Location Hydraulic Study Report

Santa Cruz Route 1 HOV

Tier I Corridor Analysis of

High Occupancy Vehicle (HOV) Lanes and Transportation System Management (TSM) Alternatives

(05 SCR-1-PM R7.24-16.13)

and

Tier II Build Project Analysis

41st Avenue to Soquel Avenue/Drive

Auxiliary Lanes and Chanticleer Avenue Pedestrian Overcrossing

(05 SCR-1-PM 13.5-14.9)

EA 0C7300

Prepared by the

State of California Department of Transportation

December 2013

U.S. Department of Transportation

Location Hydraulic Study Report

TIER I - CORRIDOR ANALYSIS OF
HIGH OCCUPANCY VEHICLE (HOV) LANES
AND TRANSPORTATION SYSTEM MANAGEMENT ALTERNATIVES
AND
TIER II - BUILD PROJECT ANALYSIS OF
41ST AVENUE TO SOQUEL AVENUE/DRIVE AUXILIARY LANES AND
CHANTICLEER AVENUE PEDESTRIAN OVERCROSSING

San Andreas-Larkin Valley Road Interchange to Morrissey Boulevard Interchange in Santa Cruz County

05-SCR-1- PM R7.24/16.13 (KP R11.64/25.96)
EA 05-0C7300

March 2013

Prepared By: _____ Date: 03/07/13
Han-Bin Liang, Ph.D., P.E.
(925) 941-0017
WRECO

Concurrence By: _____ Date: 4/5/2013
Tom Fisher, Senior Hydraulic Engineer
(559) 243-3498
Hydraulics, Branch B
District 5/Central Region

State Route 1 HOV Lane Widening Project (From Morrissey Boulevard to San Andreas Road) LOCATION HYDRAULIC STUDY REPORT

Errata

June 10, 2015

This Errata sheet revises the Location Hydraulic Study Report as described below.

1. **Need.** Section 1.3 of the report is replaced in its entirety with the following text.

1.3 Need for Project

Purpose

The purpose of the proposed Tier I project on Route 1 within the project limits is to achieve the following:

- Reduce congestion.
- Promote the use of alternative transportation modes as means to increase transportation system capacity.
- Encourage carpooling and ridesharing.

The purpose of the Tier II project is to:

- Reduce congestion.
- Improve safety.
- Promote the use of alternative transportation modes as means to increase transportation system capacity.

The main distinction between the Tier I and Tier II project purposes is the Tier II project also addresses a congestion-related safety need within its limits but will not promote carpooling in the Route 1 corridor.

The Tier I and Tier II projects are intended to address specific deficiencies and needs on Route 1, as described in the following subsection.

Need

The Tier I and Tier II projects address the following needs resulting from deficiencies on Route 1 within the project limits:

- Several bottlenecks along Route 1 in the southbound and northbound directions cause recurrent congestion during peak hours.
- Travel time delays due to congestion are experienced by commuters, commerce, and emergency vehicles.
- “Cut-through” traffic, or traffic on local streets, occurs and is increasing because drivers seek to avoid congestion on the highway.

- Limited opportunities exist for pedestrians and bicyclists to safely get across Route 1 within the project corridor.

Within the Tier I project limits, in addition to the common needs identified above there is a need to address the following corridor-wide deficiencies:

- Insufficient incentives to increase transit service in the Route 1 corridor because congestion threatens reliability and cost-effective transit service delivery.
- Inadequate facilities to support carpool and rideshare vehicles over single-occupant vehicles, reducing travel time savings and reliability.

The Tier II project, in addition to the common needs identified above, also addresses the following need:

- Improve operational safety to address accident rates in excess of the statewide average.

2. Project Alternatives. Section 1.2 of the report is replaced in its entirety with the following text.

1.2 Project Alternatives

This section describes the proposed project improvements and the project alternatives developed to meet the purpose and need, while avoiding or minimizing environmental impacts. The alternatives are the Tier I Corridor HOV Lane Alternative, the Tier I Corridor TSM Alternative, and the Tier II Auxiliary Lane Alternative.

The proposed Tier I and Tier II project locations are in Santa Cruz County, California, on Route 1.The Tier I eastern project limit is just south of the village of Aptos, approximately 0.4 mile south of the San Andreas-Larkin Valley Road interchange; the Tier I project then traverses the villages of Soquel, Live Oak and unincorporated Santa Cruz County. The western Tier I project limit is in the City of Santa Cruz, approximately 0.4 mile north of the Morrissey Boulevard interchange, for a total length of 8.9 miles. The Tier II project limits, which lie within the Tier I corridor, begin at 41st Avenue on the east and extend a distance of 1.4 miles westward to Soquel Avenue.

Within the Tier I and Tier II project limits, Route 1 is a four-lane divided freeway with 12-foot lanes. In the southbound direction the existing inside paved shoulder width varies from approximately 4 feet to 18 feet and in the northbound direction the existing inside paved shoulder width varies from 7 feet to 18 feet. In the southbound direction in the project corridor, the outside shoulder width varies from 8 feet to 12 feet. In the northbound direction in the project corridor, the outside shoulder width varies from 6 feet to 8 feet.

The purpose of the Tier I project is to reduce congestion, promote the use of alternative transportation modes as means to increase transportation system capacity, and encourage carpooling and ridesharing. The purpose of the Tier II project is to reduce congestion, improve safety, and promote the use of alternative transportation modes as means to increase transportation system capacity.

