State Route Highway 1 Auxiliary Lanes and Bus-on-Shoulder Improvements Freedom Blvd to State Park Dr. and Coastal Rail Trail Segment 12 Project
Santa Cruz County, California
05-SCR-01, PM 8.1/10.7; EA 05-0C7340; Project ID 0520000083

Floodplain Evaluation Report

Prepared for:

SCCRTC Caltrans

September 2022

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Submitted to:
California Department of Transportation and Santa Cruz County Regional Transportation Commission

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

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9/22/2022
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Executive Summary

The State Route Highway 1 (SR 1) Auxiliary Lanes and Bus-on-Shoulder (BOS) Improvements Project (Project), Freedom Boulevard to State Park Drive and Coastal Rail Segment 12, is being proposed by the California Department of Transportation (Caltrans) in cooperation with the Santa Cruz County Regional Transportation Commission (SCCRTC) and the County of Santa Cruz. The Project proposes to widen SR 1 to include auxiliary lanes and accommodate BOS operations between the Freedom Boulevard and State Park Drive interchanges and to construct the Coastal Rail Trail Segment 12 along the existing railroad tracks route in Santa Cruz County (County), California. This *Floodplain Evaluation Report* presents the findings from the location hydraulic study conducted for the Project, along approximately 2.6 miles (mi) of SR 1 and the proposed the Coastal Rail Trail Segment 12 in the census-designated communities of Soquel and Aptos, Santa Cruz County, California.

The purpose of this Project is to reduce congestion along SR 1 through the Project limits, enhance bicycle and pedestrian connectivity along Segment 12 of the Coastal Rail Trail, promote the use of alternative transportation modes to increase transportation system capacity and reliability, and provide Coastal Rail Trail access across SR 1 at two railroad bridges.

The purpose of this study is to examine and analyze the existing Federal Emergency Management Agency (FEMA) base (100-year) floodplain within the Project limits and verify potential for sea-level rise (SLR) impacts; to document any potential impacts to or encroachments upon the floodplain; and to recommend any avoidance, minimization, or mitigation measures that may be required. The Federal Highway Administration (FHWA) defines impacts to and significant encroachment on a floodplain using the following conditions:

1. Significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route,
2. Significant risk with change in land use, fill inside the floodplain, or change in water surface elevation (WSE), or
3. Significant adverse impact on the natural and beneficial floodplain values.

The receiving waters for the Project are Aptos Creek, Valencia Creek, Valencia Lagoon, and the Pacific Ocean. The northern portion of the Coastal Rail Trail Segment 12 of the Project is in the Soquel Watershed and drains directly to the Pacific Ocean through a system of stormwater drains. Valencia Creek is a tributary to Aptos Creek, and Aptos Creek drains directly to the Pacific Ocean. Aptos Creek and Valencia Creek are the two creeks in designated FEMA floodplains within the Project footprint. Valencia Creek is a tributary to Aptos Creek. Aptos Creek empties into the Pacific Ocean approximately 0.5 mi south of the Project. The Valencia Creek FEMA floodplain is designated as shaded Zone X, which represents areas subject to flooding by storm events between the 100-year

and 500-year floods. These areas are considered to be outside of the FEMA base floodplain. The Aptos Creek FEMA floodplain is designated as a Special Flood Hazard Area (SFHA) Zone AE, which represents areas subject to flooding by the 100-year flood. Zone AE areas are determined by detailed methods and depict base flood elevations (BFE). A floodway has also been defined by FEMA along this reach of Aptos Creek. Although the railroad structures will span over Aptos Creek, the improvements will be outside of the SFHA. This study primarily focuses on the FEMA base floodplains, which are associated with the improvements along SR 1, and are depicted on FEMA Flood Insurance Rate Map (FIRM) panel 06087C0357F.

Since the Project is located within coastal zone, SLR was also evaluated for the Project to comply with Executive Order S-13-08. Caltrans has provided guidance to comply with this order including the following: *Guidance on Incorporating Sea Level Rise – For use in the planning and development of Project Initiation Documents, published by Caltrans on May 16, 2011* (Caltrans Guidance) and the 2019 *Climate Change Annotated Outline Non-Capacity Increasing Projects* (AO) found in the Forms and Templates section of the Caltrans Standard Environmental Reference (SER). In addition, the Project is within the California Coastal Commission's (Coastal Commission) jurisdiction, i.e., within the coastal zone boundary of Santa Cruz County. Per the 2016 *Coastal Commission's California Coastal Commission Statewide Sea Level Rise Vulnerability Synthesis*, Santa Cruz County Local Coastal Program (LCP) was stated to be in the process of updating their LCP to address SLR. Aptos is an unincorporated place under the jurisdiction of the County of Santa Cruz and therefore, the entire Coastal Zone area within the Project limits is anticipated to be subject to the requirements of the Santa Cruz County LCP. However, the Coastal Commission's SLR Guidance provides recommendations on addressing SLR as part of the development of an LCP, LCP Amendment, or other plans that address SLR.

A SLR depth of 7 feet (ft) was estimated based on the Project's service life of 75 of the bridge. A SLR depth of 1.8 ft was estimated for the 20-year service life of the roadway. The SLR assessment was conducted following the methodologies outlined in the *State of California Sea-Level Rise Guidance*, 2018 Update (California Natural Resources Agency and California Ocean Protection Council, 2018) using, the medium-to-high risk scenario. The National Oceanic and Atmospheric Association (NOAA) Sea Level Rise Viewer tool, FEMA FIRM, and NOAA's Light Detection and Ranging (LiDAR) dataset were used to map the 100-year storm event WSE with a 7 ft SLR and the results showed the roadway elevations of SR 1 within the Project limits would not be impacted by SLR as they were between 20 to 200 ft. Therefore, further analysis of SLR impacts in the Project limits were not evaluated for this report.

A hydraulic model was developed to assess the effects of the Project on the base floodplains. The hydraulic model results showed the increase in WSE was 0.02 ft or less for Aptos and Valencia creeks. Fill in the floodplain will be limited to the additional piers needed for the bridge deck widening. The additional fill is anticipated to be offset by grading the banks. The proposed pedestrian bridges along the Coastal Rail Trail Segment

12 will be designed to have all grading, piers and others structures outside of the base floodplain with the projected SLR. Based on the results of the hydraulic model in the affected area, there would be negligible changes to the WSE based on the proposed widening and grading at Aptos Creek Bridge, and the 100-year WSEs would be below the roadway elevations of SR 1.

The Project is not proposing to change the overall land uses within the watershed and is not anticipated to cause substantial impacts due to the added impervious areas. Fill as a result of the Project would be limited to the additional piers at the Aptos Creek bridge widening on SR 1. This addition of fill will be minor compared to the watershed size. The hydraulic model showed the proposed bridge at Aptos Creek would have adequate freeboard during the 100-year flood (approximately 25.1 ft during the 100-year flood, and 20.3 ft during the 100-year flood with SLR) and therefore, traffic interruptions are not anticipated. The level of risk associated with the Project is low, and special mitigation measures to minimize floodplain impacts are not anticipated.

Potential short-term adverse effects during the construction of the Project to natural and beneficial floodplain values include: 1) loss of vegetation during construction activity; and 2) temporary disturbance to wildlife and/or aquatic habitat. Construction should be planned to avoid adverse effects to the natural and beneficial floodplain areas to the maximum extent practicable.

Per the *Draft Natural Environment Study* (NES), special-status species have the potential to occur in the Project area. Federal Endangered Species Act (FESA) Consultation with NOAA National Marine Fisheries Service is required for potential impacts to Central California coast steelhead. Consultation with the U.S. Fish and Wildlife Service (USFWS) for potential impacts to California red-legged frog, least Bell's vireo, southwestern willow flycatcher, and tidewater goby will also be required (SWCA Environmental Consultants, 2022).

Temporary environmental impacts that could potentially result from construction activities for the Project could be minimized with measures such as BMPs consistent with Caltrans' Construction Site Best Management Practices (BMP) Manual, seasonal work restrictions, revegetation, establishing a boundary for work around sensitive habitat, implementing erosion control measures, and other activities that are part of the Project's permit conditions. Additionally, implementation of avoidance and minimization measures are required to avoid spreading or introducing invasive plants that are present on the Project site.

Regulatory permits and approvals are expected to be required from the Regional Water Quality Control Board (RWQCB), United States Army Corps of Engineers (USACE), California Department of Fish and Wildlife (CDFW), and the Coastal Commission. A Section 401 Water Quality Certification from the RWQCB, a Section 404 Permit from the USACE, a Section 1602 Streambed/Lakebed Alteration Agreement

from the CDFW, and a Coastal Development Permit or Waiver from the Coastal Commission are expected to be required for the Project.

Based on the findings of this report the impacts to the Aptos Creek floodplain are anticipated to be insignificant. This report will be circulated by SCCRTC to Caltrans, the local floodplain administrators, and FEMA as necessary for concurrence on the impact assessment and the findings that the Project has minimal impacts on the base floodplain.

Acronyms

23 CFR 650A	Title 23, Code of Federal Regulations, Part 650, Subpart A
ADT	average daily traffic
BFE	base flood elevation
BIR	Bridge Inspection Report
BMP	best management practice
BSA	Biological Study Area
BOS	bus-on-shoulder
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CFR	Code of Federal Regulations
cfs	cubic feet per second
CLOMR	Conditional Letter of Map Revision
Coastal Commission	California Coastal Commission
Commission's SLR Guidance	California Coastal Commission Sea Level Rise Guidance
County	Santa Cruz County
DWR	Department of Water Resources
EA	Environmental Assessment
EIR	Environmental Impact Report
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FONSI	Finding of No Significant Impact
ft	feet, foot
HDM	Highway Design Manual
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HOV	High Occupancy Vehicle
LCP	Local Coastal Program
LiDAR	Light Detection and Ranging
LOMR	Letters of Map Revision
MBSST	Monterey Bay Sanctuary Scenic Trail
MHHW	Mean Higher High Water
NAVD 88	North American Vertical Datum of 1988
NES	Natural Environment Study
NFHL	National Flood Hazard Layer
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Association

OPC	Ocean Protection Council
PM	post mile
Project	State Highway Route 1 Auxiliary Lanes and Bus-on-Shoulder Improvements—Freedom Boulevard to State Park Drive—and Coastal Rail Trail Segment 12 Project
RS	river station
RWQCB	Regional Water Quality Control Board
RW 6	Retaining Wall 6
SCBRL	Santa Cruz Branch Rail Line
SCCRTC	Santa Cruz County Regional Transportation Commission
SCCDEH	Santa Cruz County Department of Environmental Health
SFHA	Special Flood Hazard Area
SLR	Sea-level rise
SR	State Route
STB	Surface Transportation Board
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
TBMP	Treatment best management practices
TMP	Transportation Management Plan
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WSE	water surface elevation

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1 GENERAL DESCRIPTION

The following is the *Floodplain Evaluation Report* for the State Route Highway 1 (SR 1) Auxiliary Lanes and Bus-on-Shoulder Improvements—Freedom Boulevard to State Park Drive—and Coastal Rail Trail Segment 12 Project (Project).

The Project is being proposed by the California Department of Transportation (Caltrans) in cooperation with the Santa Cruz County Regional Transportation Commission (SCCRTC) and the County of Santa Cruz. The Project proposes to widen SR 1 to include auxiliary lanes and accommodate bus-on-shoulder (BOS) operations between the Freedom Boulevard and State Park Drive interchanges and to construct the Coastal Rail Trail Segment 12. The Project limits extend approximately 2.6 miles (mi) along SR 1 through the unincorporated communities of Aptos, Seacliff, Aptos Hills-Larkin Valley, and Rio Del Mar in Santa Cruz County, California.

The Project Location Map and Vicinity Map are shown in Figure 1 and Figure 2 respectively.

1.1 Project Description

Caltrans, in cooperation with the SCCRTC and the County of Santa Cruz, proposes to widen SR 1 to include auxiliary lanes, accommodate BOS operations between the Freedom Boulevard and State Park Drive interchanges, and construct Coastal Rail Trail Segment 12.

One build alternative and the no-build alternative are proposed for further consideration. The project is located in Santa Cruz County on SR 1 from post m (PM) 8.1, south of Freedom Boulevard, to PM 10.7, north of State Park Drive, with 1.14 mi of trail along the SCCRTC-owned Santa Cruz Branch Rail Line (SCBRL) between State Park Drive and Rio Del Mar Boulevard. The total length of the project on SR 1 is 2.6 mi, and on the SCBRL is 1.14 mi. Within the limits of the proposed Project, SR 1 is a controlled access freeway with two 12-foot (ft) lanes; shoulder width varies within Project limits. The average width of the inside shoulders is approximately 5 ft, and the average width of the outside shoulders is approximately 10 ft. Within the Project area, the existing railroad right-of-way is generally in the range of 40- to 55-ft-wide, with the existing railroad tracks generally in the center of the right-of-way. The existing railroad has at-grade crossings at State Park Drive, Aptos Creek Road, and Trout Gulch Road, with bridges over SR 1 at two locations, Soquel Drive, Aptos Creek and Valencia Creek, and crosses under Rio Del Mar Boulevard. The SCBRL is currently an active freight railroad. Figure 3, Figure 4, and Figure 5 shows the Project components.

1.1.1 Purpose and Need

The purpose of the Project is to do the following.

- Reduce congestion along SR 1 through the Project limits.

- Enhance bicycle and pedestrian connectivity along Segment 12 of the Coastal Rail Trail.

- Promote the use of alternative transportation modes to increase transportation system capacity and reliability.

- Provide Coastal Rail Trail access across SR 1 at the two railroad bridges.

This Project is needed for the following reasons.

- Several bottlenecks along SR 1 in the southbound and northbound directions cause congestion during peak hours, significantly delaying drivers.

- Cut-through traffic, or traffic on local streets, is increasing because drivers are seeking to avoid congestion on SR 1.

- There are limited opportunities for pedestrians and bicyclists to safely cross SR 1 and navigate the Project corridor, even though portions of the Project area are designated as regional bicycle routes.

- There are insufficient incentives to increase transit service in the SR 1 corridor because congestion threatens reliability and cost-effective transit service delivery.

Figure 1. Project Location Map

Source: ICF, 2021

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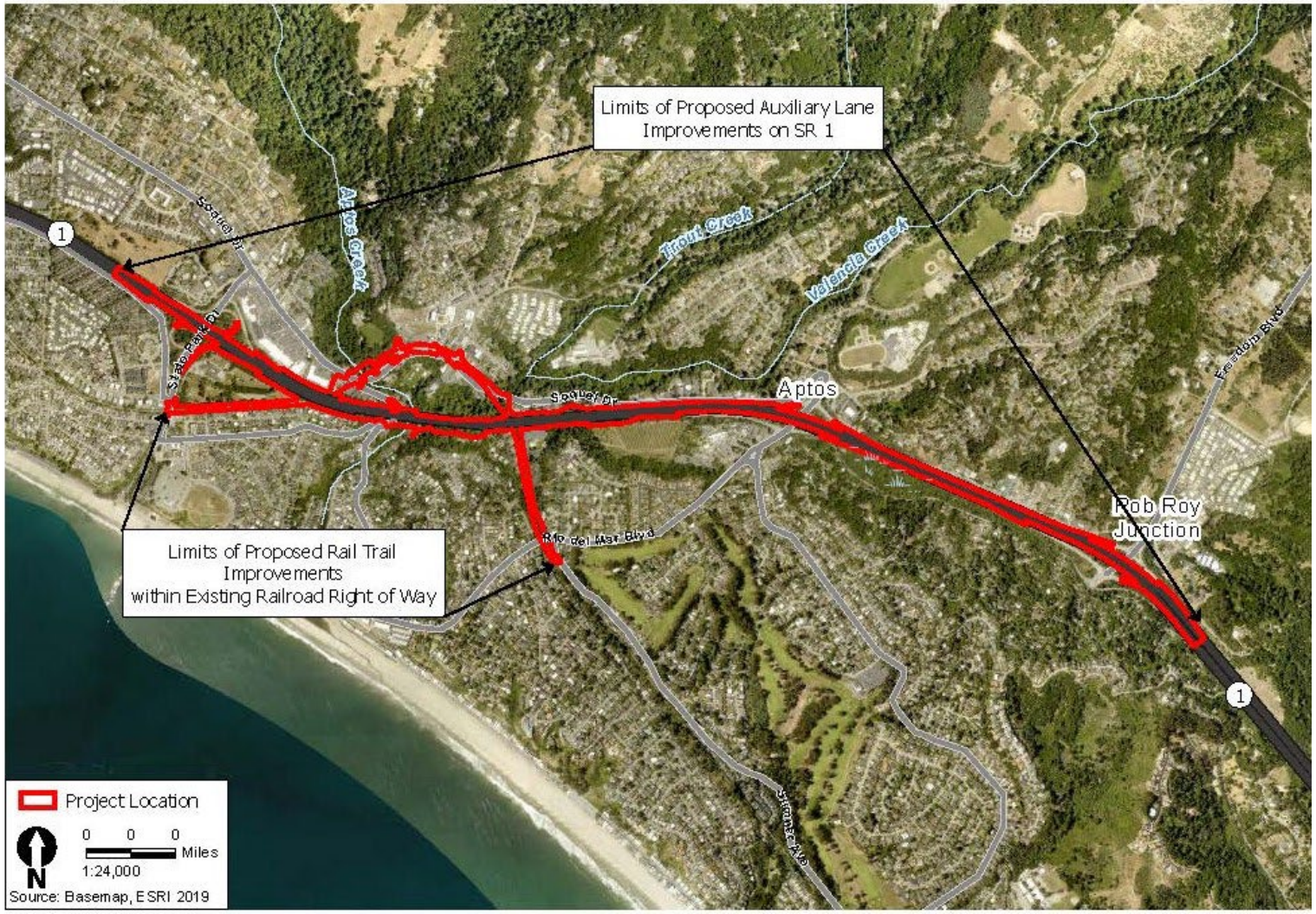

Figure 2. Project Area Map

Source: ICF, 2022

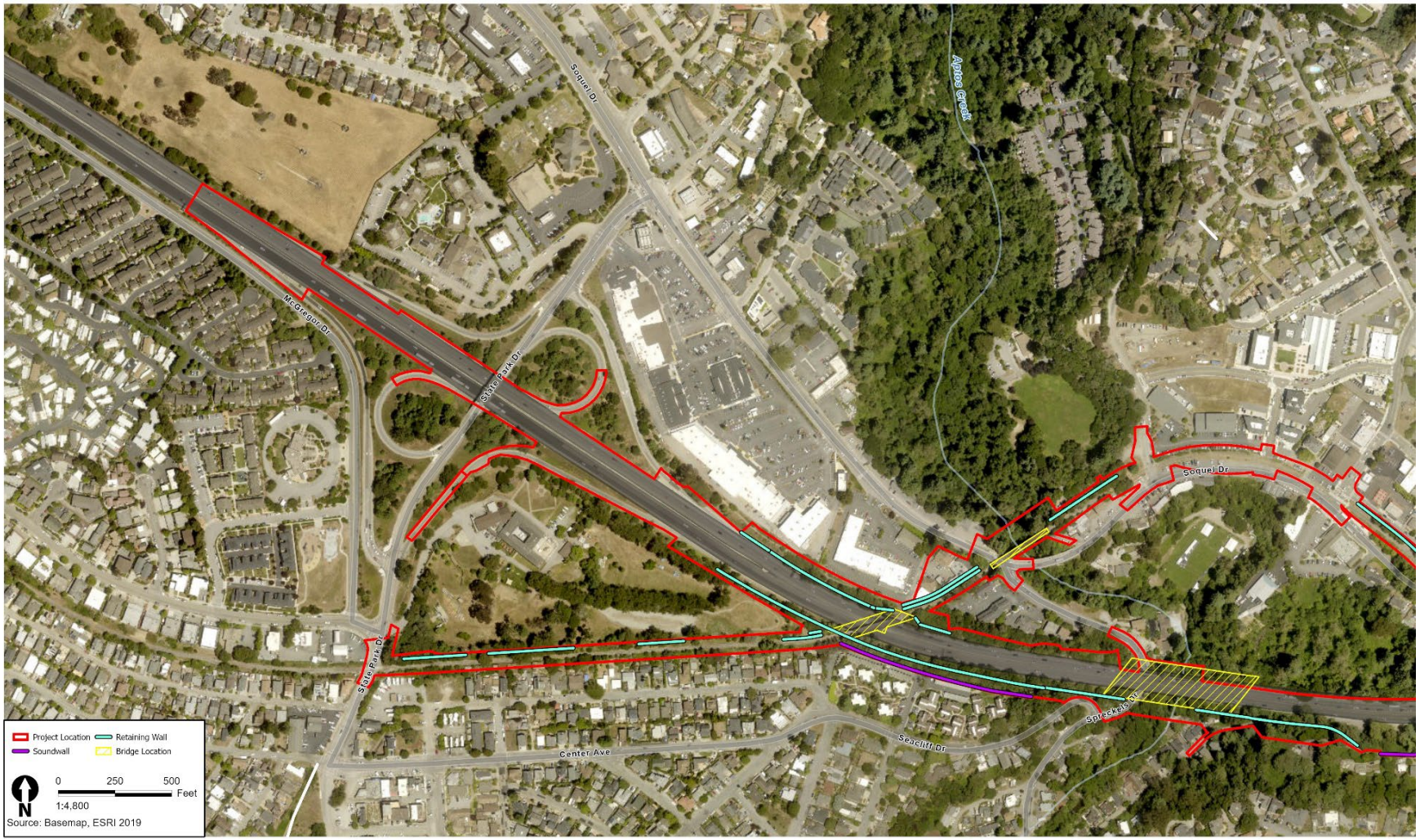

Figure 3. Project Components (page 1 of 3)

Source: ICF, 2021

Figure 4. Project Components (page 2 of 3)

Source: ICF, 2021

Figure 5. Project Components (page 3 of 3)

Source: ICF, 2021

1.2 Project Alternatives

1.2.1 Build Alternative

1.2.1.1 Auxiliary Lanes

Auxiliary lanes are designed to improve merging operations and reduce conflicts between traffic entering and exiting SR 1 by connecting the on-ramp of one interchange to the off-ramp of the next; they are not designed to serve through traffic. A southbound auxiliary lane and a northbound auxiliary lane would be added to the following segments of SR 1.

- Between the Freedom Boulevard and Rio Del Mar Boulevard interchanges.
- Between Rio Del Mar Boulevard and State Park Drive interchanges.

The total roadway widening would be approximately 2.6 mi in length. Southbound, the auxiliary lanes would begin at the existing State Park Drive loop on-ramp and end at the existing off-ramp to Freedom Boulevard. Northbound, the auxiliary lanes would begin at the existing Freedom Boulevard on-ramp and end at the existing diagonal off-ramp to State Park Drive.

The new auxiliary lanes would be 12-ft-wide. From Freedom Boulevard to Rio Del Mar Boulevard, the width needed for the new lane would be added in the median. The existing median barrier would be reconstructed in its current location. From Rio Del Mar Boulevard to State Park Drive, the width needed for the new lane would be added outside the existing shoulders; the outside shoulders would be standard 10-ft-wide.

Moosehead Drive to the south of SR 1, south of Aptos Creek, would be realigned where it runs parallel to SR 1 due to the outside widening of SR 1. A new retaining wall would be placed along the outside freeway shoulder to support the realignment that would include horizontal and vertical adjustments.

1.2.1.1.1 Structures – State Route 1

The Build Alternative would include the replacement of the two Santa Cruz Branch Line railroad bridges over SR 1 and widening of the SR 1 bridge over Aptos Creek and Spreckels Drive to accommodate the proposed auxiliary lanes. The existing two-span SCBRL bridges (underpass structures) are proposed to be replaced with longer spans to accommodate the planned SR 1 ultimate improvements that are a six-through-lane concept plus an auxiliary lane in each direction between interchanges. The ultimate SR 1 configuration was approved in the *Final Environmental Impact Report/Environmental Assessment with a Finding of No Significant Impact for the Tier I High Occupancy Vehicle (HOV) Lanes and Tier II 41st Avenue to Soquel Avenue/Drive Auxiliary Lanes Project* (Tier I/Tier II Final EA/EIR/FONSI). In addition to the railroad bridges, new trail

overcrossings would be constructed adjacent to the new railroad bridges for the ultimate trail configuration of the Coastal Rail Trail Segment 12 for the SR 1 improvements.

The widening of the SR 1 bridge over Aptos Creek and Spreckels Drive would occur on the south side of SR 1 only and require abutment walls along the existing embankments along the south side of Aptos Creek and the embankment on the north side of Spreckels Drive. The widened bridge would accommodate six lanes, each 12-ft-wide (four through-lanes plus an auxiliary lane in each direction), 10-ft-wide outside shoulders, and a 9-ft-wide median with a 2-ft-wide inside shoulder in the northbound direction and 5-ft-wide inside shoulder in the southbound direction. To accommodate the SR 1 ultimate improvements of six through-lanes plus an auxiliary lane in each direction, the SR 1 bridge over Aptos Creek and Spreckels Drive would be widened to the north (inland) side as part of a future project.

1.2.1.1.2 Retaining Walls – SR 1

The build alternative would include retaining walls at the following locations along SR 1 (Figure 3 and Figure 4).

Northbound

- "SR1" Station 258+90 - 261+26; max height = 15 ft
- "SR1" Station 288+07 - 296+00; max height = 15 ft

Southbound

- "SR1" Station 258+55 - 263+01; max height = 20 ft
- "SR1" Station 265+55 - 268+56; max height = 12 ft
- "SR1" Station 269+71 - 270+70; max height = 12 ft
- "SR1" Station 273+20 - 277+02; max height = 20 ft
- "SR1" Station 277+02 - 278+98; max height = 30 ft
- "SR1" Station 281+56 - 284+41; max height = 35 ft
- "SR1" Station 284+41 - 296+45; max height = 15 ft

The build alternative would evaluate sound walls at the following locations along SR 1 (Figure 3, Figure 4, and Figure 5).

Northbound

- "SR1" Station 258+57 – 267+49

Southbound

- "SR1" Station 263+18 – 266+78
- "SR1" Station 267+31 – 272+50
- "SR1" Station 284+79 – 291+52

1.2.1.2 Bus-on-Shoulders Features

BOS features are proposed, which would allow future bus operations on the outside shoulders of SR 1 through the interchanges during peak congestion periods. At the Freedom Boulevard, Rio Del Mar Boulevard, and State Park Drive interchanges, the Project would widen and improve SR 1 shoulders, which currently lack the width and pavement structural section to support bus operations.

Cross Section – State Route 1 Bus-on-Shoulders

The added auxiliary lanes coupled with the BOS improvements allow the transit operator to use the auxiliary lane in between interchanges and use the shoulder between the off-ramp and on-ramps through the interchanges. Within the Freedom Boulevard, Rio Del Mar Boulevard, and State Park Drive interchange areas, the highway shoulders would be 12-ft-wide.

Other Features – State Route 1 Bus-on-Shoulders

New signs would be installed to advise motorists that only buses are allowed to use the highway shoulders through interchanges during peak traffic hours. Along northbound SR 1, a sign would be provided south of each of the three interchanges in the Project area. Along southbound SR 1, a sign would be installed north of each interchange. Shoulders would be painted red to indicate bus-only use.

1.2.1.3 Coastal Rail Trail Segment 12

The limits of Coastal Rail Trail Segment 12 extend from the southern terminus of the trail segment at Sumner Avenue, just of the south of the Rio Del Mar Boulevard underpass, to the northern terminus at State Park Drive. The proposed Coastal Rail Trail Segment 12 includes the construction of a paved bicycle and pedestrian shared use trail within the SCBRL right-of-way on the inland side of the tracks, consistent with the approved *Monterey Bay Sanctuary Scenic Trail (MBSST) Network Master Plan* (MBSST Network Master Plan) (Figure 6), with an optional first phase. The trail segment would include a new at-grade trail connection to Sumner Avenue just south of the Rio Del Mar Boulevard underpass where the existing railroad tracks pass under Rio Del Mar Boulevard and a new sidewalk on the north side of Sumner Avenue between the terminus of the trail and the existing sidewalk on Rio Del Mar Boulevard.

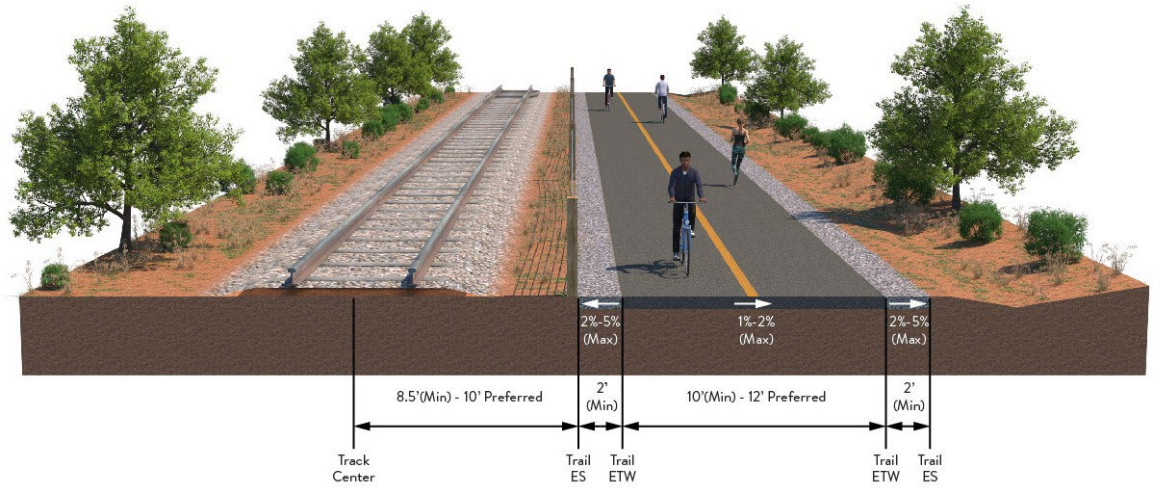

Figure 6. Coastal Rail Trail Segment – Ultimate Trail Configuration

The SCCRTC wishes to preserve the SCBRL corridor for transportation uses, which includes recreational passenger rail, freight rail, a multi-use trail, and future commuter rail transit. The ultimate configuration to accommodate all proposed transportation uses along the SCBRL is a bicycle and pedestrian shared use trail adjacent to railroad tracks. The SCBRL is currently an active freight railroad with SCCRTC owning the right-of-way. SCCRTC contracts to serve freight and recreational passenger rail along the freight easement. The SCCRTC's contracted freight operator has indicated that they may file for abandonment of freight along the SCBRL.

As a method of preserving the right-of-way of a corridor that otherwise could be abandoned, the SCCRTC could consider railbanking the corridor. The Department of Interior defines railbanking as the preservation of a railroad corridor for future rail use. Railbanking is accomplished under the National Trails System Act through provisions that allow a railbanked corridor to be used for interim trail use purposes through a voluntary agreement reached between a railroad and a trail manager. The right-of-way is preserved for future freight reactivation and could allow the removal of the railroad tracks and construction of a trail in the interim condition.

For this reason, an optional first phase is being considered for Segment 12 of the Coastal Rail Trail, where all or a portion of the trail could be located along the alignment of the existing railroad tracks.

1.2.1.3.1 Ultimate Trail Configuration

Trail Alignment

The ultimate trail configuration includes construction of a paved bicycle and pedestrian shared use trail alongside the existing railroad track alignment. New trail bridge crossings of SR 1 at two locations and adjacent to the existing railroad bridges at Soquel Drive, Aptos Creek, and Valencia Creek, would be constructed. New at-grade trail crossings

will be constructed at Aptos Creek Drive, Parade Street, and Trout Gulch Road. An at-grade trail connection from the new trail to the Aptos Village County Park between Aptos Creek and Aptos Creek Road, would be constructed.

Structures

- At the two locations where the existing railroad bridges cross over SR 1, the Rail Trail will be placed adjacent to the reconstructed rail underpasses.
- Where the Rail Trail crosses over Aptos Creek, Valencia Creek and Soquel Drive, the existing structures have been evaluated for their load bearing capacities, and it has been determined there is not enough data to cantilever the Rail Trail. Therefore, the Project would include construction of new Rail Trail bridges adjacent to the existing railroad structures.
- For areas where the Rail Trail is on an independent structure from the railroad bridges or grade, the separation between the two structures would be a minimum of 5 ft.

Retaining walls

Retaining walls would be constructed in the following locations:

- Just west of Soquel Drive - An approximate 5-ft-high, 60-ft-long retaining wall on the south side of the trail.

- Just east of Aptos Creek —An approximate 18-ft-high, 140-ft-long retaining wall on the south side of the trail and an approximate 6-ft-high, 140-ft-long retaining wall on the inland side of the trail.

Fencing

Fencing to separate trail users and the railroad for the ultimate trail improvements is proposed as shown in Figure 6. In accordance with the Federal Railroad Administration guidelines, there would be a 10-ft offset from the centerline of the railroad to the edge of the trail, although an 8-ft, 6-inch offset from the centerline of the railroad may be allowed in some circumstances. The fencing would be constructed using concrete posts (4 ft, 6 inches in height) etched to resemble wood, and multiple smooth wire strands. Fence post construction is anticipated to require 3-ft-deep excavation. The new trail bridges over Aptos Creek, Valencia Creek, and Soquel Drive would include a railing.

1.2.1.3.2 Construction of Optional First Phase for Coastal Rail Trail Segment 12

It is possible that the common carrier could file for abandonment of freight operations with the STB along the SCBRL at any time, in which case all or a portion of the SCBRL would likely be railbanked to preserve the corridor for future freight re-activation but could then be used for a multi-use trail as an interim condition.

All or a portion of the trail would be constructed in approximately the same location of the existing railroad tracks by removal of the rails and ties from just south of Rio Del Mar Boulevard at the southern terminus with Sumner Avenue to the northern terminus at State Park Drive, as shown in Figure 7. The two existing railroad bridges over SR 1 would be removed and two new trail overcrossings over SR 1 would be constructed in their place. The existing railroad bridges at Aptos Creek and Valencia Creek/Soquel Drive (south) would be repurposed for the new trail by removing the railroad decking and replacing with a new trail deck and railing system. The existing single-span railroad bridge superstructure over Soquel Drive (north) would be removed and replaced with a new trail deck and railing system.

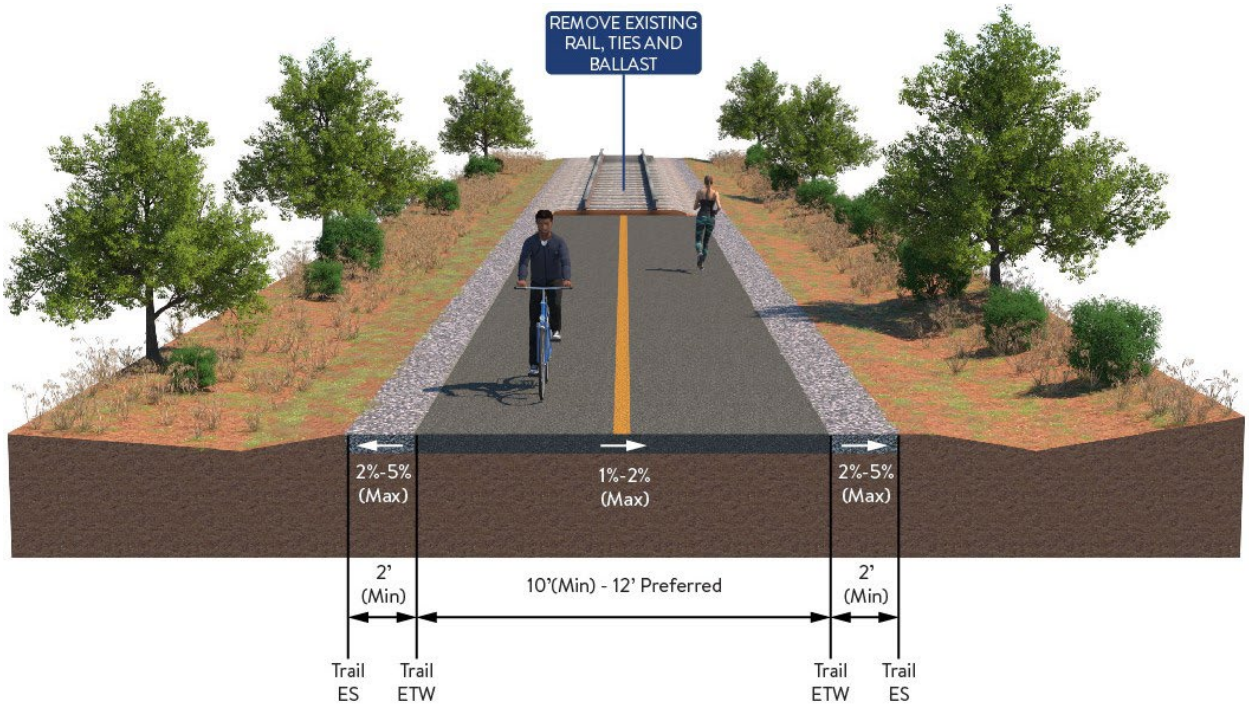

Figure 7. Coastal Rail Trail Segment – Optional First Phase

Stair access between the new trail and existing Soquel Drive (north) is proposed. A stair connection from the trail to Soquel Drive would begin on the south side of the trail west of the existing railroad bridge over Soquel Drive with a terminus at the Soquel Drive/Spreckels Drive signalized intersection. A new crosswalk would be provided at the Soquel Drive/Spreckels Drive signalized intersection. All trail users can access Soquel Drive via the at-grade trail crossing with Aptos Creek Road as an alternative to using the stairs. The alternative route would be identified with new signage. An at-grade trail connection from the new trail to the Aptos Village County Park between Aptos Creek and Aptos Creek Road would be constructed.

New at-grade trail crossings will be constructed at Aptos Creek Drive, Parade Street, and Trout Gulch Road in the approximate location of the existing railroad tracks.

Structures

- At the two locations where the existing railroad bridges cross over SR 1, the existing railroad bridges would be removed, and new single-span trail overcrossings would be constructed over SR 1 in the same general location as the existing railroad bridges. The bridge abutments constructed on either side of SR 1 would be constructed to freight railroad standards and be positioned and sized to account for the ultimate trail configuration.

- Where the trail crosses over Aptos Creek, Valencia Creek, and Soquel Drive (south), the existing bridge structures would remain, the railroad tracks removed, and new trail constructed along the existing rail centerline.

- The existing single-span railroad bridge superstructure over Soquel Drive (north) would be removed and replaced with a new trail deck and railing system.

- Slight modifications of the existing railroad bridge abutments are proposed to meet current seismic requirements.

Retaining walls

Retaining walls would be constructed in the following locations:

- Just west of Soquel Drive - An approximate 5-ft-high, 60-ft-long retaining wall on the south side of the trail.

