Appendix C

Reach 2A Update - Levee Capacity Evaluation of Geotechnical Gravelly Ford Study Area

July 2017

SAN JOAQUIN RIVER
RESTORATION PROGRAM

Reach 2A Update - Levee Capacity Evaluation of Geotechnical Gravelly Ford Study Area

May 18, 2017

1. INTRODUCTION

To support the California Department of Water Resources (DWR) with estimates of levee capacity in the San Joaquin River Restoration Program (SJRRP) project reach, Tetra Tech Inc. performed an analysis to establish a maximum flow capacity along the levees in Reach 2A (Tetra Tech, 2015) (**Figure 1**). The maximum flow capacity was based on results of a Geotechnical Condition Report (GCR) developed for the levees in this reach (Kleinfelder, 2015). The GCR indicated that a total of 8 reaches were identified in Reach 2A by the geotechnical team and designated by letters from A to H[1] (**Figure 2 and Figure 3**). An analysis cross section was selected for each reach as being representative of the location where seepage or stability issues are most likely to occur. The GCR identified the selected maximum reference water-surface elevation on the levee at each cross section that would not exceed geotechnical criteria for seepage and slope stability (Kleinfelder, 2015).

The results in Reach 2A have been updated to reflect the impact of recent subsidence. This memorandum summarizes the methods and results of the revised geotechnical capacity analysis for Gravelly Ford Study Area, and represents an update to Appendix C of the Levee Capacity Evaluation of Geotechnical Gravelly Ford (Reach 2A) Study Area 2015 Restoration Year (DWR, 2015). All results herein shall supersede those presented in Appendix C (DWR, 2015).
This memorandum summarizes the methods and results of the capacity evaluation update. This work was completed under the River Engineering Services for the San Joaquin River Restoration Program Contract, Task Order 15.

2. METHODOLOGY

The hydraulic model cross sections used in the 2015 study, which were selected as being upstream and nearest to each of the GCR cross sections, were also used in this analysis (**Figure 4**). In addition to the reach letter, the GCR cross sections are identified by a station number that refers to a distance along the levees. Both identifiers are referred to in this analysis. The elevation differences between the 2008 LiDAR/model elevations and the 2017 levee survey elevations in Reach 2A show that the land has subsided from 0.4 to 1.5 feet (**Figure 5**). The elevations in the model and the GCR cross section elevations were adjusted for subsidence according to Figure 5.

A range of flows up to 6,000 cfs was modeled in Reach 2A. Flows above the Restoration Flow of 4,500 cfs were modeled in Reach 2A because higher flows may occur in this reach in order to deliver a maximum Restoration Flow of 4,500 cfs to Reach 2B while accounting for attenuation and flow losses. The operational configurations of the Chowchilla Bypass Bifurcation Structure and the impacts on the upstream water-surface elevations are complex. As a result, computed water-surface profiles for this analysis are based on a downstream boundary condition that corresponds with observed water-surface elevations surveyed immediately upstream of the Bifurcation Structure

[1] A total of 8 reaches were identified and designated by letters A through H. Reach E, however, was not analyzed due to low levee heights (Kleinfelder, 2015).

over a range of flows, which was assumed to represent a typical operational condition (Tetra Tech, 2014). The downstream boundary condition elevations were also adjusted to reflect subsidence.

The GCR elevation at the assigned model cross section was used to interpolate a flow based on computed water-surface elevations that were run over a range of flows. If the associated flow was greater than 6,000 cfs, then a capacity of “>6,000 cfs” was reported and no further calculations were made.

3. RESULTS

Based on subsidence adjusted computed water-surface elevations, all seven of the analyzed reaches have a capacity of at least 6,000 cfs (**Figure 6**; **Table 1**) and continue to meet geotechnical criteria for levee seepage and slope stability at maximum Restoration Flows in the reach.

Table 1. Flow capacities at the GCR cross sections in Reach 2A.

GCR Reach[1]	GCR Station (ft)	Representative Model Cross Section	GCR Selected Maximum WSE (ft)	Flow Capacity (cfs)
A	11418+00	526981	174.8	>6,000
B	11560+00	541706	181.7	>6,000
C	11644+00	549708	184.7	>6,000
D	11708+00	555801	189.2	>6,000
F	11647+00	521166	171.9	>6,000
G	11742+00	532395	177.6	>6,000
H	11830+00	538908	181.7	>6,000

[1]Reaches A through D are located along the right levee, and Reaches F through H are located along the left levee of the San Joaquin River. Reach E is located along the upper end of the right levee, and was not analyzed because of low levee heights (Kleinfelder, 2015).

