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RECLAMATION

Technical Report No. ENV-2020-061

2019 Tracy Fish Collection Facility Bathymetric Survey

**Central Valley Project, Delta Division, CA
California-Great Basin Region**



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The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Cover Photograph: View of the Tracy Fish Facility from the water, looking west. (photo by: Robert Hildale).

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14. SHORT ABSTRACT The 2019 bathymetric survey of the Tracy Fish Collection Facility was used to produce a digital surface of the river bottom. This survey was performed in November 2019 using a SonTek Acoustic Doppler Current Profiler (ADCP) in conjunction with RTK GPS and Hypack software. The survey covered upstream of the trash rack (including a portion of the Old River channel), in the primary channel of the facility, and a portion of the intake channel to the Delta-Mendota Canal downstream of the primary louvers. This is the first known survey of the channel bed in, or near, this facility since construction. Deliverables include this report, including bed elevation maps, and an electronic surface in TIFF format.					
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2019 Tracy Fish Collection Facility Bathymetric Survey

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Acronyms and Abbreviations

ADCP	Acoustic Doppler Current Profiler
DMC	Delta Mendota Canal
GIS	Geographic Information System
GPS	Global Positioning System
JPP	C.W. “Bill” Jones Pumping Plant, formerly Tracy Pumping Plant
NAD 1983	North American Datum, established 1983
NGS	National Geodetic Survey
NAVD 1988	National American Vertical Datum, established 1988
Reclamation	Bureau of Reclamation
RTK	Real-Time Kinematic
SONAR	SOund Navigation And Ranging
TFCF	Tracy Fish Collection Facility
TFFIP	Tracy Fish Facility Improvement Program
TIFF	Tagged Image File Format
TSC	Technical Service Center
USBR 1946	U.S. Bureau of Reclamation datum of 1946 (local datum)

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1. Introduction

The Tracy Fish Collection Facility (TFCF) (Figure 1), a fish salvage facility that removes fish from Delta water exported by the C.W. “Bill” Jones Pumping Plant (JPP) via the Delta-Mendota Canal (DMC), is located approximately 9 miles northwest of Tracy, CA (Figure 2). The TFCF is in the southern Sacramento-San Joaquin Delta and is operated by the Bureau of Reclamation (Reclamation) as part of the Central Valley Project, Delta Division. The primary purpose of the Delta Division is to transfer water from the Sacramento River to the East Bay (Contra Costa County) of the San Francisco Bay Area and the San Joaquin Valley to bolster irrigation supplies formerly dependent on the San Joaquin River (Stene 1994).

All rivers transport sediment (e.g., clay, silt, sand, gravel, and cobble) and some Reclamation facilities can trap sediment, diminishing their effectiveness or utility over time. Periodic surveys measure the changing bed surface elevations and provide information to assist facility operations.

As part of an effort to better understand sedimentation within and around the TFCF, J. Carl Dealy requested the Technical Service Center’s (TSC) Sedimentation and River Hydraulics Group conduct a bathymetric survey of certain underwater portions of the TFCF, as well as a portion of the Old River channel in the vicinity of the facility, and a portion of the intake channel to the DMC downstream of the primary channel louvers. A complete bathymetric survey was conducted on November 19th & 20th, 2019, with the primary objective of mapping bed elevations within and around the facility.



Figure 1.—Oblique aerial photograph of the Tracy Fish Collection Facility (<https://www.usbr.gov/projects/index.php?id=477>).