- Just east of Aptos Creek —An approximate 18-ft-high, 140-ft-long retaining wall on the south side of the trail and an approximate 6-ft-high, 140-ft-long retaining wall on the inland side of the trail.

Fencing

The new trail overcrossings over SR 1 would include railings with fencing and the repurposed bridges over Aptos Creek, Valencia Creek, and Soquel Drive would have fencing added. No additional fencing is anticipated due to the railroad tracks being removed.

1.2.1.3.3 Removal of Optional First Phase for Coastal Rail Trail Segment 12

If all or a portion of the optional first phase of the trail is implemented, the trail along the existing railroad track alignment would need to be removed, a trail would be constructed adjacent to the tracks as described by the proposed ultimate trail project, and the railroad tracks re-installed in their approximate existing location. At-grade railroad crossings of Aptos Creek Drive, Parade Street, and Trout Gulch Road would need to be reconstructed.

Structures

- At the two locations where new trail overcrossings are constructed over SR 1 as part of the optional first phase improvements, the trail overcrossings would be relocated to be adjacent to the existing railroad alignment, and new railroad bridges would be constructed over SR 1 adjacent to the trail overcrossings, as described by the ultimate trail configuration. Construction of the new two-span railroad bridges over SR 1 would require the construction of support columns in the median of SR 1 to support the new railroad bridges.

- Repurpose bridges over Soquel Drive (south), Aptos Creek, and Valencia Creek from trail use to rail use by removing the trail deck and railing system and reconstructing railroad infrastructure.

- The trail deck and railing system over Soquel Drive (north) would be removed and replaced with a single-span railroad bridge with reconstructed railroad infrastructure.

1.2.1.3.4 Design Standards

Coastal Rail Trail Segment 12 would be designed as a multi-use paved path per the guidelines identified in Chapter 5 of the *MBSST Master Plan* (2014). The design standards used for this segment of the Coastal Rail Trail follow the MBSST guidelines and are listed under *Cross Section Standards*. The *MBSST Network Master Plan* incorporates and refers to design elements from the Class I Bikeways identified in Chapter 1000 of the *Highway Design Manual* (HDM) (Caltrans, 2020).

In areas where existing constraints limit the available width for the trail to be adjacent to the railroad tracks, other alternative design standards than those listed in the *MBSST Network Master Plan* may be utilized for design.

1.2.1.3.4.1 Cross Section Standards

- The paved traveled way of the Coastal Rail Trail would be a minimum of 12 ft wide but may be reduced to 10 ft in areas with existing constrained conditions.

- Shoulders would be provided on each side of the traveled way and would be 2 ft in width where possible.

- For accessibility and drainage, the cross slope of the traveled way would be between 1% and 2%.

- The shoulder cross slope would be between 2% and 5% and would angle away from the surface of the traveled way.

Horizontal Design

- The design speed for the trail would be established at 20 mi per hour and correlates to a minimum stopping sight distance of 125 ft.

- To meet a minimum stopping sight distance of 125 ft, a radius of no less than 500 ft would be used for the Coastal Rail Trail alignment where possible.

- The minimum horizonal clearance between the railroad centerline and the edge of the Coastal Rail Trail, inclusive of shoulders is 8 ft, 6 inches.

- Where roadways are adjacent to the trail, such as Soquel Drive through Aptos Village, a minimum horizonal separation of 12 ft on tangents and 10 ft on curves is recommended between edge of pavement of the roadway and edge of the trail. This standard would be modified at constrained locations along the corridor where necessary to maintain the absolute minimum horizontal separation. Such separation variances may include vertical separation, fence, or other barriers.

Vertical Design

- The vertical grade slope for the Coastal Rail Trail would be limited to no more than 5%.

- Vertical obstructions and signs would be 10 ft above the entire Coastal Rail Trail, except in limited situations where the vertical clearance may be reduced to 8 ft over the travel way and 7 ft over the shoulders.

- The Coastal Rail Trail would either be constructed following closely the existing grade or on widened segments and new bridges requiring new cuts/fills and retaining walls. Minor grading of the existing ground surface in segments on existing grade is anticipated and may involve excavation of approximately 1-ft depth.

1.2.1.4 Vegetation Removal and Planting

Construction work for the Build Alternative would require removal of existing mature landscape plantings along SR 1 and along the Coastal Rail Trail Segment 12 route. Where proper setback requirements allow, plantings would be replaced as per Caltrans' policies, and include an automated irrigation system and a 3-year plant establishment period. The replacement planting effort would include vegetation impacted by the contractor's staging, storage, and construction activities. Vegetation needed for the optional first phase trail improvements is significantly less than for the ultimate trail improvements.

1.2.1.5 Construction Activities

Construction work for the Build Alternative would be done primarily during daylight hours from 7:00 a.m. to 6:00 p.m. However, night-time work and temporary closures of lanes and roadways may be necessary to avoid major disruption for tasks that could interfere with traffic or create safety hazards such as demolition of the existing railroad bridges. Construction activities would include excavation, drilling, dewatering, pavement demolition, bridge demolition, mass grading, concrete form work, pavement installation, storm system installation, landscaping and irrigation, sign installation, striping operations, and traffic control. Such activities would require the use of the following types of equipment: drilling rig, forklift, scissor lift, backhoe, track excavator, compactor, concrete pump, crane, bulldozer, grader, front-end loader, dump trucks, jackhammer, and vibratory roller. These activities may require temporary freeway, ramp, and local street partial lane closures or full closures with possible detours.

A Transportation Management Plan (TMP) would be developed as part of the project construction planning phase. The TMP would address potential impacts to circulation of all modes of travel (i.e., transit, bicycles, pedestrians, and vehicles). Roadway and/or pedestrian access to all occupied businesses and respective parking lots would be maintained during project construction. The TMP would include an evaluation of potential detour impacts and would also include measures to minimize, avoid, and/or mitigate impacts to alternate routes. The TMP would address coordination with local agencies for traffic through or near the construction zone. Staging areas would be located within the existing Caltrans' right-of-way and within the SCBRL's right-of-way along Coastal Rail Trail Segment 12.

1.2.1.5.1 Construction Schedule

Construction of the SR 1 and Coastal Rail Trail improvements including the auxiliary lanes and BOS features is anticipated to begin in 2025, subject to availability of funds for construction and is estimated to take approximately 3 years to complete.

1.2.1.5.2 Demolition

Demolition work would generally comprise removal of existing bridge structures, abutments, columns, overhead sign foundations, rails and ties, clearing and grubbing, tree removal, pavement removal, and drainage system removal.

1.2.1.6 Stormwater Impacts

1.2.1.6.1 Permanent Stormwater Impacts

Permanent impacts from runoff from the increased impervious surface area could have the potential to increase in pollutants to the receiving water bodies. Erosion control measures such as hydroseeding and erosion control blankets will be applied on all DSAs to minimize post-construction erosion. Reducing pervious areas could also reduce the

amount of rainfall that is able to percolate into the water table. Therefore, the Project will consider treatment best management practices (TBMP) and hydromodification measures to reduce these impacts. This consideration is further discussed in the *Water Quality Assessment* (WRECO, 2022).

1.2.1.6.2 Temporary Stormwater Impacts

During construction, the contractor would be required to develop and implement a Storm Water Pollution Prevention Plan (SWPPP) in compliance with the statewide Construction General Permit and consistent with the guidelines and procedures in Caltrans' Statewide Storm Water Management Plan. The SWPPP will provide detailed, site-specific information regarding best management practices (BMP) to avoid and minimize water quality impacts. The Project would be constructed to minimize erosion by disturbing slopes only when necessary, minimizing cut and fill areas to reduce slope lengths, providing cut and fill slopes flat enough to allow revegetation to limit erosion rates, and providing concentrated flow conveyance systems such as storm drains, ditches, and gutters.

1.2.1.7 Utilities

Existing utilities located in areas subject to construction that conflict with the proposed improvements would be relocated as needed. This is anticipated to include sanitary sewer and electric utility poles adjacent to Moosehead Drive and a gas line along the Coastal Rail Trail Segment 12 route for the ultimate trail improvements, and other utility appurtenances.

1.2.1.8 Property Acquisitions

The Build Alternative would require full or partial acquisitions for the construction of the SR 1 and Coastal Rail Trail Segment 12 ultimate trail improvements, as well as temporary easements for construction activities such as the construction of sound walls and retaining walls along SR 1 and the SCBRL. Table 1 lists the full and partial property acquisitions that would occur under the Build Alternative. Along the SCBRL corridor, the acquisitions shown in Table 1 would be needed for the construction of the proposed ultimate trail configuration of Coastal Rail Trail Segment 12. No new property acquisitions would be needed to construct the optional first phase of the Coastal Rail Trail Segment 12, however the Surface Transportation Board (STB) would have to approve railbanking the corridor.

Per the WQAR, the Project is grandfathered under the 1999 Caltrans MS4 permit; therefore, the Project is not required to implement hydromodification management measures within Caltrans' right-of-way. All the Project's Rail Trail improvements within unincorporated Santa Cruz County's right-of-way would also be exempt from implementing stormwater treatment and baseline hydromodification management per the Phase II MS4 permit. For non-exempt portions of the Project within Santa Cruz County's

right-of-way, the Project proposes to create 0.23 acres of impervious surface where Moosehead Drive is realigned within the County's right-of way, which is less than 15,000 square feet; and therefore, the Project would not be subject to hydromodification requirements per the Central Coast RWQCB Post-construction Stormwater Requirements of the Phase II MS4 permit (WRECO, 2022). No property acquisition is anticipated. Opportunities for additional flow control measures will be considered as needed.

Table 1. Property Acquisitions

Assessor's Parcel No.	Street Address	Partial Acquisition (square feet)	Full Acquisition (square feet)
Coastal Rail Trail Segment 12 – Ultimate Trail Improvements			
039-232-03	7992 Soquel Drive	2,700	7,510[a]
039-232-02	7994 Soquel Drive	1,100	3,350[a]
039-232-01	7996 Soquel Drive	5,370	12,110[a]
041-561-11	8035 Soquel Drive 23	2,100	-
041-011-42	10 Parade St A	400	-
041-011-41	15 Parade St B	400	-
044-282-47	379 Sandalwood Drive	320	-
044-282-48	369 Sandalwood Drive	3,300	-
041-052-16	9006 Soquel Drive	520	-
041-052-17	Soquel Drive - Vacant	1,560	-
Highway 1			
042-071-01, 042-071-02, 042-071-03, 042-067-18	345 Moosehead Drive	1,129	-
042-067-16	Moosehead Drive - Vacant	343	-
042-067-17	Moosehead Drive - Vacant	735	-

[a] During final design, partial acquisition of parcel numbers 039-232-01, 039-232-02, and 039-232-03 may be determined to be feasible, in which case, the respective amounts shown in the "Partial Acquisition" column of Table 1 would be acquired. In the event that it is determined during final design that partial acquisition is infeasible, the respective amounts shown in the "Full Acquisition" column of Table 1 would be acquired.

1.2.2 No-Build Alternative

Under the No-Build Alternative, there would be no construction of auxiliary lanes or BOS features on SR 1 within the Project area, and Coastal Rail Trail Segment 12 would not be constructed. The existing transportation facilities within the project area would remain unchanged. The No-Build Alternative assumes the construction of other planned and programmed projects in the region, including other auxiliary lanes projects on SR 1 and other segments of the Coastal Rail Trail.

1.3 Study Purpose

The purpose of this location hydraulic study is to examine and analyze the existing base floodplain within the Project limits; to document any potential impacts to or encroachments upon the base floodplain as a result of the Project and verify potential for sea level rise (SLR) impacts; and to recommend any avoidance, minimization, or mitigation measures that may be required. The base flood is defined as a flood that has a 1% chance of being equaled or exceeded in any given year, and it is also referred to as a 100-year flood (Federal Emergency Management Agency [FEMA], 2021).

1.4 Existing Conditions

1.4.1 Creek, Streams, and River Crossings

The Project's receiving waters are Aptos Creek, Valencia Creek, Valencia Lagoon and the Pacific Ocean. The northern portion of the Coastal Rail Trail Segment 12 of the Project is in the Soquel Watershed and drains directly to the Pacific Ocean through a system of stormwater drains. Valencia Creek is a tributary to Aptos Creek, and Aptos Creek drains directly to the Pacific Ocean. The northern portion of Rail Trail Segment 12 of the Project is located in Soquel Watershed and drains directly to the Pacific Ocean through a system of stormwater drains. Valencia Creek is a tributary to Aptos Creek, and Aptos Creek drains directly to the Pacific Ocean (see Figure 8) (Santa Cruz County Department of Environmental Health [SCCDEH], 2019).

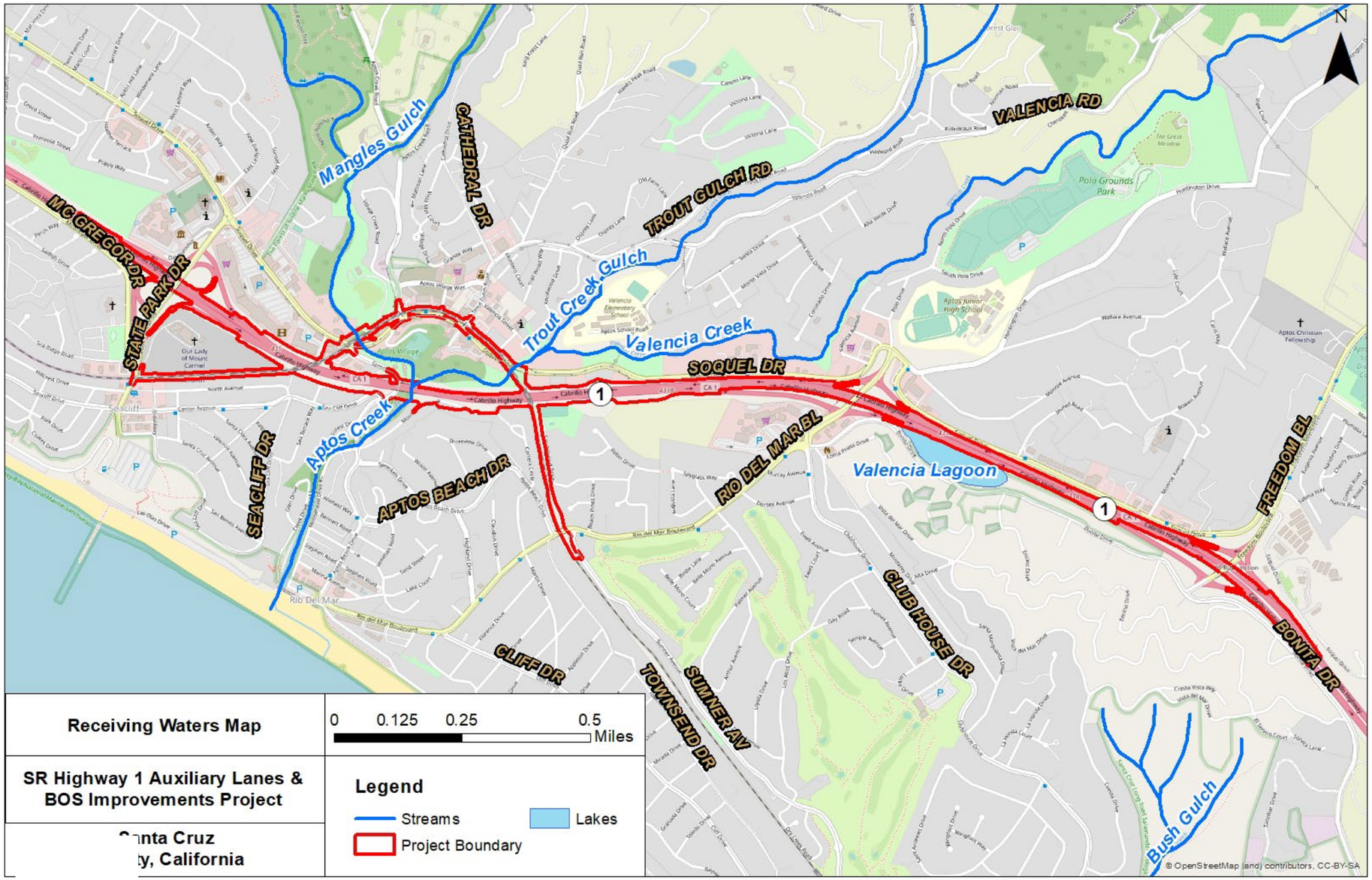

Figure 8. Receiving Waters Map

Source: Mark Thomas 2022, ICF, 2022 and SCCDEH, 2019

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Aptos Creek flows approximately from north to south as it crosses the Coastal Rail Segment 12 alignment and SR 1 at Bridge No. 36 0011. The Caltrans Bridge Inspection Report (BIR) describes the channel as earth and gravel (2019). See Photo 1, which shows the Aptos Creek channel at SR 1. The existing railroad bridge at Aptos Creek spans over the creek (see Photo 2). The existing piers at both railroad bridge crossings are not within the floodplain water surface elevation (WSE).

Photo 1. Aptos Creek Looking Southwest at the SR 1 Bridge (July 24, 2022)
Source: WRECO, 2022

Photo 2. Aptos Creek Railroad Bridge (February 8, 2021)

Source: WRECO, 2021

The SR 1 bridge at Aptos Creek (Bridge No. 36 0011) is a five-span bridge with four 56-ft-long spans and a 32-ft-long span at the west span. The total length of the bridge is 260 ft, and the width of the bridge is approximately 60.8 ft. The existing bridge has four rectangular bridge piers. The two on the east are 8-ft-wide and the two on the west are 7-ft-wide. On the east side of the Aptos Creek bridge is an arch culvert that carries the low flows of Valencia Creek (see Photo 3 and Photo 4). The arch culvert has an 11-ft span and is approximately 11 ft in height. The culvert is approximately 169.3-ft-long (Caltrans, 1947). Aptos Creek bridge as-built is shown in Figure 9. Of the Project's receiving waters, Aptos Creek is associated with base floodplains, and is discussed in detail in Section 2.3.

Photo 3. Valencia Creek SR 1 Culvert Entrance, Looking Southwest (February 8, 2021)

Source: WRECO, 2021

Photo 4. Valencia Creek SR 1 Culvert Outfall, Looking Northeast (July 24, 2022)

Source: WRECO, 2022

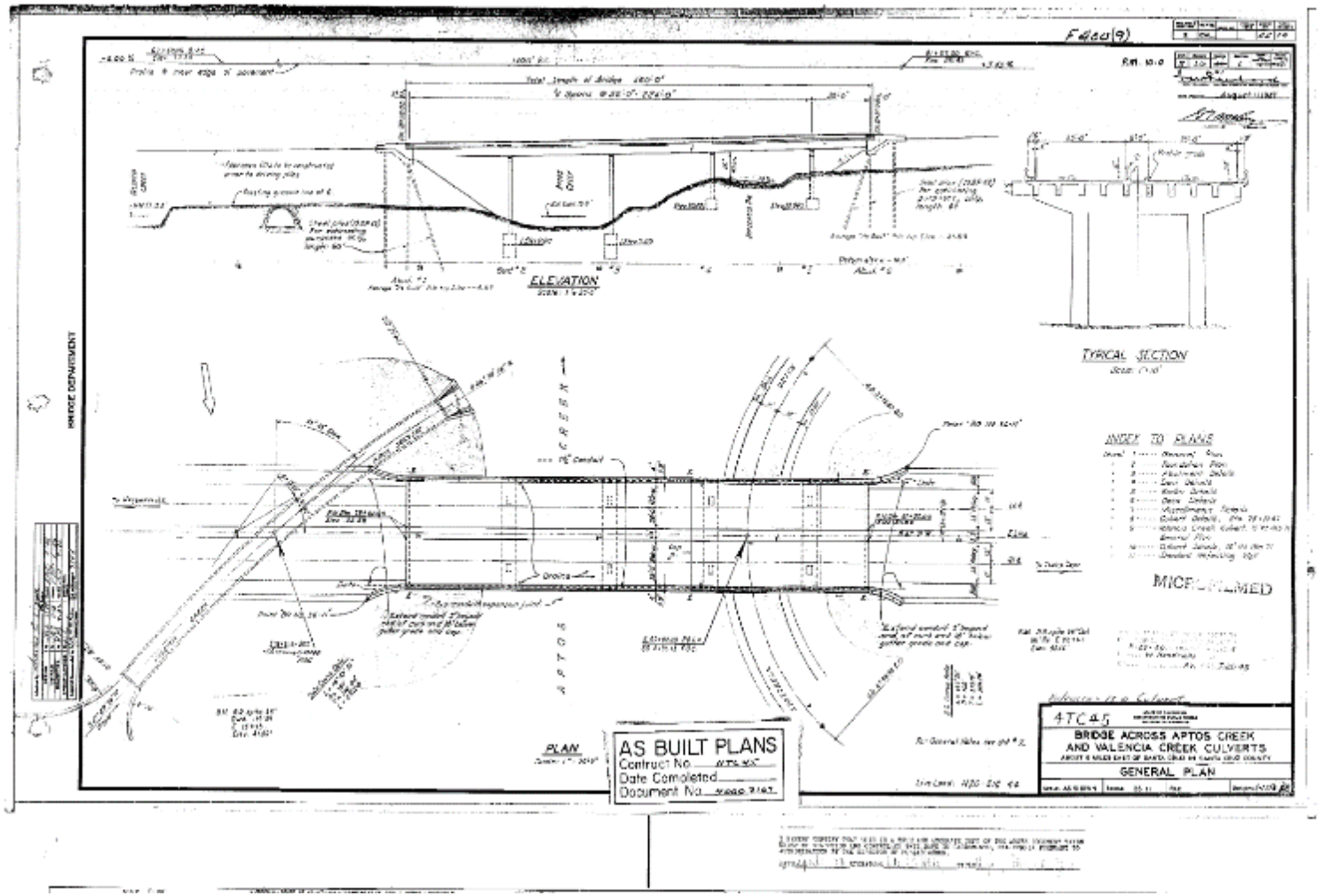

Figure 9. Aptos Creek Bridge and Culvert As-built

Source: Caltrans, 2019

1.5 Proposed Conditions

The proposed widening of the SR 1 bridge over Aptos Creek and Spreckels Drive is described in Section 1.2.1.1.1 of the Project description. The bridge widening is proposed to extend south approximately 43.7 ft. Four piers are proposed to accommodate the bridge widening. Each pier will consist of two columns that are 4 ft by 4 ft square and will be along the existing piers alignment. The proposed columns would be within the base floodplain. Figure 10 and Figure 11 shows the general plan for the proposed widening (ICF, 2022). Per conversation with Mark Thomas on June 20, 2022, Abutment 1 (southeastern-most abutment) of the Aptos Creek Bridge widening will be designed to span over the existing Valencia Creek arch culvert using large diameter cast-in-drilled-hole concrete piling on either side of the arch culvert supporting the widened bridge above. The intent is to eliminate added loading on the existing arch culvert. Driven piles are not proposed in this location to minimize potential vibration adjacent to the existing arch culvert.

The SR 1 ultimate improvements of six through-lanes plus an auxiliary lane in each direction would entail widening to the north (inland) of SR 1. However, this ultimate improvement and widening to the north is part of a future project and will not be studied in this Floodplain Evaluation Report.

The proposed Coastal Rail Trail Segment 12 crosses over Valencia and Aptos Creek. The optional first phase of the trail will be isolated to the railroad bridge decks and will not be impacting the floodplain. The ultimate trail configuration proposed trail bridge crossings at two locations and adjacent to the existing railroad bridges at Soquel Drive, Aptos Creek, and Valencia Creek. All grading, piers and any additional structures needed to construct these crossings will be designed to be outside of the base floodplain WSE with the evaluated SLR discussed in Section 2.4 (E-mail communication with Marshall Moore from Mark Thomas, March 8, 2022). Therefore, detailed hydraulic modeling was not necessary for this *Floodplain Evaluation Report*.

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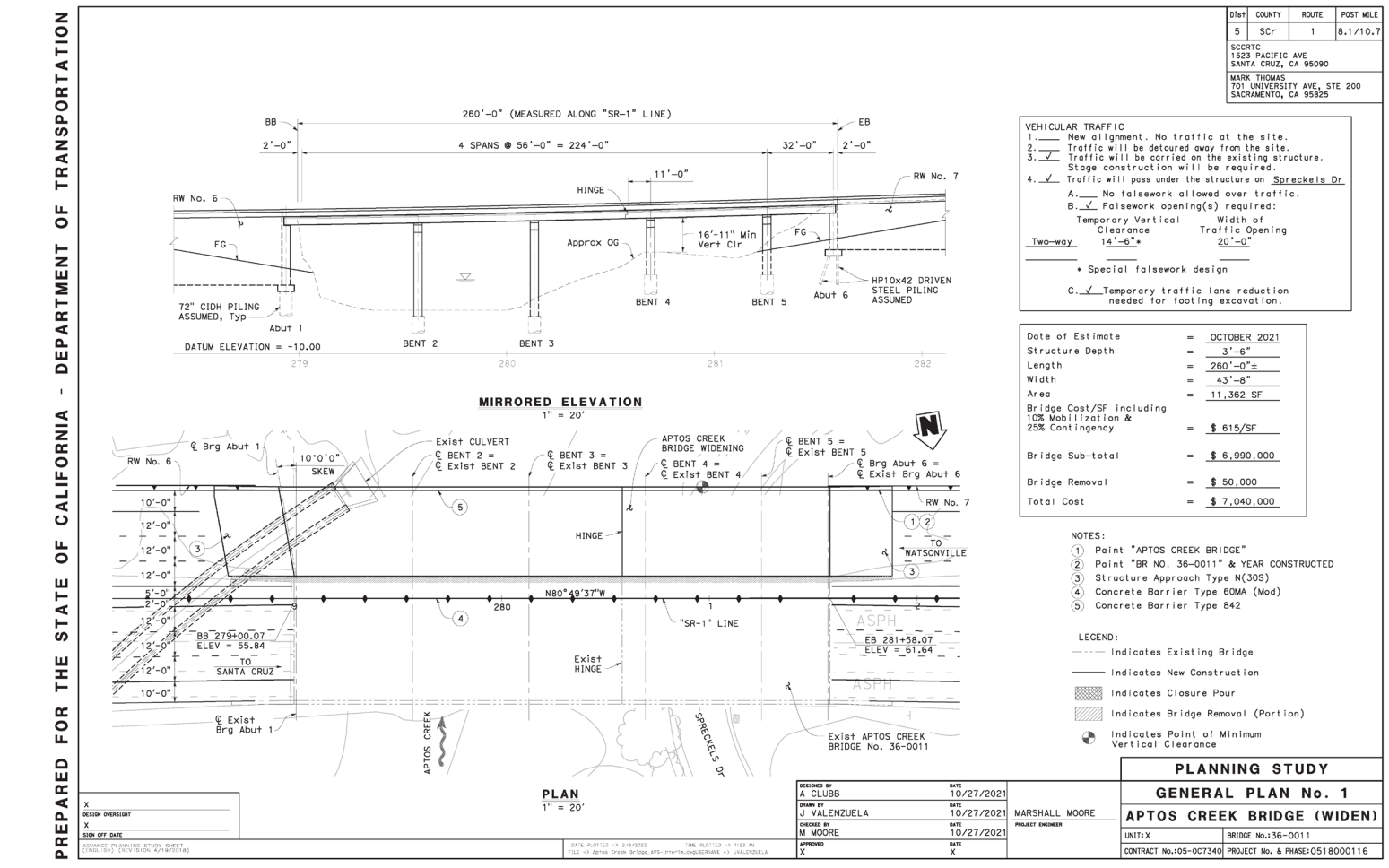

Figure 10. General Plan for Aptos Bridge Widening (1 of 2)

Source: ICF, 2022

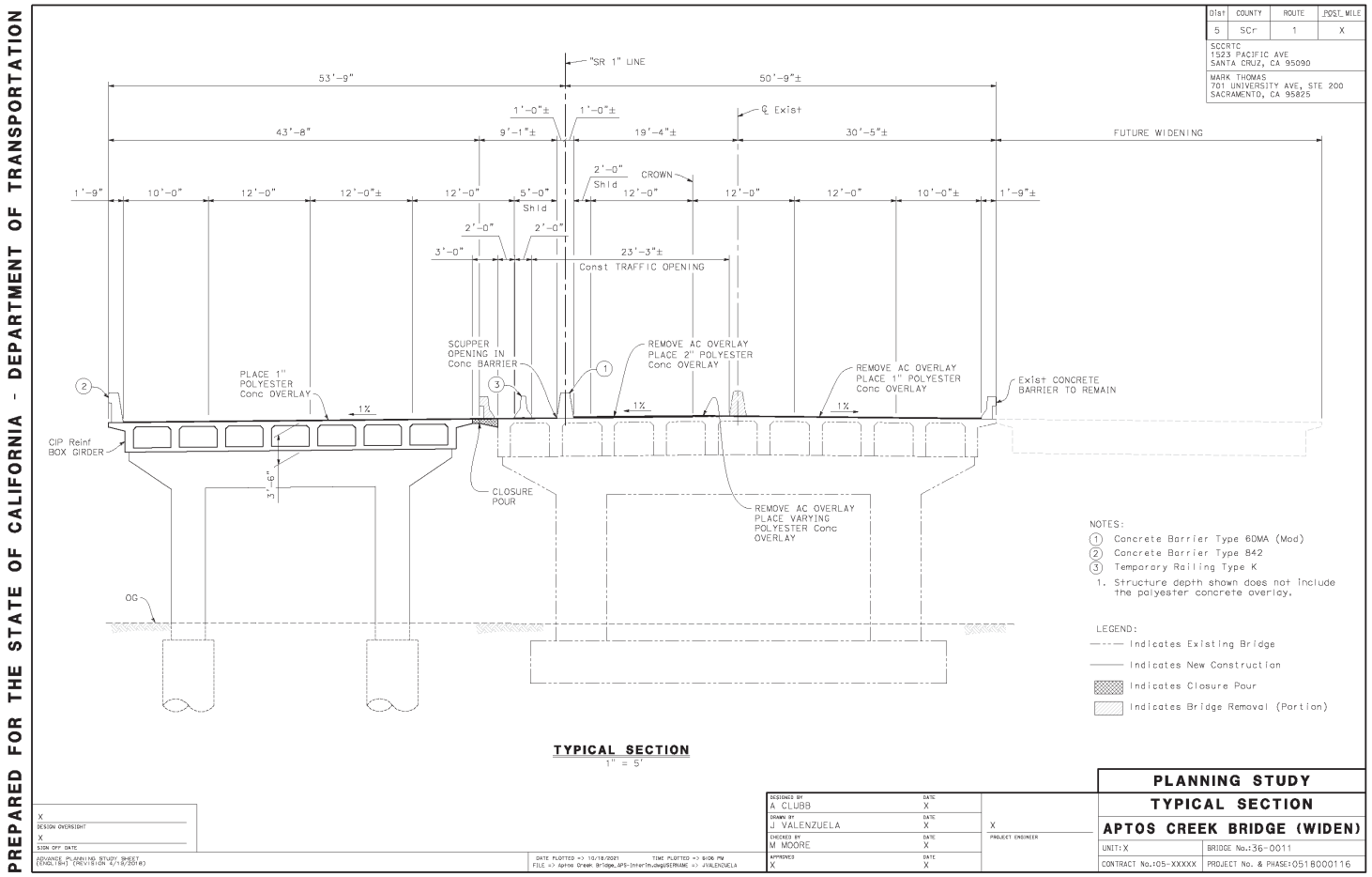

Figure 11. General Plan for Aptos Bridge Widening (2 of 2)

Source: ICF, 2022

1.6 Regulatory Setting

1.6.1 Executive Order 11988 (Floodplain Management, 1977)

Executive Order 11988 (Floodplain Management) directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative (1977). Requirements for compliance are outlined in Title 23, Code of Federal Regulations, Part 650, Subpart A (23 CFR 650A) titled "Location and Hydraulic Design of Encroachment on Floodplains" (Federal Highway Administration [FHWA], 2019).

If the preferred alternative involves significant encroachment onto the floodplain, the final environmental document (final Environmental Impact Statement or finding of no significant impact) must include:

- The reasons why the proposed action must be located in the floodplain,
- The alternatives considered and why they were not practicable, and
- A statement indicating whether the action conforms to applicable state or local floodplain protection standards.

1.6.2 California's National Flood Insurance Program

FEMA is the nationwide administrator of the National Flood Insurance Program (NFIP), which is a program that was established by the National Flood Insurance Act of 1968 to protect lives and property, and to reduce the financial burden of providing disaster assistance. Under the NFIP, FEMA has the lead responsibility for flood hazard assessment and mitigation, and it offers federally backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. FEMA has adopted the 100-year floodplain as the base flood standard for the NFIP. FEMA is also concerned with construction that would be within a 500-year floodplain for proposed projects that are considered "critical actions," which are defined as any activities where even a slight chance of flooding is too great. FEMA issues the Flood Insurance Rate Maps (FIRM) for communities that participate in the NFIP. These FIRMs present delineations of flood hazard zones.

In California, nearly all of the State's flood-prone communities participate in the NFIP, which is locally administered by the California Department of Water Resources' (DWR) Division of Flood Management. Under California's NFIP, communities have a mutual agreement with the State and federal governments to regulate floodplain development according to certain criteria and standards, which are further detailed in the NFIP.

1.6.3 Santa Cruz County Floodplain Data

As part of the NFIP, typically, each county (or community) has a Flood Insurance Study (FIS) that is used to locally develop FIRMs and base flood elevations (BFE). The

effective FIS for Santa Cruz County, California, and Incorporated Areas (FEMA, 2017a) last revised on September 29, 2017, the county-wide National Flood Hazard Layer (NFHL) last revised on July 11, 2019 (2019a), and FIRM 06087C0356F, 06087C0357F, 06087C0380F, and 06087C0378F (2017b) were reviewed to obtain floodplain information of the Project area.

1.6.4 Sea Level Rise

1.6.4.1 Caltrans Sea Level Rise Guidelines

Per Executive Order S-13-08 (November 14, 2008) all state agencies planning to construct projects in areas vulnerable to future SLR must consider a range of sea-level projections for years 2050 and 2100, assess project vulnerability, and to the extent feasible, reduce expected risks and increase resiliency to SLR.

Caltrans adheres to Order S-13-08 with guidance summarized in *Guidance on Incorporating Sea Level Rise* – For use in the planning and development of Project Initiation Documents, published by Caltrans on May 16, 2011 (Caltrans Guidance). This guidance includes statewide SLR projections published by the Ocean Protection Council (OPC) in March 2011. The latest SLR study*, State of California Sea-Level Rise Guidance*, 2018 Update published by the California Natural Resources Agency and California OPC, provides scenario-based SLR projections at local active tidal gauge locations. In addition, according to the 2019 *Climate Change Annotated Outline Non-Capacity Increasing Projects* (AO) found in the Forms and Templates section of the Caltrans Standard Environmental Reference (SER), a project is recommended to consider a list of factors to determine the need for SLR adaptation measures.

1.6.4.2 Coastal Commission Regulations

The California Coastal Commission (Coastal Commission) plans and regulates the use of land and water in the coastal zone. The potential impacts of SLR fall directly within the Coastal Commission's planning and regulatory responsibilities under the California Coastal Act (Coastal Commission, 2018).

The California Coastal Act mandates the protection of public access and recreation along the coast, coastal habitats, and other sensitive resources, as well as providing priority visitor-serving and coastal dependent or coastal-related development while simultaneously minimizing risks from coastal hazards. Implementation of Coastal Act policies is accomplished primarily through the preparation of Local Coastal Programs (LCP) that are required to be completed by each of the 15 counties and 61 cities located in whole or in part in the coastal zone.

The Coastal Commission's *Sea Level Rise Guidance* (Commission's SLR Guidance), which was first adopted in 2015, was republished in 2018 with science updates. The Commission's SLR Guidance uses the *State of California Sea-Level Rise Guidance*, 2018 Update published by the California Natural Resources Agency and California Ocean Protection Council (OPC SLR Guidance) as the best available science for SLR

projections for the State of California. The Commission's SLR Guidance includes recommendations for addressing SLR in LCPs and other plans as seen in Figure 12 .

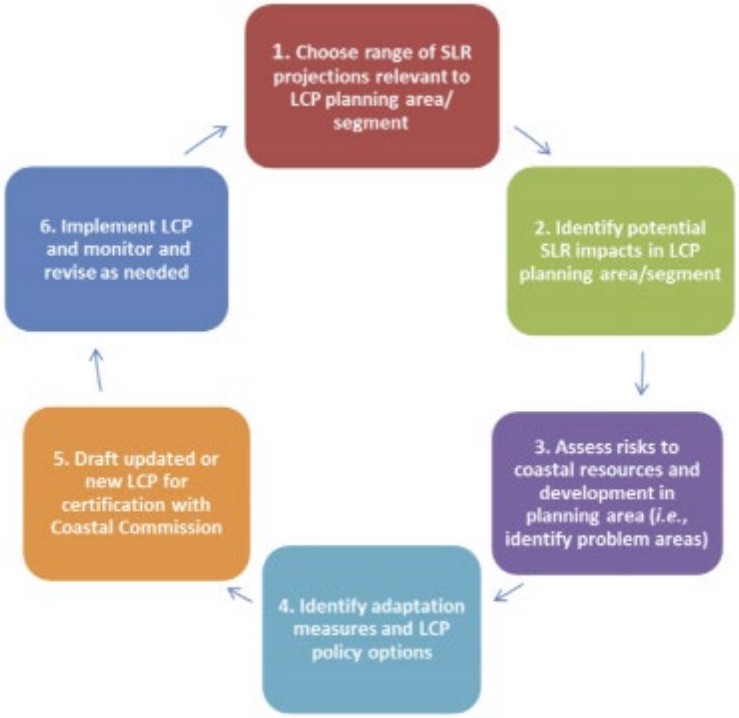

Figure 12. Coastal Commission's Recommendations on Addressing SLR for New and Updated LCPs

Source: Coastal Commission, 2018

1.7 Design Standards

1.7.1 FEMA Standards

FEMA standards are employed for design, construction, and regulation to reduce flood loss and to protect resources. Two types of standards are often employed: design criteria and performance standards.

A design criteria or specified standard dictates that a provision, practice, requirement, or limit be met; e.g., using the 1% flood and establishing floodway boundaries so as not to cause more than a 1-ft increase in flood stages.

A performance standard dictates that a goal is to be achieved, leaving it to the individual application as to how to achieve the goal; e.g., providing protection to the regulatory flood, keeping post-development stormwater runoff the same as pre-development, or maintaining the present quantity and quality of water in a wetland.

The 1% annual chance flood and floodplain have been adopted as a common design and regulatory standard in the United States. The NFIP adopted it in the early 1970s, and it was adopted as a standard for use by all federal agencies with the issuance of Executive Order 11988. States or local agencies are free to impose a more stringent standard within their jurisdiction.