4. REFERENCES

Bureau of Reclamation, 2013. December 2011 to December 2013 Subsidence Result Maps.

Tetra Tech (dba Mussetter Engineering, Inc.), 2012. San Joaquin River Reaches 1B, 2A, 2B, 3 and 4B1 One-dimensional HEC-RAS Steady-state Hydraulic Model Bathymetry Updates. Review Draft technical memorandum prepared for the California Dept. of Water Resources, Fresno, California, January 31.

Tetra Tech, 2014. San Joaquin River and Bypass System 1-D Steady State HEC-RAS Model Documentation, Draft technical memorandum prepared for the California Dept. of Water Resources, Fresno, California, March.

Tetra Tech, 2015. Levee Capacity Evaluation of Geotechnical Gravelly Ford (Reach 2A) Study Area, Technical memorandum prepared for the California Dept. of Water Resources, Fresno, California, August.

Kleinfelder, 2015. Geotechnical Condition Report, San Joaquin River Restoration Program Gravelly Ford (Reach 2A) Study Area. Prepared for Department of Water Resources, April.

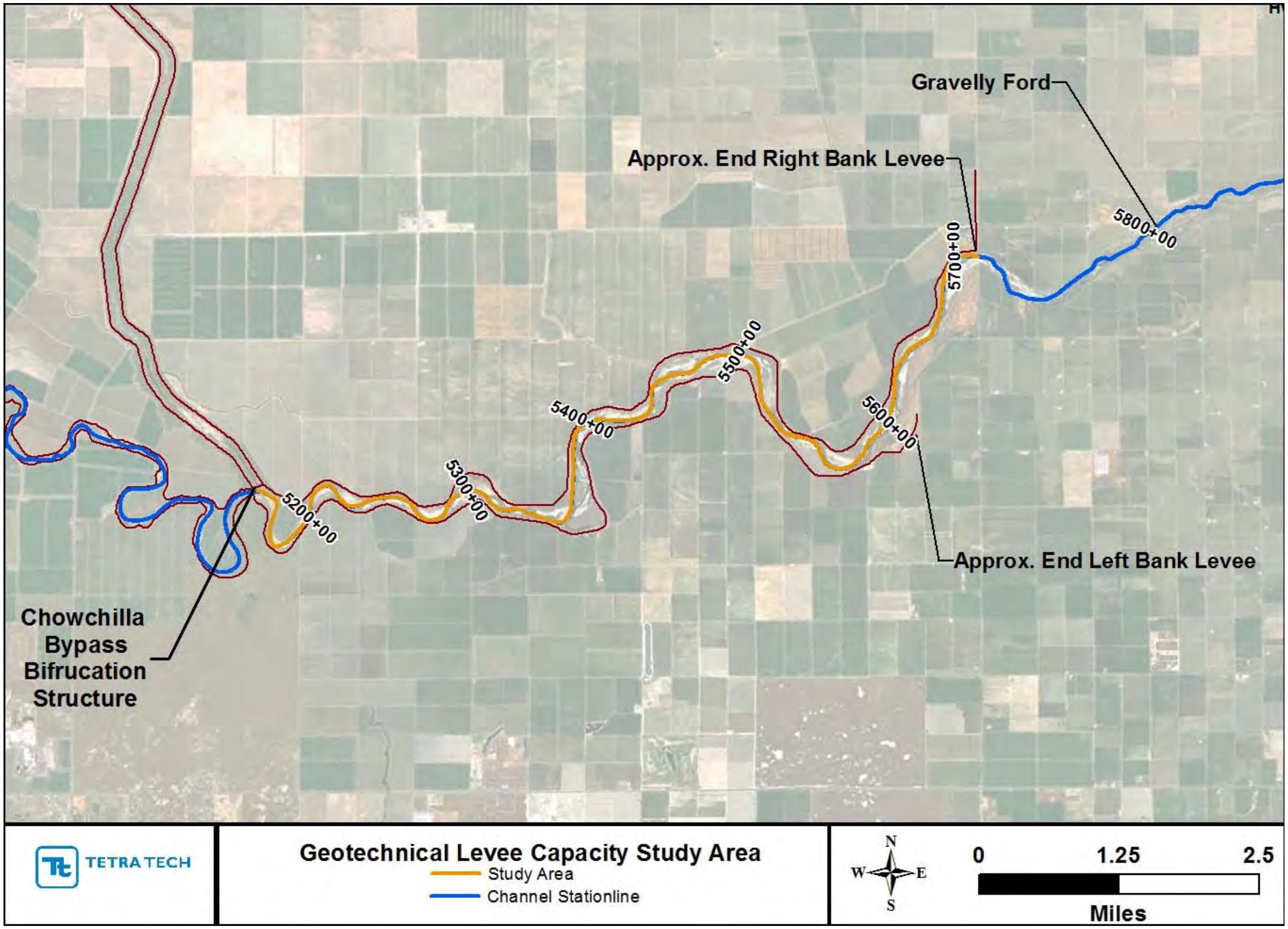

Figure 1. Site map of Reach 2A study area.