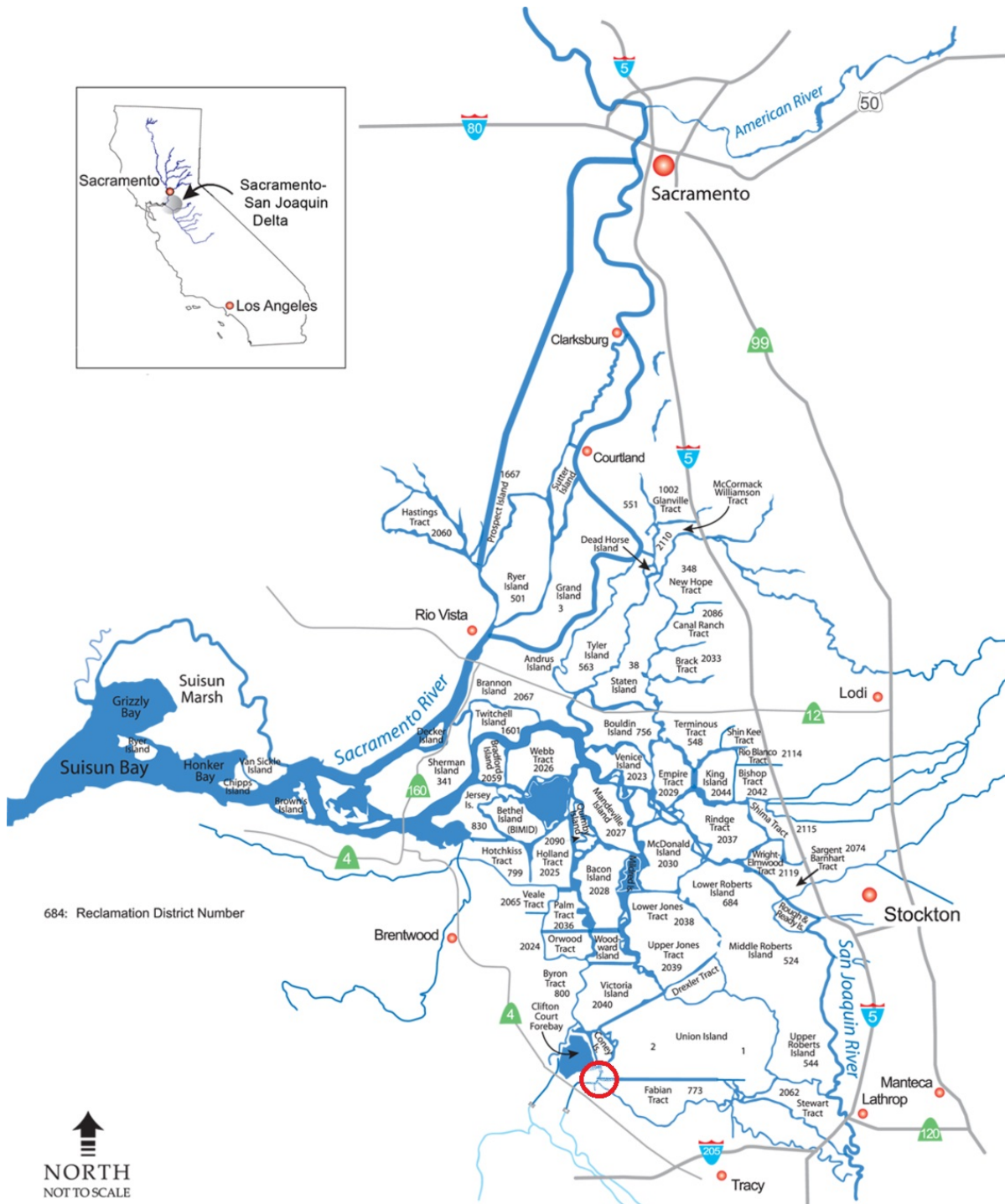


Figure 2.—Location map of the Sacramento-San Joaquin Delta. The Tracy Fish Collection Facility is in the red circle immediately south of Clifton Court Forebay
<https://www.usgs.gov/media/images/map-sacramento-san-joaquin-delta>.

1.1. Project Setting

The Delta Division provides for the transport of Sacramento River water through the Sacramento-San Joaquin River Delta to Contra Costa County and to the San Joaquin Valley and surrounding farmland. The main features of the division are the Delta Cross Channel, Contra Costa Canal, C.W. “Bill” Jones Pumping Plant (JPP; formerly Tracy Pumping Plant) and Delta-Mendota Canal, constructed and operated by the Bureau of Reclamation. The Delta Cross Channel diverts water from the Sacramento River to the intakes of the Contra Costa and Delta-Mendota Canals. The TFCF is located 2.5 miles upstream of JPP and functions to salvage fish from water destined for export by the JPP.

There are no known bathymetric surveys of the TFCF (since construction) prior to the one documented in this report. There are some contours in the original construction drawings, but a more complete set of bed contours was not located.

2. Survey Control and Datum

For the 2019 survey, all bathymetry and Global Positioning System (GPS) control measurements were collected in North American Datum 1983 (NAD 1983; 2011) State Plane (horizontal) coordinates, California SP Zone III. The vertical datum is the North American Vertical Datum 1988 (NAVD 1988) using Geoid 12A. All units are in US survey feet. It is worth noting that most of the bed elevations at this location are below sea level and therefore have a negative elevation value.

The GPS base station receiver was set up over a monument located on the north side of the facility (Figure 3). This monument is pictured in Figure 4 & Figure 5 and is referred to as “Fish”. Coordinates for this monument were provided by Mark Morberg (California Great Basin Region surveyor). Those coordinates are as follows (US survey ft.):

 Northing = 2121644.79

 Easting = 6255684.30

 Elevation = 17.18

The vertical shift from NAVD 1988 and the local USBR1946 Datum for the TFCF was not as precisely identified. The vertical difference between original drawings and the current survey indicates that the modern survey is 0.8 feet lower than elevations indicated on original drawings. This conclusion is based on several survey points located on the decks and walls of the structure.



Figure 3.—Aerial photograph of the Tracy Fish Collection Facility. The red circle indicates the location of the control point “Fish” that was used for the survey.



Figure 4.—Photograph of the monument “Fish” (BC FISH 1971 @ FISH COLLECTION FACILITY) used for survey control. The general location is shown in Figure 3.



Figure 5.—GPS base station set-up over the 'Fish' monument.

3. Methods Summary

A complete bathymetric survey of the Tracy Fish Collection Facility and surrounding areas was conducted in November 2019 from a cataraft using an Acoustic Doppler Current Profiler (ADCP) as a depth sounder to continuously measure water depths (Figure 6). The horizontal and vertical position of the moving raft was continually tracked using Real Time Kinematic (RTK) GPS. Hypack 2019 software was used for data collection. This software provides a means to link the SONAR depth readings and GPS position measurements to obtain bottom elevations. A map of the data points collected is presented in Figure 7. Point density ranges from 21.3 to 43.3 points per 100 ft².