1.7.2 Floodplain Regulations

FEMA defines a regulatory floodway as:

> the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations. (FEMA, 2019b)

According to Title 44, Section 60.3(d)(3) of the Code of Federal Regulations (CFR), a community shall:

> prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge (FEMA, 2019b).

The community is responsible to review and maintain record of the documentation demonstrating that any permitted floodway encroachment meets NFIP requirements. A "no-rise certification" for floodways may be used to document the analyses.

Per Title 44, Section 60.3(d)(4) of the CFR, floodway encroachments that cause an increase may be permitted, provided the community first applies for a conditional FIRM and floodway revision (Conditional Letter of Map Revision, or CLOMR) and fulfills the requirements for such revisions as established under the provisions of Title 44 Section 65.12 of the CFR and receives the approval of the Floodplain Administrator (FEMA, 2019b).

1.7.3 Hydraulic Design Criteria

1.7.3.1 FHWA Standards

Bridges must be designed per the *California American Association of State Highways and Transportation Officials Load and Resistance Factor Design Bridge Design Specifications (2017 Eighth Edition)* (AASHTO LRFD BDS) (Caltrans, 2019). AASHTO LRFD BDS Section 2.6.3 defers to state requirements for hydraulic studies.

From *Memo to Designers 16-1 Hydraulic Design for Structures over Waterways*, the proposed bridge soffit should provide adequate freeboard to pass anticipated drift for the 50-year design flood, or to pass the 100-year base flood without freeboard, whichever is greater (Caltrans, 2017a).

1.7.3.2 Caltrans Standards

From Chapter 820 of the Caltrans' HDM, the criteria for the hydraulic design of bridges is that they be designed to pass the 2% probability of annual exceedance flow (50-year design discharge) with adequate freeboard to pass anticipated drift and debris (2020). Two (2) ft of freeboard is commonly used in bridge designs. Alternatively, the bridge can also be designed to pass the 1% probability of annual exceedance flow (100-year design discharge, or base flood). No freeboard is added to the base flood.

1.7.3.3 Santa Cruz County Standards

Santa Cruz County Design Criteria for bridge structures is the design flood (100-year) shall provide 1-ft of freeboard below the finished floor elevation of the existing and proposed structure.

1.8 Traffic

1.8.1 Project Traffic Operations Analysis Report

The Project's *Traffic Operations Analysis Report* (CDM Smith, 2021) provides traffic volume counts for the AM (6 AM to 12 PM) and PM (2 PM to 8 PM) peak travel periods for the SR 1 segment within the Project limits of Freedom Boulevard and State Park Drive. The average peak traffic volumes in each travel direction are provided in Table 1 for the existing (year 2019) and proposed (year 2045) for the no build and build scenarios. The study covered the SR 1 mainline and ramps within the Project limits.

Table 1. Average Weekday Volumes (In Vehicles) within SR 1 Project Limits

Direction	Location	Existing (2019) No Build Condition		Proposed (2045) Plus Build Condition	
		AM	PM	AM	PM
Northbound	Mainline Average	18,900	14,190	21,820	17,100
	On-Ramps Total	11,350	8,910	12,650	9,610
	Off-Ramps Total	5,840	6,090	7,130	6,890
Southbound	Mainline Average	15,580	19,690	19,180	23,400
	On-Ramps Total	5,110	6,960	5,530	7,940
	Off-Ramps Total	7,070	10,400	8,150	11,810

Source: CDM Smith, 2021

1.8.2 Traffic Information from Caltrans Bridge Inspection Reports

The Caltrans BIR provides average daily traffic (ADT) at SR 1 over Aptos Creek. Per the BIR, the current ADT for the year 2019 is 78,000, and the future ADT projected to the year 2037 is 128,534 (2019).

1.9 Vertical Datum

The Project references the North American Vertical Datum of 1988 (NAVD 88).

2 AFFECTED ENVIRONMENT

2.1 Geographic Location

The Project limits extend approximately 2.6 mi along SR 1 with surrounding properties consisting of a mix of commercial, residential, and recreational sites around the community of Aptos. The Project is located in Santa Cruz County on SR 1 from PM 8.1, south of Freedom Boulevard, to PM 10.7, north of State Park Drive. The SR 1 bridge crossing of Aptos Creek is located at 36°58'30.6" North latitude and 121°54'6.58" West longitude (Caltrans, 2019). The rail trail bridge crossing of Aptos Creek is located approximately 0.1 mi northwest of the SR 1 bridge crossing of Aptos Creek.

2.2 Watershed Description

The Project limits are within Aptos Creek, San Andreas, and Soquel Creek watersheds.

The Aptos Creek watershed originates in the San Rosalia Mountains and flows predominantly from north to south. The watershed includes portions of the Forest of Nisene Marks State Park. One of the major tributaries that contributes to Aptos Creek is Mangels Gulch; its confluence with Aptos Creek is approximately 0.5 mi upstream of the SR 1 bridge crossing. Another major tributary to Aptos Creek is Valencia Creek. Valencia Creek originates along the northeastern boundary of the Aptos Creek watershed, and like Aptos Creek, it flows predominantly in a north to south direction. Trout Creek Gulch is a major tributary to Valencia Creek, and their confluence is approximately 0.3 mi upstream of the confluence of Valencia Creek with Aptos Creek. Upstream of the confluence to Aptos Creek, Valencia Creek flows east west along the north side of SR 1. At the confluence, the low flows of Valencia Creek are directed through an arch culvert (described in Section 1.4.1), which crosses under SR 1 and outfalls into Aptos Creek. An overflow channel just upstream (north) of the SR 1 crossing allows the Valencia Creek flows not conveyed through the culvert to overflow into Aptos Creek upstream of the SR 1 bridge crossing over Aptos Creek. As stated in Section 1.4.1, the SR 1 crossing at Aptos Creek is a five-span bridge. Downstream (south) Aptos Creek continues to flow south to the Pacific Ocean.

Aptos Creek (upstream of its confluence with Valencia Creek) drains a watershed area of approximately 12.2 square mi, and StreamStats indicates that approximately 74% of the land is covered by forest (USGS, 2019). Valencia Creek (upstream of its confluence with Aptos Creek) drains a watershed area of approximately 12.1 square mi, and StreamStats indicates that approximately 53 percent of the land is covered by forest (USGS, 2019).

The 2017 effective FIS for Santa Cruz County and Incorporated Areas, 06087CV001C (FEMA, 2017a), provides watershed areas for Aptos Creek at two locations: above the confluence with Valencia Creek and at the mouth of the Pacific Ocean. The watershed areas included in the FIS are comparable to the watershed areas delineated using

StreamStats. According to the FIS, the watershed area of Aptos Creek above the confluence with Valencia Creek is 12.4 square mi, and the watershed area of Aptos Creek at the mouth of the Pacific Ocean is 24.5 square mi.

Aptos Creek and Valencia Creek are the principal tributaries in the watershed. Aptos Creek converges with Valencia Creek approximately 1 mi inland of Monterey Bay. Bridge Creek and Mangels Gulch empty into the Aptos Creek portion of the watershed, and Trout Gulch empties into Valencia Creek (SCCDEH, 2021).

The northern Project limits of the SR 1 and the western limits of the Rail Trail Segment 12 are located within the Soquel Creek watershed and San Andreas watershed. The stormwater drains located within Soquel Creek watersheds drain through underground pipes to the Pacific Ocean. Soquel Creek watershed is one of the major watersheds in Santa Cruz County (SSCDEH, 2021)

A small portion of the southwestern Project limits within the Rail Trail Segment 12 is located within the San Andreas watershed. San Andreas watershed is bordered on the north and east by the Pajaro River watershed and to the west by the Aptos Creek watershed. San Andreas drains an area of approximately 15 square mi and is comprised of Bush Gulch and two unnamed streams. Land use is predominantly agriculture with some rural and urban residential areas (SCCDEH, 2021).

Figure 13 shows the various watersheds located within Santa Cruz County and Figure 14 shows the three watersheds within the Project limits. The Aptos Creek and Valencia Creek watersheds are shown Figure 15.

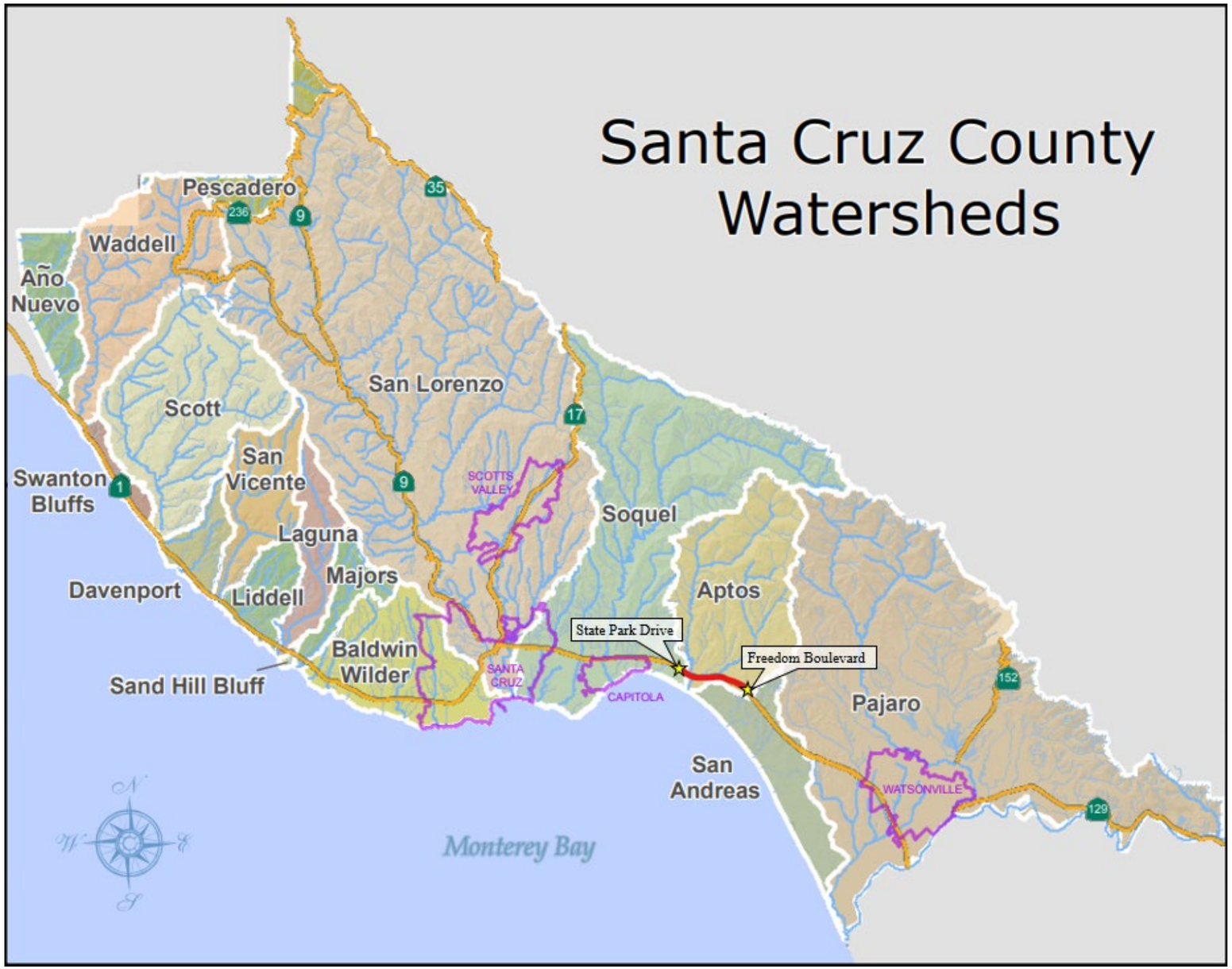

Figure 13. Santa Cruz County Watersheds

Source: Santa Cruz County, 2019

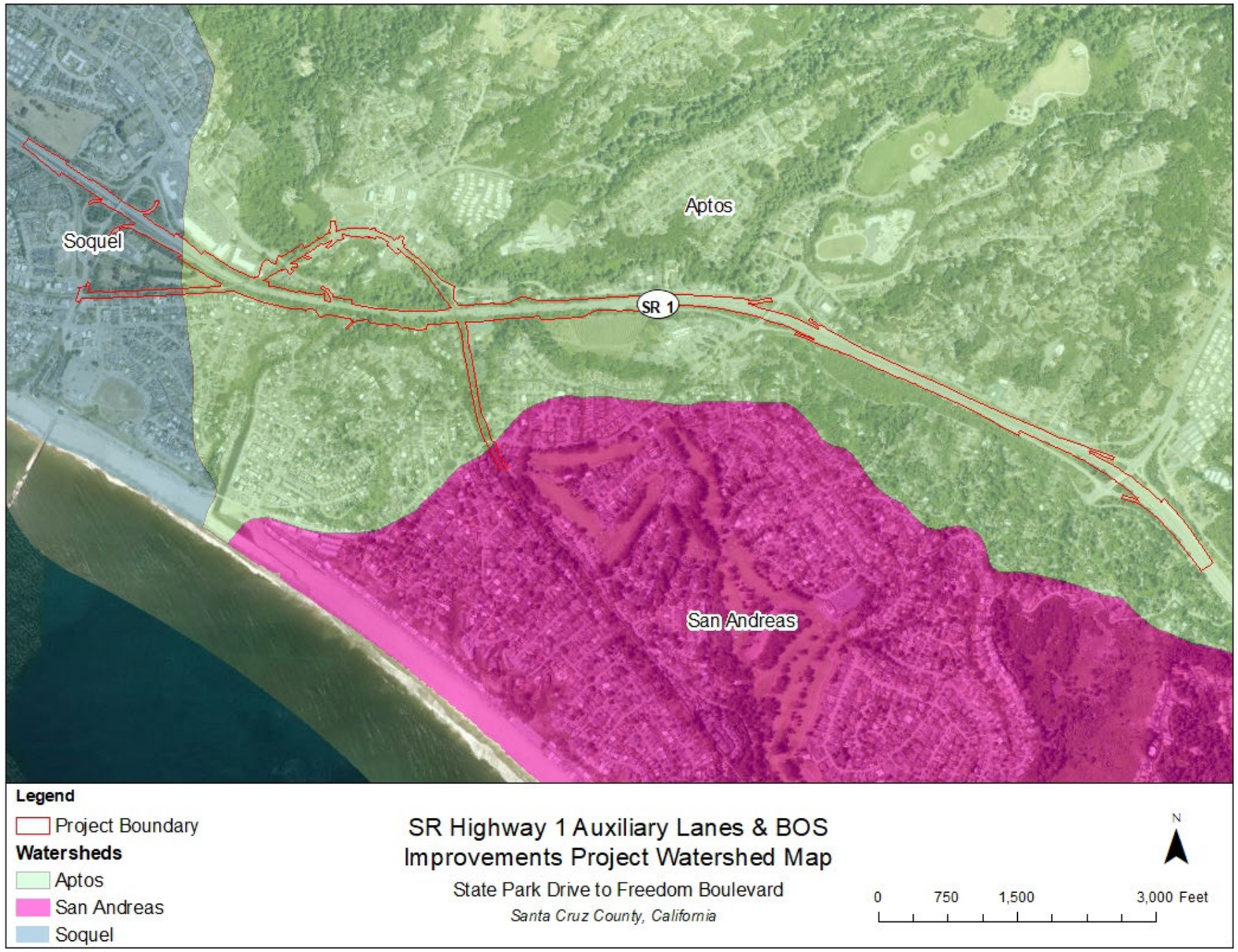

Figure 14. Watershed Map with Project Limits

Source: Santa Cruz County 2019c & Mark Thomas

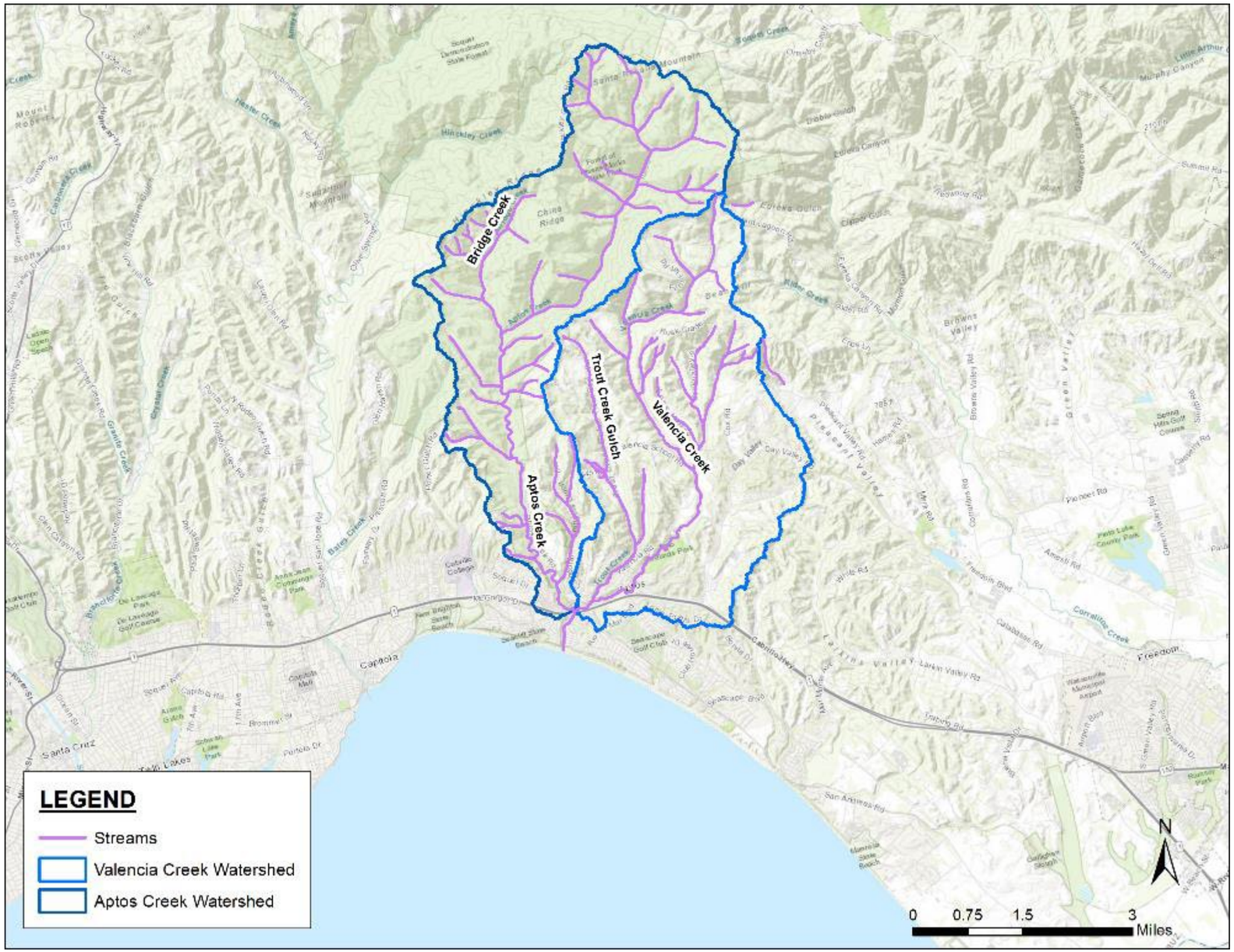

Figure 15. Aptos Creek and Valencia Creek Watersheds

Source: ESRI and USGS

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2.3 FEMA Floodplains

The NFHL is a digital database that contains flood hazard mapping data from FEMA's NFIP. The map data is derived from a compilation of FEMA's FIRM databases and Letters of Map Revision (LOMR). The NFHLs were used to produce a figure showing the flood hazards adjacent to and within the Project limits encompassing Santa Cruz County (see Figure 16) and a closer view of the flood hazards that are associated with the Aptos Creek flooding source (see Figure 17). The FEMA FIRM and the flood profiles from the FIS are presented in Appendix A.

The Project limits span several FIRMs (see Figure 16). The majority of the Project site is located within unshaded Zone X regions. Zone X floodplain areas represents areas that have a moderate to minimal flood hazard. Unshaded Zone X represents areas that have a minimal flood hazard, which is above the 500-year flood level.

The Aptos Creek crossing is located in Special Flood Hazard Area (SFHA) Zone AE, which represents areas subject to flooding by the 100-year flood event determined by detailed methods where BFEs are shown. At the Project site, the 100-year flood elevation is approximately 27 ft NAVD 88. According to the FEMA FIRM, residential properties are within the Aptos Creek floodplain downstream of the SR 1 bridge.

The Project site is also within a regulatory floodway. According to Title 44, Section 60.3(d)(3) of the Code of Federal Regulations (CFR), a community shall "prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge."

The SR 1 bridge over Aptos Creek is bound by FEMA cross sections F and G (See Figure 17), which have base flood elevations of 24.9 ft and 27 ft respectively, as listed in the Floodway Data table. No increase of any amount in the BFE is allowed in the floodway.

The cross sections along Aptos Creek within the Project vicinity are presented in Table 2. SR 1 is located between FEMA cross sections F (downstream of SR 1) and G (upstream of SR 1) and the railroad is located between FEMA cross sections I, downstream of the railroad, and J, upstream of the railroad (FEMA, 2017b). Cross section E is at the downstream extent of the model and is used as the boundary condition for the hydraulic analysis.

Table 2. FEMA BFE Along Aptos Creek

FEMA Cross Section	BFE (ft NAVD 88)
J	31.6
I	29.0
H	28.6
G	27.0
F	24.9
E	24.1

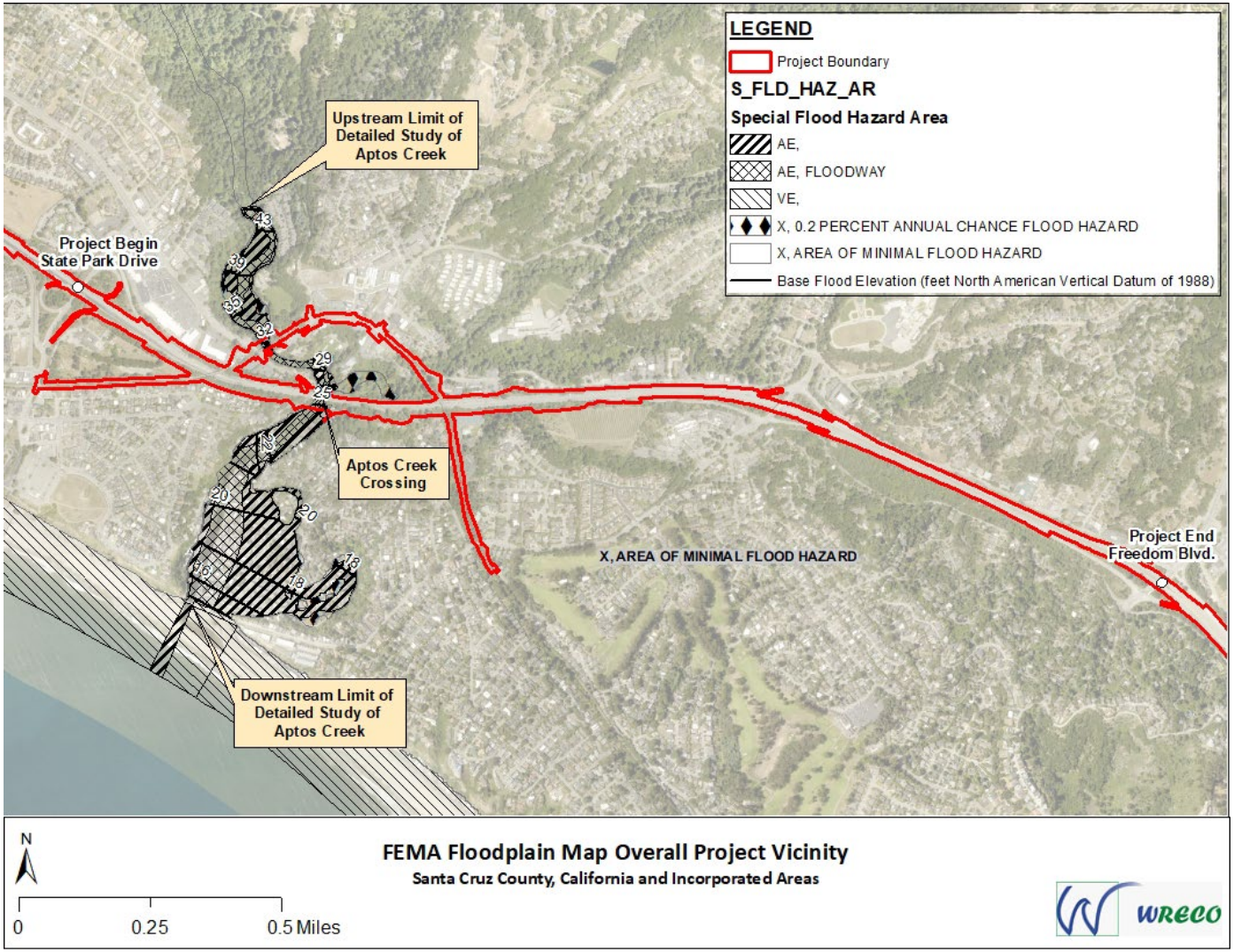

Figure 16. FEMA Floodplain Map – Overall Project Vicinity

Sources: FEMA, 2019a and ESRI

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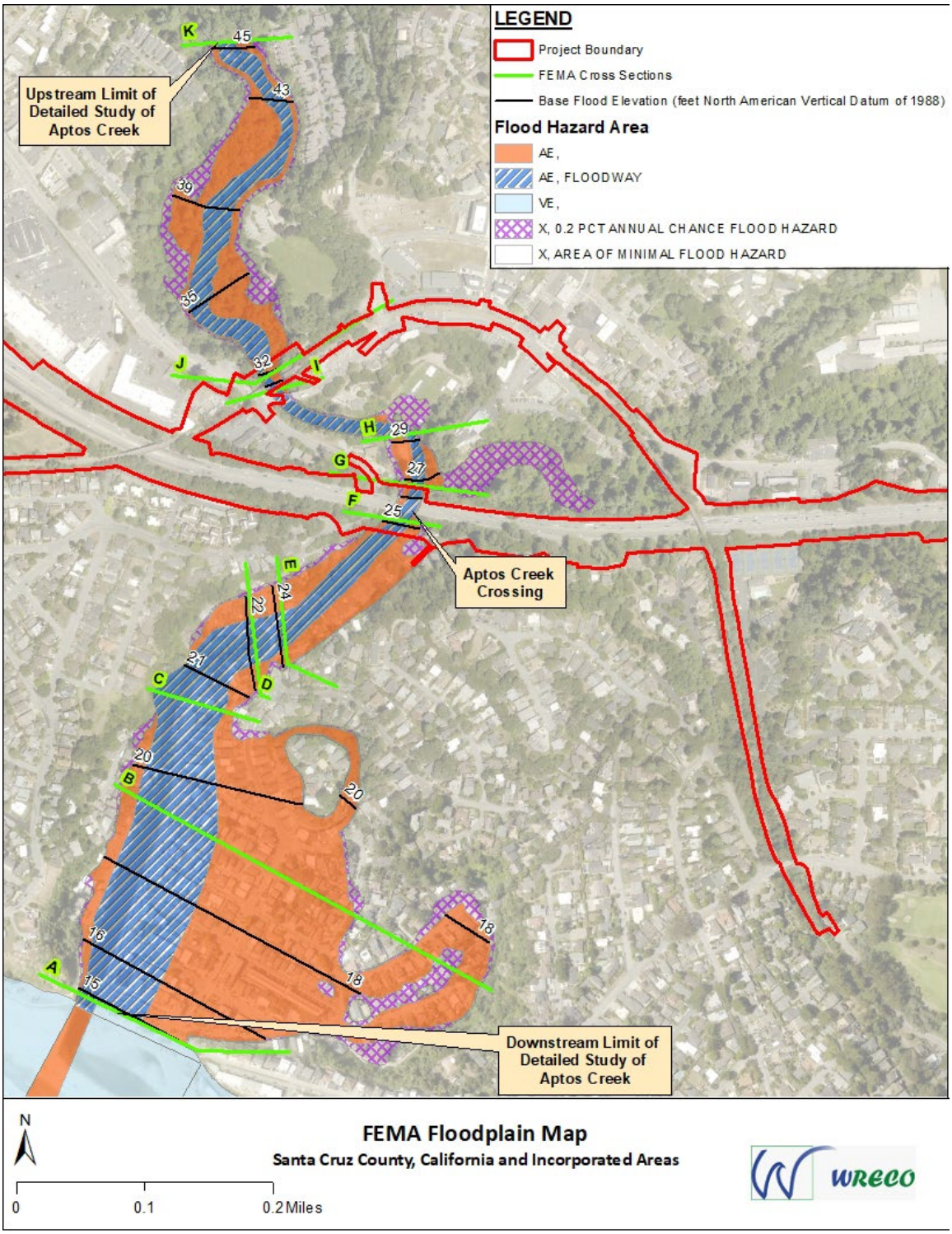

Figure 17. FEMA Floodplain Map – Aptos Creek

Sources: FEMA, 2017

2.4 Sea Level Rise Projections

State of California Guidance

The *State of California Sea-Level Rise Guidance, 2018 Update* (2018 SLR Guidance) was used to determine the scenario-based SLR projections of the Project site. The SLR projections for Monterey, which is the closest location to the Project site that is included in the 2018 SLR Guidance, are provided in Table 3. The 2018 SLR Guidance uses the year 2000 as the baseline for the probabilistic projections and include a low to high emission scenario leading up to 2150.

California Coastal Commission

The Project is within the Coastal Commission jurisdiction, (i.e., within the coastal zone boundary). Figure 18 shows the coastal zone boundary within the Project limits, which begins east of the Soquel Creek crossing at SR 1 and extends beyond the eastern Project limits. The Project is located within the Santa Cruz County and south of City of Capitola LCPs (see Section 1.6.4.2).

Per the 2016 Coastal Commission's *California Coastal Commission Statewide Sea Level Rise Vulnerability Synthesis*, the Santa Cruz County LCP was stated to be in the process of updating their LCP to address SLR. Aptos is an unincorporated place under the jurisdiction of Santa Cruz County; therefore, the entire Coastal Zone area within the Project limits is anticipated to be subject to the requirements of the Santa Cruz County LCP. However, the Coastal Commission's SLR Guidance provides recommendations on addressing SLR as part of the development of an LCP, LCP Amendment, or other plan (Section 1.6.4.2 presents a summary of the recommendations).

Table 3. SLR Projections (in feet) for Monterey

		Probabilistic Projections (in feet) (based on Kopp et al. 2014)				
		MEDIAN	LIKELY RANGE		1-IN-20 CHANCE	1-IN-200 CHANCE
		50% probability sea-level rise meets or exceeds...	66% probability sea-level rise is between...		5% probability sea-level rise meets or exceeds...	0.5% probability sea-level rise meets or exceeds...
				Low Risk Aversion		Medium - High Risk Aversion
High emissions	2030	0.4	0.3 -	0.5	0.6	0.8
	2040	0.6	0.4 -	0.8	0.9	1.2
	2050	0.8	0.5 -	1.1	1.3	1.9
Low emissions	2060	0.9	0.5 -	1.2	1.5	2.3
High emissions	2060	1.0	0.7 -	1.4	1.8	2.6
Low emissions	2070	1.0	0.6 -	1.4	1.9	3.0
High emissions	2070	1.3	0.9 -	1.8	2.3	3.4
Low emissions	2080	1.2	0.7 -	1.7	2.3	3.8
High emissions	2080	1.6	1.1 -	2.3	2.9	4.4
Low emissions	2090	1.3	0.8 -	2.0	2.7	4.6
High emissions	2090	2.0	1.3 -	2.8	3.5	5.5
Low emissions	2100	1.5	0.9 -	2.3	3.1	5.5
High emissions	2100	2.3	1.5 -	3.3	4.3	6.9
Low emissions	2110*	1.6	1.0 -	2.4	3.3	6.1
High emissions	2110*	2.5	1.7 -	3.4	4.4	7.2
Low emissions	2120	1.7	1.0 -	2.7	3.8	7.3
High emissions	2120	2.8	2.0 -	4.0	5.2	8.5
Low emissions	2130	1.9	1.1 -	3.0	4.2	8.3
High emissions	2130	3.1	2.2 -	4.5	5.9	9.9
Low emissions	2140	2.0	1.1 -	3.2	4.7	9.5
High emissions	2140	3.5	2.4 -	5.1	6.7	11.3
Low emissions	2150	2.1	1.1 -	3.6	5.3	10.8
High emissions	2150	3.8	2.6 -	5.7	7.6	12.9

Source: OPC, 2018

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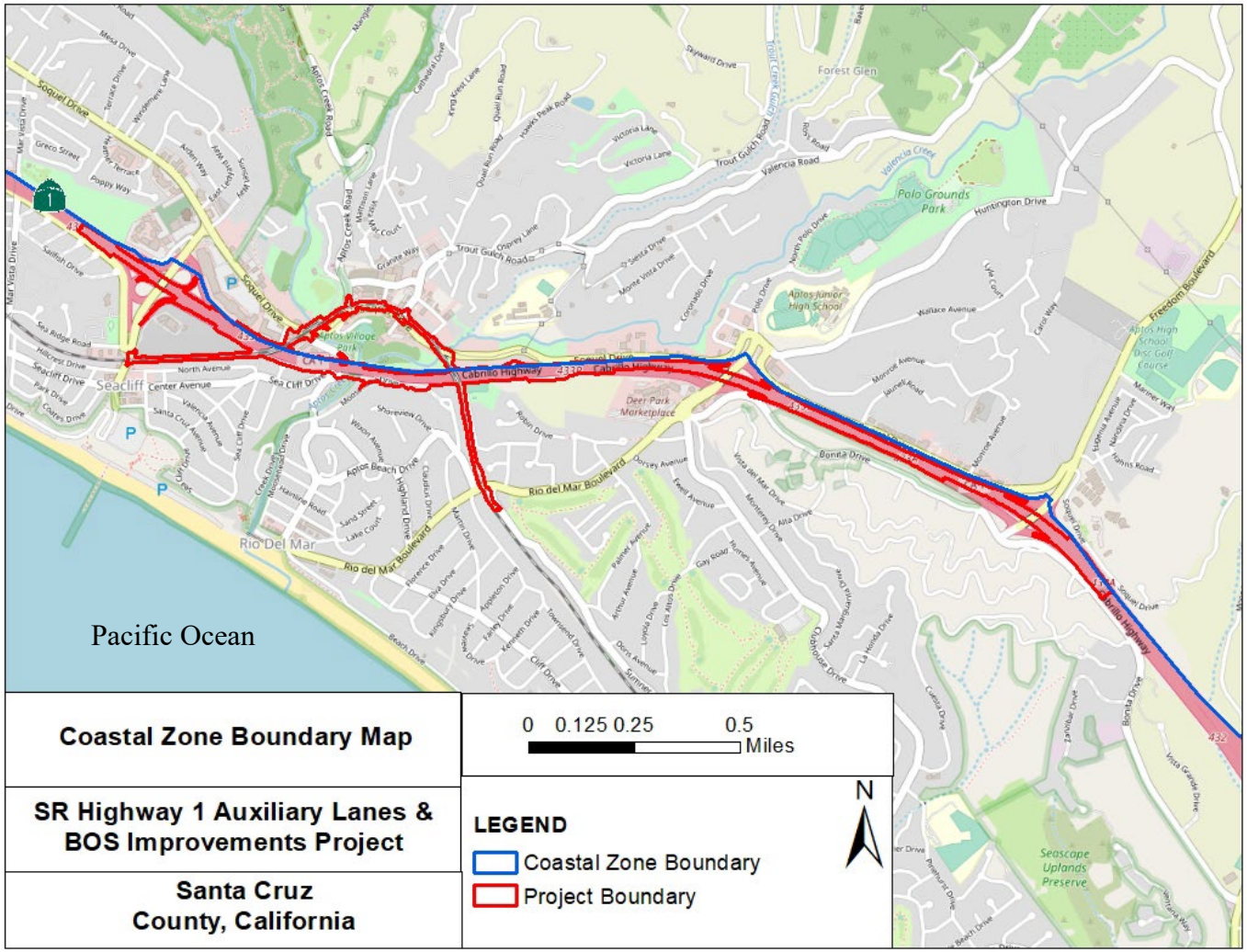

Figure 18. Project Footprint Within Coastal Zone Boundary

Source: California Coastal Commission, 2016

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2.4.1 Potential Sea Level Rise at End of Project Service Life

The Project's service life for the roadway is estimated to be 20 years based on the Caltrans' HDM (2020) Section 618. With this design life, the pavement would last through 2048 after the expected construction ends in 2028. Based on the Project design life and the medium-to-high-risk scenario, a SLR projection of 1.8 ft in the year 2048 for the Project's SLR impact evaluations was estimated by interpolating between the SLR projections between 2040 (1.2 ft) and 2050 (1.9 ft) for the medium-to-high risk scenario.

The Project's service life for the bridges is estimated to be 75 years according to the Caltrans' HDM (2020). With this design life, the Aptos and Valencia Creek bridges would last through 2103 after the expected construction ends in 2028. Based on the Project design life and the medium-to-high-risk scenario, a SLR projection of 7.0 ft in the year 2103 for the Project's SLR impact evaluations was estimated by interpolating between the SLR projections between 2100 (6.9 ft) and 2110 (7.2 ft) for the medium-to-high risk scenario. See Table 4 for the projected depths for the low and medium-to-high risk emissions at the roadway and bridge end of service life.

Table 4. SLR Projected Depth at the End of Service Life

Location	2018 SLR Guidance Projected depths	
	Low Risk depth increase (ft)	Medium-to-High Risk depth increase (ft)
Roadway (Year 2048)	0.9	1.8
Bridge (Year 2103)	3.33	7.0

Source: OPC SLR Guidance, 2018

One of the Coastal Commission's recommendations for addressing SLR by LCPs is for all communities to evaluate the impacts from the medium-high risk aversion SLR scenario presented in the 2018 OPC SLR Guidance. The OPC SLR Guidance provides emissions-based SLR projections at local active tidal gauge locations. The Monterey gauge is the closest tidal gauge to the Project location (see Table 5 for the SLR projections at Project site for service life year 2048 for the roadway and year 2103 for the bridge).

2.4.2 Potential Sea Level Rise Inundations at Project Site

Based on the steps and resources incorporated in the Coastal Commission's recommendations for addressing SLR by LCPs, the potential inundations of the Project limits due to SLR were estimated using following elevation datasets:

- NOAA's Sea Level Rise Viewer
- NOAA's Coastal Topographic LiDAR dataset with FEMA coastal 100-year WSEs

The Coastal Commission's SLR Guidance suggests looking at various storm events (annual, 20-year, 100-year, etc.) in addition to the various tidal scenarios (Mean Higher High Water

[MHHW], king tide, etc.) before selecting the scenario that a Project would be evaluated on. Figure 19 shows the inundation of the local MHHW datum with SLR depth increase of 7 ft estimated using NOAA Sea Level Rise Viewer. Based on the Present Epoch, years 1983 to 2001, the local MHHW for Monterey, CA gauge station (Station No. 9413450) is 5.5 ft (NOAA Tides and Currents, 2022).