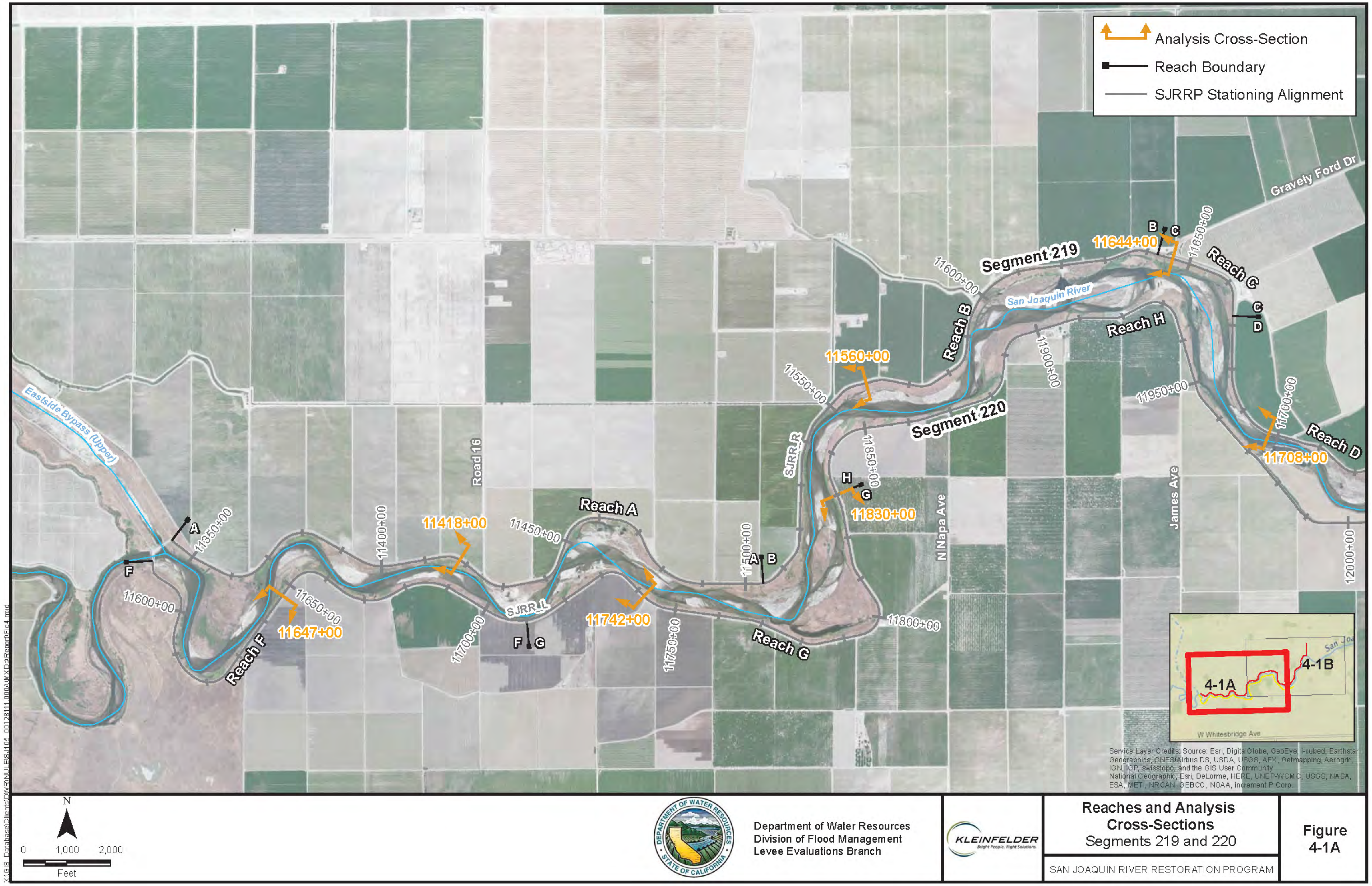

Figure 2. GCR analysis reaches and cross sections in the lower portion of Reach 2A (Figure 4-1a from Kleinfelder, 2015).