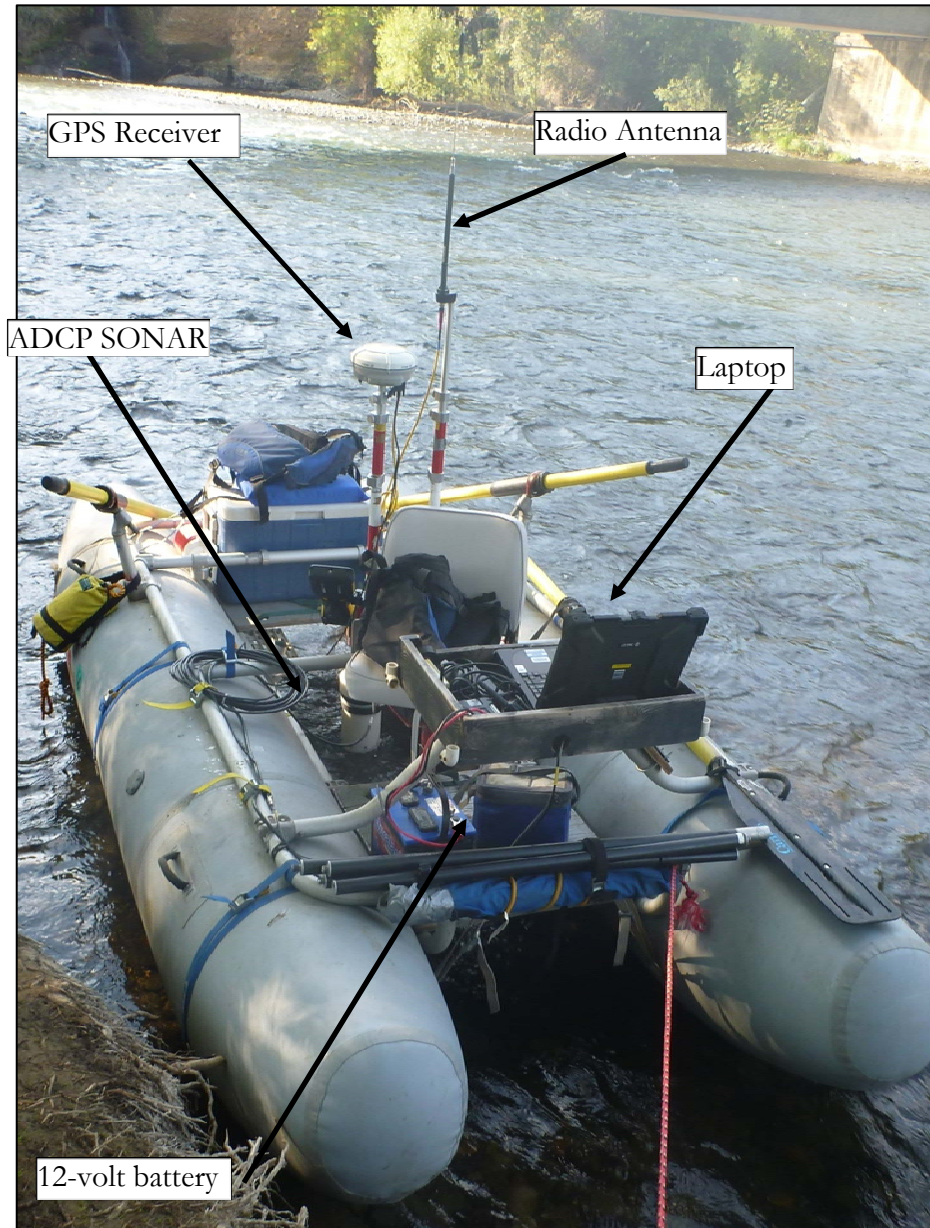


Figure 6.—Photograph of the cataraft configured for bed surveying.

The cataraft had to be lifted into and out of two sections of the facility; the areas above and below the trash rack (rack). The movement of the cataraft into and out of the facility was accomplished with a crane (Figure 8). For the area below the louvers and in Old River, the cataraft was launched from the shore.