Alternatives

This section describes the Tier I Corridor Alternatives and the Tier II Auxiliary Lane Alternative that were analyzed in this document. The Project Development Team studied various design alternatives and options. In an effort to reduce and avoid impacts, the Project Development Team also considered preliminary environmental information to better understand the impacts of those alternatives. The views of stakeholders were elicited through public information meetings and meetings with local agency staff and elected officials. From this preliminary analysis and public outreach, a longer list of alternatives and options was narrowed to include the alternatives described below.

The Tier I Corridor HOV Lane and TSM Alternatives were originally conceived as construction-level study alternatives, under the assumption that funding would be available in the near future. The Project Development Team recognized that funding sources to construct either of those alternatives would be limited in the short term and that implementation of the Tier I project would occur over a multi-year period. To make a decision on the types of transportation improvements that would occur within the corridor in the future, Tier I project implementation alternatives were identified. The team decided to study the HOV Lane and TSM Alternatives in a Tier I or Master Plan environmental document. The Tier I/II DEIR/EA will allow for the identification of a preferred corridor alternative for the 8.9-mile-long project corridor and facilitate the programming of funds. At the same time, the team also recognized that there was sufficient funding to implement a construction-level Tier II project within the corridor that would have more immediate congestion-relief benefits. Accordingly, a Tier II Auxiliary Lane and Pedestrian/Bicycle Overcrossing Alternative is also defined and analyzed in the Tier I/II DEIR/EA.

The Tier I corridor analysis includes three alternatives: a Tier I Corridor HOV Lane Alternative, a Tier I Corridor TSM Alternative, and a Tier I No Build Alternative. As funding becomes available, the high-priority improvements in the corridor would become subsequent incremental (Tier II) construction-level projects and would be subject to separate environmental reviews.

The Tier II corridor analysis considers an Auxiliary Lane Alternative and Pedestrian/Bicycle Overcrossing, and a No Build Alternative. The Tier II project is located between 41st Avenue and Soquel Avenue/Drive. It is anticipated that construction of the Tier II project could begin in 2019.

Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives

The Tier I HOV Lane and TSM Alternatives share many features, such as: the addition of auxiliary lanes, new pedestrian/bicycle overcrossings over Route 1, and Transportation Operations System elements. These common design features are described below.

Auxiliary Lanes

Auxiliary lanes are designed to reduce conflicts between traffic entering and exiting the highway by connecting the on-ramp of one interchange to the off-ramp of the next; they are not designed to serve through traffic. Auxiliary lanes would be constructed to improve merging operations at the locations listed below:

- Freedom Boulevard and Rio Del Mar Boulevard – northbound and southbound
- Rio Del Mar Boulevard and State Park Drive – northbound and southbound
- State Park Drive and Park Avenue – both directions in the TSM Alternative; southbound only in the HOV Lane Alternative
- Park Avenue and Bay Avenue/Porter Street – northbound and southbound
- 41st Avenue and Soquel Avenue/Drive – northbound and southbound

New Pedestrian/Bicycle Overcrossings

Both Tier I alternatives would construct new pedestrian/bicycle overcrossings of Route 1 at the following locations:

- Mar Vista Drive – The crossing would start on the north side of Route 1 and parallel the highway eastward for approximately 600 feet, doubling back westward as it climbs before crossing the highway and McGregor Drive at a right angle and then descending by switchbacks to and along Mar Vista Drive for approximately 550 feet; the final design will be determined as part of the Tier II design/environmental analysis of this facility.
- Chanticleer Avenue – The crossing would start at the Chanticleer Avenue cul-de-sac on the north side of Route 1 and run parallel the highway for approximately 400 feet to the west and then cross Route 1 and Soquel Avenue (frontage road) on a curved alignment, terminating just west of Chanticleer Avenue on the south side of the highway and Soquel Avenue (frontage road).
- Trevethan Avenue – The crossing would start on the north side of Route 1 at Trevethan Avenue and parallel the highway approximately 600 feet before crossing on an angle and continuing along the banks of the western tributary to Arana Gulch to terminate close to Harbor High School; multiple configurations are possible, with the final design to be determined as part of the subsequent design/environmental analysis of this facility.

Other Common Features of the Tier I Corridor Alternatives

The Tier I Corridor Alternatives would include reconstruction of the Santa Cruz Branch Rail Line bridges over Route 1 and the State Park Drive, Capitola Avenue, 41st Avenue, and Soquel Avenue overcrossings. The Santa Cruz Branch Line railroad underpass structures are proposed to be modified or replaced to accommodate highway widening to match the ultimate six-through-lane concept, including shoulder and sidewalk facilities to accommodate pedestrians and bicycles. These modifications will lower the highway profile to provide standard clearances. In addition the Aptos Creek Bridge would be widened.

Both build alternatives would include Transportation Operations System elements such as changeable message signs, closed-circuit television, microwave detection systems, and vehicle detection systems. In addition, ramp metering and HOV on-ramp bypass lanes with highway patrol enforcement areas would be constructed on the Route 1 ramps within the Tier I project limits; however, only the HOV Lane Alternative would include HOV lanes on the mainline.

Table 1-4 summarizes the major features of the Tier I Corridor Alternatives.