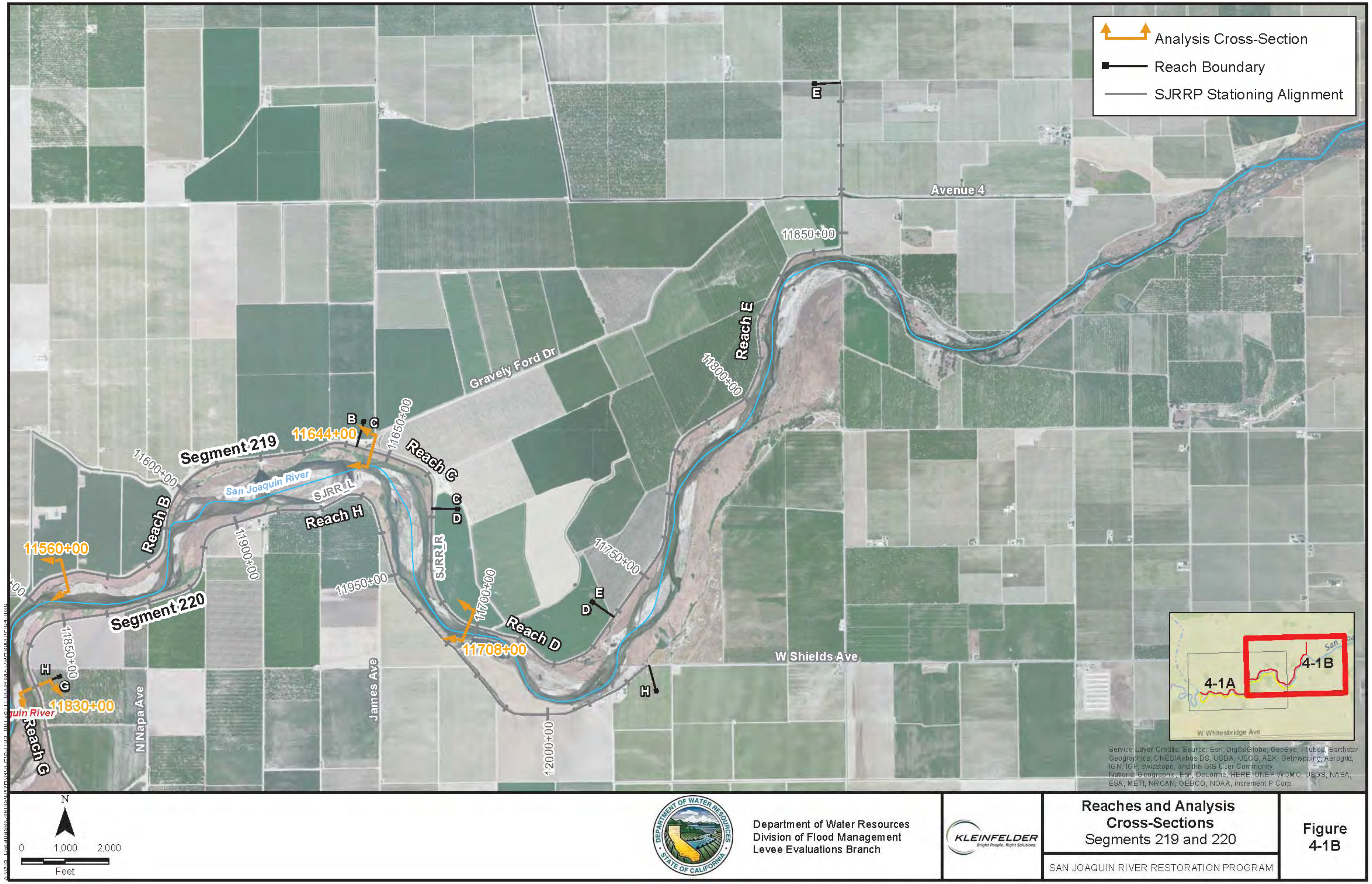

Figure 3. GCR analysis reaches and cross sections in the upper portion of Reach 2A (Figure 4-1b from Kleinfelder, 2015).