Table 5. MHHW SLR Projected Elevation at Project Site

Scenario Source	Existing Elevations (ft NAVD 88)	Year 2048 Elevations (ft NAVD 88)	Year 2103 Elevations (ft NAVD 88)
2018 SLR Guidance	5.5	7.3	12.5

Source: NOAA Tides and Currents, 2021

According to the FEMA FIRMs in the Project vicinity (06087C0356F, 06087C0357F, 06087C0358F, 06087C0359F, and 06087C0380F), the stillwater elevation of the Pacific Ocean in the Project vicinity is 8.6 ft NAVD 88 (see Figure 20). The stillwater 100-year WSE of 8.6 ft was increased by a depth of 7 ft to account for SLR resulting in a SLR WSE of 15.6 ft. The 7.0 ft SLR depth was based on the 75-year service life for bridges. The SLR depth of 1.8 ft is based on the 20-year service life of the roadway.

The SLR WSE for the 75-year service life of the bridge was used as the most conservative scenario for the SLR analysis. The NOAA Coastal Topographic LiDAR dataset was used to determine ground elevation below 15.6 ft NAVD 88 in the Project Vicinity (see Figure 21). The Project limits are located outside of the areas of the inundations during the 100-year storm event with SLR depth increase. Additionally, the profile for SR 1 in the Project limits using NOAA LiDAR data measures between 20 and 220 ft NAVD 88, which is well above the future 100-year WSE with SLR (see Figure 22). Although the Coastal Rail Trail Segment 12 is located within areas that are less 20 ft in elevation, the nearby creeks are not susceptible to SLR per the analysis of NOAA SLR Viewer tool or the LiDAR imagery as shown in Figure 19 and Figure 21.

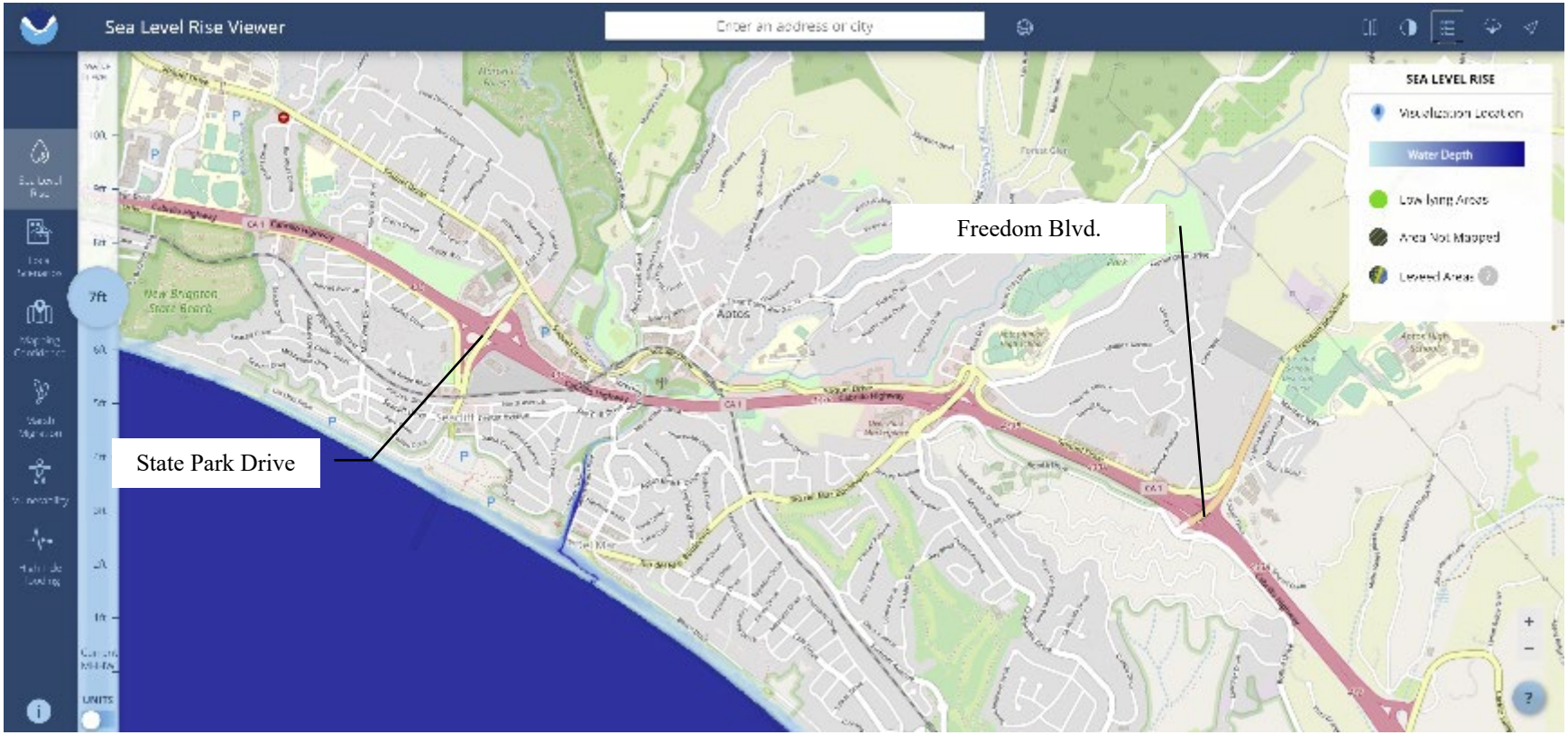

Figure 19. NOAA Sea Level Rise Viewer with 7 ft SLR

Source: NOAA, 2021

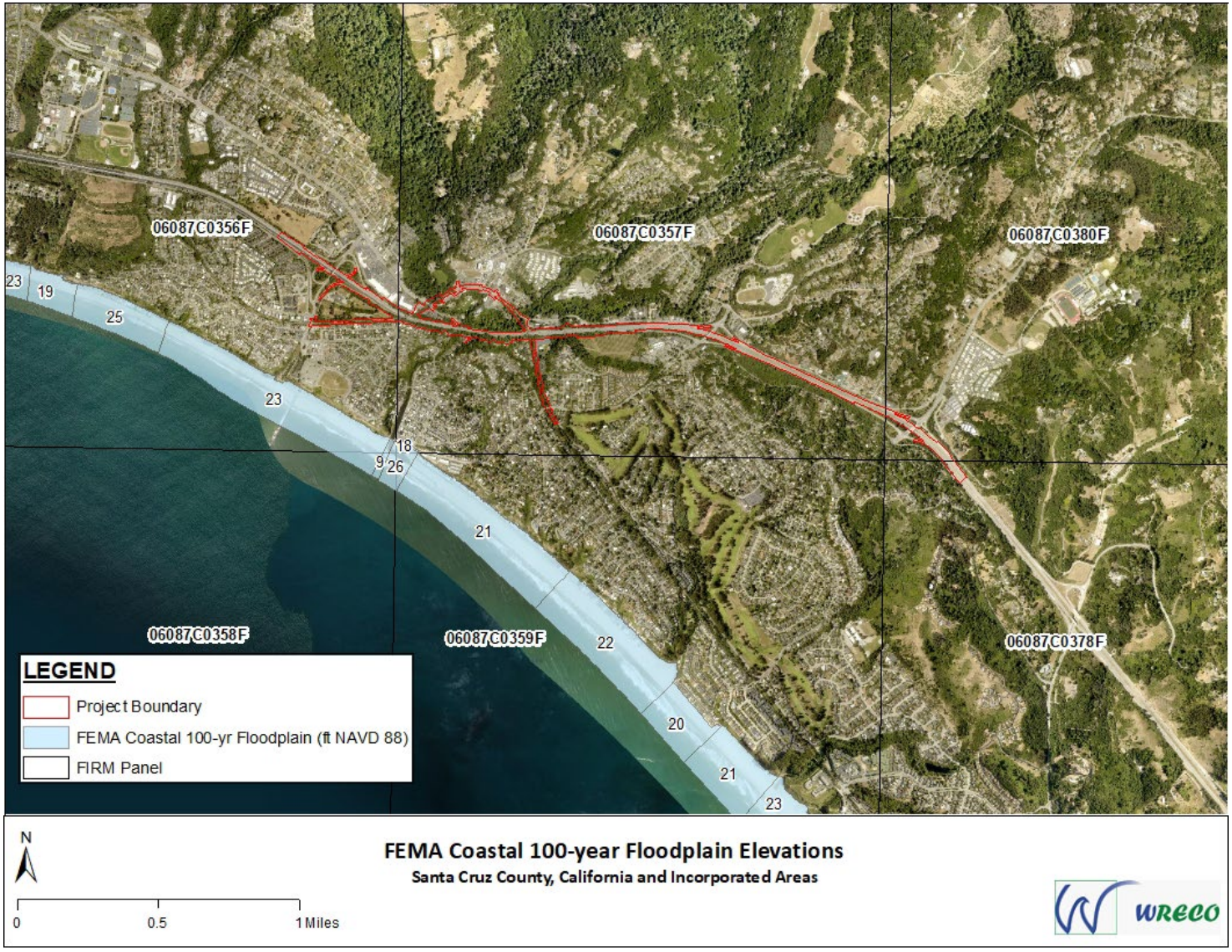

Figure 20. FEMA Coastal 100-Year Floodplain Elevations in the Project Vicinity

Sources: ESRI and FEMA, 2019a

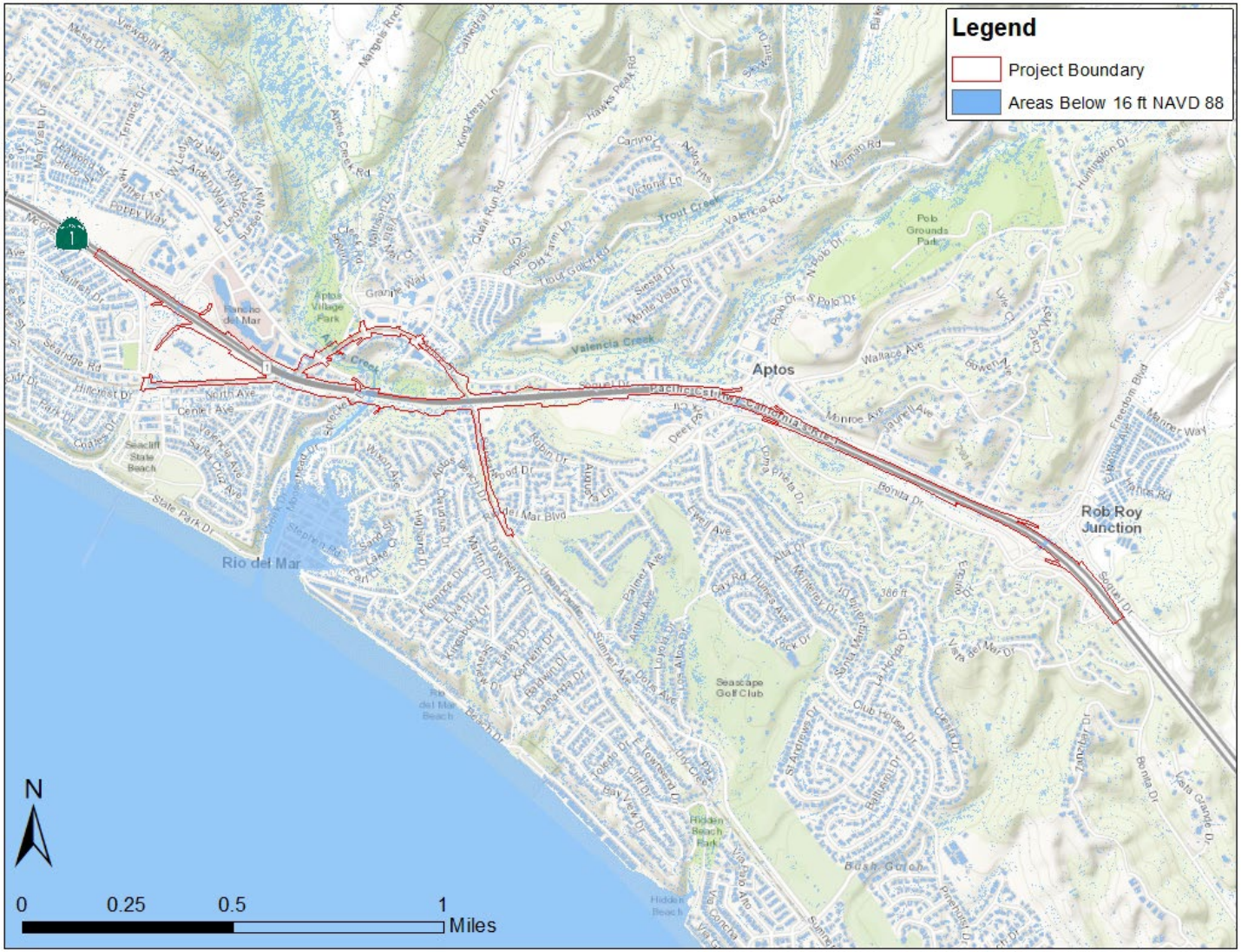

Figure 21. Extents of Future 100-Year Coastal Elevation of 15.8 ft with SLR for 2103

Sources: NOAA, 2017

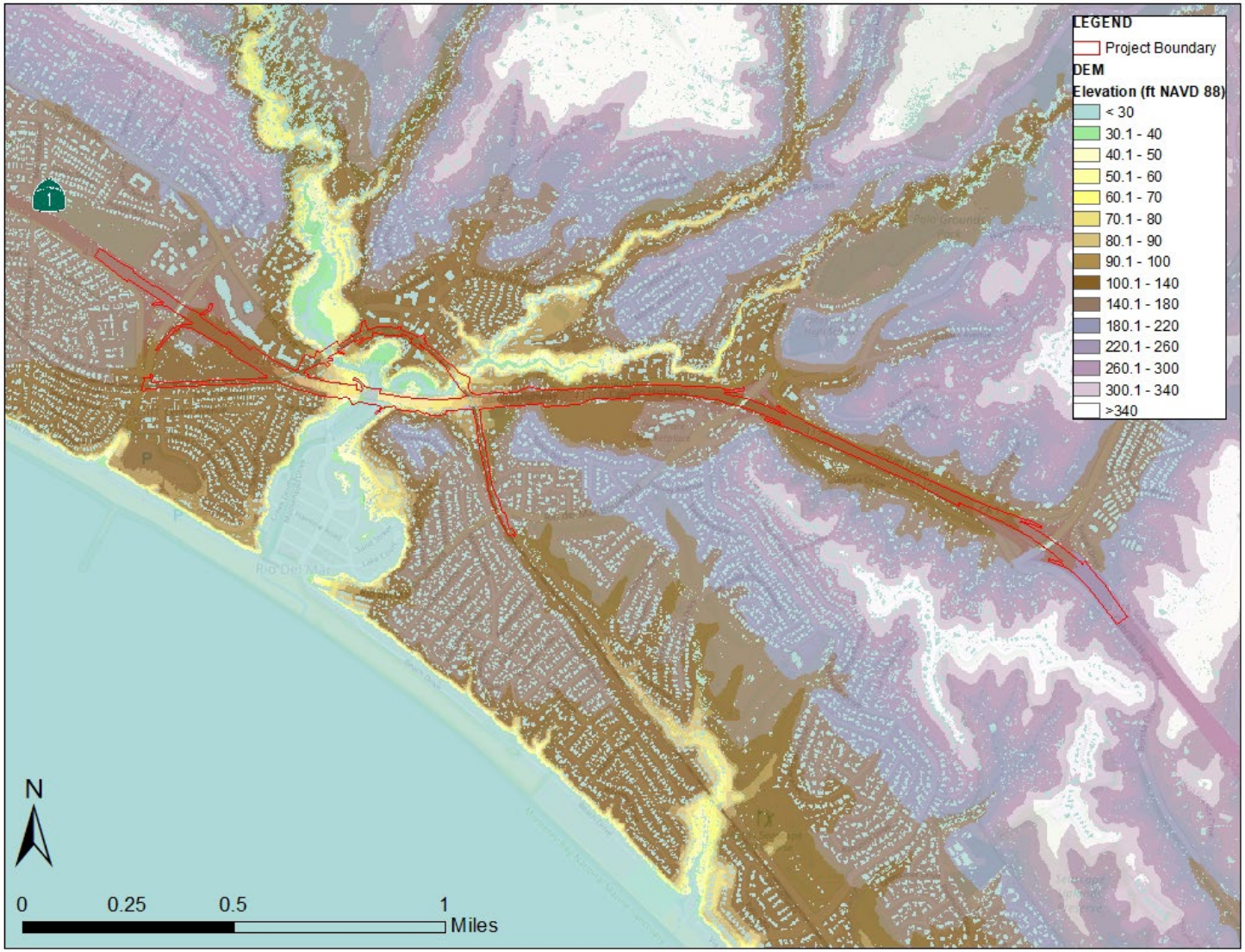

Figure 22. Topographic Map

Sources: NOAA, 2017

2.4.3 SLR Conclusion

Santa Cruz County is in the process of updating their LCPs to address SLR. The communities of Seacliff, Aptos, Rio del Mar, and Aptos Hills-Larkin Valley are unincorporated places under the jurisdiction of Santa Cruz County; activities in the unincorporated areas within Santa Cruz County are anticipated to be subject to the requirements of the Santa Cruz County LCP.

For this report, the extent of the inundations due to the 100-year storm with SLR were estimated. Based on the analysis of the NOAA Sea Level Rise Viewer mapping tool and NOAA Coastal LiDAR, which includes the FEMA 100-year coastal WSE, the Project would not be impacted by the 100-year storm event with the medium-high risk scenario of 7.0 ft SLR projection. Therefore, further analysis of SLR impacts on the Project limits were not evaluated for this Project. However, SLR is considered in the hydraulic analysis of this report and will be taken in to consideration for Project construction and impacts.

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3 HYDROLOGY AND HYDRAULICS

3.1 Hydrologic Assessment

WRECO evaluated the hydrology at the Project site using the following hydrologic design methods/sources:

1. United States Geological Survey (USGS) regional regression analysis
2. FEMA FIS

3.1.1 USGS Regional Regression Flows

Flood-frequency equations have been developed by the USGS and based on analysis of data from gaging stations as described in *Magnitude and Frequency of Floods in California* by Waananen and Crippen (1977). These flood-frequency equations are generally used to estimate stream flow for un-gaged sites that are not affected by substantial urban development and that are natural (unregulated) streams.

On July 18, 2012, the USGS issued *Methods for Determining Magnitude and Frequency of Floods in California*, *Based on Data through Water Year 2006* (Gotvald et al., 2012), which contains updated regional flood-frequency equations, and revised the boundaries of the six unique regions within California. These equations are based on annual peak flow data through water year 2006 for 771 streamflow-gaging stations in California with 10 or more years of data. The updated equations were used in support of the Project's hydrologic analysis.

California is divided into six regions. The Project site is within the North Coast region (Region 1). The regional regression equations were developed for the North Coast region using data from sites with a wide range of basin characteristics: drainage areas ranging from 0.04 to 3,200 square mi, and mean annual precipitation ranging from 20 to 125 inches (Gotvald et al., 2012).

$$Q_{100} = 48.5(\text{DRNAREA})^{0.866}(\text{PRECIP})^{0.556}$$

Where:

Q_{100}	=	peak discharge for a storm event with a return period of 100 years, cubic ft per second (cfs)
DRNAREA	=	drainage area, square mi
PRECIP	=	mean annual precipitation, inches

The basin characteristics associated with the Project watershed were obtained from USGS StreamStats (see Table 6). These basin characteristics are within the range of basin characteristics for which the regional regression equations were developed.

Table 6. USGS Flood-Frequency Parameters

Location	Drainage Area (square mi)	Mean Annual Precipitation (inches)
Aptos Creek (upstream of confluence with Valencia Creek)	12.2	36.8
Valencia Creek (upstream of confluence with Aptos Creek)	12.1	28.2

Source: USGS, 2021

The resulting peak flow rates estimated using the USGS regional regression equation are presented in Table 7.

Table 7. 100-Year Regional Flood-Frequency Flows

Location	Peak Flow (cfs)
Aptos Creek (upstream of confluence with Valencia Creek)	3,140
Valencia Creek (upstream of confluence with Aptos Creek)	2,690

3.1.2 FEMA FIS Flows

The effective FIS (FEMA, 2017a) for Santa Cruz County includes peak flows for Aptos Creek at two locations: upstream of the confluence of Valencia Creek and at the mouth of the Pacific Ocean (see Table 8).

Table 8. 100-Year FEMA Flows for Aptos Creek

Flow Change Location	Drainage Area (square mi)	Peak Flow (cfs)
Above confluence with Valencia Creek	12.4	5,540
At Mouth	24.5	8,280

Source: FEMA, 2017a

Based on the information from StreamStats, the combined watershed area of the Aptos Creek watershed and Valencia Creek watershed is approximately 24.3 square mi, which is within 1% of the drainage area presented in the FIS for Aptos Creek at the mouth of the Pacific Ocean. The mouth of the Pacific Ocean is approximately 0.5 mi downstream of the SR 1 crossing with Aptos Creek.

3.1.3 Project Flows

The flow for Valencia Creek was calculated using the regional regression equation and the flow for Aptos Creek upstream of the confluence with Valencia Creek were calculated from the FEMA FIS were used for the floodplain assessment for this Project.

The flow for Aptos Creek at the mouth of the Pacific Ocean from the FEMA FIS was used as flow for Aptos Creek downstream of the confluence with Valencia Creek. See Table 9 for a summary of the Project flows.

Table 9. Project 100-Year Flows

Location	100-year Flow (cfs)
Aptos Creek (upstream)	5,540
Valencia Creek (upstream)	2,690
Aptos Creek (downstream of confluence with Valencia Creek)	8,280

3.2 Hydraulic Assessment

A hydraulic assessment was performed for Aptos Creek and Valencia Creek, the only direct receiving water bodies within the Project limits that is associated with a FEMA base floodplain.

3.2.1 Effective Hydraulic Model

In the vicinity of the Project, Aptos Creek is located within a Zone AE base floodplain, which indicates that the floodplain was studied with detailed methods. The Project Team requested the effective model from the FEMA Engineering Library and Santa Cruz County and indicated that although records show that a hydraulic model is available in the area, it was not located (Personal communication, Susan Greene, September 15, 2020; see Appendix B).

3.2.2 Hydraulic Model Development

As stated in Section 3.2.1, the effective model was unavailable. Therefore, a hydraulic model was developed for the Project with the best available data. A one-dimensional steady-state hydraulic model was developed to evaluate and assess whether the Project improvements would affect the 100-year WSEs of Aptos Creek within the Project vicinity. The hydraulic analyses were performed for the existing and proposed conditions using the United States Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) modeling software, Version 5.0.7.

3.2.2.1 Bridges and Culverts

The hydraulic model was developed to encompass the area in the vicinity of SR 1 where the bridge is proposed to be widened to accommodate the auxiliary lanes (see Figure 10 and Figure 11 for the general plan). The existing railroad bridge currently spans over Aptos Creek and the structure is above the limits of the 100-year base flood WSEs. The Segment 12 bridges at Aptos Creek and Valencia Creek will span over the creek and will be above the 100-year WSEs. Therefore, the railroad and Segment 12 bridges were not incorporated in the hydraulic model.

The existing SR 1 bridge at Aptos Creek was modeled using elevation data provided by HMH in 2020 and as-built information from 1947. The existing arch culvert that crosses underneath SR 1 and conveys Valencia Creek was also modeled using as-built information from 1947 in the BIR (Caltrans, 2021). The SR 1 bridge widening at Aptos Creek was modeled using design drawings and general plans provided by ICF in 2022.

The existing SR 1 bridge is modeled as a five-span bridge with 56-ft-long spans for Spans 1 through 4 (eastern spans) and a 32-ft-long span for Span 5 (western span). The bridge is modeled with a width of 60.8 ft and a minimum soffit elevation of 51.1 ft. According to the as-built, the two piers to the east are 8 ft wide and the two piers to the west are 7-ft-wide. The piers are modeled as two, 8-ft-wide with triple the pier width (24 ft) to account for potential debris accumulation on the east and 7-ft-wide piers with 21 ft of potential debris on the west.

The widening of the SR 1 bridge at Aptos Creek will extend south (downstream) of the existing SR 1 alignment. The proposed SR 1 bridge widening is modeled as an extension of the existing bridge with the piers in the same alignment and width as the existing bridge. The additional piers for the bridge widening are designed to be 4 ft by 4 ft square columns. Due to the limitation of the one-dimensional model, the piers have to be a consistent width along the bridge deck. The existing width of the piers was extended along the widened bridge deck. This is over-representing the impacts of the proposed Project and should be considered a conservative assessment of the hydraulic impacts. The widening will be an additional 43.8 ft resulting in an overall bridge width of 104.5 ft for the proposed condition. The minimum soffit elevation of the proposed bridge is 51.8 ft. The widening will extend over the Valencia Creek culvert, but the additional piers will not add obstructions at the outlet of the culvert.

The existing Valencia Creek culvert is modeled as an arch culvert with an 11-ft span and 11-ft rise. The culvert is approximately 169-ft-long with a 14-ft-long outfall. The culvert length was modeled as 169 ft. The Manning's n value was 0.013. The invert elevation of the culvert exit was modeled using survey information obtained by Mark Thomas (2021). The invert elevation of the culvert entrance was not surveyed, and was modeled using as-built information.

The overflow channel for Valencia creek upstream of SR 1 was modeled as a lateral structure to accommodate the high flows in Valencia Creek that flow into Aptos Creek. The elevation of the overflow channel was limited by the topographic survey available for this study (Mark Thomas, 2021). The lateral structure was modeled with a top elevation ranging from 17.8 to 22.6 ft, and is approximately 116 ft along the left bank of Aptos Creek. At the junction between the culvert outfall of Valencia Creek and Aptos Creek downstream of the SR 1 bridge, a small lateral structure was placed on the higher terrain west of the culvert outfall.

3.2.2.2 Terrain and Channel Cross Sections

Cross sections of Aptos Creek and Valencia Creek were developed using surveyed elevation data provided by Mark Thomas (2021). The model was developed to represent reaches of Aptos and Valencia creeks upstream of SR 1, and approximately 650 ft downstream after their confluence. The cross sections of Valencia Creek were surveyed just upstream and downstream of the culvert. The upstream reach cross sections were developed using topographic data alone. Along the reach of Aptos Creek upstream of SR 1, one cross section was developed using surveyed elevation data and the remaining cross sections were developed using topographic data. The locations of the cross sections are identified in Figure 23. The cross section naming convention is by river station (RS) with the RS number increasing in the upstream direction.

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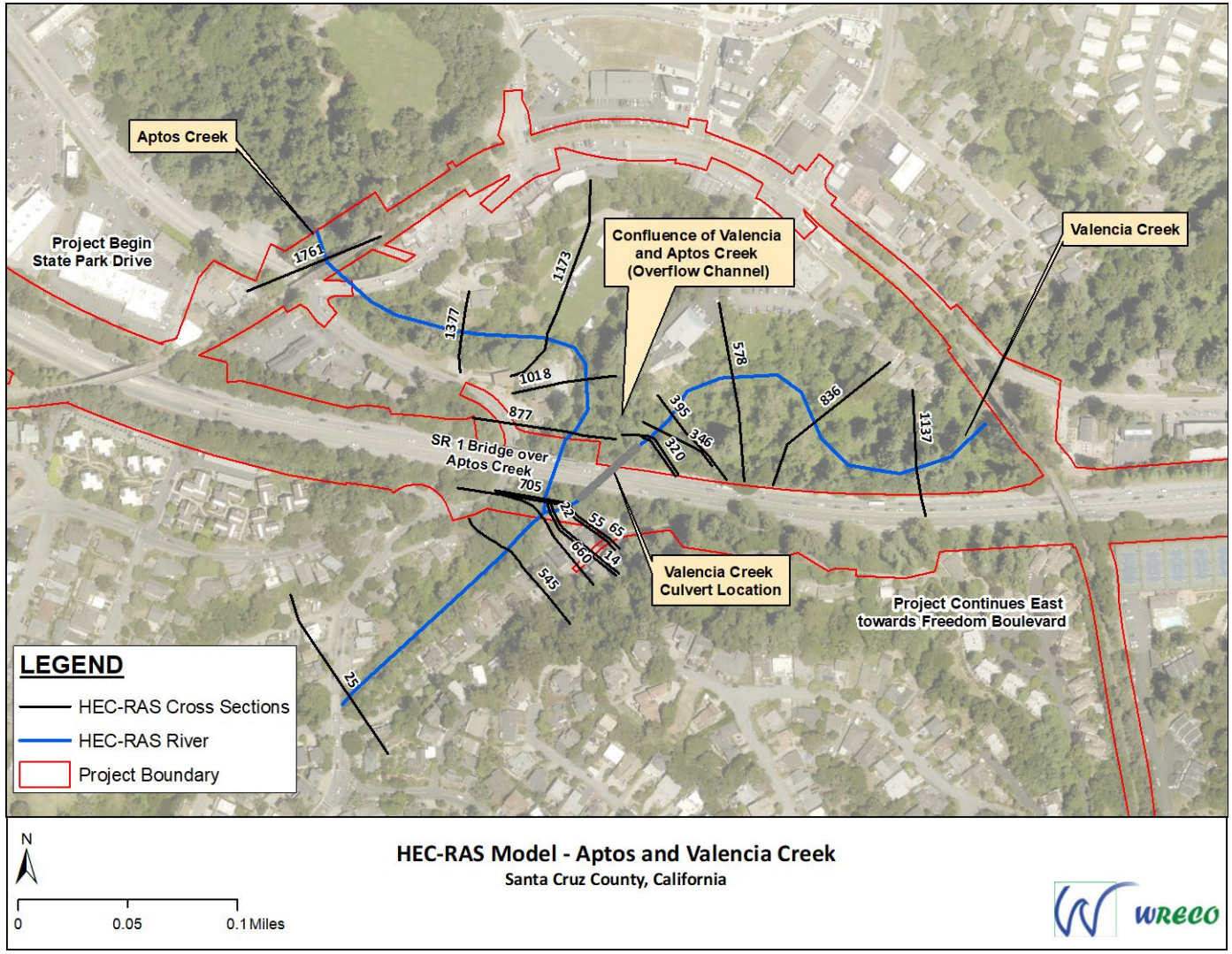

Figure 23. Cross Sections Locations

Sources: HEC-RAS, 2019 & ICF, 2022

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3.2.2.3 Boundary Conditions

The downstream boundary condition was modeled based on two conditions for river station 22 that is located at the FEMA cross section E:

1) 100-year elevation at the FEMA cross section E
2) 100-year elevation at the FEMA cross section E with SLR

As stated in Section 2.4.1, the SLR depth increase was projected to be 7.0 ft based on a 75-year design service life and a construction end date of 2028. The hydraulic model does not extend to the mouth of the Pacific Ocean. However, the elevations of the flood profile were based on the 100-year FEMA elevation at cross section E. For the first condition, the WSE for the boundary condition was obtained from the from the FIS (FEMA, 2017a) cross sections data. For the second condition, the WSE for the boundary condition was based on the WSE from the first condition with the projected depth increase of 7 ft with SLR making the WSE 31.1 ft (see Table 10).

Table 10. Hydraulic Model Boundary Conditions

Condition	WSE (ft)
1	24.1
2	31.1

3.2.3 Hydraulic Model Results

The water surface profile comparisons for the Project for the 100-year flows and 100-year flows with SLR are shown in Figure 24 through Figure 27. The downstream direction is on the left side of the figures. The Aptos bridge upstream cross sections for the existing and proposed bridge are shown in Figure 28 and Figure 29, respectively. The results of the hydraulic model show a maximum increase of 0.02 ft in the WSEs from the existing to proposed 100-year event upstream of the Aptos bridge. During the 100-year storm event with SLR the maximum increase in WSE is 0.02 ft approximately 400 ft upstream of the existing. The differences in WSEs are summarized in Table 11 for the 100-year storm event and Table 12 for the 100-year storm event with SLR. The detailed model results for the existing and proposed models are provided in Appendix C and Appendix D, respectively.

To offset the additional fill from the added pier columns in the channel, terraced grading will be developed and no increase in the base flood WSE is anticipated.

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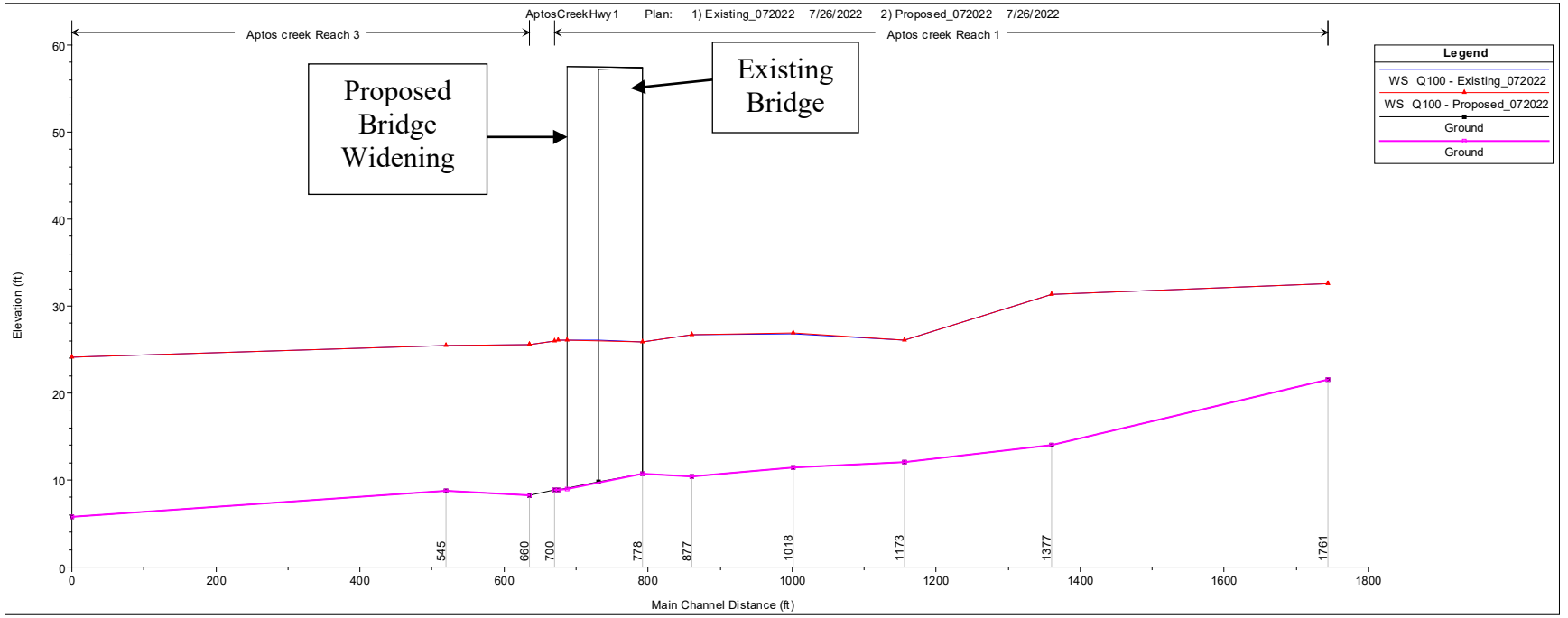