Tier I Corridor HOV Lane Alternative

The Tier I Corridor HOV Lane Alternative includes the following main components, which are discussed in detail below and are shown in Figure 1-3 and in plan view in Appendix G of the EIR/EA:

- Highway mainline to include northbound and southbound HOV lanes throughout the project limits;
- Auxiliary lanes;
- Highway interchange reconfigurations and improvements such as ramp metering, on-ramp HOV bypass lanes and California Highway Patrol enforcement areas, and stormwater drainage/treatment facilities;
- Construction of three pedestrian/bicycle overcrossings;
- Reconstruction of two Santa Cruz Branch Rail Line overcrossings in Aptos;
- Widening of the Aptos Creek Bridge;
- Replacement of the Capitola Avenue overcrossing;
- Retaining walls;
- Soundwalls; and
- Traffic signal coordination and other transportation operation system improvements.

The Tier I Corridor HOV Lane Alternative would expand the existing four-lane highway to a six through-lane facility by adding HOV lanes in both the northbound and southbound directions. HOV lanes would be constructed entirely within the existing median where possible. In those areas where the median is not wide enough to accommodate additional

lanes, widening would occur outside of the existing freeway footprint. The southernmost 1.5 miles of the freeway can accommodate an HOV lane inside the existing median. From approximately Freedom Boulevard to Soquel Drive, the existing median is not wide enough to accommodate an HOV lane, so the space needed for the additional lanes would be achieved through a combination of median conversion within existing right-of-way and acquisition of property adjacent to the freeway. Plan drawings depicting the Tier I Corridor HOV Lane Alternative are presented in Appendix G of the EIR/EA, Figures HOV-1 through HOV-20.

Table 1-4: Major Project Features
Tier I Project Alternatives

Project Features	HOV Lane Alternative	TSM Alternative	No Build Alternative
Highway Mainline Changes			
HOV lanes	X		
Lower highway profile at Santa Cruz Branch Line bridge crossings[1]	X	X	
Auxiliary Lane Improvements			
Northbound and southbound between Freedom Boulevard and Rio Del Mar Boulevard	X	X	
Northbound and southbound between Rio Del Mar Boulevard and State Park Drive	X	X	
Northbound between State Park Drive and Park Avenue		X	
Southbound between State Park Drive and Park Avenue	X	X	
Northbound and southbound between Park Avenue and Bay Avenue/Porter Street	X	X	
Northbound and southbound from 41st Avenue to Soquel Avenue/Drive	X	X	
Highway Interchange Improvements			
Reconfigure all nine interchanges within project limits	X		
Reconstruct State Park Drive, 41st Avenue, and Soquel overcrossings		X	
Ramp metering	X	X	
On-ramp HOV bypass lanes	X	X	
On-ramp California Highway Patrol enforcement areas	X	X	
Stormwater drainage and treatment facilities	X	X	
New Pedestrian/Bicycle Overcrossings			
Mar Vista Drive Crossing	X	X	
Chanticleer Avenue Crossing	X	X	
Trevethan Avenue Crossing	X	X	
Santa Cruz Branch Line Bridges Replacement	X	X	
Aptos Creek Bridge Widening	X	X	
Capitola Avenue Overcrossing Replacement	X	X	
Retaining Walls	X	X	
Soundwalls	X	X	
Traffic Signal Coordination	X	X	X
Transportation Operations System	X	X	X
Transit-Supportive Improvements	X		
1 Existing highway profile does not meet vertical clearance standards for railroad bridge crossings.			