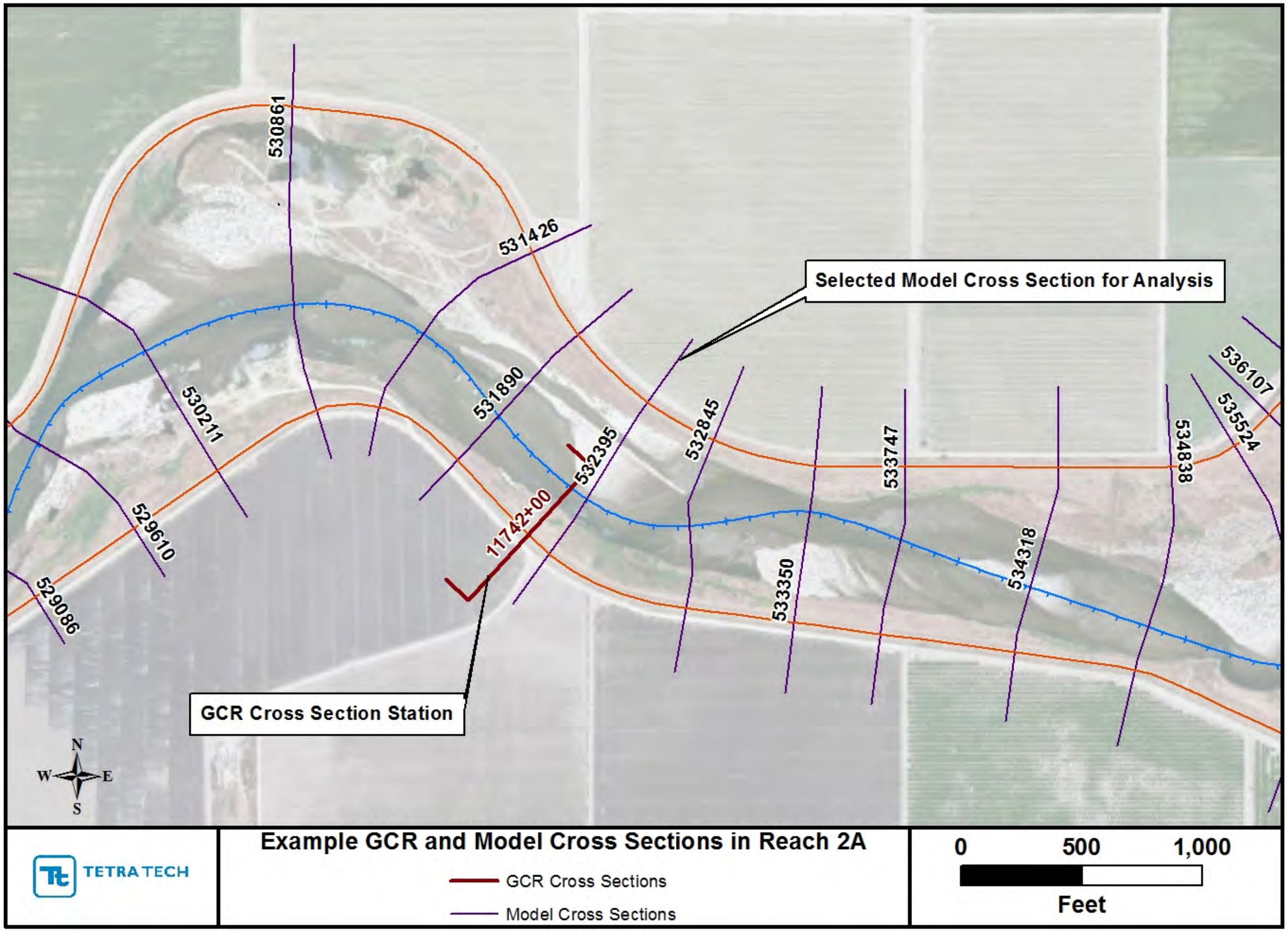

Figure 4. Planview of example GCR cross section and HEC-RAS model cross section selected for capacity calculations.