Figure 24. Aptos Creek Water Surface Profile Comparison: 100-year

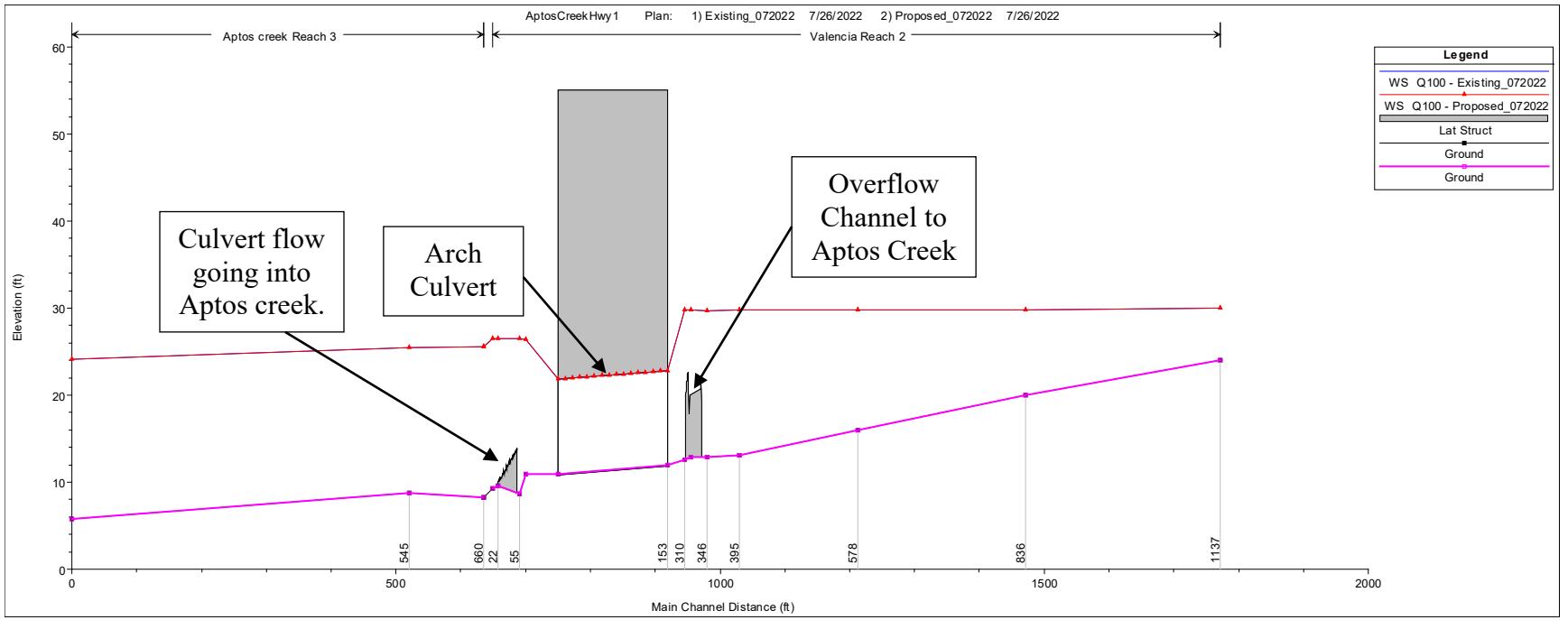

Figure 25. Valencia Creek Water Surface Profile Comparison: 100-Year

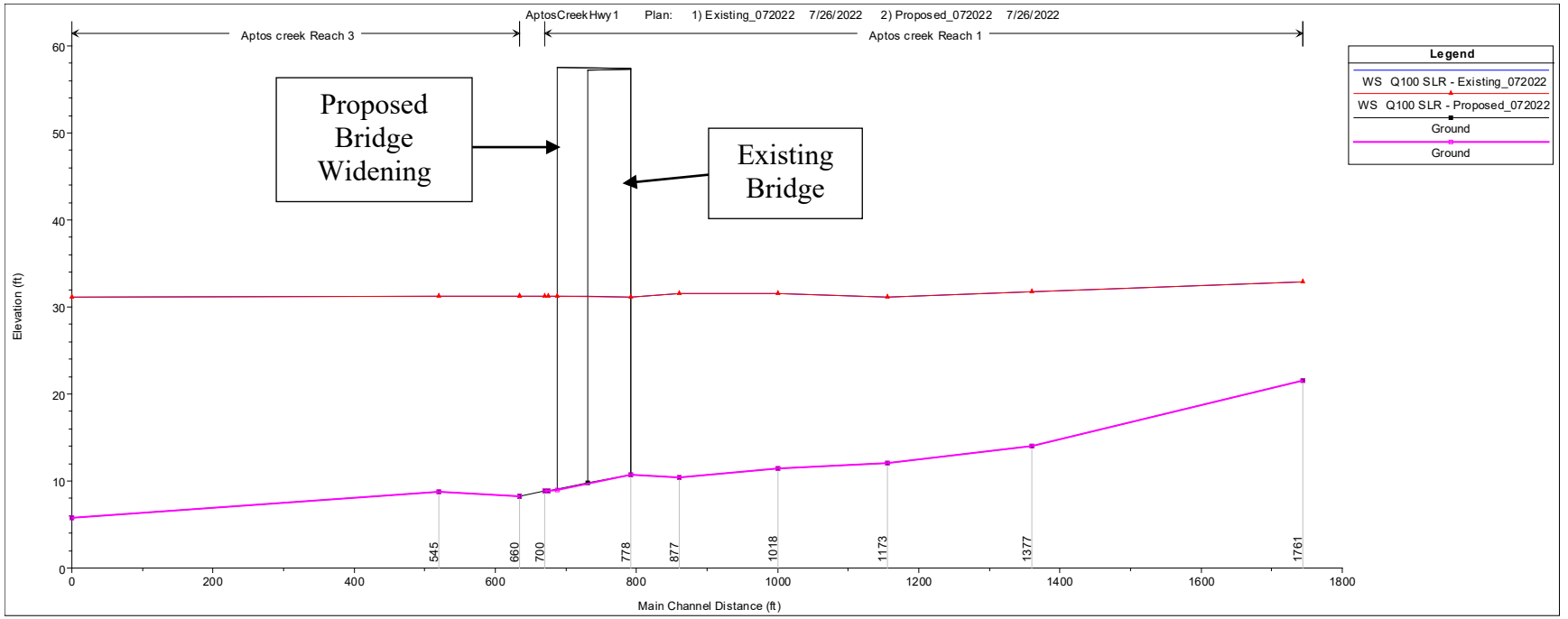

Figure 26. Aptos Creek Water Surface Profile Comparison: 100-Year with SLR

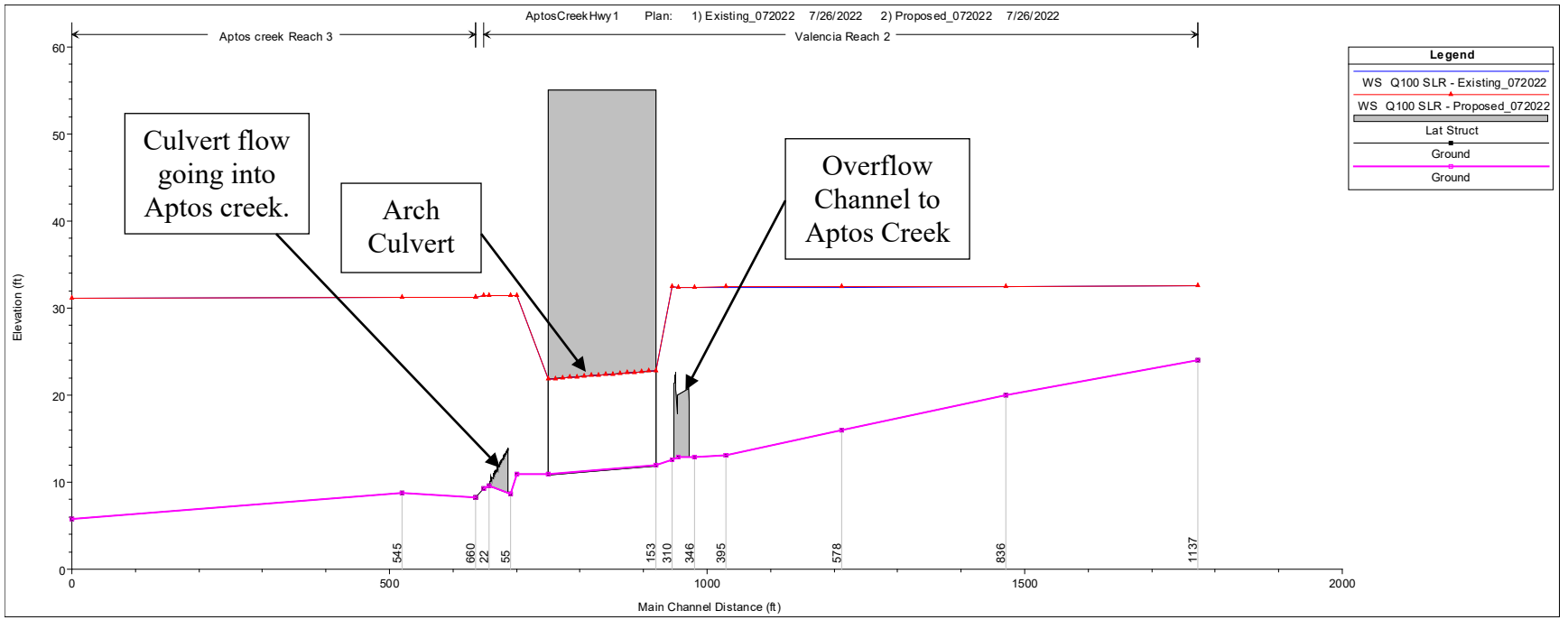

Figure 27. Valencia Creek Water Surface Profile Comparison: 100-Year with SLR

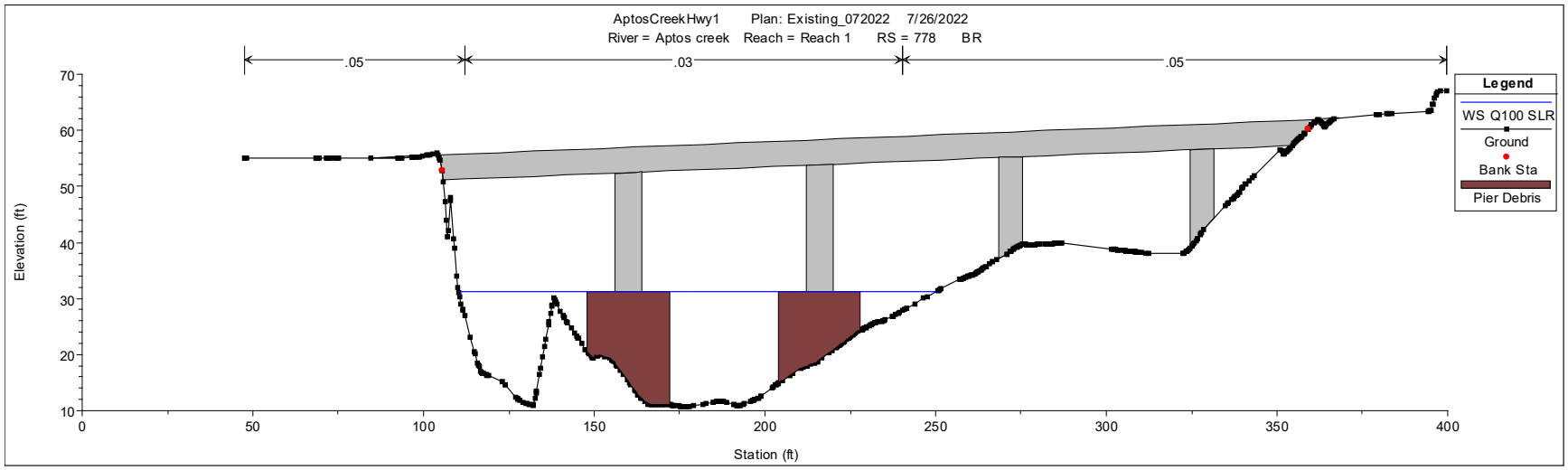

Figure 28. Existing Aptos Creek Bridge Cross Section

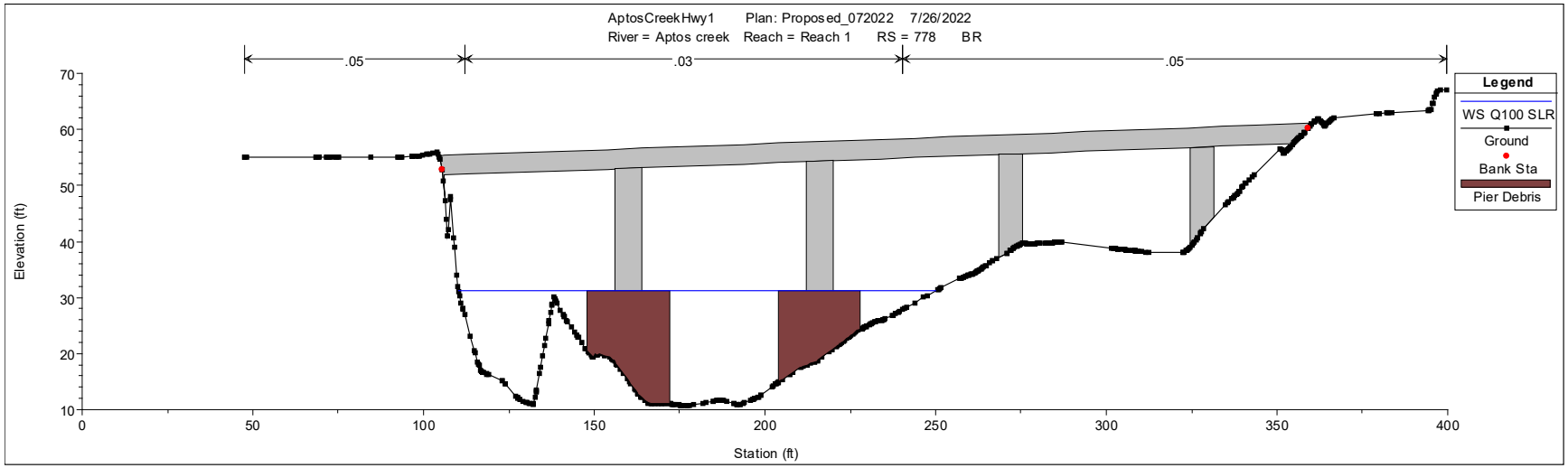

Figure 29. Proposed Aptos Creek Bridge Cross Section

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Table 11. WSE Summary: 100-Year

River Station	Description/Distance from Existing Bridge Centerline (ft)	WSE (ft)		Difference in WSE (ft)
		Existing	Proposed	
		[1]	[2]	[2]-[1]
Valencia Creek Culvert				
1137	1,137 ft upstream of Confluence	30.01	30.01	0.00
836	836 ft upstream of Confluence	29.79	29.79	0.00
578	578 ft upstream of Confluence	29.78	29.78	0.00
395	395 ft upstream of Confluence	29.77	29.77	0.00
346	346 ft upstream of Confluence	29.74	29.74	0.00
320	320 ft upstream of Confluence	29.76	29.76	0.00
310	Upstream of Culvert	29.76	29.76	0.00
65	Downstream of Culvert	26.42	26.42	0.00
55	10 ft Downstream of Culvert	26.49	26.49	0.00
25	30 ft Downstream of Culvert	--	--	--
22	33 ft Downstream of Culvert	26.54	26.54	0.00
14	41 ft Downstream of Culvert	26.54	26.54	0.00
Aptos Creek Bridge				
1761	982 ft upstream	32.55	32.55	0.00
1377	598 ft upstream	31.36	31.36	0.00
1173	394 ft upstream	26.11	26.11	0.00
1018	239 ft upstream	26.85	26.87	0.02
877	98 ft upstream	26.68	26.70	0.02
778 BR U[1]	Upstream Existing and Proposed Bridge Face	25.86	25.88	0.02
778 BR D[2]	Downstream of Existing Bridge Face	--	--	--
778 BR D[2]	Downstream of Proposed Bridge Face	--	--	--
705	74 ft downstream	26.08	26.08	0.00
700	79 ft downstream	26.01	26.01	0.00
660	119 ft downstream	25.57	25.57	0.00
545	234 ft downstream	25.47	25.47	0.00

Notes:
1. BR U is bridge upstream face.
2. BR D is bridge downstream face

Table 12. WSE Summary: 100-Year with SLR

River Station	Description/Distance from Existing Bridge Centerline (ft)	WSE (ft)		Difference in WSE (ft)
		Existing	Proposed	
		[1]	[2]	[2]-[1]
Valencia Creek Culvert				
1137	1,137 ft upstream of Confluence	32.54	32.54	0.00
836	836 ft upstream of Confluence	32.44	32.44	0.00
578	578 ft upstream of Confluence	32.42	32.42	0.00
395	395 ft upstream of Confluence	32.42	32.42	0.00
346	346 ft upstream of Confluence	32.40	32.41	0.01
320	320 ft upstream of Confluence	32.41	32.42	0.01
310	Upstream of Culvert	32.43	32.43	0.00
65	Downstream of Culvert	31.43	31.43	0.00
55	10 ft Downstream of Culvert	31.43	31.43	0.00
25	30 ft Downstream of Culvert	--	--	--
22	33 ft Downstream of Culvert	31.44	31.44	0.00
14	41 ft Downstream of Culvert	31.44	31.44	0.00
Aptos Creek Bridge				
1761	982 ft upstream	32.86	32.87	0.01
1377	598 ft upstream	31.78	31.79	0.01
1173	394 ft upstream	31.09	31.11	0.02
1018	239 ft upstream	31.53	31.54	0.01
877	98 ft upstream	31.50	31.52	0.02
778 BR U[1]	Upstream Existing and Proposed Bridge Face	31.15	31.17	0.02
778 BR D[2]	Downstream of Existing Bridge Face	--	--	--
778 BR D[2]	Downstream of Proposed Bridge Face	--	--	--
705	74 ft downstream	--	--	--
700	79 ft downstream	31.20	31.20	0.00
660	119 ft downstream	31.22	31.22	0.00
545	234 ft downstream	31.21	31.21	0.00

Notes:
3. BR U is bridge upstream face.
4. BR D is bridge downstream face

3.2.4 Bridge Freeboard

The hydraulic model showed the proposed bridge at Aptos Creek would have adequate freeboard during the 100-year flood (approximately 25.1 ft during the 100-year flood, and 20.3 ft during the 100-year flood with SLR). Table 13 shows the WSE and freeboard for the existing and proposed bridges for the 100-year flows and 100-year flows with SLR.

Table 13. Freeboard for Existing and Propose Bridges

Alternative	Soffit Elevation (ft)	Return Period	WSE (ft)	Freeboard (ft)
Existing	51.1	100-year	26.7	24.4
Proposed	51.8		26.7	25.1
Existing	51.1	100-year with SLR	31.5	19.6
Proposed	51.8		31.5	20.3

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4 PROJECT EVALUATION

Executive Order 11988 requires federal agencies to avoid to the maximum extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. This section analyzes the impacts associated with this Project.

As stated in Section 3.2.2.1, the new trail bridge at Aptos Creek will span over the creek and the piers, grading and all structures will be designed to be above the 100-year WSEs with SLR. Therefore, the railroad improvements are not expected to affect the BFEs at Aptos Creek. The following assessment pertains primarily to the Aptos Creek crossing at SR 1, which is associated with a FEMA base floodplain. Valencia Creek is also discussed; however, the floodplain associated with Valencia Creek is outside of a SFHA and is therefore, not a mapped base floodplain on the FEMA FIRM. See Appendix E for the Technical Information for Location Hydraulic Study forms and Appendix F for the Floodplain Evaluation Report Summary forms for Aptos Creek and Valencia Creek.

4.1 Risk Associated with the Proposed Action

As defined by the FHWA, risk shall mean the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life during the service life of the bridge and roadway.

The potential risk associated with the implementation of the proposed action includes but is not limited to: 1) change in land use, 2) change in impervious surface area, 3) fill inside the floodplain, or 4) change in the 100-year WSE. The measures to minimize the potential floodplain impacts associated with the action are summarized in Section 5.

4.1.1 Change in Land Use

The Project proposes improvements along the existing SR 1 roadway with minimal modifications to the roadway profile. The overall existing general land use of the Project watershed area would be maintained. Therefore, there are no risks associated with changes in land use as a result of the Project. The WSE changes from the existing to proposed condition is insignificant. Therefore, the properties within the floodplain are expected to maintain the same delineation and damage cost as the existing floodplain.

4.1.2 Change in Impervious Surface Area

The Project would result in a net increase of impervious area of 3.61 acres in the Caltrans' right-of-way, 6.28 acres for the interim trail in the Santa Cruz County's right-of-way and 6.51 acres for the ultimate trail in the Santa Cruz's right-of-way. The *Water Quality Assessment* (WRECO, 2022) provided additional information for changes in impervious area for the Project. The Aptos Creek watershed area is approximately 12.2 square mi, and the Valencia Creek watershed area is approximately 12.1 square mi for a combined watershed area of 24.3 square mi at the Project locations. Based on the minimal net impervious area that would be drained to the different

receiving waters within the Project limits, substantial impacts to the base floodplains are not anticipated.

4.1.3 Fill Inside the Floodplain

The proposed grading associated with the Project improvements is proposed to be above the 100-yr WSE. The minimal fill in the floodplain will be the additional 4 ft by 4 ft square columns in the channel for the bridge widening. The additional fill is anticipated to be offset be grading the banks. Therefore, the minimal fill anticipated to be inside the floodplain will be offset by grading around the SR 1 bridge.

4.1.4 Change in the 100-Year Water Surface Elevation

The proposed improvements would result in negligible changes in the WSE at and upstream of the SR 1 bridge. the model results in a localized increase in WSE of 0.02 ft upstream of the proposed SR 1 bridge at Aptos Creek during the 100-year storm event and an increase of 0.02 ft during the 100-year flows with SLR. The 0.02 ft increase is negligible based on the resolution of the elevation data used in the model. The model will be updated when more survey is available. In addition, the added fill from the additional columns in the floodplain is anticipated to be offset by grading. A floodway analysis will be performed when more survey is available to satisfy Title 44 of the CFR described in Section 2.3. Because the Project is associated with a floodway at Aptos Creek, and the Project could potentially result in a change in the BFE, the local floodplain administrator should review this study to confirm a CLOMR or LOMR will not be required for the Project. Overall, there would be reduced to negligible change in WSE upstream of SR 1 and the 100-year WSE would be below the roadway elevations of SR 1.

4.2 Summary of Potential Encroachments

The FHWA defines a significant encroachment as a highway encroachment, and any direct support of likely base floodplain development, that would involve one or more of the following construction or flood-related impacts: 1) significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route, 2) a significant risk, or 3) a significant adverse impact on the natural and beneficial floodplain values (FHWA, 1994). The following sections discuss the potential impacts to the floodplain that may result from the proposed action. The risk associated with implementation of the action is discussed in Section 4.1.

4.2.1 Potential Traffic Interruptions for the Base Flood

The results of the hydraulic modeling show the base flood is passed under the soffit of the proposed Aptos Creek bridge with freeboard (approximately 23 ft during the 100-year flood, and 19 ft during the 100-year flood with SLR). See Figure 29, which shows the cross section at the upstream face of the proposed Aptos Creek bridge. The proposed bridge would not be overtopped by the base flood and therefore, traffic interruptions are not anticipated to result from the base flood at Aptos Creek.

4.2.2 Potential Impacts on Natural and Beneficial Floodplain Values

Natural and beneficial floodplain values include, but are not limited to: fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

Potential short-term adverse effects during the construction of the Project to natural and beneficial floodplain values include: 1) loss of vegetation during construction activity; and 2) temporary disturbance to wildlife and/or aquatic habitat. Construction should be planned to avoid adverse effects to the natural and beneficial floodplain areas to the maximum extent practicable.

The *Draft Natural Environment Study* (NES) provides information about the potential affects to biological communities within the Project area. Botanical and wildlife surveys, habitat mapping, and wetland assessments were conducted to determine whether any special-status plant species or special-status animal species were present within the biological study area (BSA). According to the NES, California red-legged frog, foothill yellow-legged frog, Santa Cruz long-toed salamander, western pond turtle, central California coast steelhead, tidewater goby, Cooper's hawk, white-tailed kite, hoary bat, pallid bat, and Townsend's big-eared bat have potential to occur within the biological study area. Two special-status fish species; the Central California steelhead and tidewater goby, have the potential to occur in Aptos Creek. The Central California steelhead could also occur in Valencia Creek. Twenty-six (26) invasive plant species were present throughout the BSA. The Project activities has the potential to contribute to the spread and introduction of these invasive species (SWCA Environmental Consultants, 2022).

Based on the Central Coast Regional Water Quality Control Board (2019), *Central Coast Basin (Region 3) Water Quality Control Plan* (Basin Plan), the beneficial uses of Aptos Creek, Valencia Creek, Valencia Lagoon, and the Pacific Ocean are listed in Table 14. See the *Water Quality Assessment Report* (WRECO, 2022) for more details.

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Table 14. Listed Beneficial Uses for Project Receiving Waters

Water Body	Beneficial Uses																		
	MUN	AGR	IND	GWR	REC1	REC2	WILD	COLD	WARM	MIGR	SPWN	BIOL	EST	FRSH	NAV	COMM	AQUA	MAR	SHELL	RARE
Aptos Creek	E	E	E	E	E	E	E	E		E	E	E	E	E		E				
Valencia Creek	E				E	E	E	E		E		E	E			E				
Valencia Lagoon					E	E	E		E	E		E		E		E				E
Pacific Ocean			E		E	E				E	E				E	E	E	E	E	E

Source: RWQCB and SWRCB, 2019

Notes:

- MUN – municipal and domestic supply
- AGR – agricultural supply
- IND – industrial process supply
- GWR – groundwater recharge
- REC1 – water contact recreation
- REC2 – non-water contact recreation
- WILD – wildlife habitat
- COLD – cold freshwater habitat
- WARM – warm freshwater habitat
- MIGR – fish migration
- SWPN – fish spawning
- BIOL – preservation of biological habitats of special significance
- EST – estuarine habitat
- FRSH – fresh water replenishment
- NAV - navigation
- COMM – commercial and sports fishing
- AQUA – mariculture
- MAR – marine habitat
- SHELL – shellfish harvesting
- RARE – rare, threatened, or endangered species
- E - existing

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4.2.3 Support of Probable Incompatible Floodplain Development

As defined by the FHWA, the support of incompatible base floodplain development will encourage, allow, serve, or otherwise facilitate incompatible base floodplain development, such as commercial development or urban growth. The Project would not trigger incompatible floodplain development and be designed to have minimal work in the designated floodplains. The Project would generally maintain local and regional access, and would not create new access routes to developed or undeveloped lands.

4.2.4 Longitudinal Encroachments

As defined by the FHWA, a longitudinal encroachment is an action within the limits of the base floodplain that is longitudinal to the normal direction of the floodplain.

A longitudinal encroachment is "[a]n encroachment that is parallel to the direction of flow. Example: A highway that runs along the edge of a river is usually considered a longitudinal encroachment." The requirement for consideration of avoidance alternatives must be included in a Location Hydraulic Study by including an evaluation and a discussion of the practicability of alternatives to any significant encroachment or any support of incompatible floodplain development.

The improvements along the upstream reach of Valencia Creek are considered to be longitudinal to the direction of the flow. However, FEMA depicts the area at the upstream reach of Valencia Creek as a shaded Zone X area, which is not considered a SFHA. The proposed action would not constitute a significant longitudinal encroachment.

4.3 Sea-level Rise Impacts

As discussed in Section 2.4, the Project is not anticipated to be inundated by the estimated SLR with the 100-year storm and therefore, the Project is not anticipated to have any impacts due to SLR and was not further evaluated for potential SLR impacts.

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5 AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

5.1 Minimize Floodplain Impacts

The proposed Project would not change the overall land use of the Project area. Although the Project would increase impervious areas and would involve the placement of fill within the floodplain, the Project improvements are not anticipated to cause substantial floodplain impacts. Based on the hydraulic model, the Project improvements would result in a negligible change in WSE upstream of SR 1 for the 100-year event and with SLR. Therefore, the Project has been designed to minimize floodplain impacts and special mitigation measures are not proposed.

5.2 Restore and Preserve Natural and Beneficial Floodplain Values

As stated in Section 4.2.2, special-status species have a potential to occur within the Project area. Per the NES, Federal Endangered Species Act (FESA) Consultation with NOAA National Marine Fisheries Service is required for potential impacts to Central California coast steelhead. Consultation with the U.S. Fish and Wildlife Service (USFWS) for potential impacts to California red-legged frog, least Bell's vireo, southwestern willow flycatcher, and tidewater goby will also be required (SWCA Environmental Consultants, 2022).

Temporary environmental impacts that could potentially result from construction activities for the Project could be minimized with measures such as BMPs consistent with Caltrans' *Construction Site BMP Manual* (2017b), seasonal work restrictions, revegetation, establishing a boundary for work around sensitive habitat, implementing erosion control measures, and other activities that are part of the Project's permit conditions. Additionally, implementation of avoidance and minimization measures are required to avoid spreading or introducing invasive plants that are present on the Project site.

Regulatory permits and approvals are expected to be required from the RWQCB, USACE, California Department of Fish and Wildlife (CDFW), and the Coastal Commission. A Section 401 Water Quality Certification from the RWQCB, a Section 404 Permit from the USACE, a Section 1602 Streambed/Lakebed Alteration Agreement from the CDFW, and a Coastal Development Permit or Waiver from the Coastal Commission are expected to be required for the Project.

5.3 Alternatives to Significant Encroachments

The Project would not be a significant encroachment to the base floodplain. Therefore, alternatives to significant encroachments were not analyzed.

5.4 Alternatives to Longitudinal Encroachments

The proposed Project would not constitute a significant longitudinal encroachment to the base floodplain. Therefore, alternatives to longitudinal encroachments were not analyzed.

5.5 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies

SCCRTC will coordinate with local, state, and federal water resources and floodplain management agencies as necessary during all aspects of the proposed Project. This report will be circulated as necessary to the appropriate agencies such as Caltrans, the local Floodplain Administrator, and FEMA to obtain concurrence on the impact assessment and findings that the Project has minimal impact on the base floodplain. The need and extent of coordination with FEMA will be also verified during the Project's design phase.

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Appendix A Federal Emergency Management Agency Flood Insurance Rate Maps and FIS Flood Profiles

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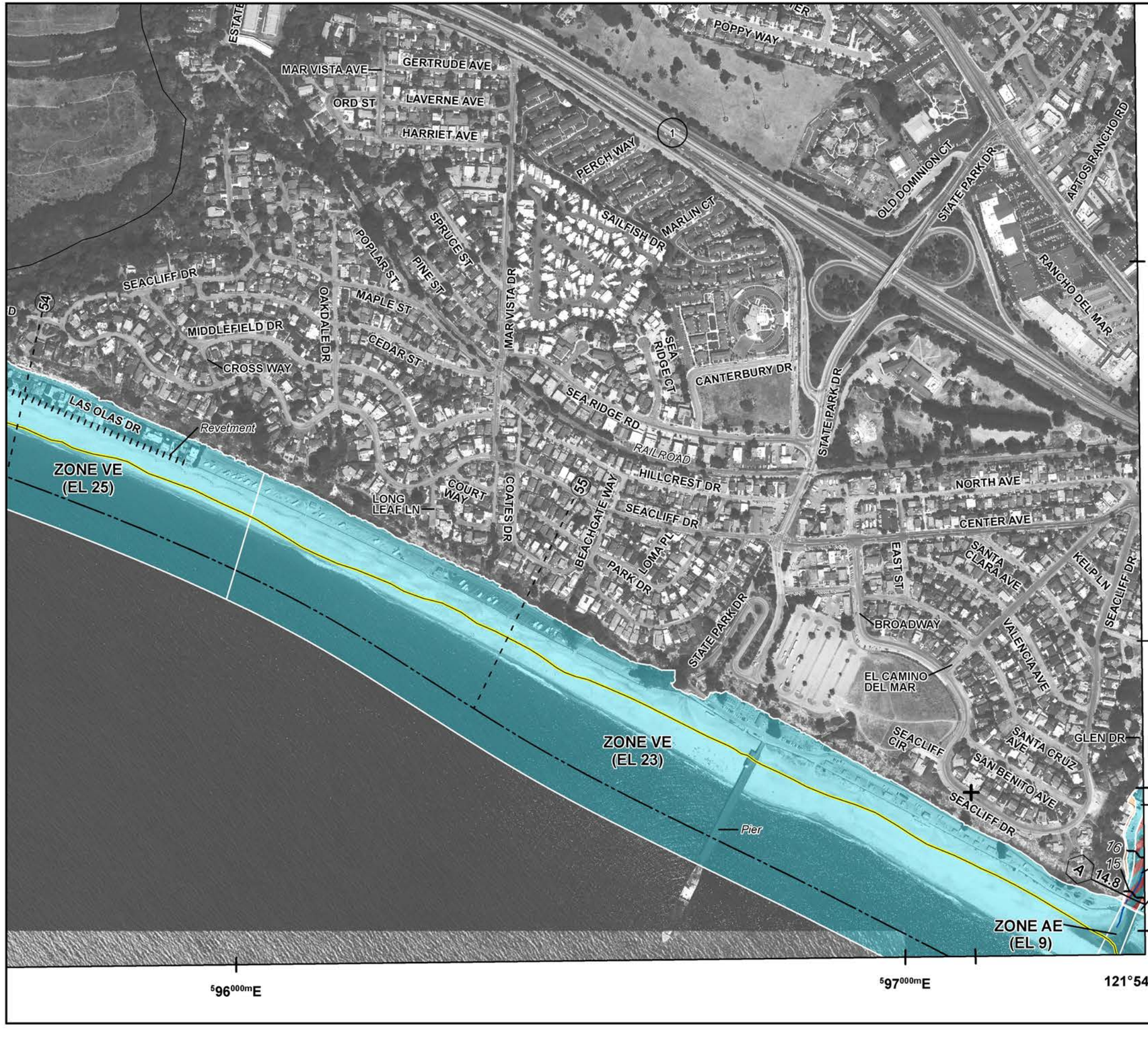

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NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

SANTA CRUZ COUNTY, CALIFORNIA

and Incorporated Areas

PANEL 356 OF 470

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
CAPITOLA, CITY OF	060354	0356	F
SANTA CRUZ COUNTY	060353	0356	F

VERSION NUMBEF
2.3.2.(

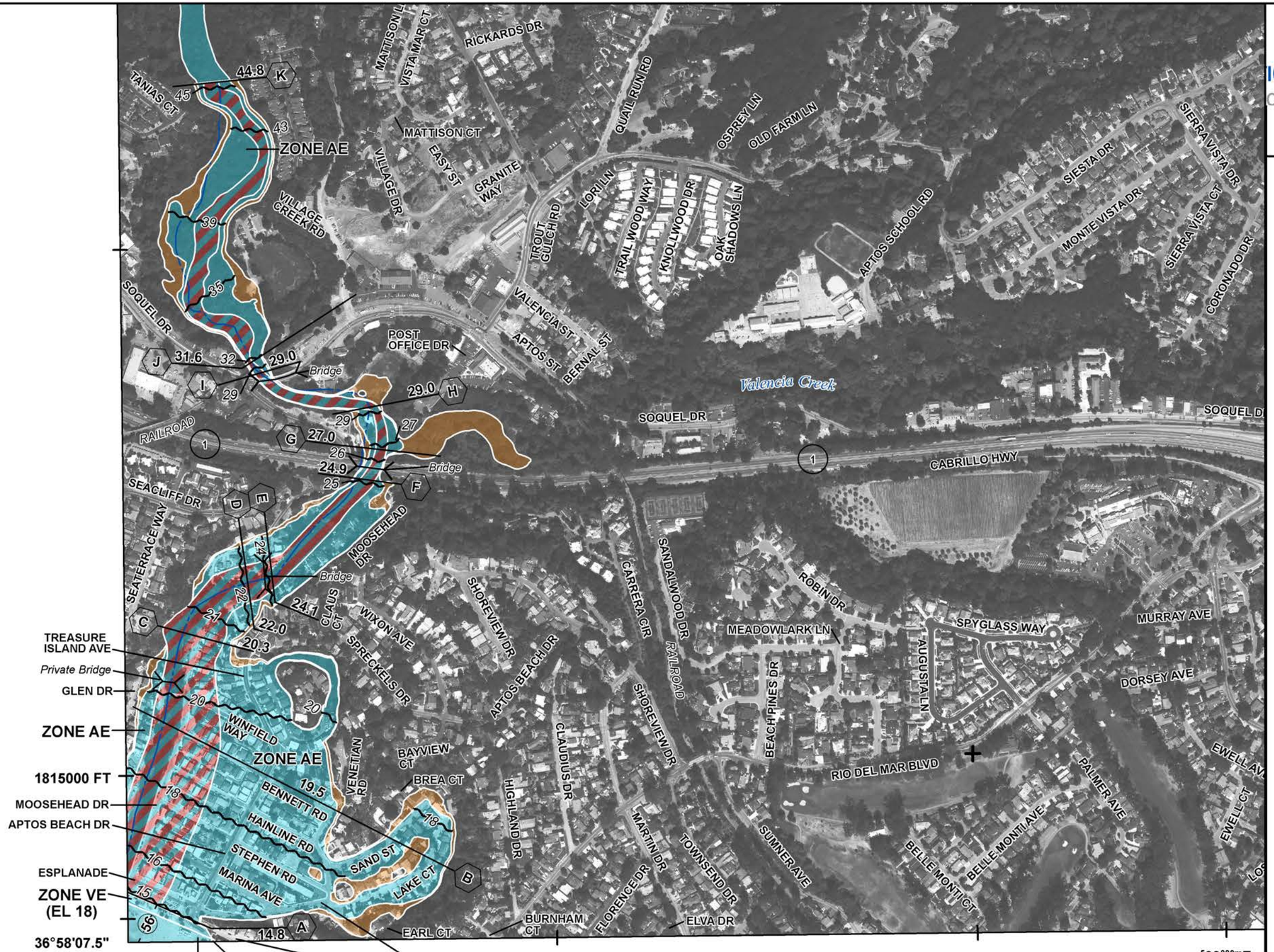
MAP NUMBEF
06087C0356I

MAP REVISEI
SEPTEMBER 29, 201

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

IONAL FLOOD INSURANCE PROGRAM

OD INSURANCE RATE MAP



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

SANTA CRUZ COUNTY, CALIFORNIA

and Incorporated Areas

PANEL 357 OF 470

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFD
SANTA CRUZ COUNTY	060353	0357	F

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Map Projection:
Universal Transverse Mercator Zone 10N; North Ame
Western Hemisphere; Vertical Datum: NAVD 88

N

1 inch = 500 feet

0 250 500 750 1,000

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

SANTA CRUZ COUNTY, CALIFORNIA

and Incorporated Areas

PANEL 378 OF 470

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
SANTA CRUZ COUNTY	060353	0378	F

VERSION NUMBER
2.3.2.0

MAP NUMBER
06087C0378F

MAP REVISED
SEPTEMBER 29, 2017

Map Projection:
Universal Transverse Mercator Zone 10N; North Amer
Western Hemisphere; Vertical Datum: NAVD 88

N

1 inch = 1,000 feet

0 1,000 2,000

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

SANTA CRUZ COUNTY, CALIFORNIA
and Incorporated Areas

PANEL 380 OF 470

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
SANTA CRUZ COUNTY	060353	0380	F

VERSION NUMBER
2.3.2.0

MAP NUMBER
06087C0380F

MAP REVISED
SEPTEMBER 29, 2017

SEE FLOOD INSURANCE RATE MAP FOR BASE FLOOD ELEVATIONS AND COASTAL TRANSECT DATA TABLE FOR STILLWATER ELEVATIONS

LIMIT OF DETAILED STUDY

SPRECKELS DRIVE

PRIVATE BRIDGE

ELEVATIONS DOWNSTREAM OF THIS POINT CONTROLLED BY PACIFIC OCEAN

A B C D E

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

ELEVATION IN FEET (NAVD)

30 25 20 15 10 5 0 −5 −10 −15

0 200 400 600 800 1,000 1,200 1,400 1,600 1,800 2,000 2,200 2,400 2,600

STREAM DISTANCE IN FEET ABOVE MOUTH AT PACIFIC OCEAN

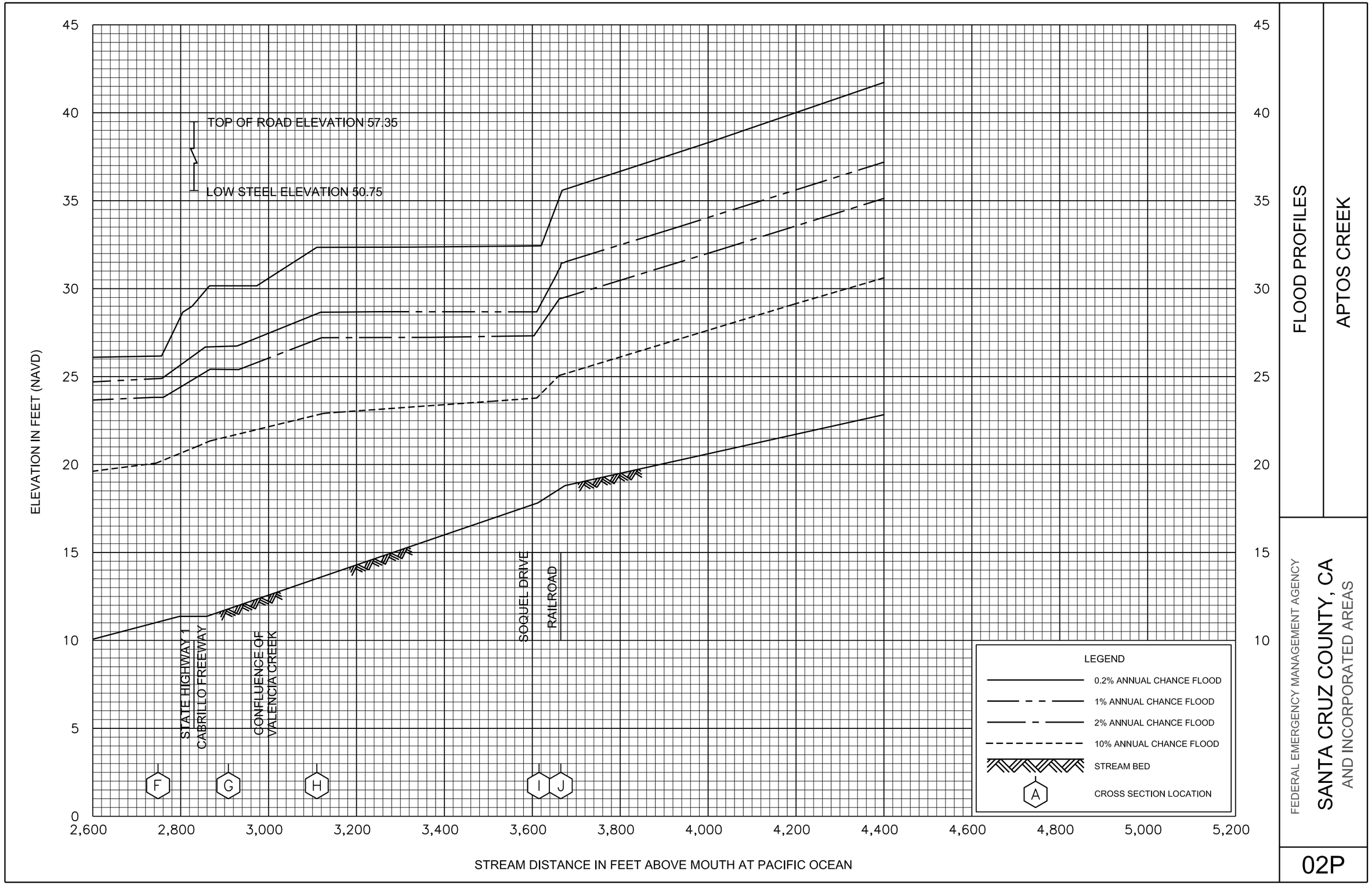
FLOOD PROFILES

APTOS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANTA CRUZ COUNTY, CA
AND INCORPORATED AREAS

01P



FLOOD PROFILES

APTOS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

SANTA CRUZ COUNTY, CA
AND INCORPORATED AREAS

02P

Appendix B FEMA Engineering Library Correspondence

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Michael Baker
INTERNATIONAL

"… the strength of the Pack is the Wolf, and the strength of the Wolf is the Pack…"

Wana Chiu
WRECO
1243 Alpine Road, Suite 108
Walnut Creek, CA 94596

Dear Wana Chiu:

I have researched your request and was unable to locate the effective model for Aptos Creek in Capitola, City of Santa Cruz, Santa Cruz County. This county modeling has been inventoried. I have included a copy of the inventory for your future use. Please contact me at susan.greene@mbakerintl.com with any questions you may have.