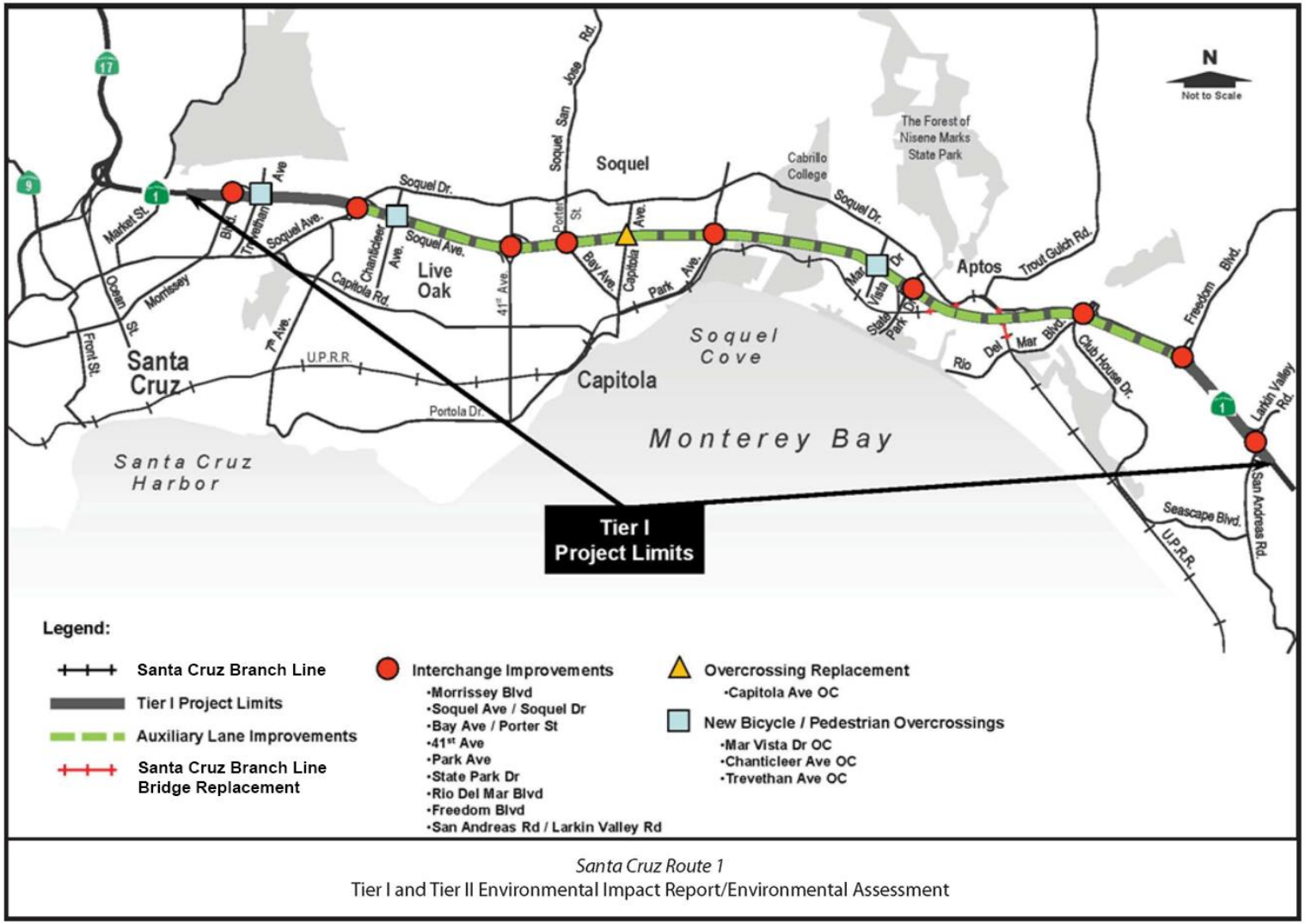


Figure 1-3: Tier I Corridor HOV Lane Alternative – Project Features

The Tier I Corridor HOV Lane Alternative would expand the existing four-lane highway to a six through-lane facility by adding HOV lanes in both the northbound and southbound directions. HOV lanes would be constructed entirely within the existing median where possible. In those areas where the median is not wide enough to accommodate additional lanes, widening would occur outside of the existing freeway footprint. The southernmost 1.5 miles of the freeway can accommodate an HOV lane inside the existing median. From approximately Freedom Boulevard to Soquel Drive, the existing median is not wide enough to accommodate an HOV lane, so the space needed for the additional lanes would be achieved through a combination of median conversion within existing right-of-way and acquisition of property adjacent to the freeway. Plan drawings depicting the Tier I Corridor HOV Lane Alternative are presented in Appendix G of the EIR/EA, Figures HOV-1 through HOV-20.

A mandatory standard median width (22 feet) set by Caltrans in its Highway Design Manual is proposed through most of the project corridor, north of Freedom Boulevard. The mandatory standard median width comprises two 10-foot-wide inside shoulders and a 2-foot-wide barrier. Where meeting the mandatory median width standard would result in acquiring property on the non-highway side of existing frontage roads, inside shoulder widths of 5 feet are proposed to reduce property requirements and impacts. Five feet is a nonstandard inside shoulder width for a Caltrans facility. This exception to shoulder-width design standards has received conceptual review in meetings between Caltrans and the project sponsor. All projects requiring design exceptions must ultimately be approved by Caltrans.

The Tier I Corridor HOV Lane Alternative would modify or reconstruct all nine interchanges within the project corridor to improve merging operations and ramp geometry by increasing the length of lanes for acceleration and deceleration, adding HOV bypass lanes and mixed-flow lanes to on-ramps, and improving sight distances. The Bay Avenue/Porter Street and 41st Avenue interchanges would be modified to operate as one interchange with frontage roads connecting the two interchanges. Where feasible, design deficiencies on existing ramps would be corrected to meet current design standards. Ramp metering and HOV bypass lanes would be provided on all Route 1 on-ramps. This alternative would include auxiliary lanes between all interchange ramps (with the exception of a northbound auxiliary lane between State Park Drive and Park Avenue) and Transportation Operations System elements, such as changeable message signs, microwave detection systems, and vehicle detection systems. Bridge structures and the Capitola Avenue overcrossing would be modified or replaced to accommodate the HOV lanes. New and widened highway crossing structures would include shoulder and sidewalk facilities to accommodate pedestrians and bicycles. The HOV Lane Alternative would include three new pedestrian/bicycle overcrossings of Route 1. The two existing Santa Cruz Branch Line structures over Route 1 in Aptos would be replaced with longer bridges at the same elevation, and the highway profile

would be lowered to achieve standard vertical clearance under the bridges to make room for the HOV and auxiliary lanes. In addition, this design configuration would reduce environmental impacts. The existing Route 1 bridge over Aptos Creek would be widened on the outside to accommodate the HOV lanes in each direction. The existing Capitola Avenue overcrossing would be replaced with a longer structure.

Retaining walls would be constructed to minimize property acquisitions and reduce environmental impacts. At locations where frontage roads are adjacent to Route 1, concrete barriers would be constructed to separate the highway and frontage road.