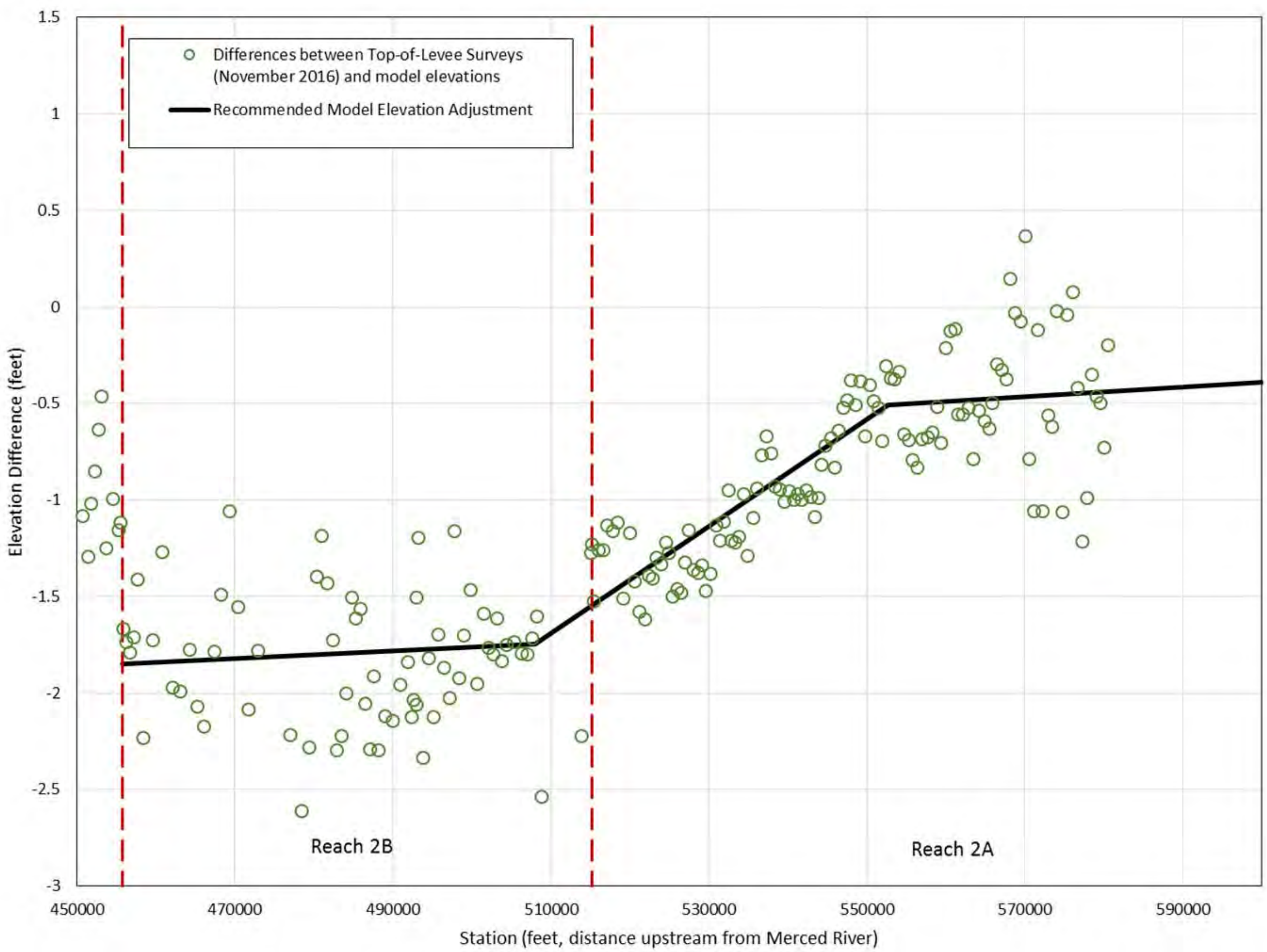

Figure 5. Elevation adjustment in Reaches 2A and 2B to accommodate the subsidence from 2008 (Tt-Mei, 2012) to November 2016.