Thank you,
Susan Greene

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Appendix C Existing HEC-RAS Results

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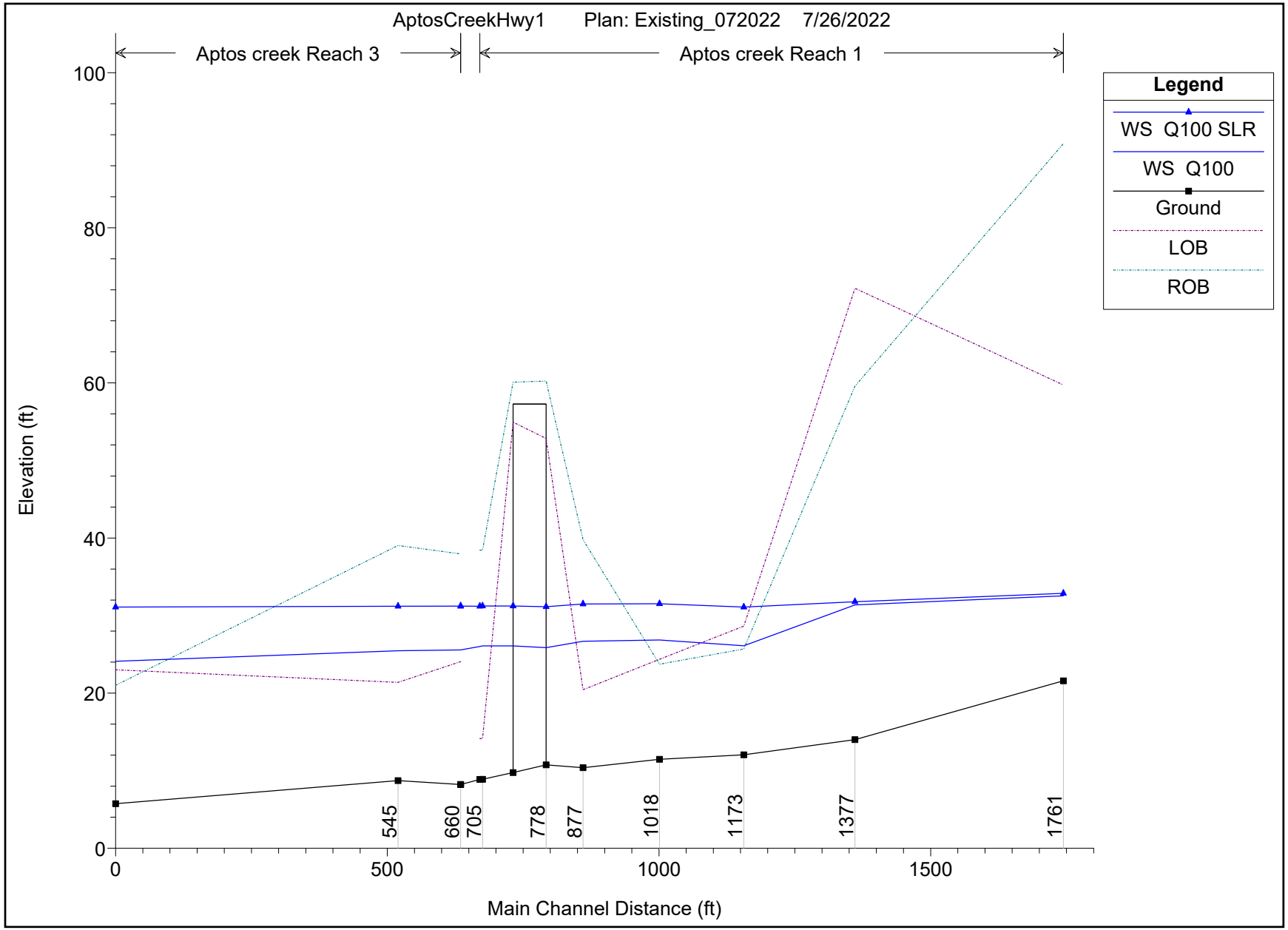
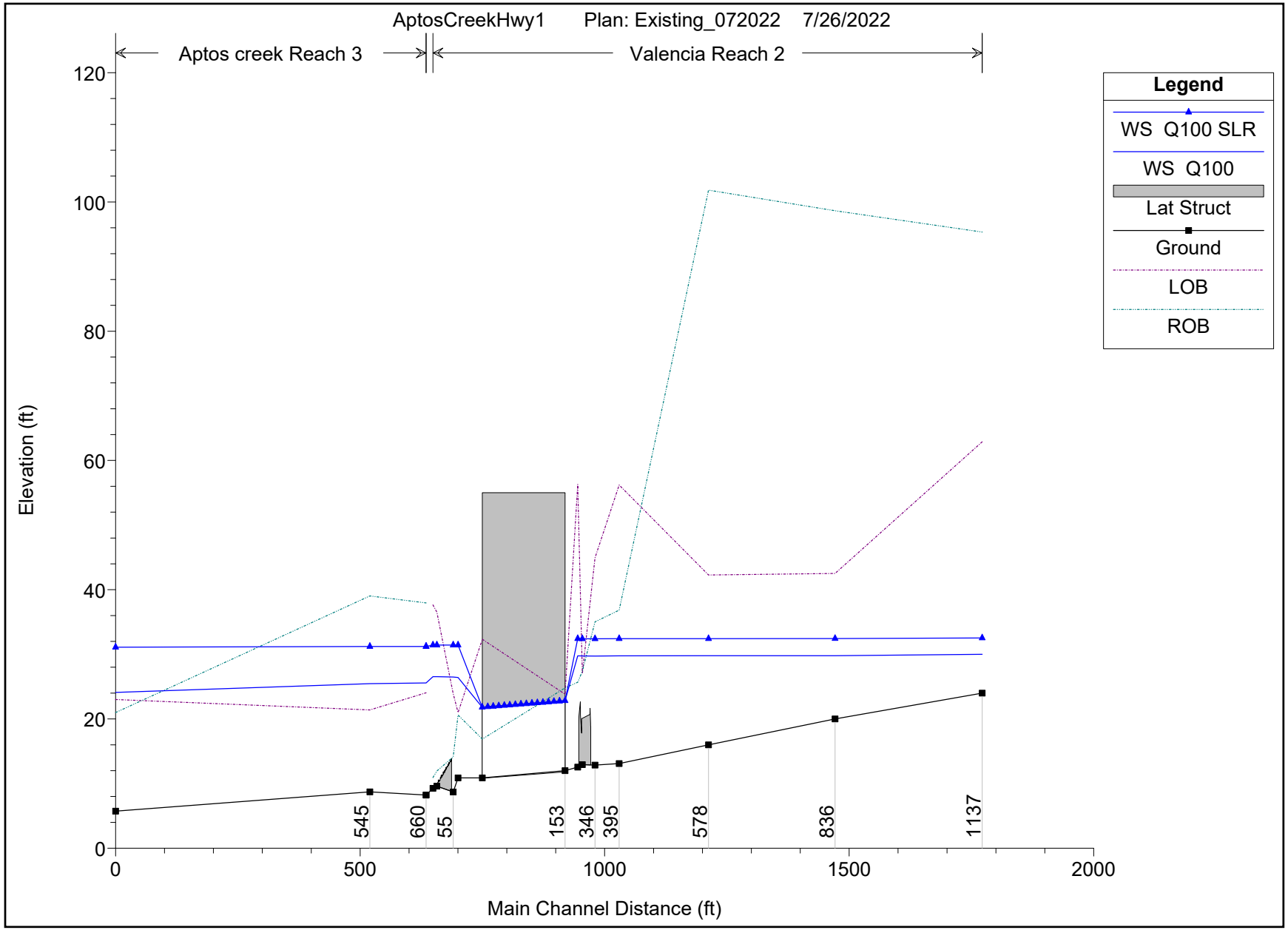
HEC-RAS Plan: Existing_072022

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Hydr Depth	Hydr Depth C	Length Chnl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)	(ft)
Valencia	Reach 2	1137	Q100	2690.00	24.00	30.01		31.57	0.009533	10.01	268.82	50.88	0.77	5.28	5.28	300.90
Valencia	Reach 2	1137	Q100 SLR	2690.00	24.00	32.54		33.21	0.003544	6.56	410.36	61.28	0.45	6.70	6.70	300.90
Valencia	Reach 2	836	Q100	2690.00	20.00	29.79		30.12	0.001876	4.61	584.08	98.31	0.33	5.94	5.94	258.60
Valencia	Reach 2	836	Q100 SLR	2690.00	20.00	32.44		32.58	0.000870	3.04	885.29	136.27	0.21	6.50	6.50	258.60
Valencia	Reach 2	578	Q100	2690.00	16.00	29.78		29.89	0.000304	2.72	988.26	110.39	0.16	8.95	8.95	182.70
Valencia	Reach 2	578	Q100 SLR	2690.00	16.00	32.42		32.49	0.000141	2.07	1296.93	122.53	0.11	10.58	10.58	182.70
Valencia	Reach 2	395	Q100	2690.00	13.09	29.77		29.84	0.000165	2.01	1335.76	132.99	0.11	10.04	10.04	49.50
Valencia	Reach 2	395	Q100 SLR	2690.00	13.09	32.42		32.46	0.000083	1.58	1699.38	141.23	0.08	12.03	12.03	49.50
Valencia	Reach 2	346	Q100	2690.00	12.86	29.74		29.82	0.000303	2.34	1149.70	129.35	0.14	8.89	8.89	25.80
Valencia	Reach 2	346	Q100 SLR	2690.00	12.86	32.40		32.45	0.000142	1.79	1501.45	136.77	0.10	10.98	10.98	25.80
Valencia	Reach 2	330		Lat Struct												
Valencia	Reach 2	320	Q100	2351.41	12.93	29.76		29.81	0.000144	2.24	1468.17	130.69	0.11	11.23	13.97	9.50
Valencia	Reach 2	320	Q100 SLR	2248.38	12.93	32.41		32.44	0.000068	1.73	1816.03	131.25	0.07	13.84	16.62	9.50
Valencia	Reach 2	310	Q100	1063.30	12.55	29.76	18.68	29.81	0.000177	1.87	661.20	67.72	0.10	9.76	11.44	244.70
Valencia	Reach 2	310	Q100 SLR	579.59	12.55	32.43	17.44	32.44	0.000027	0.80	842.26	67.91	0.04	12.40	14.05	244.70
Valencia	Reach 2	153 315		Culvert												
Valencia	Reach 2	65	Q100	1063.30	10.88	26.42		26.60	0.000200	3.82	465.87	104.41	0.20	4.46	11.51	10.00
Valencia	Reach 2	65	Q100 SLR	579.59	10.88	31.43		31.44	0.000010	1.10	1169.15	155.33	0.05	7.53	16.53	10.00
Valencia	Reach 2	55	Q100	1063.30	8.71	26.49		26.57	0.000304	2.20	520.09	89.76	0.12	5.79	10.81	33.40
Valencia	Reach 2	55	Q100 SLR	579.59	8.71	31.43		31.44	0.000019	0.67	1114.83	143.30	0.03	7.78	15.75	33.40
Valencia	Reach 2	25		Lat Struct												
Valencia	Reach 2	22	Q100	584.06	9.59	26.54		26.54	0.000014	0.60	968.44	166.77	0.04	5.81	5.81	8.00
Valencia	Reach 2	22	Q100 SLR	94.78	9.59	31.44		31.44	0.000000	0.05	1811.06	178.11	0.00	10.17	10.17	8.00
Valencia	Reach 2	14	Q100	554.96	9.27	26.54		26.54	0.000011	0.56	994.00	168.37	0.04	5.90	5.90	13.94
Valencia	Reach 2	14	Q100 SLR	66.76	9.27	31.44		31.44	0.000000	0.04	1838.88	181.45	0.00	10.13	10.13	13.94
Aptos creek	Reach 1	1761	Q100	5540.00	21.59	32.55		33.40	0.003425	7.40	748.60	97.27	0.47	7.70	7.70	383.70
Aptos creek	Reach 1	1761	Q100 SLR	5540.00	21.59	32.86		33.65	0.003066	7.11	779.52	97.96	0.44	7.96	7.96	383.70
Aptos creek	Reach 1	1377	Q100	5540.00	14.00	31.36		32.16	0.002985	7.15	775.10	60.40	0.35	12.83	12.83	204.50
Aptos creek	Reach 1	1377	Q100 SLR	5540.00	14.00	31.78		32.52	0.002749	6.92	800.50	61.27	0.34	13.07	13.07	204.50
Aptos creek	Reach 1	1173	Q100	5540.00	12.04	26.11	26.11	30.49	0.022407	16.78	330.29	40.50	1.02	8.16	8.45	155.10
Aptos creek	Reach 1	1173	Q100 SLR	5540.00	12.04	31.09		31.91	0.003197	8.03	945.91	211.23	0.40	4.48	12.49	155.10
Aptos creek	Reach 1	1018	Q100	5540.00	11.47	26.85		27.11	0.000468	4.12	1427.89	172.43	0.20	8.28	12.74	140.70
Aptos creek	Reach 1	1018	Q100 SLR	5540.00	11.47	31.53		31.64	0.000142	2.80	2349.64	210.86	0.12	11.14	17.41	140.70
Aptos creek	Reach 1	877	Q100	5540.00	10.38	26.68	21.81	26.99	0.001876	4.88	1276.13	159.46	0.28	8.00	9.47	68.00
Aptos creek	Reach 1	877	Q100 SLR	5540.00	10.38	31.50	21.80	31.60	0.000497	2.63	2132.49	198.36	0.14	10.75	10.34	68.00
Aptos creek	Reach 1	778 BR U	Q100	5540.00	10.75	25.86	19.04	26.68	0.003083	7.26	763.33	67.52	0.38	11.30	11.30	60.83
Aptos creek	Reach 1	778 BR U	Q100 SLR	5540.00	10.75	31.15	19.04	31.48	0.001203	4.65	1190.43	91.60	0.23	13.00	13.00	60.83
Aptos creek	Reach 1	778 BR D	Q100	5540.00	9.75	26.09	16.55	26.33	0.000415	3.97	1394.02	113.63	0.20	12.27	12.27	56.17

HEC-RAS Plan: Existing_072022 (Continued)

River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Hydr Depth	Hydr Depth C	Length Chnl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)	(ft)
Aptos creek	Reach 1	778 BR D	Q100 SLR	5540.00	9.75	31.24	16.55	31.35	0.000159	2.73	2026.14	131.98	0.12	15.35	15.35	56.17
Aptos creek	Reach 1	705	Q100	7166.70	8.88	26.08		26.43	0.000923	4.70	1525.07	123.31	0.24	12.37	12.37	5.00
Aptos creek	Reach 1	705	Q100 SLR	7650.41	8.88	31.23		31.42	0.000376	3.51	2182.07	130.31	0.15	16.75	16.75	5.00
Aptos creek	Reach 1	700	Q100	7675.04	8.88	26.01		26.40	0.000899	5.06	1515.63	123.04	0.25	12.32	12.32	35.39
Aptos creek	Reach 1	700	Q100 SLR	8163.24	8.88	31.20		31.41	0.000360	3.75	2176.98	130.23	0.16	16.72	16.72	35.39
Aptos creek	Reach 3	660	Q100	8280.00	8.22	25.57		26.31	0.003752	7.00	1278.77	234.53	0.42	5.45	8.69	115.10
Aptos creek	Reach 3	660	Q100 SLR	8280.00	8.22	31.22		31.38	0.000543	3.52	2689.03	262.39	0.17	10.25	13.51	115.10
Aptos creek	Reach 3	545	Q100	8280.00	8.72	25.47		25.90	0.002117	5.55	1690.21	243.84	0.32	6.93	9.18	519.80
Aptos creek	Reach 3	545	Q100 SLR	8280.00	8.72	31.21		31.32	0.000351	2.89	3198.10	274.94	0.14	11.63	13.61	519.80
Aptos creek	Reach 3	25	Q100	8280.00	5.74	24.10	19.05	24.69	0.002483	6.95	1687.39	349.12	0.38	4.83	10.54	
Aptos creek	Reach 3	25	Q100 SLR	8280.00	5.74	31.10	19.05	31.17	0.000192	2.71	4295.81	389.69	0.11	11.02	17.54	


AptosCreekHwy1
Plan: Existing_072022 7/26/2022
Aptos creek Reach 3
Aptos creek Reach 1
Legend
WS Q100 SLR
WS Q100
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
0
20
40
60
80
100
0
500
1000
1500
545
660
705
778
877
1018
1173
1377
1761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7/26/2022
Aptos creek Reach 3
Valencia Reach 2
Legend
WS Q100 SLR
WS Q100
Lat Struct
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
0
20
40
60
80
100
120
0
500
1000
1500
2000
545
660
55
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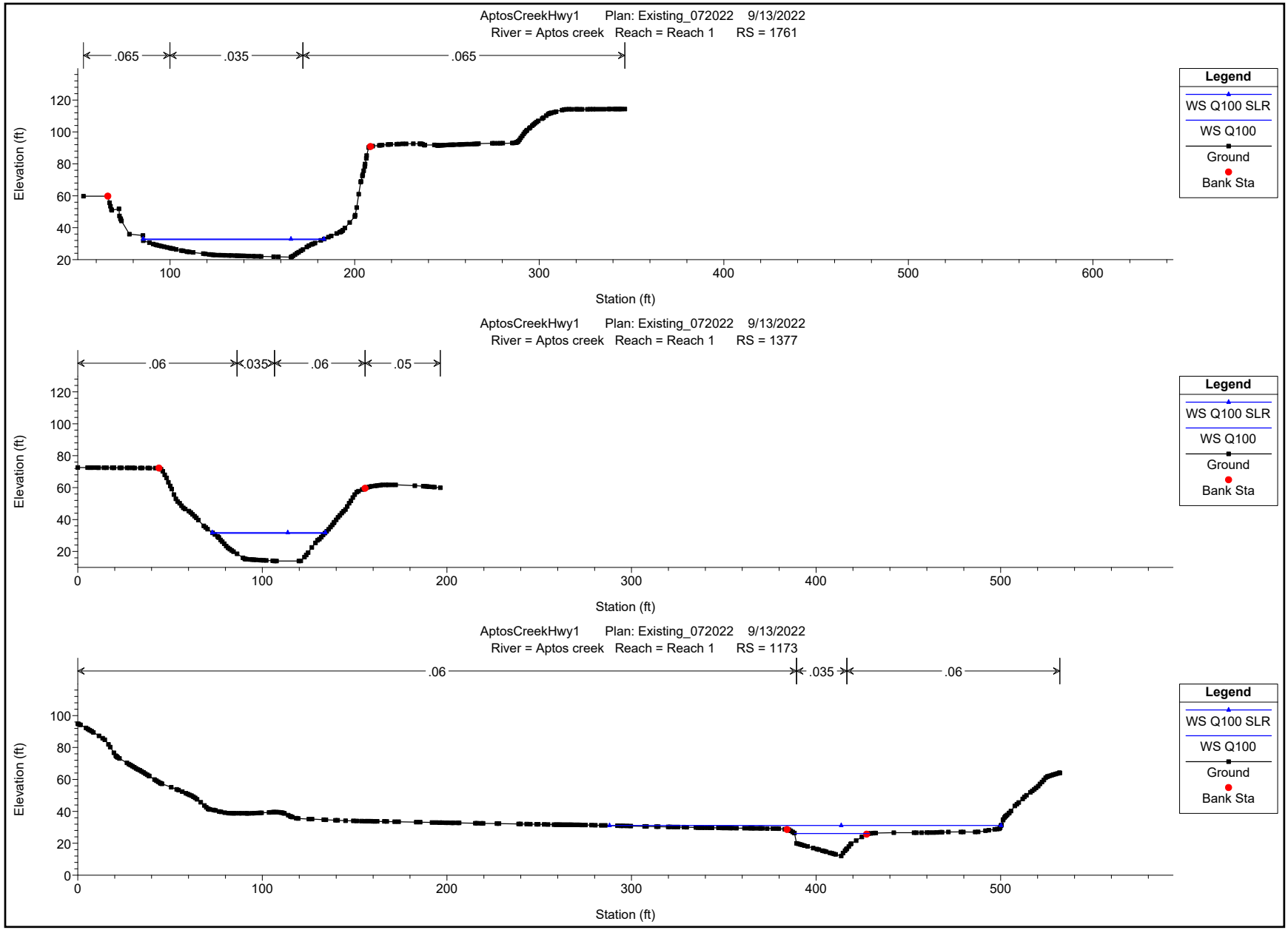
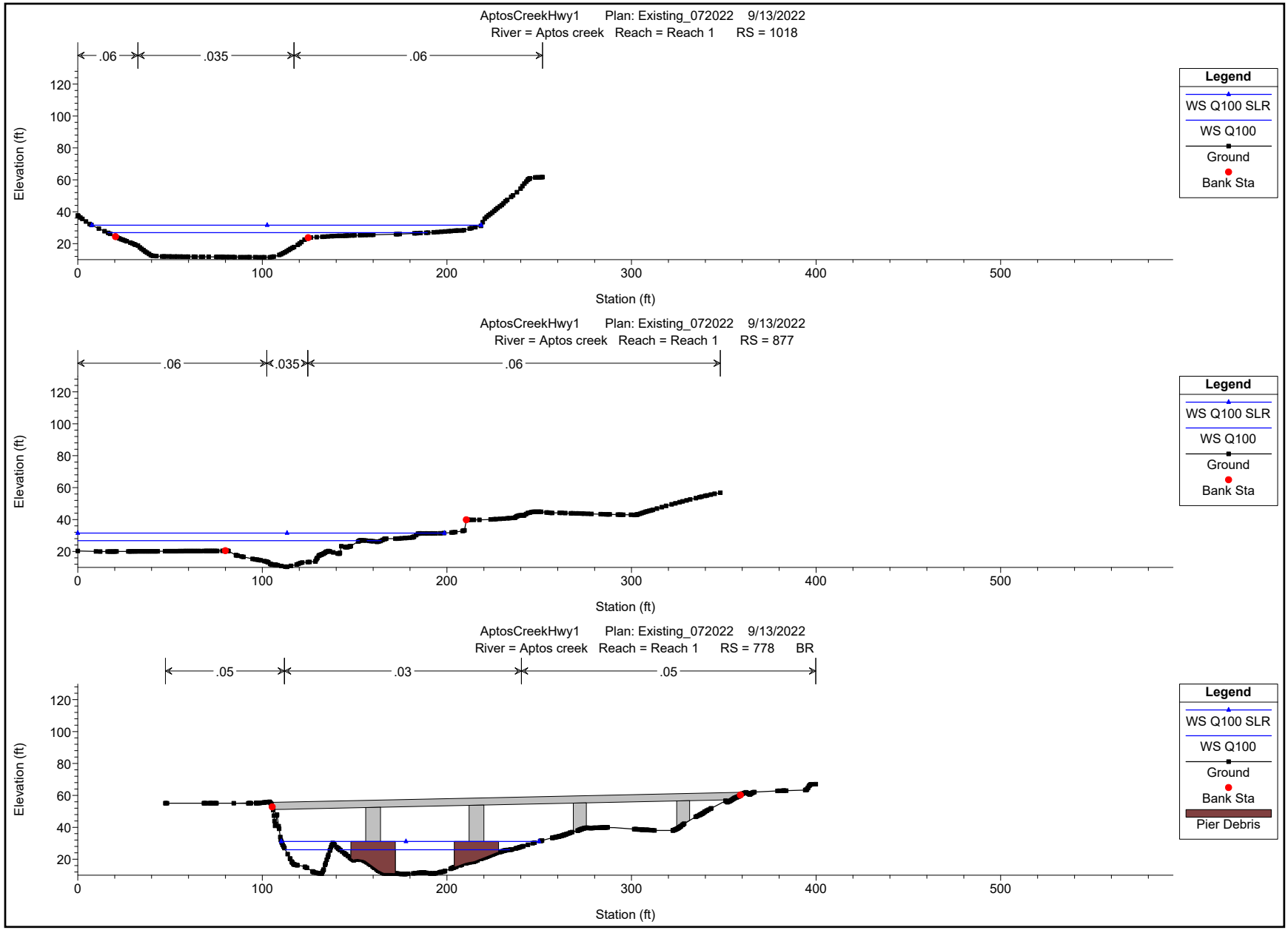
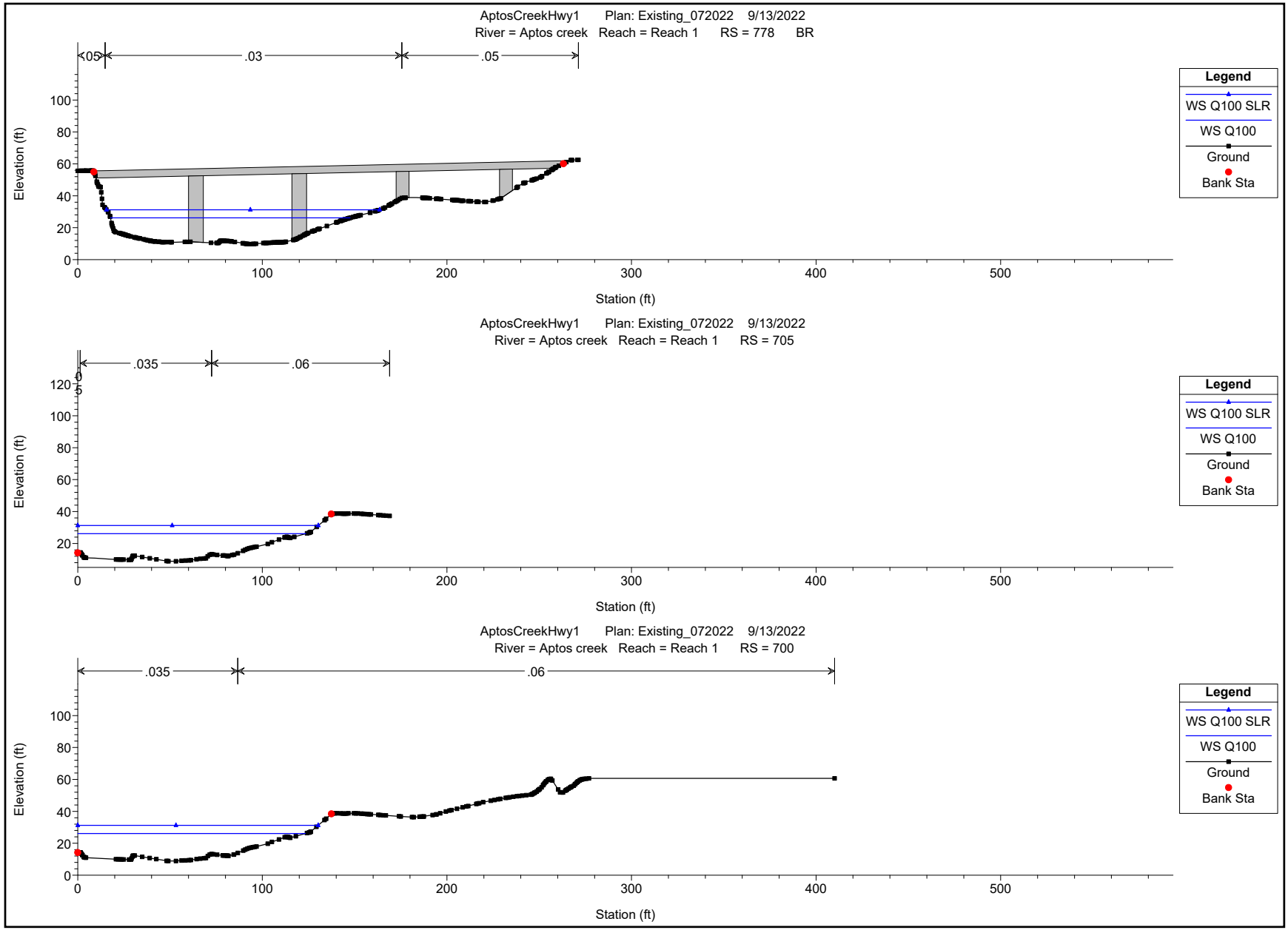
578
836
1137



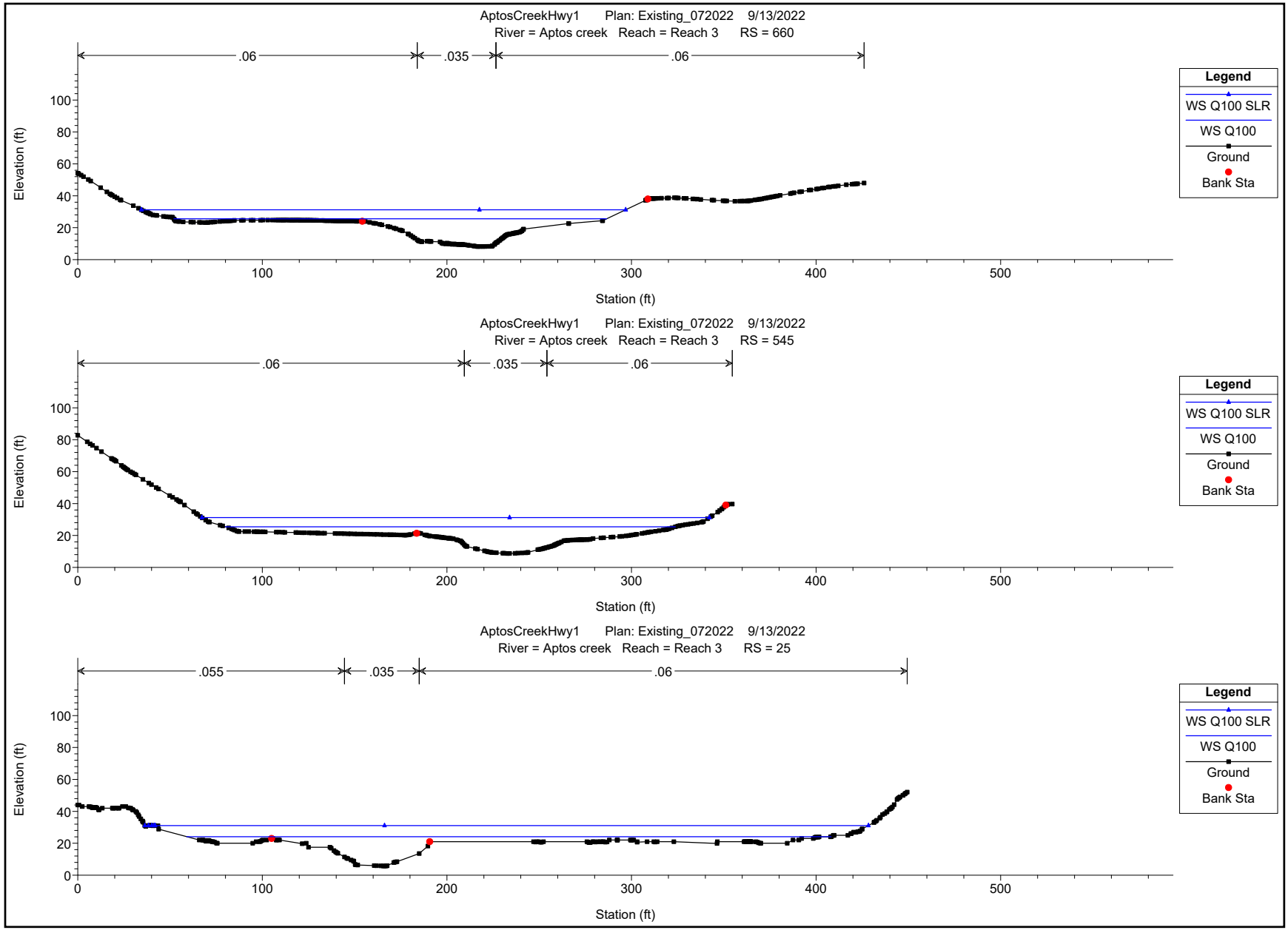
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



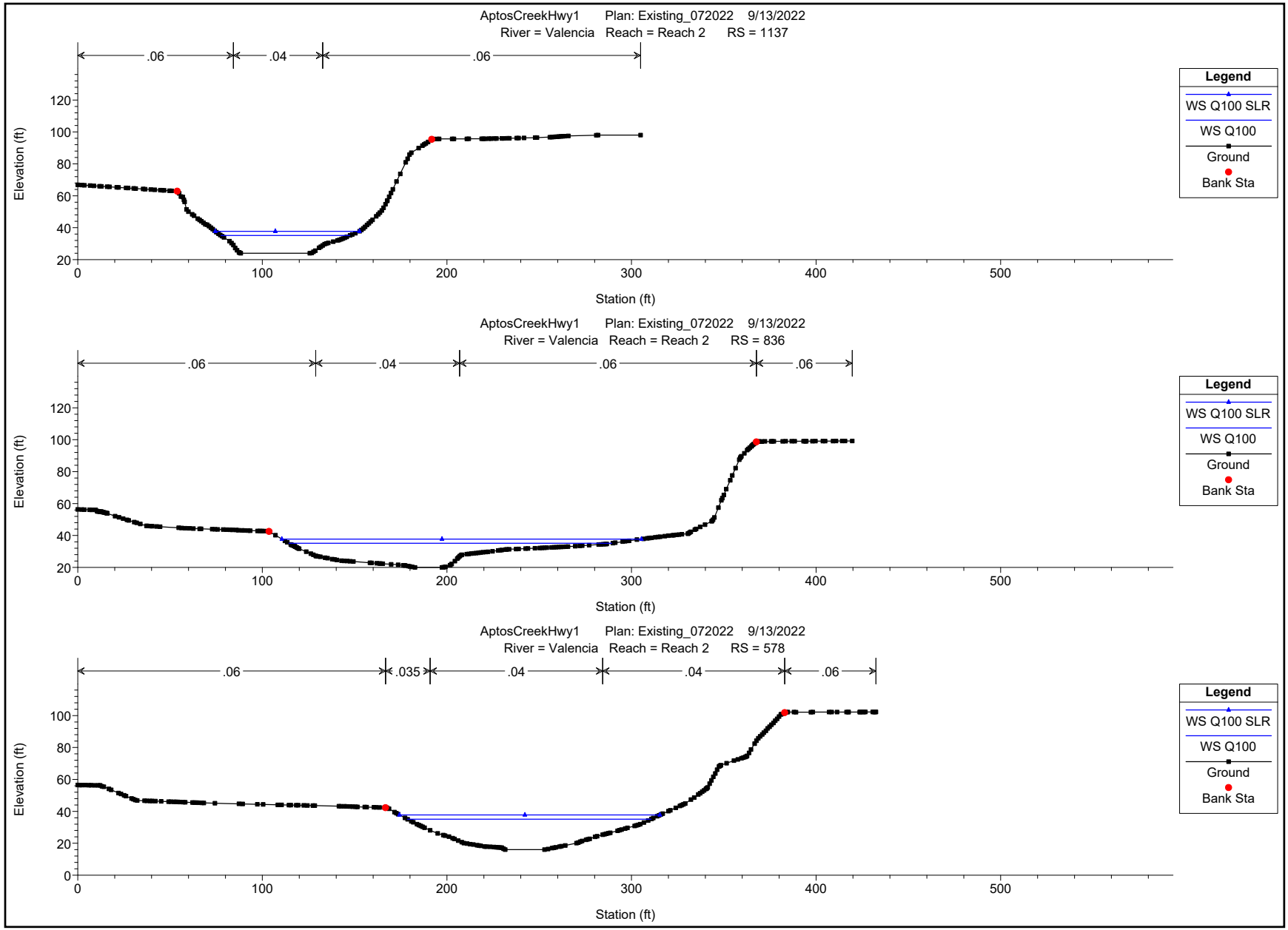
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