Changes to Highway Mainline with the Tier I Corridor HOV Lane Alternative

- Route 1 would be expanded to allow for two standard-width (12-foot) mixed-flow lanes, one standard-width (12-foot) HOV lane, and standard-width outside (10-foot) shoulders in each direction.
- The proposed lanes would be constructed within the existing 45-foot median. In locations where the existing median width is less than 45 feet, widening would occur both in the median and at the outside, generally within the existing Route 1 right-of-way.
- Where auxiliary lanes are proposed, widening by approximately 12 feet outside of the existing highway footprint would occur.
- A mandatory standard median width of 22 feet is proposed through most of the corridor.
- The highway centerline would be shifted northward in the vicinity of the Santa Cruz Branch Line crossings in Aptos to reduce impacts to wetlands. The bridge over Aptos Creek would be widened to allow for four new lanes: two HOV, two auxiliary, and pedestrian/bicycle facilities.
- Route 1 would be lowered to obtain vertical clearance at the Santa Cruz Branch Line crossings in Aptos (see Appendix G of the EIR/EA, Figures HOV-14 and HOV-15). A mandatory standard median width of 22 feet is proposed to minimize impact to the railroad bridge.
- At three locations, median and inside shoulder widths would be nonstandard to reduce impacts to adjacent streets. The three locations are: McGregor Drive, Cabrillo College Drive, and Kennedy Drive. At these three constrained locations, the inside shoulder in the constrained direction would be a nonstandard 5 feet, and the median would be a nonstandard 17 feet.

Auxiliary Lane Improvements with the Tier I Corridor HOV Lane Alternative

The auxiliary lane improvements are discussed above in Section 1.5 Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives.

Interchange Improvements with the Tier I Corridor HOV Lane Alternative

All nine interchanges within the project corridor would be modified under the Tier I Corridor HOV Lane Alternative, including overcrossing and undercrossing widening or replacement. These modifications would improve merging operations and ramp geometrics, and accessibility and safety for pedestrians and bicyclists. Major interchange improvements would include the following:

- Reconfiguration of intersections, including replacement or widening of highway overcrossings and undercrossings.
- Intersections of freeway ramps with local roads would be modified to shorten the pedestrian and bike crossing distances. Additionally, free right turns would be eliminated where feasible and traffic signals installed to improve traffic flow and slow vehicle traffic speeds through the bike and pedestrian crossing areas.
- Local roadways would be widened at the interchanges to accommodate the anticipated travel demand.
- Drainage and stormwater runoff treatment facilities would be provided.

Interchange improvements and design reconfigurations proposed for each interchange are listed in Table 1-5.

Table 1-5: Interchange Improvements and Reconfigurations
Tier I Corridor HOV Lane Alternative

Route 1 Interchange Location	Project Plan Sheet No.[1]	Tier I Corridor HOV Lane Alternative Features
San Andreas/ Larkin Valley Roads Interchange	HOV-20	The existing northbound cloverleaf off-ramp free right-turn onto Larkin Valley Road would be eliminated in favor of a signalized 90-degree intersection.
		A signalized intersection would be provided at the San Andreas Road ramps and the free right-turns would be eliminated.
		The existing on-ramps would be widened to accommodate HOV bypass lanes.
		The southbound Route 1 bridge over San Andreas/Larkin Valley Road would be widened into the median to accommodate the HOV lanes.
		San Andreas/Larkin Valley Roads would be widened within the Tier I project limits to add turn lanes.
		New sidewalks would be added along San Andreas/Larkin Valley Roads within the Tier I project limits.
Freedom Boulevard Interchange	HOV-18	The existing ramp termini at Freedom Boulevard would be modified to provide less-skewed intersections with Freedom Boulevard. These intersections would be signalized, and free right-turns would be eliminated.
		The southbound off-ramp would be widened to two exit lanes.
		The existing on-ramps would be widened to accommodate HOV bypass lanes.
		Freedom Boulevard would be widened within the Tier I project limits to add turn lanes.
		The Freedom Boulevard/Bonita Drive intersection would be enlarged to add turn lanes and achieve acceptable level of service.

Table 1-5: Interchange Improvements and Reconfigurations
Tier I Corridor HOV Lane Alternative

Route 1 Interchange Location	Project Plan Sheet No.[1]	Tier I Corridor HOV Lane Alternative Features
		The Freedom Boulevard bridge would be replaced with a wider structure that would accommodate a new turn lane on Freedom Boulevard and the new HOV lanes on Route 1.
		New sidewalks would be added along Freedom Boulevard within the Tier I project limits.
Rio Del Mar Boulevard Interchange	HOV-16	The northbound on-ramp would be realigned to form the north leg of a four-way intersection with Rio Del Mar Boulevard and the northbound off-ramp. This intersection would be signalized, and free right turns would be eliminated
		The northbound off-ramp would be widened to two exit lanes.
		The southbound ramps would be widened, the intersection with Rio Del Mar Boulevard signalized, and free right-turns eliminated.
		The existing on-ramps would be widened to accommodate HOV bypass lanes.
		Soquel Drive would be shifted northward to accommodate the roadway widening along the northbound off-ramp.
		Rio Del Mar Boulevard would be widened within the Tier I project limits to add turn lanes and a through lane in each direction.
		The Rio Del Mar Boulevard bridge over Route 1 would be replaced with a longer, wider bridge to accommodate a new turn lane and a through lane in each direction on Rio Del Mar Boulevard and the new HOV lanes on Route 1.
		Sidewalk would be added along eastbound Rio Del Mar Boulevard within the Tier I project limits; the sidewalk on westbound Rio Del Mar Boulevard would be retained.
State Park Drive Interchange	HOV-13	The existing northbound cloverleaf on-ramp free-right turn would be changed to a signalized right turn.
		The existing northbound off-ramp terminus would be modified to form, together with the realigned northbound on-ramp terminus, the south leg of a signalized intersection with State Park Drive.
		The northbound and southbound off-ramps would be widened to two exit lanes.
		The existing on-ramps would be widened to accommodate HOV bypass lanes.
		State Park Drive would be widened within the Tier I project limits to add turn lanes and a through lane in each direction.
		The State Park Drive bridge over Route 1 would be replaced with a longer, wider bridge to accommodate a new through-lane in each direction on State Park Drive and the new HOV lanes on Route 1.
		Sidewalk would be added along eastbound State Park Drive within the Tier I project limits; the sidewalk along westbound State Park Drive would be retained.
Park Avenue Interchange	HOV-10	The existing diamond interchange ramp design would be retained and ramps would be widened.
		The northbound and southbound off-ramps would be widened to two exit lanes.
		The existing on-ramps would be widened to accommodate HOV bypass lanes.
		Park Avenue would be widened within the Tier I project limits to add turn lanes.
		The two Route 1 bridges over Park Avenue would be replaced with one, wider structure to accommodate the new HOV lanes on Route 1.
		Sidewalk would be added within the Tier I project limits along westbound Park Avenue; the sidewalk along eastbound Park Avenue would be retained.