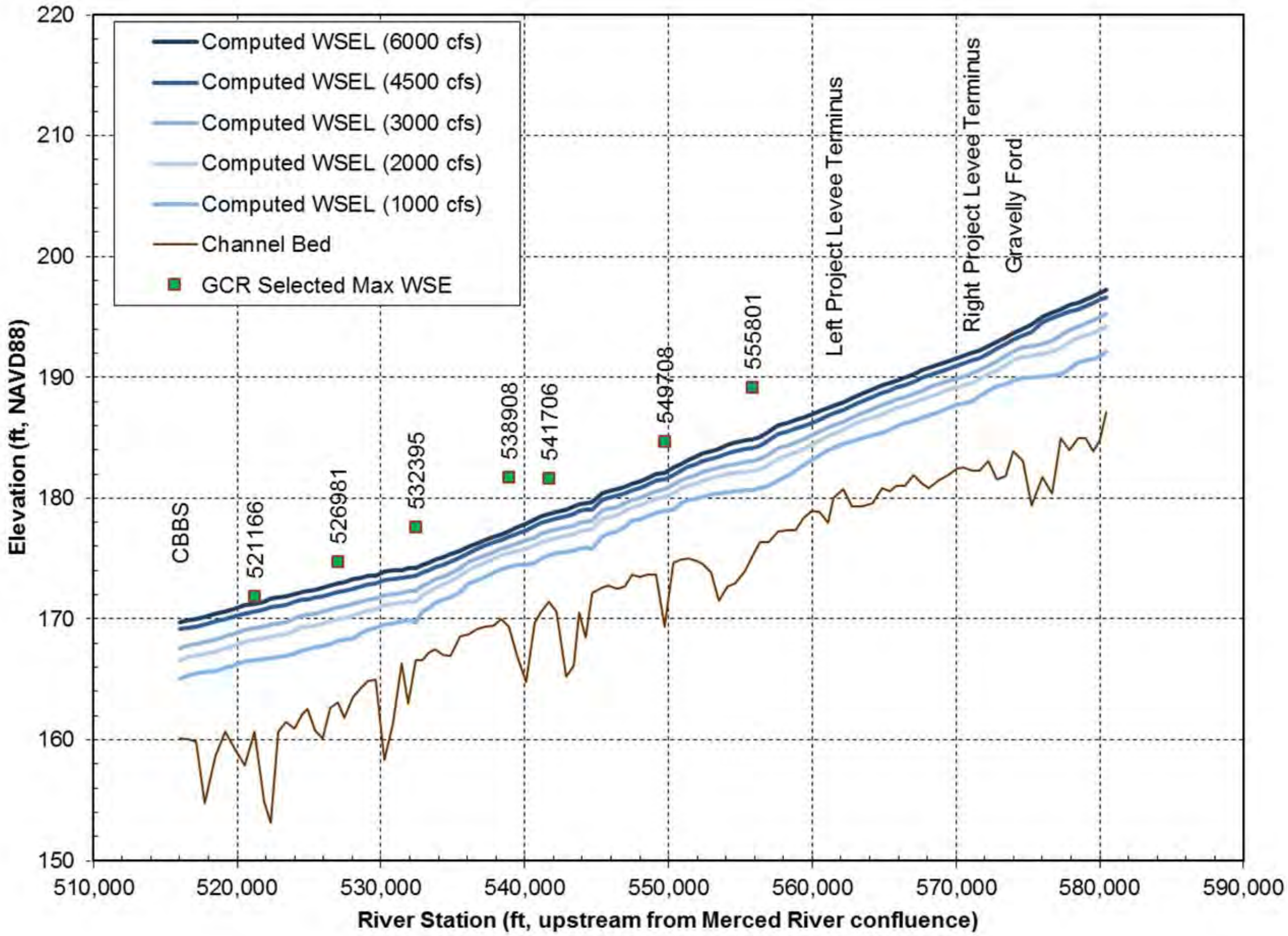

Figure 6. Computed water-surface profiles along Reach 2A. Also shown are the reference points and station identifier for each of the GCR cross sections in this reach.