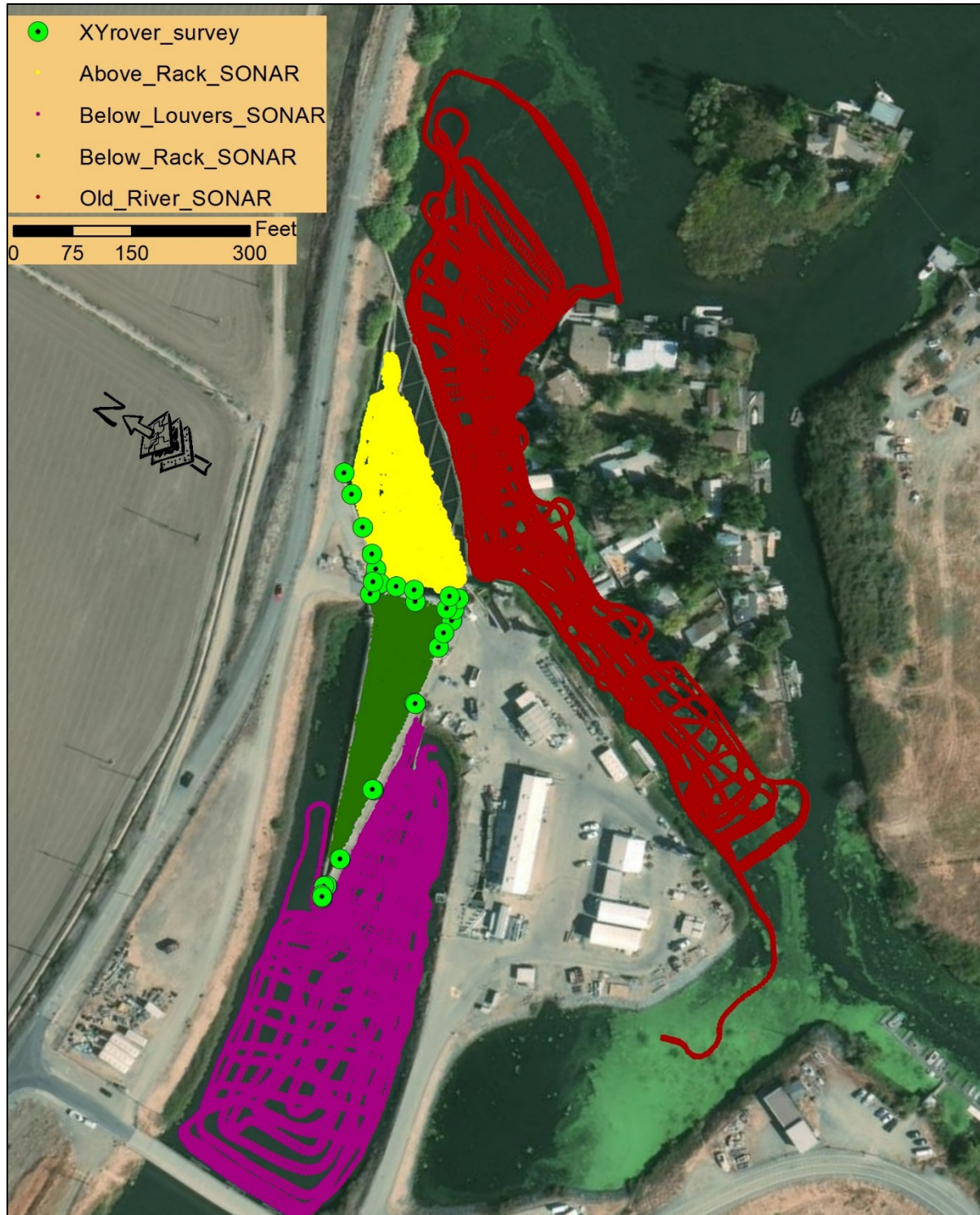


Figure 7.—Map of bathymetric survey data coverage.



Figure 8.—The cataraft being lowered into the Tracy Fish Collection Facility.

The SonTek M9 ADCP has a total of 9 transducers, 5 of which are in use during a ping (transmit pulse). The footprint of the depth measurements from each ping normally results in 5 points. The 4 outer beams are positioned at a 25-degree angle from nadir, which results in a footprint approximately equal to the depth. These depth measurements are matched to coordinates provided by the GPS equipment to obtain horizontal position and bed elevation.

3.1. Processing Survey Data

Following the SONAR data collection, data were processed using Hypack 2020 software. During a SONAR survey there are spurious points that do not properly represent the bed elevation and these points must be removed. After the processing in Hypack was completed the data were exported as a point cloud (Figure 7). During data export a small shift was applied to adjust the coordinates used during the survey to the control point “Fish” provided by Morberg. These points were used to make an electronic surface of the channel bathymetry using Arc GIS (ESRI, Redlands, CA). These maps are included in Appendix A. Additionally, a georeferenced electronic surface is available in TIFF format (www.usbr.gov/tsc/techreferences/eereports.html).

4. Conclusions and Recommendations

4.1. Sedimentation Observations

The original construction drawings have some locations that indicate channel bed elevations that can be compared to the current survey to evaluate aggradation or degradation. It is important to consider the different vertical datums of the surveys when making this comparison. As stated previously, the modern NAVD 1988 datum is approximately 0.8 feet below the USBR 1946 vertical datum.

At the trash rack, the original construction drawing (#214-D-19561) indicates that the concrete footer on the bed is at elevation -14.8 ft (adjusted to NAVD 1988). The 2019 survey indicates bed elevations range from -14.8 to -14 ft on the upstream side of the rack. Bed elevations range between -14.9 to -14.4 ft on the downstream side of the rack (Figure 9). The concrete on the bed at the base of the louver structure is also at elevation -14.8 ft (adjusted to NAVD 1988) in the drawing (#214-D-19564). The 2019 survey indicates bed elevations on the north side of the louver structure are between -14.9 and -14.3 feet (NAVD 1988) and on the south side of the structure elevations are between -14.9 and -14.4 ft (Figure 9). These comparisons indicate a small amount (~ 0.5 ft on average) of aggradation in some locations along the profiles indicated (Figure 9 and Appendix A). This aggradation is likely a combination of sediment and vegetation along the rack and louvers.