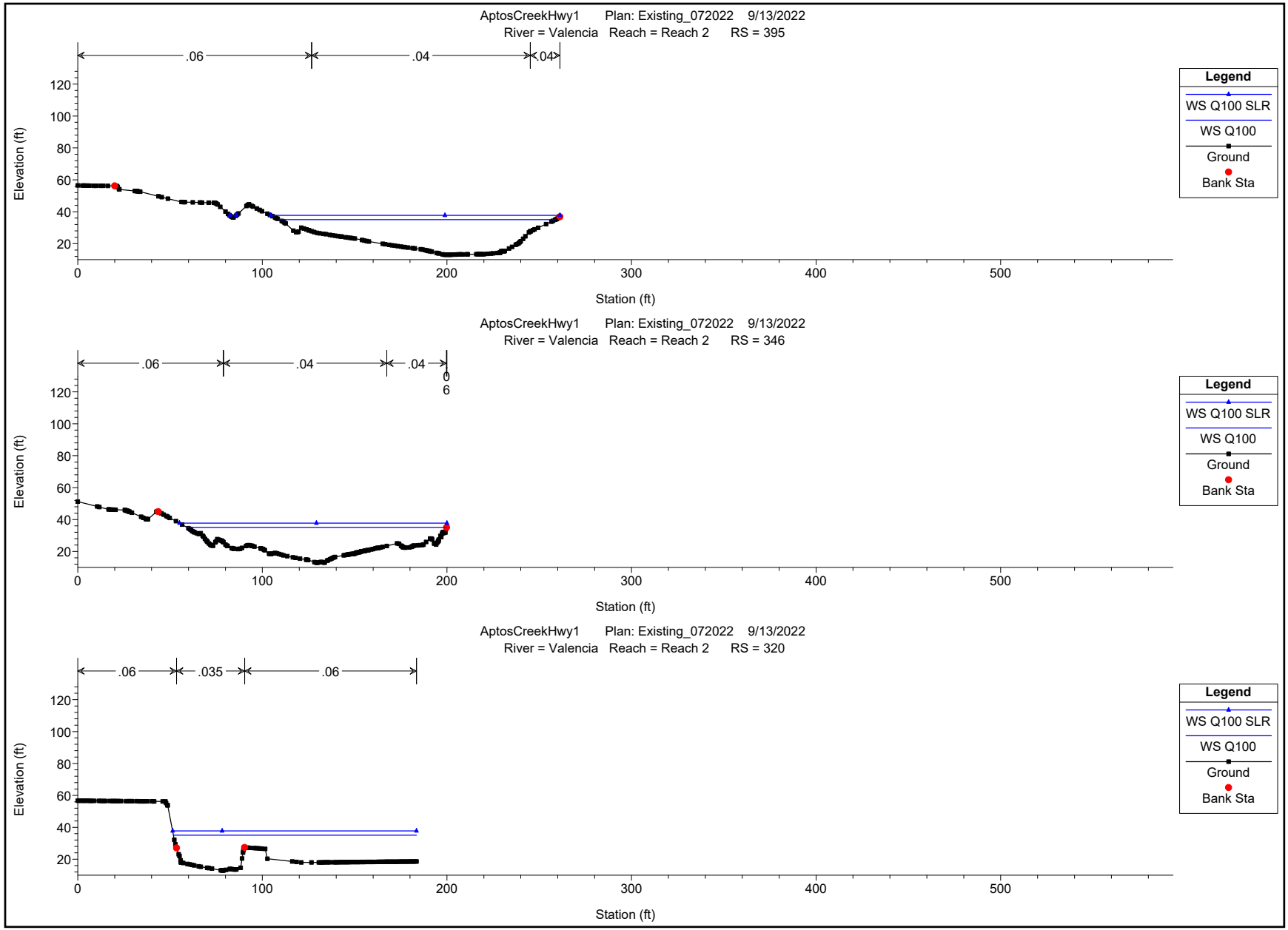
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



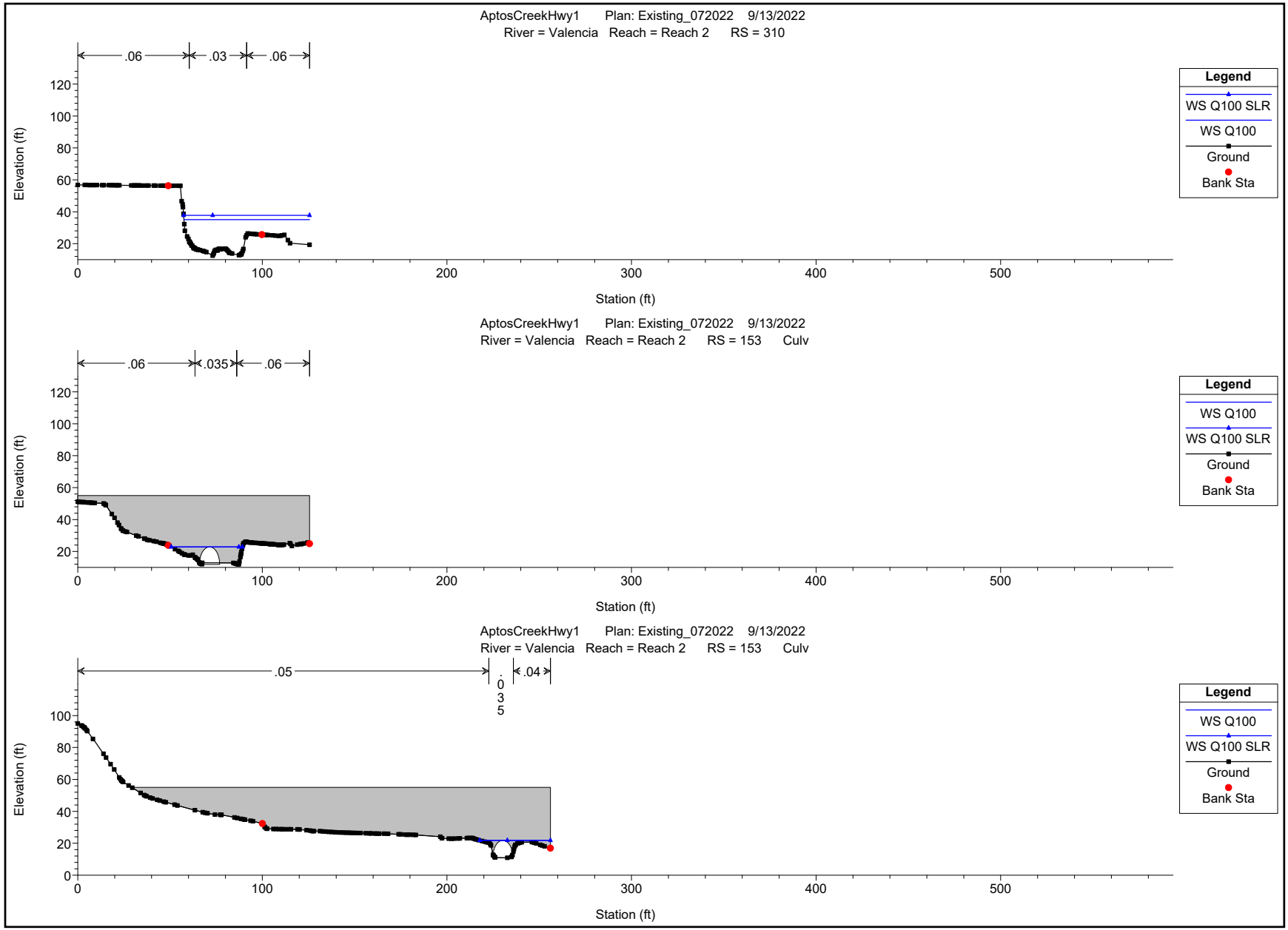
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



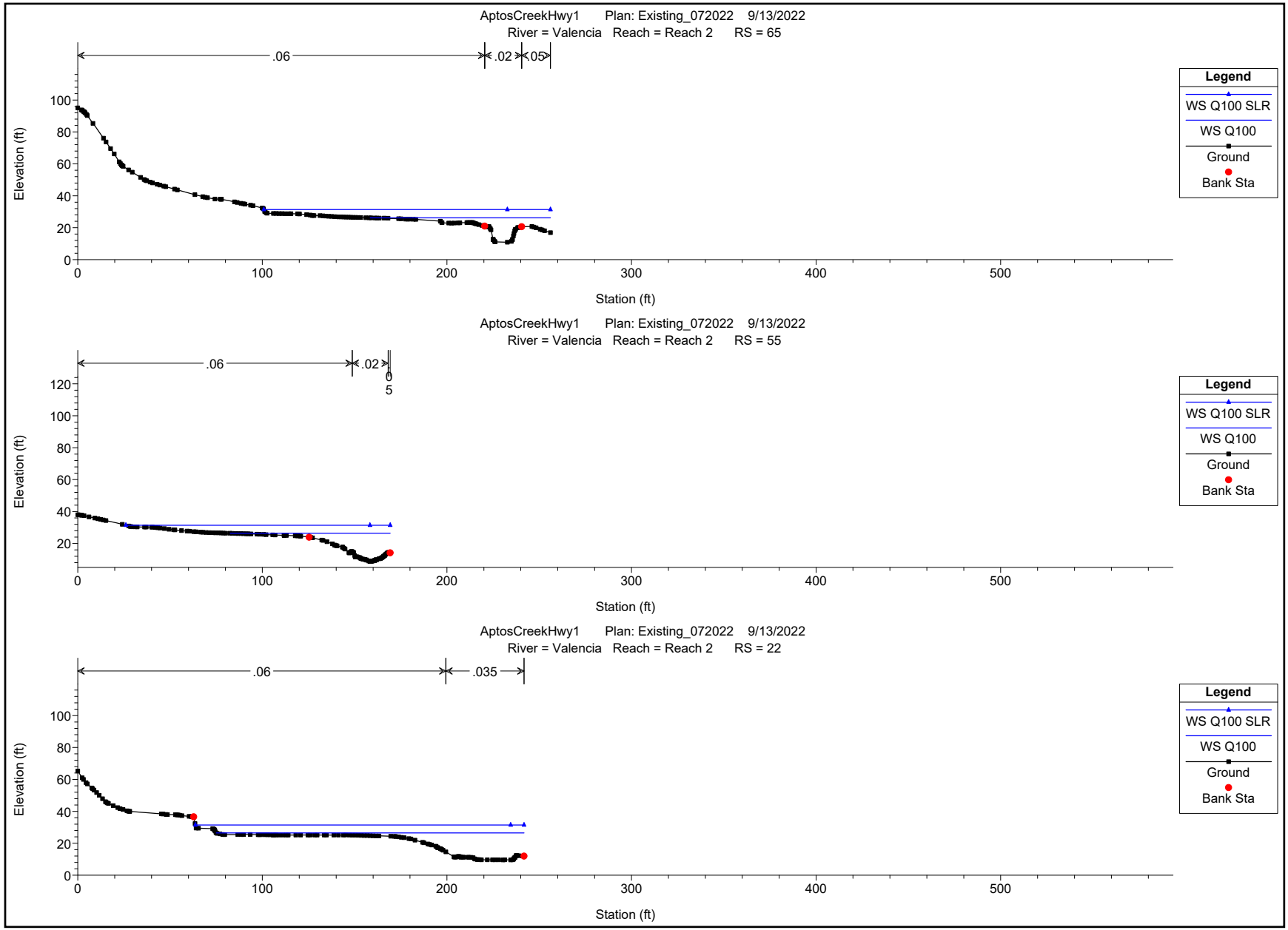
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



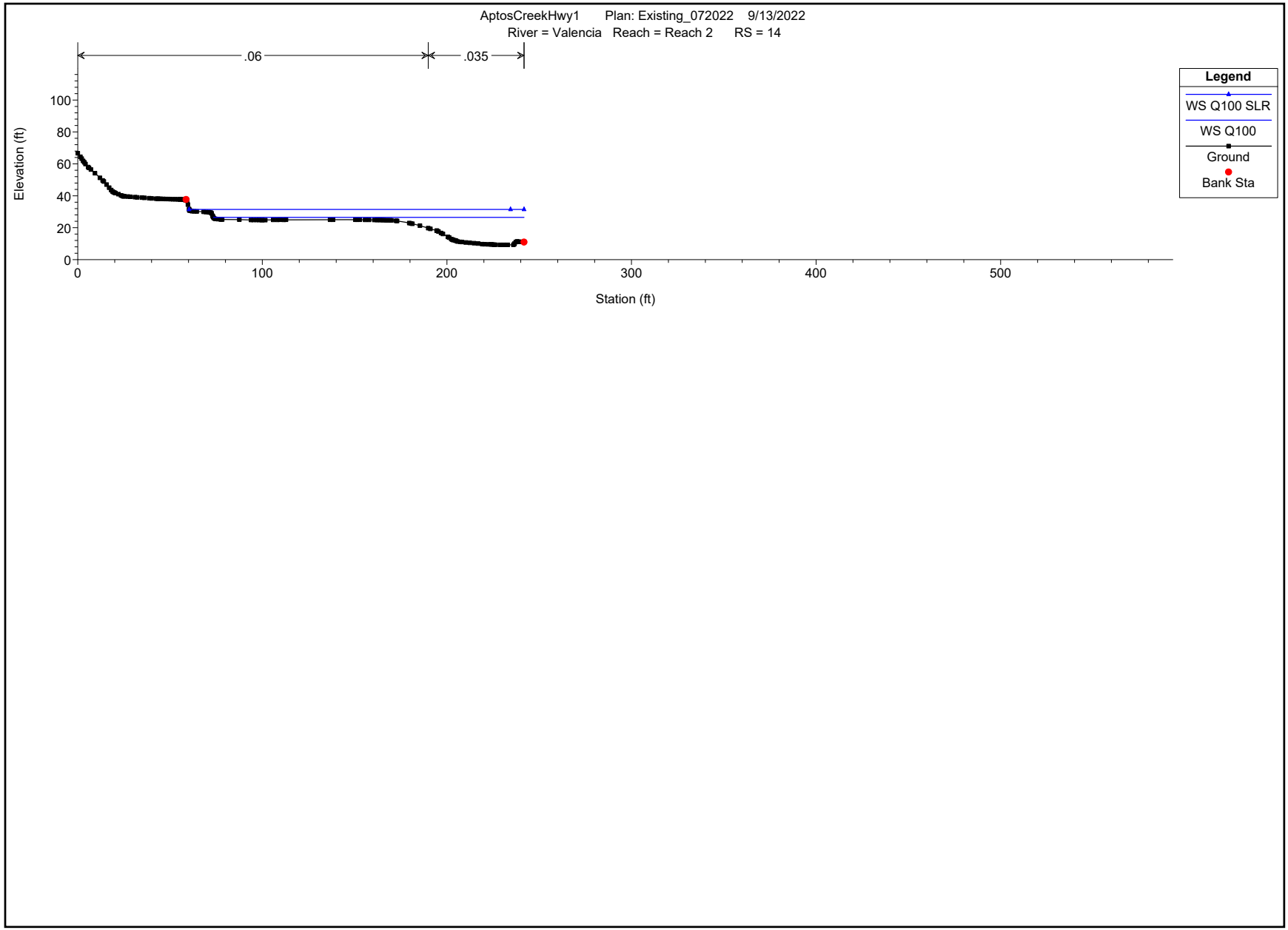
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



1 in Horiz. = 77 ft 1 in Vert. = 89 ft



1 in Horiz. = 77 ft 1 in Vert. = 89 ft



1 in Horiz. = 77 ft 1 in Vert. = 89 ft

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Appendix D Proposed HEC-RAS Results

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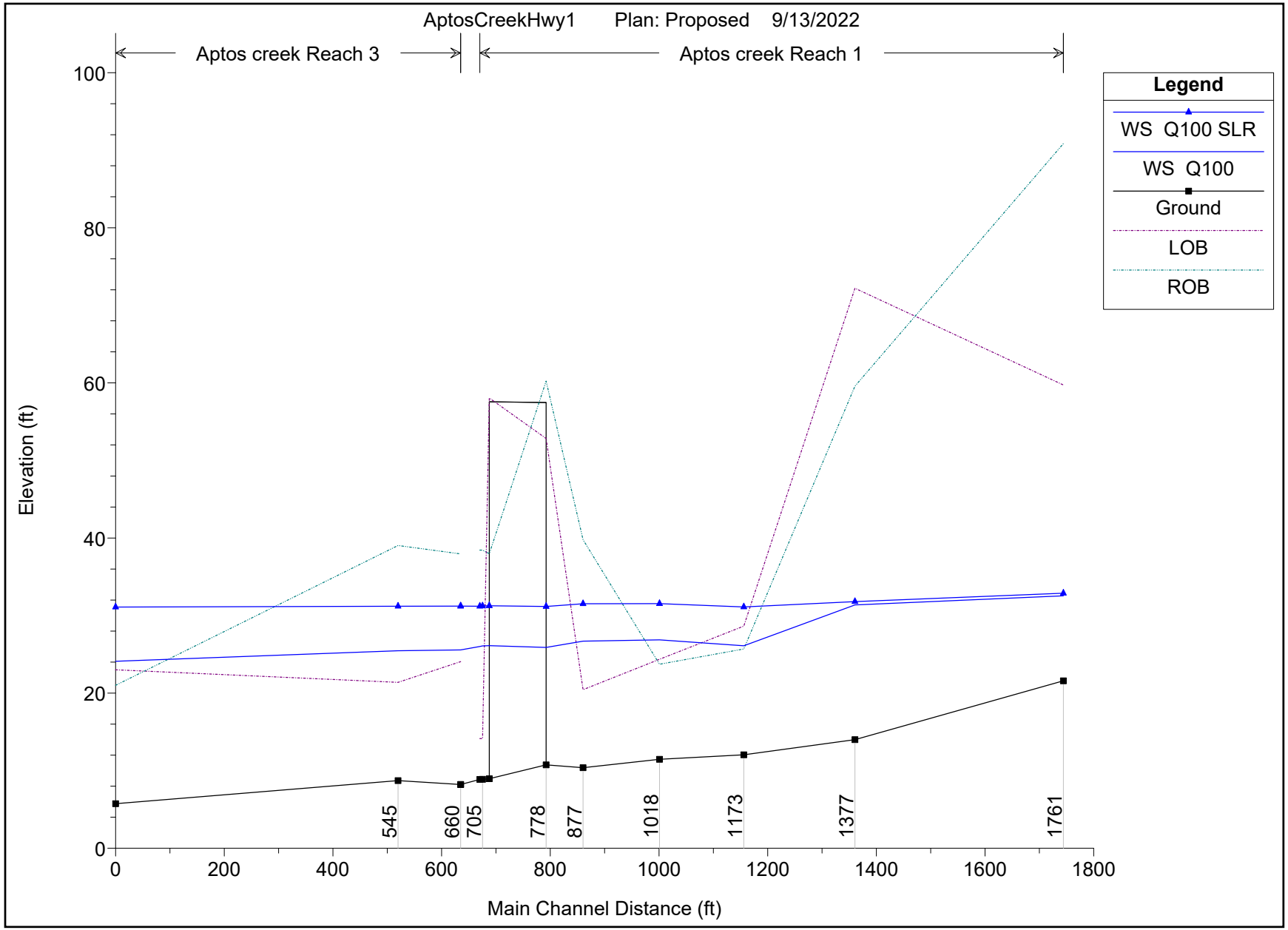
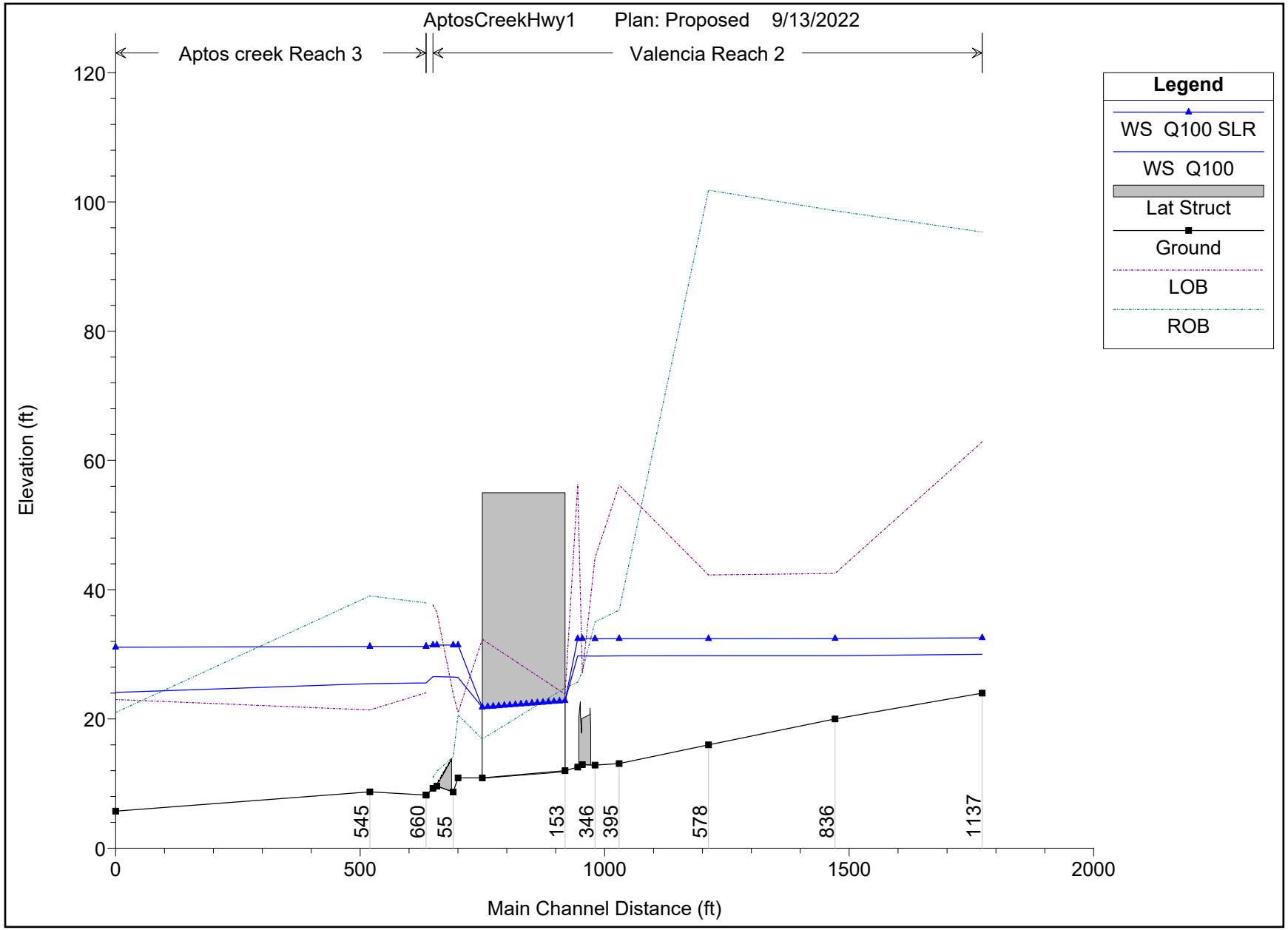
HEC-RAS Plan: Propsoed

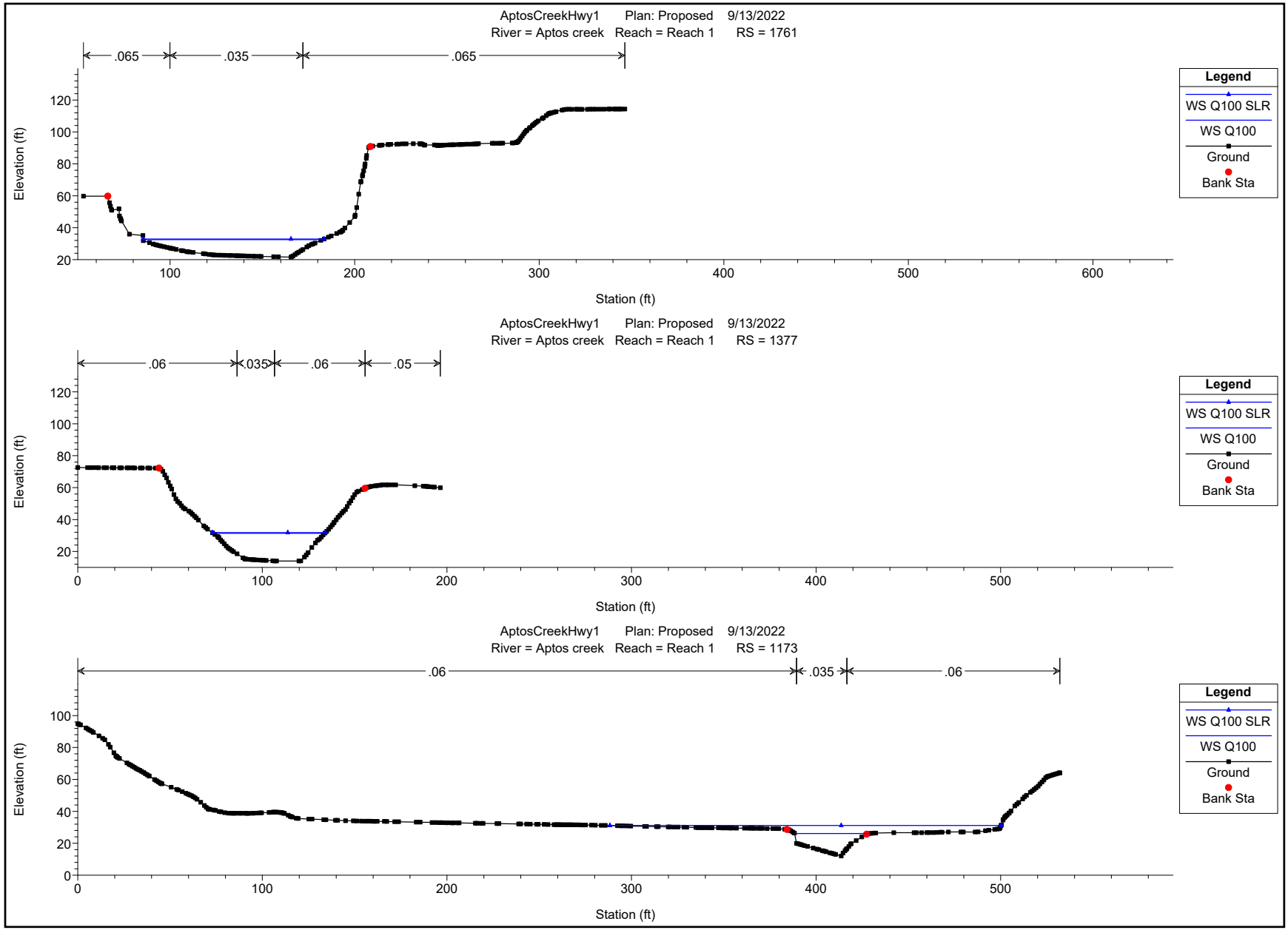
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Hydr Depth	Hydr Depth C	Length Chnl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)	(ft)
Valencia	Reach 2	1137	Q100	2690.00	24.00	30.01		31.57	0.009533	10.01	268.82	50.88	0.77	5.28	5.28	300.90
Valencia	Reach 2	1137	Q100 SLR	2690.00	24.00	32.54		33.21	0.003538	6.55	410.59	61.29	0.45	6.70	6.70	300.90
Valencia	Reach 2	836	Q100	2690.00	20.00	29.79		30.12	0.001876	4.61	584.08	98.31	0.33	5.94	5.94	258.60
Valencia	Reach 2	836	Q100 SLR	2690.00	20.00	32.44		32.59	0.000869	3.04	885.85	136.33	0.21	6.50	6.50	258.60
Valencia	Reach 2	578	Q100	2690.00	16.00	29.78		29.89	0.000304	2.72	988.26	110.39	0.16	8.95	8.95	182.70
Valencia	Reach 2	578	Q100 SLR	2690.00	16.00	32.42		32.49	0.000140	2.07	1297.43	122.54	0.11	10.59	10.59	182.70
Valencia	Reach 2	395	Q100	2690.00	13.09	29.77		29.84	0.000165	2.01	1335.76	132.99	0.11	10.04	10.04	49.50
Valencia	Reach 2	395	Q100 SLR	2690.00	13.09	32.42		32.46	0.000083	1.58	1699.96	141.24	0.08	12.04	12.04	49.50
Valencia	Reach 2	346	Q100	2690.00	12.86	29.74		29.82	0.000303	2.34	1149.70	129.35	0.14	8.89	8.89	25.80
Valencia	Reach 2	346	Q100 SLR	2690.00	12.86	32.41		32.46	0.000142	1.79	1502.01	136.78	0.10	10.98	10.98	25.80
Valencia	Reach 2	330		Lat Struct												
Valencia	Reach 2	320	Q100	2351.41	12.93	29.76		29.81	0.000144	2.24	1468.17	130.69	0.11	11.23	13.97	9.50
Valencia	Reach 2	320	Q100 SLR	2248.64	12.93	32.42		32.45	0.000068	1.73	1816.56	131.25	0.07	13.84	16.63	9.50
Valencia	Reach 2	310	Q100	1063.30	12.55	29.76	18.68	29.81	0.000177	1.87	661.20	67.72	0.10	9.76	11.44	244.70
Valencia	Reach 2	310	Q100 SLR	580.77	12.55	32.43	17.44	32.44	0.000027	0.80	842.53	67.91	0.04	12.41	14.06	244.70
Valencia	Reach 2	153 315		Culvert												
Valencia	Reach 2	65	Q100	1063.30	10.88	26.42		26.60	0.000200	3.82	465.87	104.41	0.20	4.46	11.51	10.00
Valencia	Reach 2	65	Q100 SLR	580.77	10.88	31.43		31.44	0.000010	1.10	1169.14	155.33	0.05	7.53	16.53	10.00
Valencia	Reach 2	55	Q100	1063.30	8.71	26.49		26.57	0.000304	2.20	520.09	89.76	0.12	5.79	10.81	33.40
Valencia	Reach 2	55	Q100 SLR	580.77	8.71	31.43		31.44	0.000019	0.67	1114.83	143.30	0.03	7.78	15.75	33.40
Valencia	Reach 2	25		Lat Struct												
Valencia	Reach 2	22	Q100	584.06	9.59	26.54		26.54	0.000014	0.60	968.44	166.77	0.04	5.81	5.81	8.00
Valencia	Reach 2	22	Q100 SLR	95.85	9.59	31.44		31.44	0.000000	0.05	1811.06	178.11	0.00	10.17	10.17	8.00
Valencia	Reach 2	14	Q100	554.96	9.27	26.54		26.54	0.000011	0.56	994.00	168.37	0.04	5.90	5.90	13.94
Valencia	Reach 2	14	Q100 SLR	67.83	9.27	31.44		31.44	0.000000	0.04	1838.88	181.45	0.00	10.13	10.13	13.94
Aptos creek	Reach 1	1761	Q100	5540.00	21.59	32.55		33.40	0.003425	7.40	748.60	97.27	0.47	7.70	7.70	383.70
Aptos creek	Reach 1	1761	Q100 SLR	5540.00	21.59	32.87		33.66	0.003056	7.10	780.49	97.99	0.44	7.97	7.97	383.70
Aptos creek	Reach 1	1377	Q100	5540.00	14.00	31.36		32.16	0.002985	7.15	775.10	60.40	0.35	12.83	12.83	204.50
Aptos creek	Reach 1	1377	Q100 SLR	5540.00	14.00	31.79		32.54	0.002742	6.91	801.28	61.29	0.34	13.07	13.07	204.50
Aptos creek	Reach 1	1173	Q100	5540.00	12.04	26.11	26.11	30.49	0.022407	16.78	330.29	40.50	1.02	8.16	8.45	155.10
Aptos creek	Reach 1	1173	Q100 SLR	5540.00	12.04	31.11		31.93	0.003166	8.00	950.69	211.99	0.40	4.48	12.51	155.10
Aptos creek	Reach 1	1018	Q100	5540.00	11.47	26.87		27.13	0.000466	4.11	1431.52	172.70	0.20	8.29	12.76	140.70
Aptos creek	Reach 1	1018	Q100 SLR	5540.00	11.47	31.54		31.66	0.000142	2.79	2353.46	210.90	0.12	11.16	17.43	140.70
Aptos creek	Reach 1	877	Q100	5540.00	10.38	26.70	21.81	27.01	0.001867	4.86	1279.80	159.78	0.28	8.01	9.46	68.00
Aptos creek	Reach 1	877	Q100 SLR	5540.00	10.38	31.52	21.80	31.62	0.000495	2.62	2136.12	198.58	0.14	10.76	10.34	68.00
Aptos creek	Reach 1	778 BR U	Q100	5540.00	10.75	25.88	19.04	26.70	0.003072	7.24	765.06	67.85	0.38	11.28	11.28	104.50
Aptos creek	Reach 1	778 BR U	Q100 SLR	5540.00	10.75	31.17	19.04	31.50	0.001199	4.65	1192.20	91.66	0.23	13.01	13.01	104.50
Aptos creek	Reach 1	778 BR D	Q100	5540.00	8.97	26.11	16.00	26.30	0.000363	3.47	1598.34	145.20	0.18	11.01	11.01	12.50

HEC-RAS Plan: Propsoed (Continued)

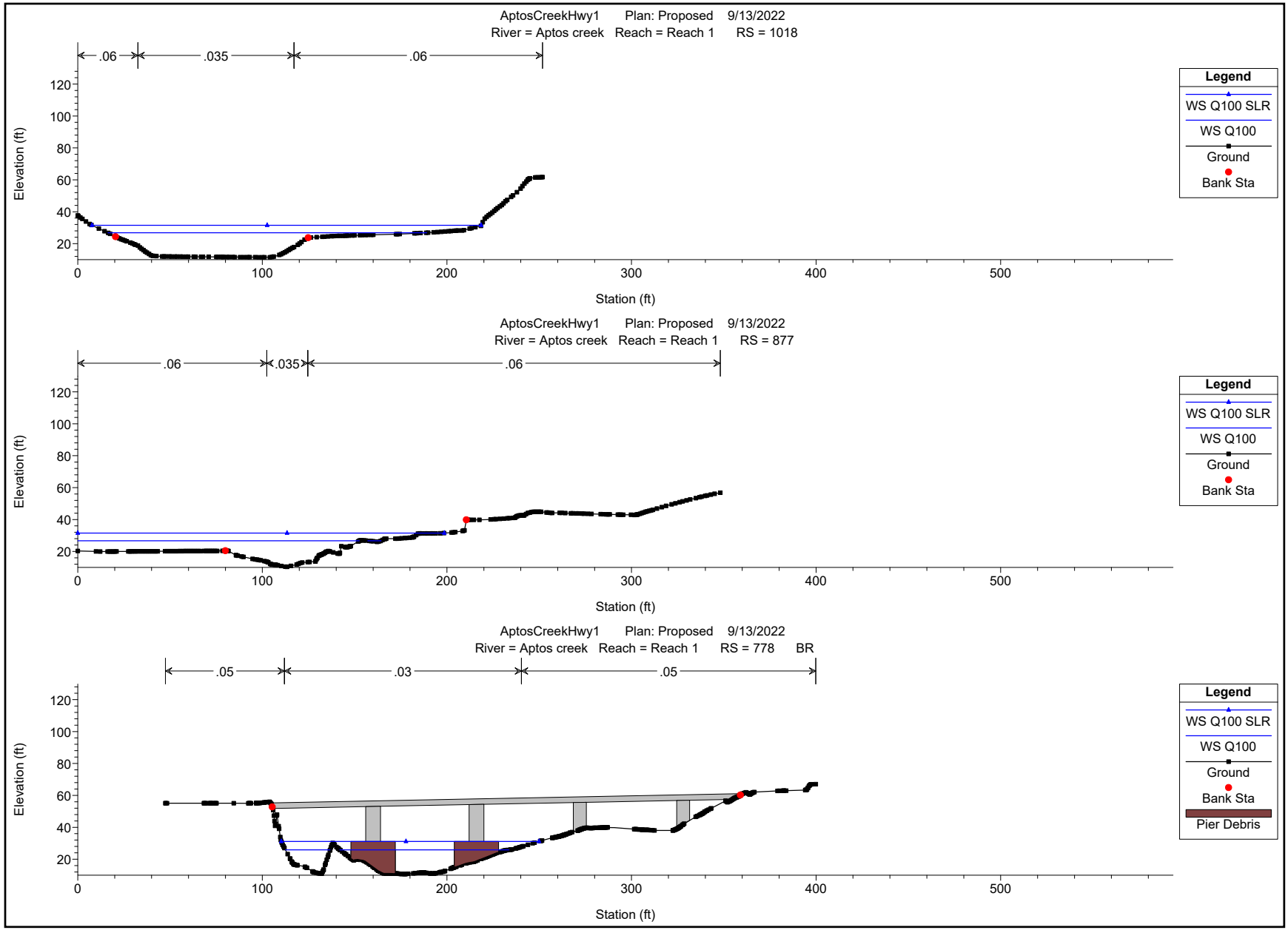
River	Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Hydr Depth	Hydr Depth C	Length Chnl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(ft)	(ft)	(ft)
Aptos creek	Reach 1	778 BR D	Q100 SLR	5540.00	8.97	31.26	16.00	31.34	0.000140	2.29	2420.48	169.81	0.11	14.25	14.25	12.50
Aptos creek	Reach 1	705	Q100	7166.70	8.88	26.08		26.43	0.000923	4.70	1525.07	123.31	0.24	12.37	12.37	5.00
Aptos creek	Reach 1	705	Q100 SLR	7649.23	8.88	31.23		31.42	0.000375	3.51	2182.08	130.31	0.15	16.75	16.75	5.00
Aptos creek	Reach 1	700	Q100	7675.04	8.88	26.01		26.40	0.000899	5.06	1515.63	123.04	0.25	12.32	12.32	35.39
Aptos creek	Reach 1	700	Q100 SLR	8162.17	8.88	31.20		31.41	0.000360	3.75	2176.98	130.23	0.16	16.72	16.72	35.39
Aptos creek	Reach 3	660	Q100	8280.00	8.22	25.57		26.31	0.003752	7.00	1278.77	234.53	0.42	5.45	8.69	115.10
Aptos creek	Reach 3	660	Q100 SLR	8280.00	8.22	31.22		31.38	0.000543	3.52	2689.03	262.39	0.17	10.25	13.51	115.10
Aptos creek	Reach 3	545	Q100	8280.00	8.72	25.47		25.90	0.002117	5.55	1690.21	243.84	0.32	6.93	9.18	519.80
Aptos creek	Reach 3	545	Q100 SLR	8280.00	8.72	31.21		31.32	0.000351	2.89	3198.10	274.94	0.14	11.63	13.61	519.80
Aptos creek	Reach 3	25	Q100	8280.00	5.74	24.10	19.05	24.69	0.002483	6.95	1687.39	349.12	0.38	4.83	10.54	
Aptos creek	Reach 3	25	Q100 SLR	8280.00	5.74	31.10	19.05	31.17	0.000192	2.71	4295.81	389.69	0.11	11.02	17.54	


AptosCreekHwy1
Plan: Proposed
9/13/2022
Aptos creek Reach 3
Aptos creek Reach 1
Legend
WS Q100 SLR
WS Q100
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
0
20
40
60
80
100
0
200
400
600
800
1000
1200
1400
1600
1800
545
660
705
778
877
1018
1173
1377
1761