Table 1-5: Interchange Improvements and Reconfigurations
Tier I Corridor HOV Lane Alternative

Route 1 Interchange Location	Project Plan Sheet No.[1]	Tier I Corridor HOV Lane Alternative Features
Bay Avenue/ Porter Street and 41st Avenue Interchanges	HOV-7	Improvements at the Bay Avenue/Porter Street and 41st Avenue interchanges would be designed so that these two interchanges would work as a single interchange connected by a collector/frontage road running between the interchanges.
		The freeway ramps would be reconstructed to form less-skewed intersections with Bay Avenue/Porter Street.
		The existing southbound Route 1 off-ramp to Bay Avenue/Porter Street would be eliminated. Southbound traffic bound for Bay Avenue/Porter Street would exit at the 41st Avenue two-lane off-ramp and continue on a new southbound collector/frontage road to Bay Avenue/Porter Street.
		The existing two-lane on-ramp from Porter Street to northbound Route 1 would be modified to become a northbound collector/frontage road serving traffic bound for 41st Avenue or northbound Route 1.
		Northbound traffic exiting Route 1 would either bear right to intersect with Porter Street and continue north, or stay left and continue on a new structure over Porter Street, join the northbound collector/frontage road, and end at a new signalized intersection at 41st Avenue.
		At 41st Avenue, southbound on- and off-ramps would be eliminated and replaced with a diagonal off-ramp and a collector/frontage road serving traffic bound for Bay Avenue/Porter Street or southbound Route 1. The new ramp and collector/frontage road would form a signalized intersection with 41st Avenue.
		At 41st Avenue, the northbound on-ramps would be realigned.
		New on-ramps would include HOV bypass lanes.
		41st Avenue would be widened within the Tier I project limits to add turn lanes and eastbound though lanes over Route 1.
		Bay Avenue/Porter Street would be widened to add right-turn lanes at the on-ramps.
		A new bridge over Soquel Creek and Soquel Wharf Road would be constructed for the new southbound collector/frontage road from 41st Avenue to Bay Avenue/Porter Street.
		The 41st Avenue bridge over Route 1 would be replaced with a longer, wider bridge to accommodate the new eastbound through lane and turn lanes on 41st Avenue, and the new HOV lanes on Route 1. Northbound and southbound Class I bike paths would be constructed between 41st Avenue and Bay Avenue/Porter Street on either side of the new collector/frontage roads, respectively.
Soquel Avenue/ Drive Interchange	HOV-3	The northbound off-ramp would be realigned to a signalized 90-degree intersection with Soquel Drive. The existing access to Commercial Way would be eliminated.
		The westbound Soquel Drive on-ramp to northbound Route 1 would be modified to eliminate the free right-turn access.
		The existing northbound loop on-ramp from eastbound Soquel Avenue would be realigned and its free-right terminus would become a signalized 90-degree intersection.
		A new, wider southbound diagonal off-ramp that adds turn lanes at its terminus and a new loop on-ramp would form the north leg of a signalized intersection at Soquel Avenue.

Table 1-5: Interchange Improvements and Reconfigurations
Tier I Corridor HOV Lane Alternative