Although past bed elevation in the area away from the structures is not known, it appears as though there is no significant aggradation or scour that poses a threat to the structure or normal operations. Although without any historical surveys of the channel, this is difficult to ascertain.

4.2. Recommendation for Next Survey

Should a future survey be performed it will be important to use the control point (Fish) and its coordinates established by the regional surveyor. These coordinates and projection are included in Section 2. This will ensure the compatibility of the two surveys and make their comparison meaningful.

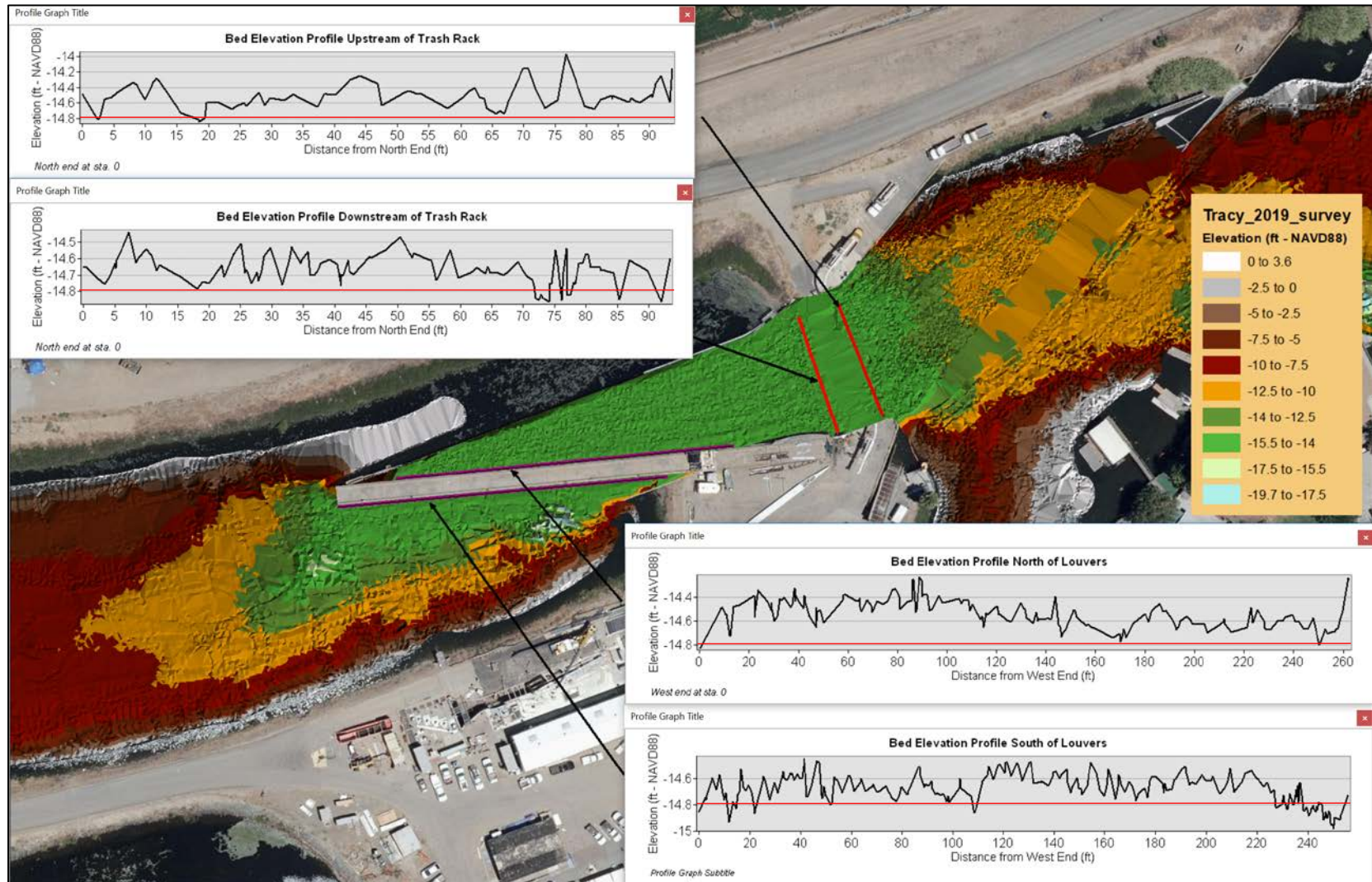
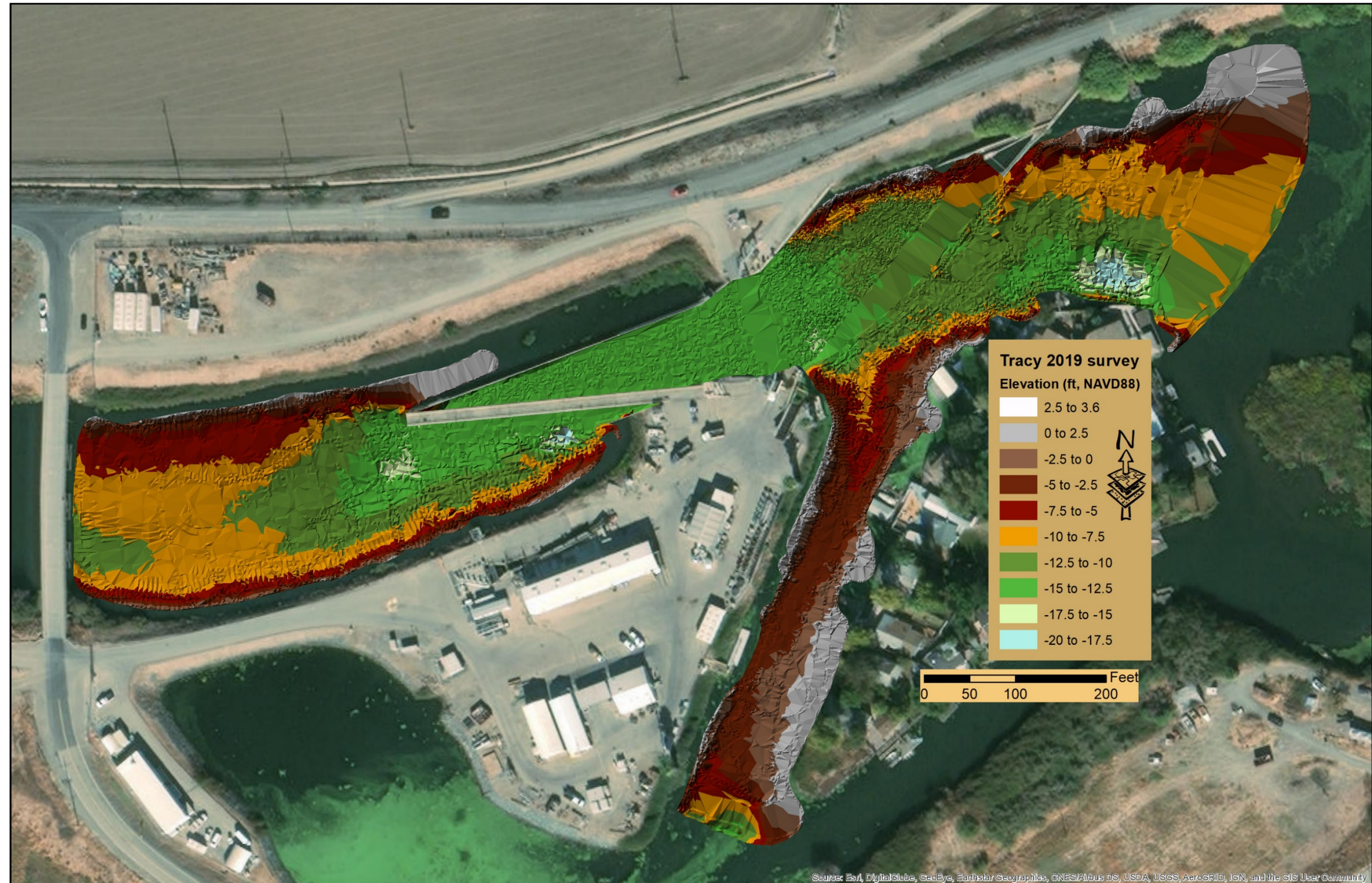