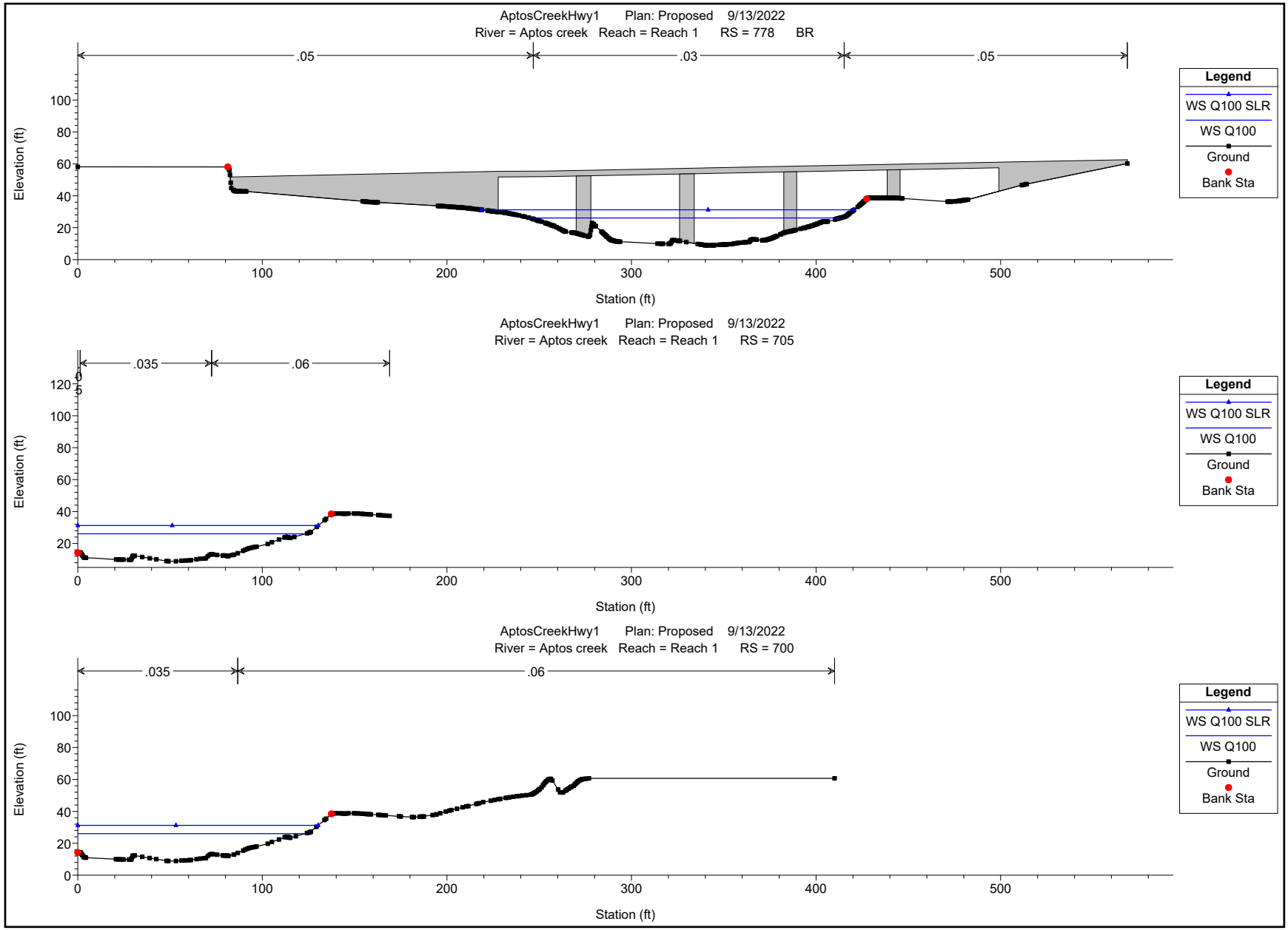

AptosCreekHwy1 Plan: Proposed 9/13/2022
Aptos creek Reach 3
Valencia Reach 2
Legend
WS Q100 SLR
WS Q100
Lat Struct
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
0
20
40
60
80
100
120
0
500
1000
1500
2000
545
660
55
153
346
395
578
836
1137



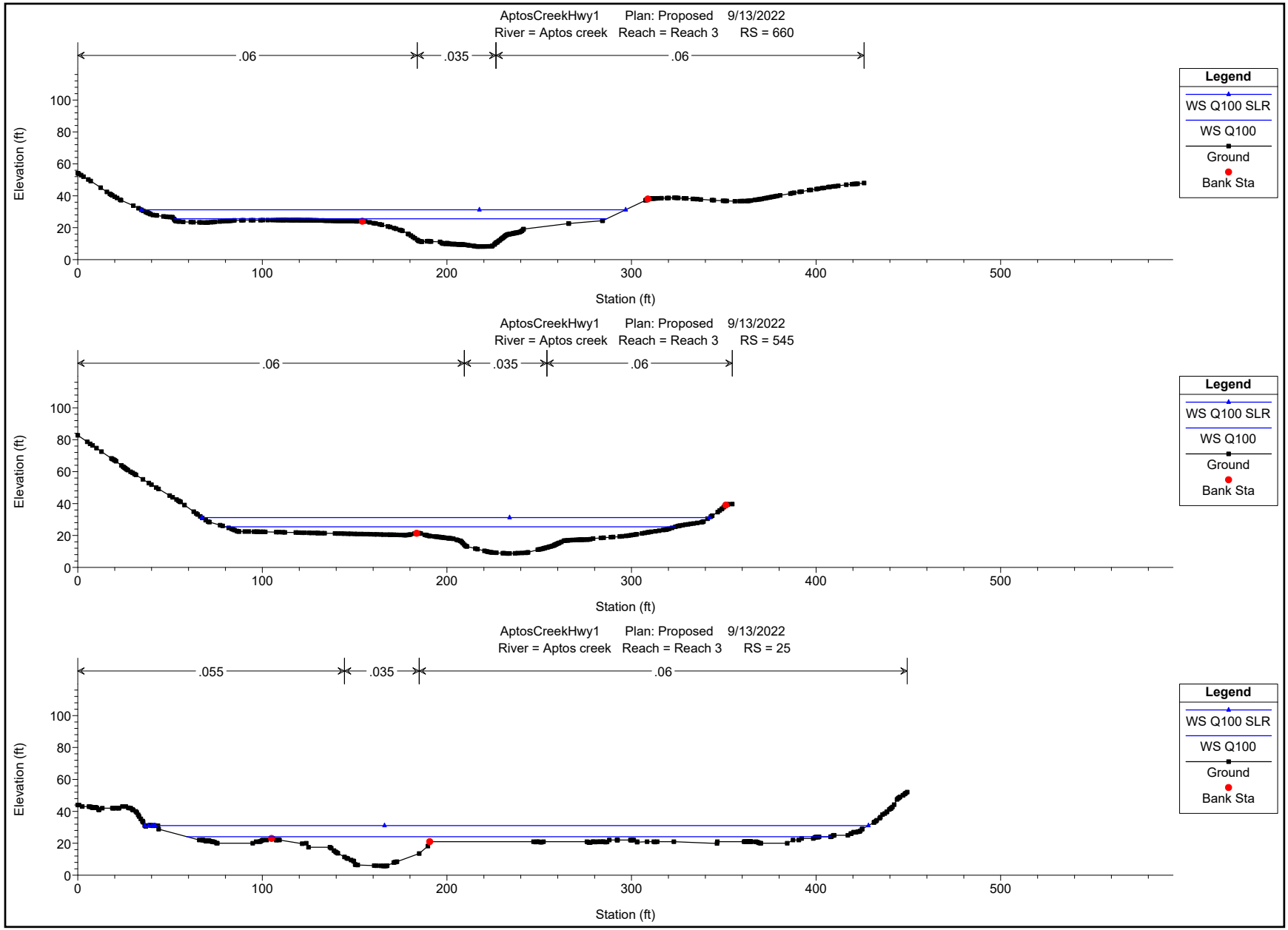
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



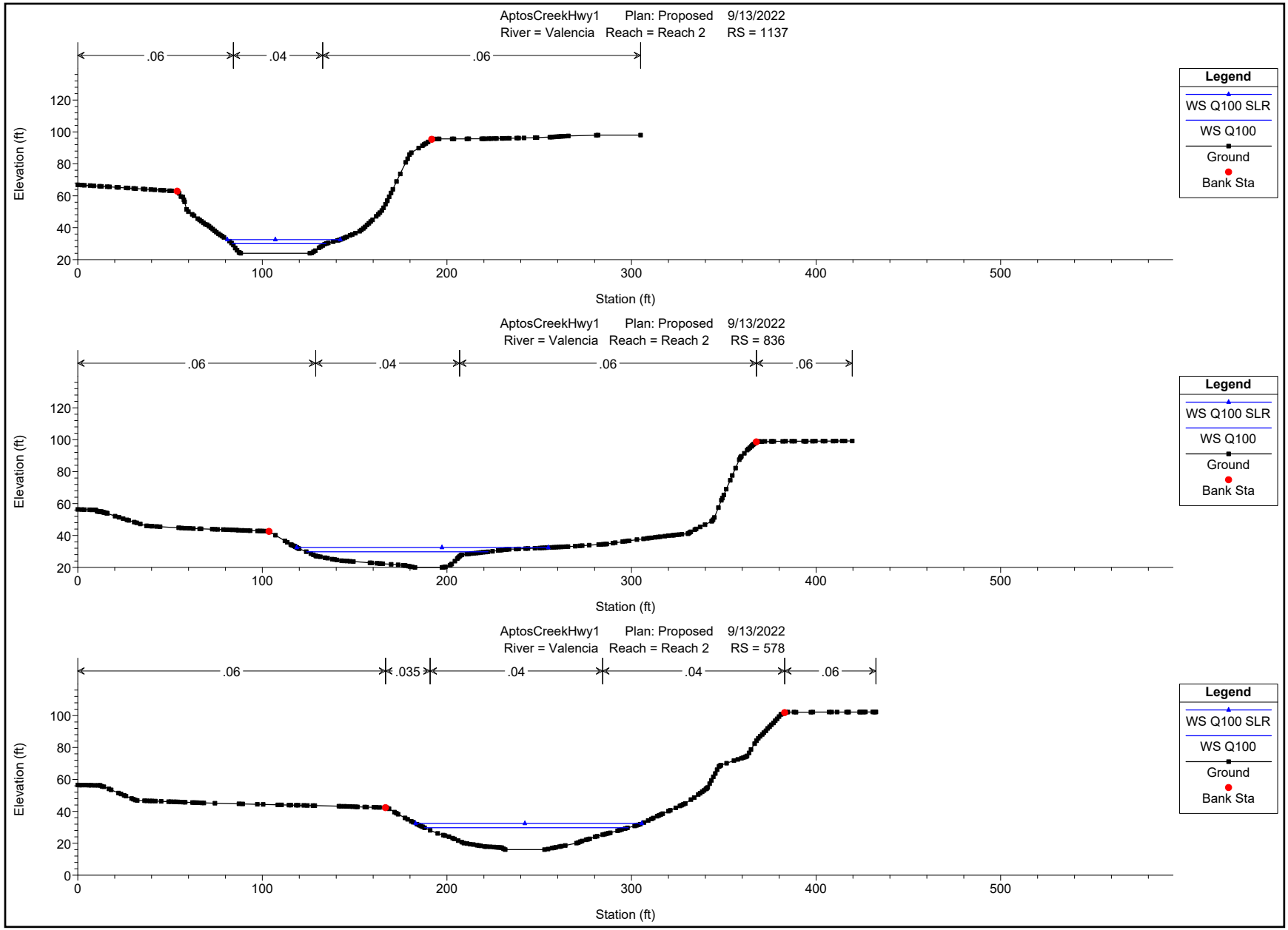
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



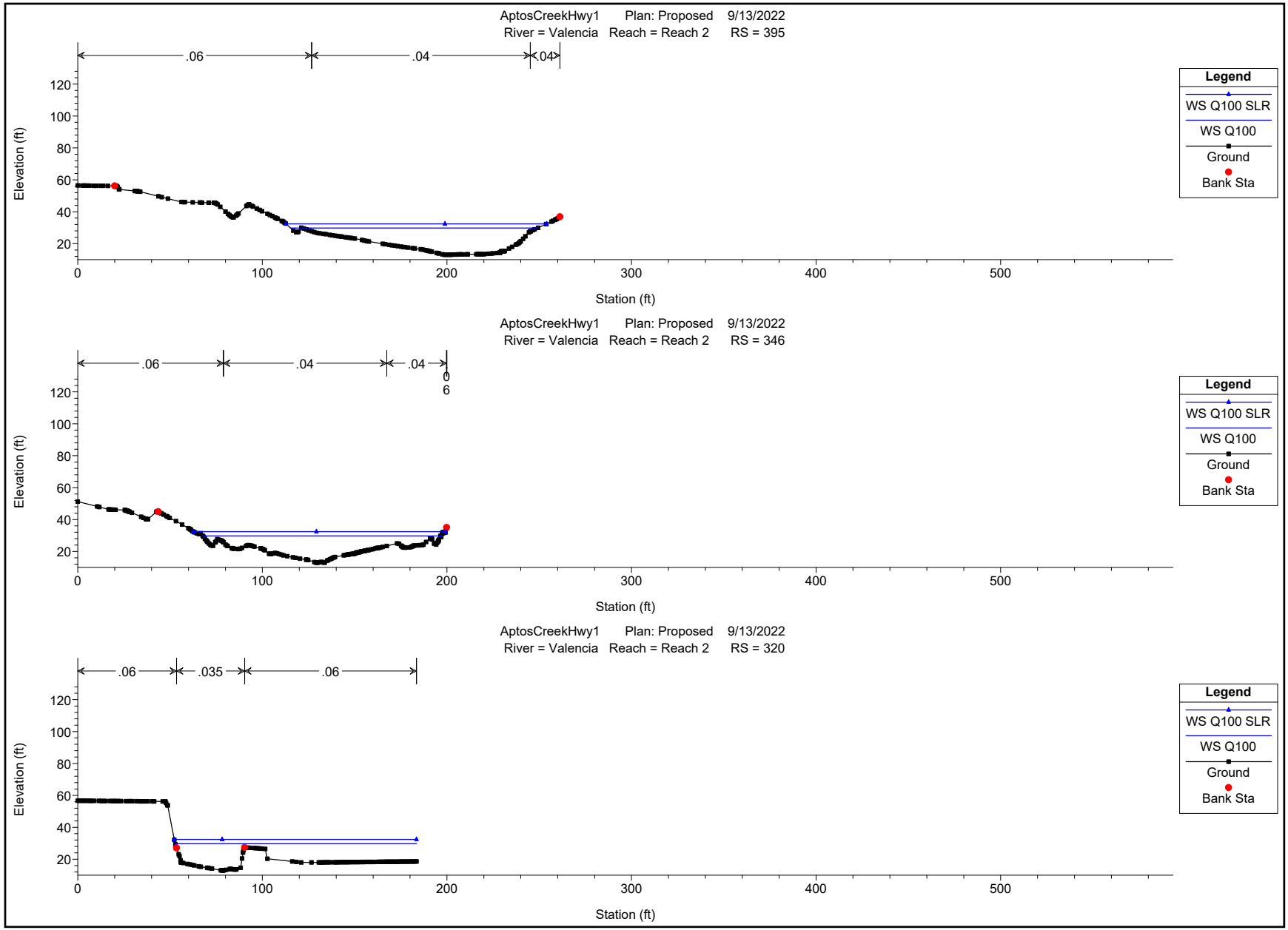
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



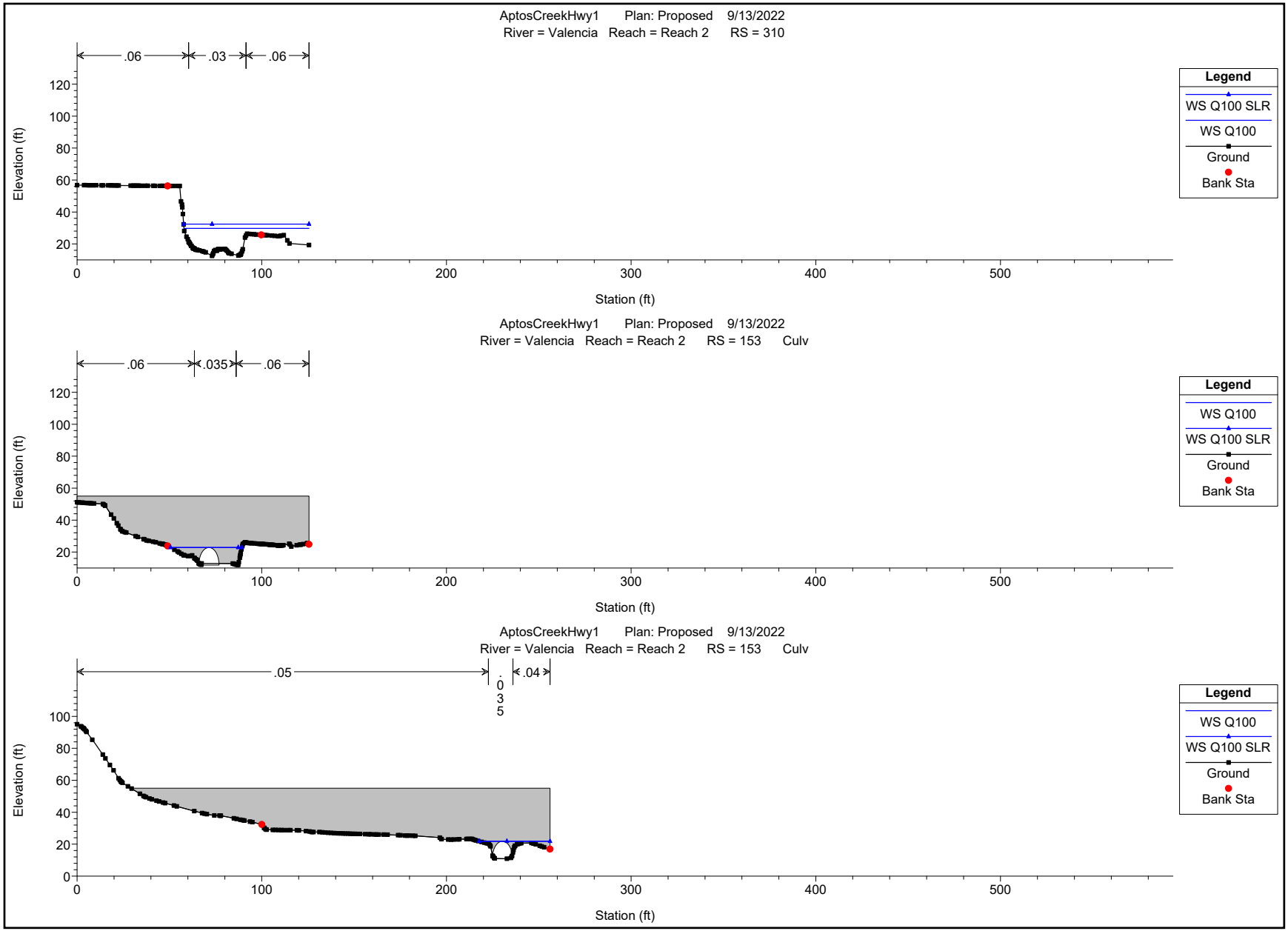
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



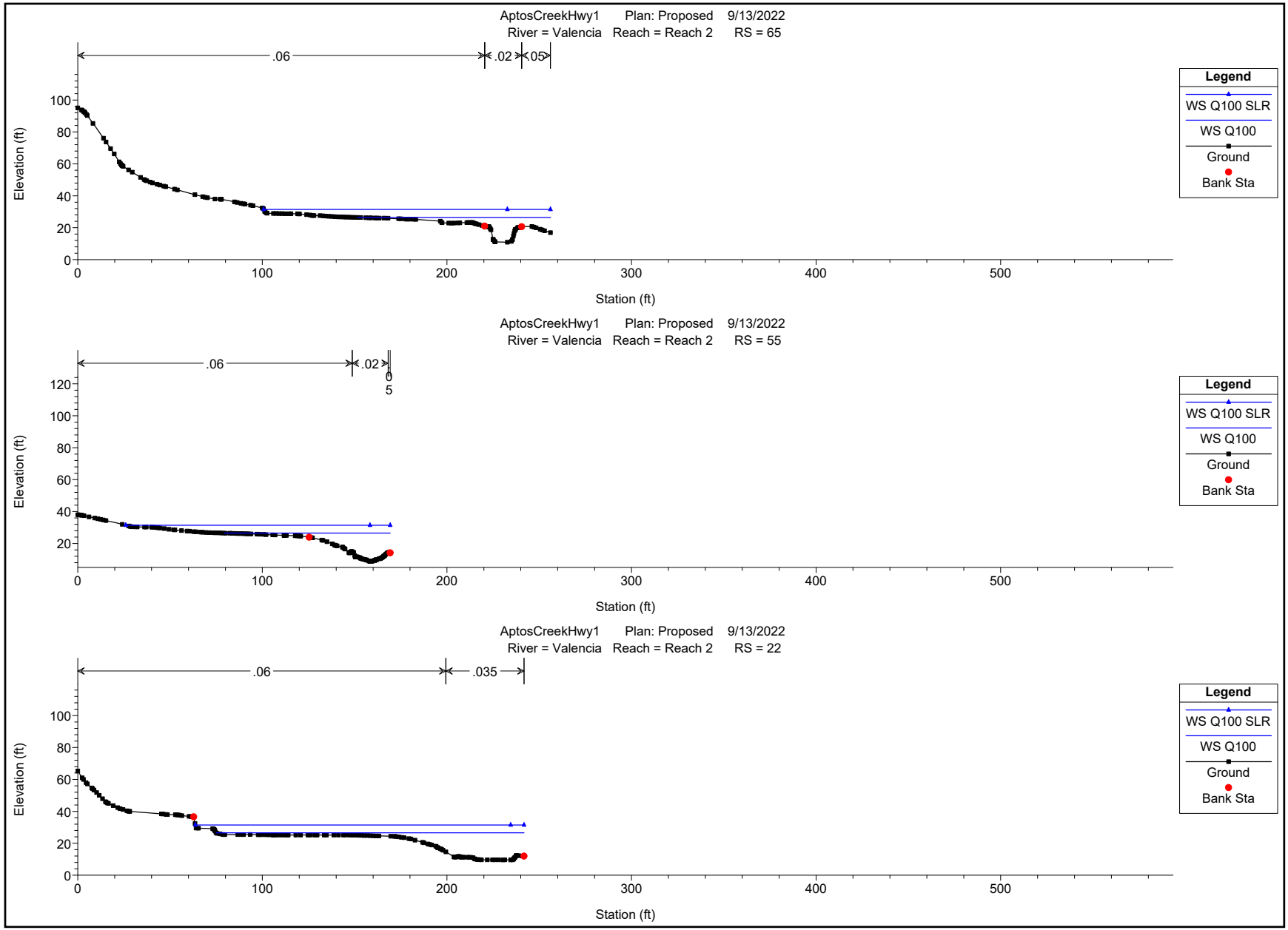
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



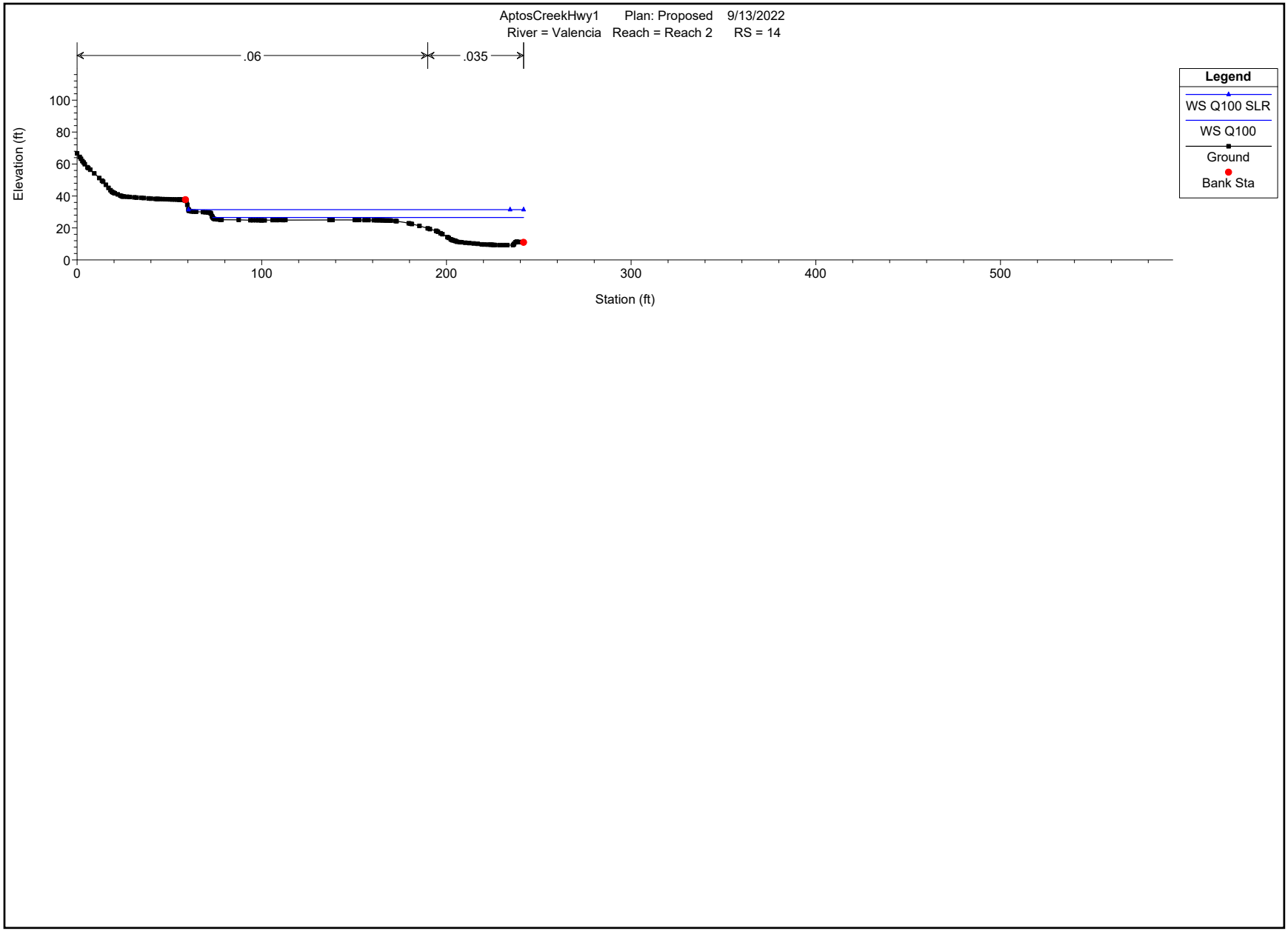
1 in Horiz. = 77 ft 1 in Vert. = 89 ft



1 in Horiz. = 77 ft 1 in Vert. = 89 ft



1 in Horiz. = 77 ft 1 in Vert. = 89 ft



1 in Horiz. = 77 ft 1 in Vert. = 89 ft

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Appendix E Technical Information for Location Hydraulic Study Forms

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TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY – APTOS CREEK

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 Project ID 0520000083
Federal-Aid Project Number: N/A

Floodplain Description:
A portion of the proposed improvements for the Project are located within Special Flood Hazard Area (SFHA) Zone AE at Aptos Creek, which represents areas subject to flooding by the 100-year flood event (1-percent-annual-chance flood) determined by detailed methods where BFEs are shown. A floodway has also been defined along this reach of Aptos Creek. SR 1 is located between FEMA cross sections F (downstream of SR 1) and G (upstream of SR 1) and the railroad is located between FEMA cross sections H, downstream of the railroad, and I, upstream of the railroad.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, sound walls, etc. and design elements to minimize floodplain impacts)* 10/13/22

The Project proposes to widen to SR 1 bridge over Aptos Creek on the downstream side (to the south). The widening of the SR 1 bridge over Aptos Creek and Spreckels Drive would occur on the south side of SR 1 only and require abutment walls along the existing embankments along the south side of Aptos Creek and the embankment on the north side of Spreckels Drive. The widened bridge would accommodate six lanes, each 12-feet wide (four through-lanes plus an auxiliary lane in each direction), 10-foot-wide outside shoulders, and a 9-foot-wide median with a 2-foot-wide inside shoulder in the northbound direction and 5-foot-wide inside shoulder in the southbound direction. The Coastal Rail Trail Segment 12 proposes an interim phase of work at the railroad bridge over Aptos Creek and an ultimate phase that would include a clear span bridge adjacent to the railroad bridge over Aptos creek. All structures and grading will be designed to be outside of the floodplain.

2. ADT: Current see following table Projected see following table

Average Weekday Volumes (In Vehicles) within SR 1 Project Limits

Direction	Location	Existing (2019) No Build Condition		Proposed (2045) Plus Build Condition	
		AM	PM	AM	PM
Northbound	Mainline Average	18,900	14,190	21,820	17,100
	On-Ramps Total	11,350	8,910	12,650	9,610
	Off-Ramps Total	5,840	6,090	7,130	6,890
Southbound	Mainline Average	15,580	19,690	19,180	23,400
	On-Ramps Total	5,110	6,960	5,530	7,940
	Off-Ramps Total	7,070	10,400	8,150	11,810

Source: CDM Smith, 2021

3. Hydraulic Data: Base Flood Q100= 5,540 CFS
WSE 100= 100-year = 26.7 (existing), 26.7 (proposed) ft NAVD 88, 100-year with SLR = 31.5 (existing), 31.5 (proposed) ft NAVD 88 *The flood of record, if greater than Q100:*
Q= N/A CFS WSE= N/A
Overtopping flood Q= N/A CFS WSE= N/A

Are NFIP maps and studies available? NO _____ YES ✓

4. Is the highway location alternative within a regulatory floodway?
NO _____ YES ✓

TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY – APTOS CREEK cont.

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number: N/A
Project ID 0520000083 Bridge No. 36 0011 (existing)

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.
Potential Q100 backwater damages:

A.	Residences?	NO	YES ✓
B.	Other Bldgs?	NO ✓	YES
C.	Crops?	NO ✓	YES
D.	Natural and beneficial Floodplain values?	NO ✓	YES

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO	YES ✓
B. Emergency vehicle access?	NO	YES ✓
C. Practicable detour available?	NO	YES ✓
D. School bus or mail route?	NO	YES ✓

7. Estimated duration of traffic interruption for 100-year event hours: N/A

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$ N/A
B	Property	$ N/A
	Total	$ N/A

9. Assessment of Level of Risk
Low ✓
Moderate
High

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 7, and 9 of this form is accurate.

Anabelle Ochoa *Date* 10/12/2022
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO ✓ YES

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 8 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

Date
Local Agency Project Engineer *(local assistance projects)*

TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY – APTOS CREEK cont.

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number: N/A
Project ID 0520000083 Bridge No. 36 0011 (existing)

CONCURRED BY:

I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

Jeff Payne for Claudia Espino *Date* 1/31/2023 Type text here
District Project Engineer *(capital and 'on' system projects)*

Jon Fisher *Date* 10/13/2022
District Hydraulic Engineer *(capital and 'on' system projects)*

Date 2/1/23
District Project Manager *(capital and 'on' system projects)*

Date
Local Agency Project Manager *(Local Assistance projects)*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

Karen Bertaina *Date* 10/14/2022
District Senior Environmental Planner *(or Designee)*

Julia Mousavi *Date* 10/14/2022
Local Agency Environmental Planner

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY – VALENCIA CREEK

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 Project ID 0520000083
Federal-Aid Project Number: N/A

Floodplain Description:
A portion of the proposed improvements for the Project are located within shaded Zone X at Valencia Creek, which represents areas subject to flooding by storm events between the 100-year flood event (1-percent-annual-chance flood) and the 500-year flood event (0.2-percent-annual-chance flood).

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, sound walls, etc. and design elements to minimize floodplain impacts)*
The Project proposes two phases of constructing the Coastal Rail Trail Segment 12; An interim phase of work at the railroad bridge over Valencia Creek and an ultimate phase that would include a clear span bridge adjacent to the railroad bridge over Valencia Creek. All structures and grading will be designed to be outside of the floodplain.

2. ADT: Current N/A Projected N/A

3. Hydraulic Data: Base Flood Q100= 2,690 CFS
WSE100= 100-year = 29.8 (existing), 29.8 (proposed) ft NAVD 88, 100-year with SLR = 32.4 (existing), 32.4 (proposed) ft NAVD 88 *The flood of record, if greater than Q100:*
Q= N/A CFS WSE= N/A
Overtopping flood Q= N/A CFS WSE= N/A

Are NFIP maps and studies available? NO ____ YES ✓

4. Is the highway location alternative within a regulatory floodway?
NO ✓ YES ____

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.
Potential Q100 backwater damages:
A. Residences? NO ✓ YES ____
B. Other Bldgs? NO ✓ YES ____
C. Crops? NO ✓ YES ____
D. Natural and beneficial Floodplain values? NO ✓ YES ____

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:
A. Emergency supply or evacuation route? NO ____ YES ✓
B. Emergency vehicle access? NO ____ YES ✓
C. Practicable detour available? NO ____ YES ✓
D. School bus or mail route? NO ____ YES ✓

7. Estimated duration of traffic interruption for 100-year event hours: N/A

8. Estimated value of Q100 flood damages (if any) – moderate risk level.
A. Roadway $ N/A
B Property $ N/A
Total $ N/A

9. Assessment of Level of Risk
Low ✓
Moderate ____
High ____

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

TECHNICAL INFORMATION FOR LOCATION HYDRAULIC STUDY – VALENCIA CREEK cont.

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number: N/A
Project ID 0520000083 Bridge No. N/A

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 7, and 9 of this form is accurate.

Anabelle Ochoa *Date* 10/12/2022
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO ✓ YES

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 8 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

Date
Local Agency Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

Jeff Payne for Claudia Espino *Date* 1/31/2023
District Project Engineer *(capital and 'on' system projects)*

Date 10/13/2022
District Hydraulic Engineer *(capital and 'on' system projects)*

Date 2/1/23
District Project Manager *(capital and 'on' system projects)*

Date
Local Agency Project Manager *(Local Assistance projects)*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

Date 10/14/2022
District Senior Environmental Planner *(or Designee)*

Date 10/14/2022
Local Agency Environmental Planner

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

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Appendix F Floodplain Evaluation Report Summary Form

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FLOODPLAIN EVALUATION REPORT SUMMARY – APTOS CREEK

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number *(Local Assistance)* N/A
Project No.: 0520000083 Bridge No. 36 0011 (existing)

Limits: The project is located in Santa Cruz County on SR 1 from post mile (PM) 8.1, south of Freedom Boulevard, to PM 10.7, north of State Park Drive, with 1.14 miles of trail along the SCCRTC-owned Santa Cruz Branch Rail Line (SCBRL) between State Park Drive and Rio Del Mar Boulevard. The total length of the Project on SR 1 is 2.6 miles, and on the SCBRL is 1.14 miles.

Floodplain Description: The proposed improvements for the Project are located within Special Flood Hazard Area (SFHA) Zone AE, which represents areas subject to flooding by the 100-year flood event (1-percent-annual-chance flood) determined by detailed methods where BFEs are shown. A floodway has also been defined along this reach of Aptos Creek. SR 1 is located between FEMA cross sections F (downstream of SR 1) and G (upstream of SR 1) and the railroad is located between FEMA cross sections H, downstream of the railroad, and I, upstream of the railroad.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	✓	
2.	Are the risks associated with the implementation of the proposed action significant?	✓	
3.	Will the proposed action support probable incompatible floodplain development?	✓	
4.	Are there any significant impacts on natural and beneficial floodplain values?	✓	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	✓	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	✓	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		✓

PREPARED BY:

_____ *Date* _____
Local Agency/Consulting Project Engineer *(capital and 'on' system projects)*

Anabelle Ochoa *Date* 10/12/2022
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

Jon Fisher *Date* 10/13/2022
District Hydraulic Engineer *(capital and 'on' system projects)*

_____ *Date* 2/1/23
District Project Manager *(capital and 'on' system projects)*

Jeff Payne for Claudia Espino *Date* 1/31/2023
District Project Engineer

FLOODPLAIN EVALUATION REPORT SUMMARY – APTOS CREEK cont.

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number *(Local Assistance)* N/A
Project No.: 0520000083 Bridge No. 36 0011 (existing)

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

Kara Bertaina *Date* 10/14/2022
District Senior Environmental Planner *(or Designee)*

Julia Mousavi *Date* 10/14/2022
Local Agency Environmental Planner

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

FLOODPLAIN EVALUATION REPORT SUMMARY – VALENCIA CREEK

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number *(Local Assistance)* N/A
Project No.: 0520000083 Bridge No. N/A

Limits: The project is located in Santa Cruz County on SR 1 from post mile (PM) 8.1, south of Freedom Boulevard, to PM 10.7, north of State Park Drive. The total length of the project on SR 1 is 2.6 miles. The project also includes the proposed Coastal Rail Trail Segment 12, which would extend approximately 1.14 miles along the Santa Cruz Branch Line railroad, between Rio Del Mar Boulevard and State Park Drive. Within the project area, the existing railroad right of way is generally in the range of 40 to 55 feet wide.

Floodplain Description: The proposed improvements for the Project are located within shaded Zone X, which represents areas subject to flooding by storm events between the 100-year flood event (1-percent-annual-chance flood) and the 500-year flood event (0.2-percent-annual-chance flood). These areas are considered to be outside of the base floodplain.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	✓	
2.	Are the risks associated with the implementation of the proposed action significant?	✓	
3.	Will the proposed action support probable incompatible floodplain development?	✓	
4.	Are there any significant impacts on natural and beneficial floodplain values?	✓	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	✓	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	✓	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		✓

PREPARED BY:

_____ *Date* _____
Local Agency/Consulting Project Engineer *(capital and 'on' system projects)*

Analeth Ochoa *Date* 10/12/2022
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

Jon Fisher *Date* 10/13/2022
District Hydraulic Engineer *(capital and 'on' system projects)*

Date 2/1/23
District Project Manager *(capital and 'on' system projects)*

Jeff Payne for Claudia Espino *Date* 1/31/2023
District Project Engineer

FLOODPLAIN EVALUATION REPORT SUMMARY – VALENCIA CREEK cont.

Dist. 5 Co. Santa Cruz Rte. SR 1 and Coastal Rail Trail Segment 12 P.M. 10.0
Federal-Aid Project Number *(Local Assistance)* N/A
Project No.: 0520000083 Bridge No. N/A

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

_____ *Date* 10/14/2022
District Senior Environmental Planner *(or Designee)*

_____ *Date* 10/14/2022
Local Agency Environmental Planner

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.