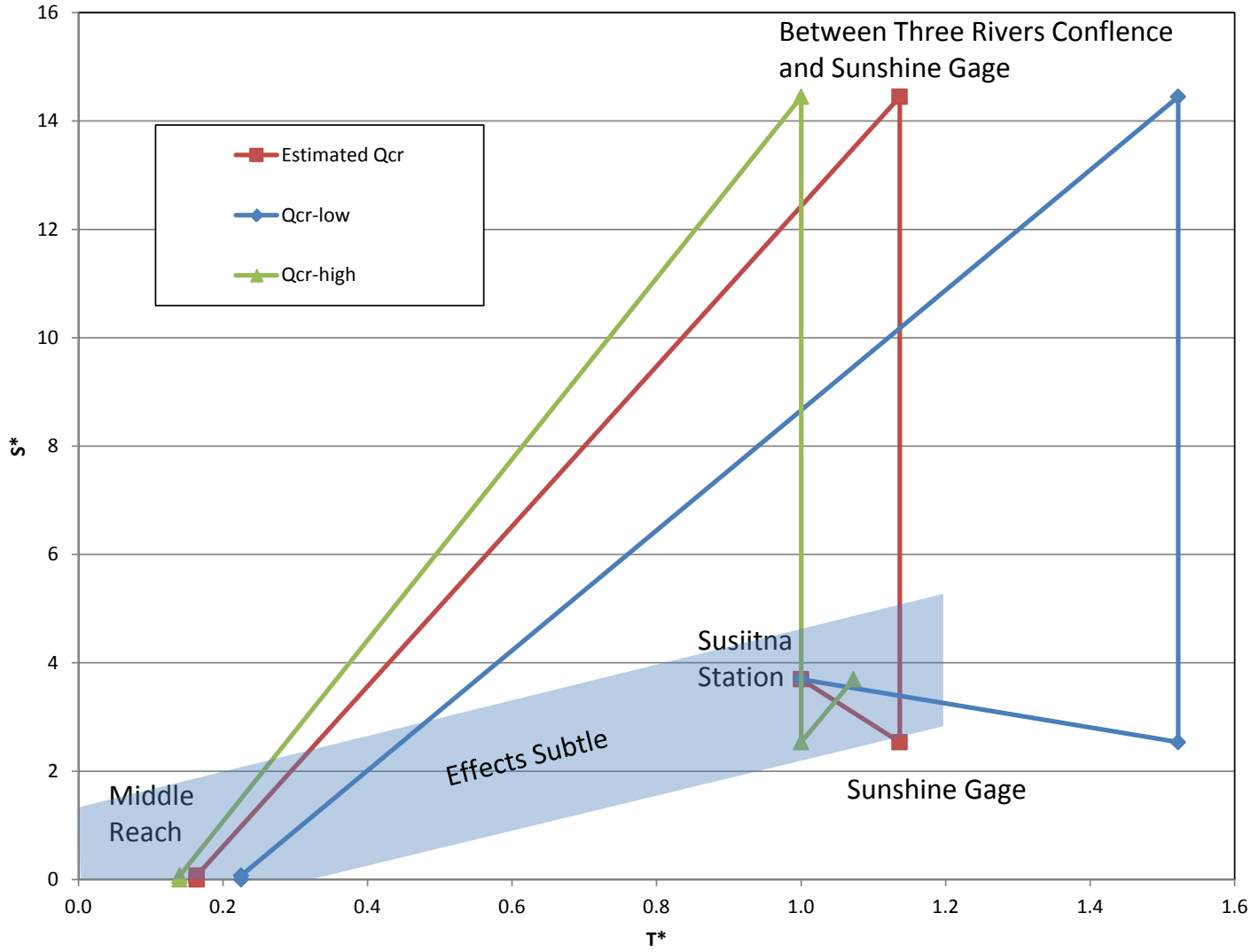

Figure 6.6.3. S* and T* on the Middle and Lower Susitna River Reaches.