Figure 9.—Bed elevation profiles at select locations for comparison to original drawings. The red line in each profile graph represents the original elevation of the concrete footers on the channel bed, the elevation of which has been adjusted to NAVD1988.

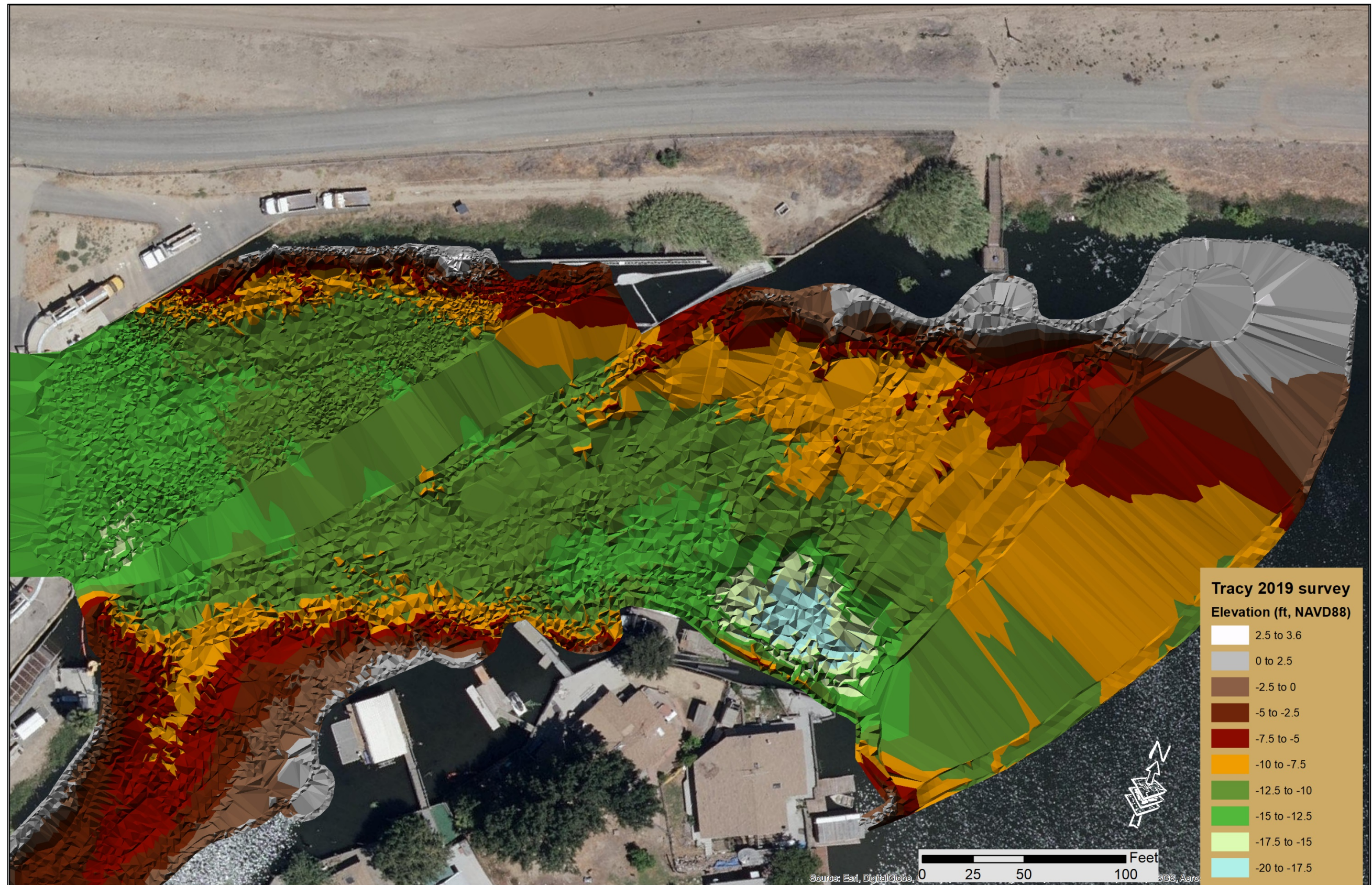
5. References

Stene EA. 1994. *Delta Division: Central Valley Project*. Research on Historic Reclamation Projects, Bureau of Reclamation History Program, Denver, CO.

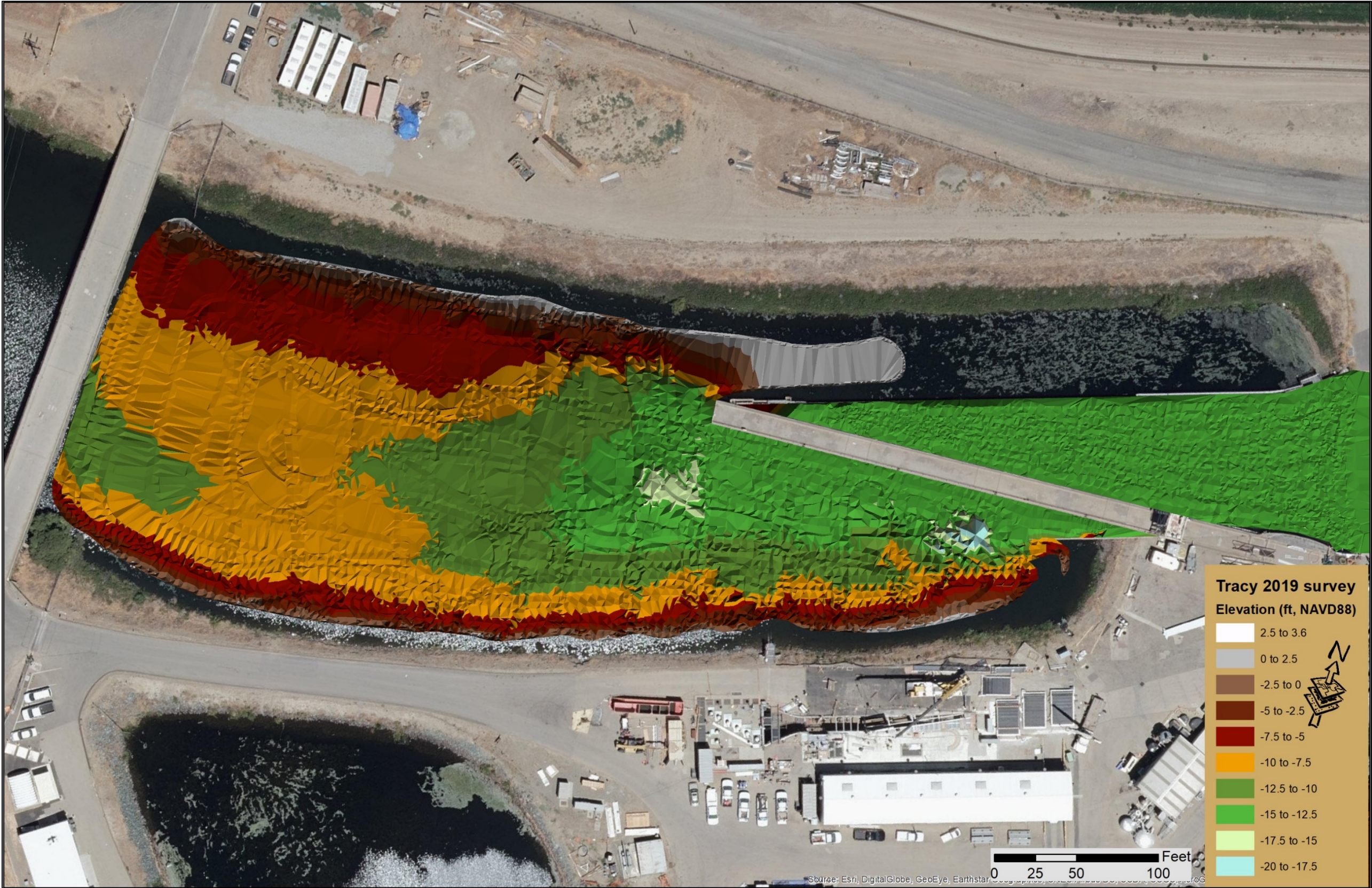
Appendix A — Bed Elevation Maps



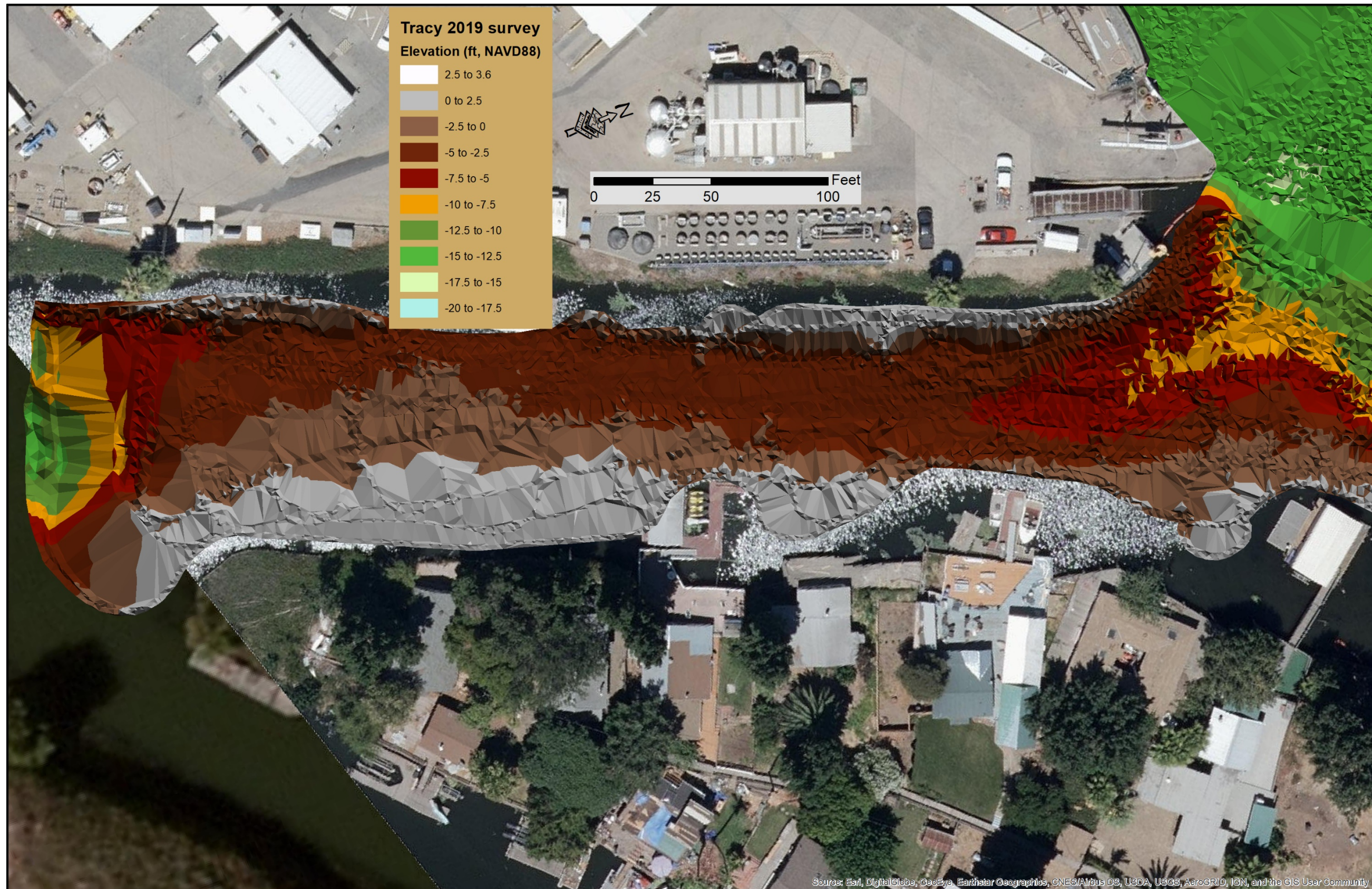
Bed Elevation map of the Tracy Fish Collection Facility primary channel and surrounding channels.



Bed elevation map of the area upstream of the Tracy Fish Collection Facility trash rack.



“Bed elevation map of the Tracy Fish Collection Facility (TFCF) primary channel and intake channel to the Delta-Mendota Canal downstream of the TFCF primary louvers.”



Bed elevation map of the Old River channel adjacent to the Tracy Fish Collection Facility