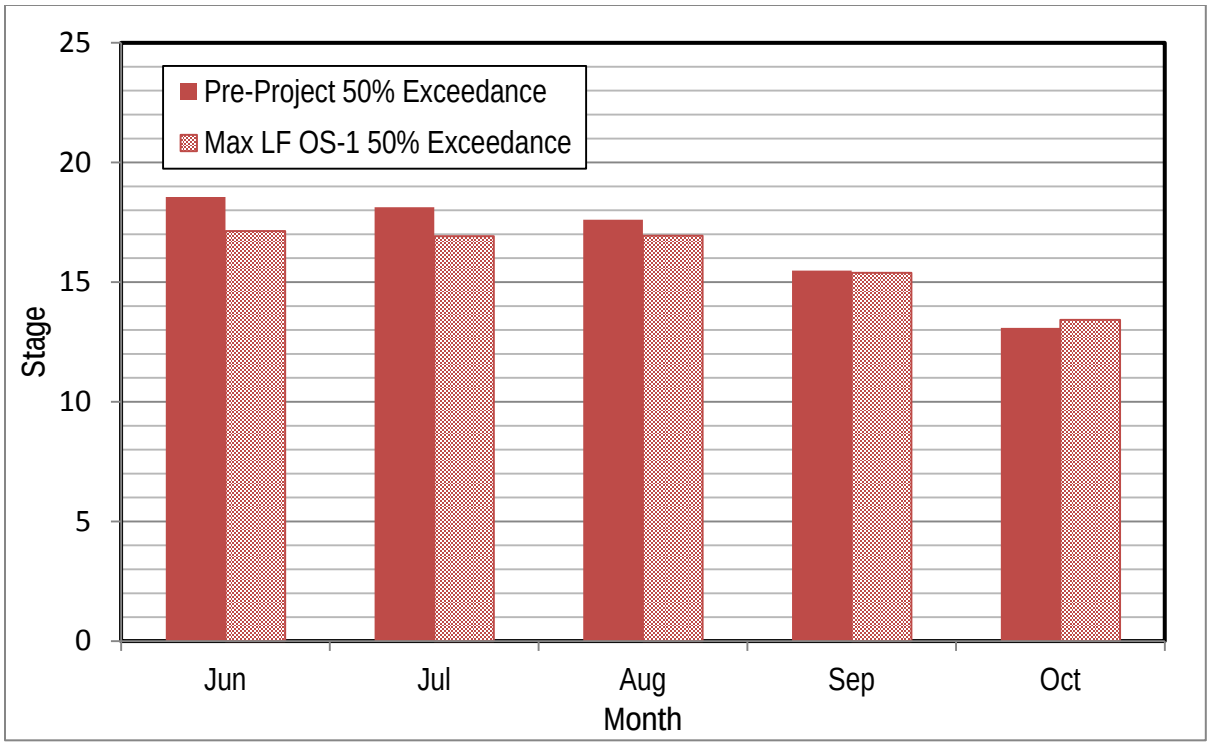

Figure 6.7-1. Monthly 50 percent pre-Project and Max LF OS-1 Stage-Exceedance Values at Sunshine Gage during the open-water period (Tetra Tech, Inc. 2013d).

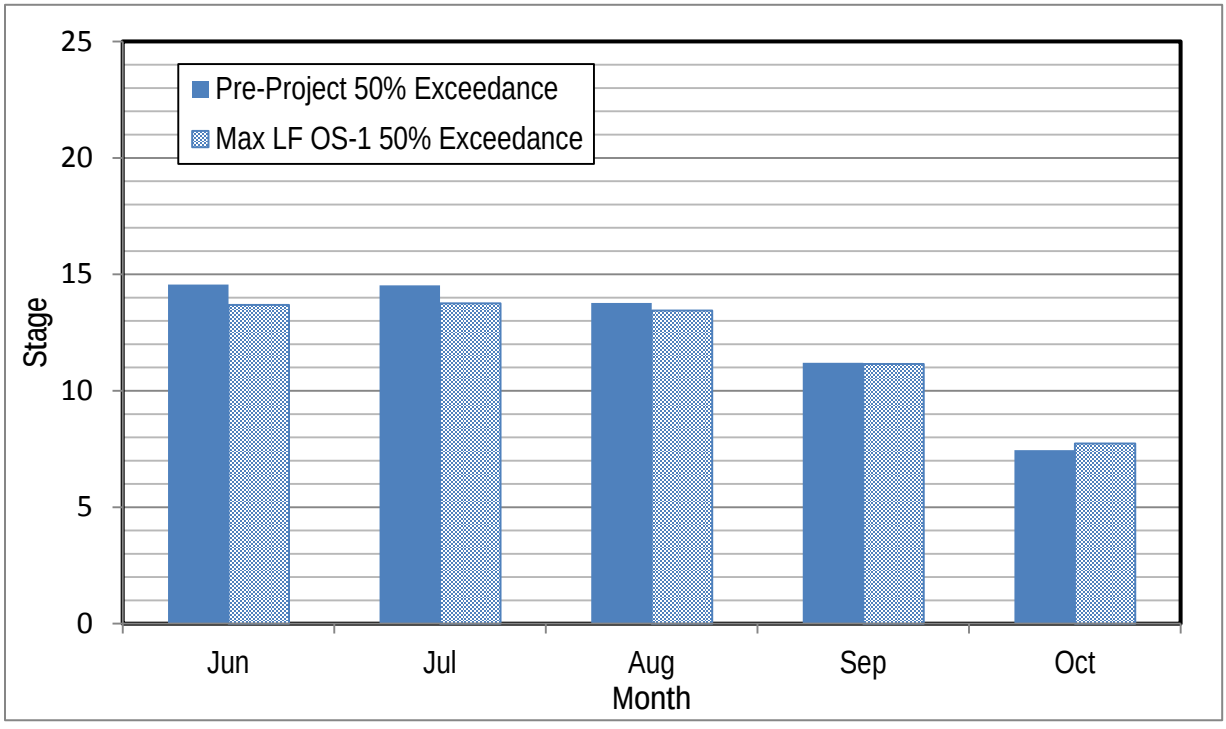

Figure 6.7-2. Monthly 50 percent pre-Project and Max LF OS-1 Stage-Exceedance Values at Susitna Station Gage during the open-water period (Tetra Tech, Inc. 2013d).