Route 1 Interchange Location	Project Plan Sheet No.[1]	Tier I Corridor HOV Lane Alternative Features
		The existing southbound hook on-ramp would be widened to add an HOV bypass lane and realigned to be made standard.
		The northbound and southbound off-ramps would be widened to two exit lanes.
		All new on-ramps would include HOV bypass lanes.
		Soquel Avenue within the Tier I project limits would be widened to add an eastbound through lane and turn lanes.
		Salisbury Lane would be shifted eastward to form an intersection with the realigned northbound off-ramp and loop on-ramp.
		The Soquel Drive bridge over Route 1 would be replaced with a longer, wider bridge to add an eastbound through lane and a turn lane to Soquel Drive and accommodate the new HOV lanes on Route 1.
		The culvert at Arana Gulch would be extended underneath the widened Route 1 and new southbound off-ramp.
		Sidewalk would be added along eastbound Soquel Drive within the Tier I (and Tier II) project limits; the sidewalk along westbound Soquel Drive would be retained.
Morrissey Boulevard Interchange	HOV-1	The southbound exit would be realigned to terminate at a new signalized intersection with Morrissey Boulevard.
		The existing southbound on-ramp would be eliminated and replaced with a new, wider diagonal ramp with a signalized terminus.
		The existing southbound off- and on-ramp at Elk Street would be eliminated.
		The existing northbound loop on-ramp would be eliminated, as would access to Rooney Street from this northbound loop.
		The northbound off-ramp would be widened to two exit lanes.
		New on-ramps would include HOV bypass lanes.
		Morrissey Boulevard is being replaced with a wider bridge to add an eastbound through lane and turn lanes, and realigned to form a straight line between its intersections with Fairmont Avenue and Rooney Street.
		The Morrissey Boulevard bridge is being replaced with a longer, wider bridge to accommodate a new eastbound through lane and turn lanes on Morrissey Boulevard and new HOV lanes on Route 1.
		Sidewalk would be added along eastbound Morrissey Boulevard within the Tier I project limits; the sidewalk along westbound Morrissey Boulevard would be retained.
Transit-Related Facilities	NA	Both on-ramps and both off-ramps at the reconfigured Park Avenue interchange include options for bus pads and bus shelters.
		Ramps and collectors at the Bay Avenue/Porter Street and 41st Avenue interchanges include options for bus pads and shelters.

[1] Project plan sheets are provided in Appendix G of the EIR/EA.

Transit Supportive Planning and Design

The Tier I Corridor HOV Lane Alternative would not preclude the development of the following features from being added in the future to facilitate freeway-oriented transit services and operations:

- The reconfigured Park Avenue and Bay Avenue/Porter Street/41st Avenue interchanges would allow for future bus pads and bus stop shelters to be constructed as part of a separate project.
- Future park-and-ride lots are under consideration by RTC at the Larkin Valley Road/San Andreas Road and 41st Avenue interchanges, to be coordinated with the bus facilities as part of a future project.

The aforementioned features are not part of the proposed project and would be subject to future environmental clearance. The proposed Tier I project is simply taking into consideration potential future transit projects as a collaborative planning effort.

New Pedestrian/Bicycle Overcrossings

The proposed pedestrian/bicycle overcrossings are discussed above in Section 1.5 Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives.

Tier I Corridor TSM Alternative

The Tier I Corridor TSM Alternative was formulated to provide Route 1 improvements that would partially address the purpose and need, and could be achieved at lower cost and with fewer impacts than the Tier I Corridor HOV Lane Alternative. TSM strategies typically consist of improvements that can benefit the operations of existing facilities without increasing the number of through lanes.

As discussed in Section 1.5 Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives, the Tier I Corridor TSM Alternative proposes to add auxiliary lanes, ramp metering and HOV on-ramp bypass lanes; improve existing nonstandard geometric elements at various ramps; and incorporate other TSM elements, such as changeable message signs, closed circuit television, microwave detection systems, and vehicle detection systems.). In short, the TSM Alternative shares many of the Tier I Corridor HOV Lane Alternative features, except HOV lanes would not be constructed along the mainline and the Soquel Drive interchange would be the only interchange reconfigured. Plan drawings depicting the TSM Alternative are presented in Appendix H of the EIR/EA, Figures TSM-1 through TSM-20. An overview of the major features of the TSM Alternative is provided in Figure 1-4 and in plan view in Appendix H of the EIR/EA.

Auxiliary Lanes

The majority of auxiliary lane improvements are discussed above in Section 1.5 Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives. In addition, the TSM

Alternative would have both a southbound and northbound auxiliary lane between State Park Drive and Park Avenue — improvements that are not included in the HOV Lane Alternative.

Interchange Improvements

Improvements to interchanges proposed under the Tier I Corridor TSM Alternative include the following:

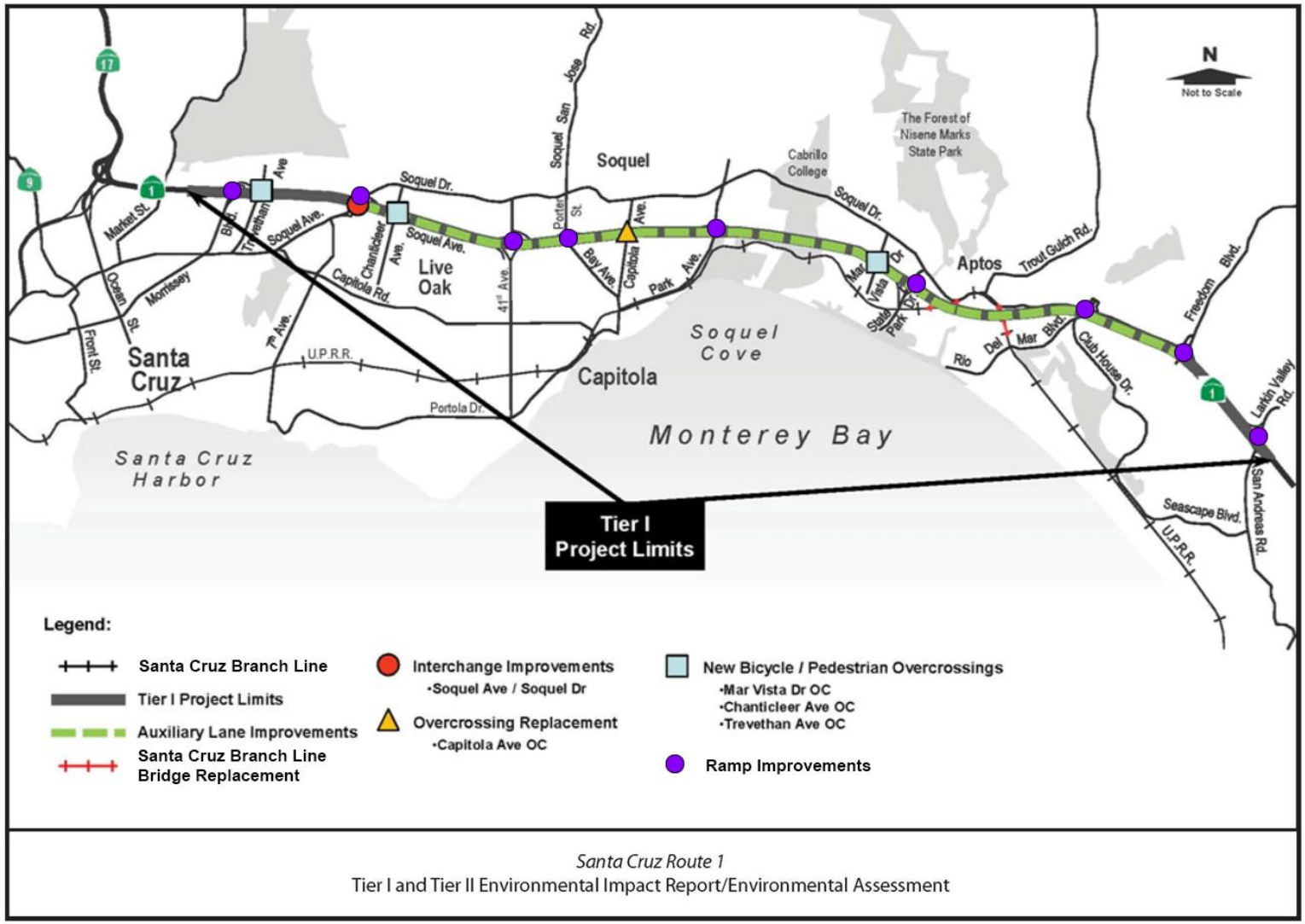
- The Soquel Avenue northbound off-ramp from Route 1 would be realigned and widened from one to two exit lanes for a distance of approximately 1,300 feet, widening to four lanes at its intersection with Soquel Drive. The northbound off-ramp/Commercial Way connection would be eliminated, and Commercial Way would become a cul-de-sac north of the realigned ramp. The intersection of the northbound off-ramp with Soquel Drive would be enlarged to achieve an acceptable level of service for the anticipated traffic volume.
- Improve existing nonstandard geometric elements at various ramps.
- Provide HOV bypass lanes on all except northbound Morrissey Boulevard on-ramps.
- Add California Highway Patrol enforcement areas at on-ramps with HOV bypass lanes.

New Pedestrian/Bicycle Overcrossings

The proposed pedestrian/bicycle overcrossings are discussed above in Section 1.5 Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives.

Other Improvements

The details of the other improvements are included above in Section 1.5 Common Design Features of the Tier I Corridor HOV Lane and TSM Alternatives.



Santa Cruz Route 1
Tier I and Tier II Environmental Impact Report/Environmental Assessment

Figure 1-4: Tier I Corridor TSM Alternative – Project Features

Tier II Auxiliary Lane Alternative

The Tier II Auxiliary Lane Alternative would construct northbound and southbound auxiliary lanes on Route 1 from 41st Avenue to Soquel Drive and make other improvements, as discussed below. Figure 1-5 shows features of the Auxiliary Lane Alternative, and Appendix I of the EIR/EA provides a plan view of the proposed Tier II project. To construct the Auxiliary Lane Alternative, right-of-way would be acquired along Soquel Avenue west of Chanticleer Avenue and at the Chanticleer Avenue cul-de-sac north of Route 1 to accommodate the bicycle/pedestrian overcrossing.

Auxiliary Lanes

The Tier II Auxiliary Lane Alternative proposes to widen Route 1 by adding an auxiliary lane in both the northbound and southbound directions between the 41st Avenue and Soquel Avenue/Drive interchanges. The total roadway widening would be approximately 1.4 miles in length. Southbound, the auxiliary lane would begin at the existing Soquel Avenue on-ramp and end at the existing off-ramp to 41st Avenue. Northbound, the auxiliary lane would begin just south of the 41st Avenue overcrossing, at the existing loop on-ramp from northbound 41st Avenue. North of the overcrossing, the on-ramp from 41st Avenue to northbound Route 1 would merge with the new auxiliary lane, approximately 1,000 feet downstream from the loop ramp.

The new auxiliary lanes would be 12 feet wide. In the southbound direction, the width needed for the new lane would be added in the median, and the median barrier would be shifted approximately 5 feet toward the northbound side of the freeway to make room for the new lane and a standard 10-foot-wide shoulder. Where the new southbound lane meets the existing ramps, outside shoulder widening would occur to achieve standard 10-foot-wide shoulders. In the northbound direction, the Tier II project proposes to pave a 10-foot-wide median shoulder and widen to the outside to add the 12-foot-wide auxiliary lane and a new 10–foot-wide shoulder.

As part of the widening in the northbound direction, the Tier II project proposes to repair an existing pavement failure in the outside lane and shoulder by improving the pavement section, installing a retaining wall and, if necessary, replacing the underlying County-owned sanitary sewer line crossing Route 1. A new concrete median battier would also be constructed.

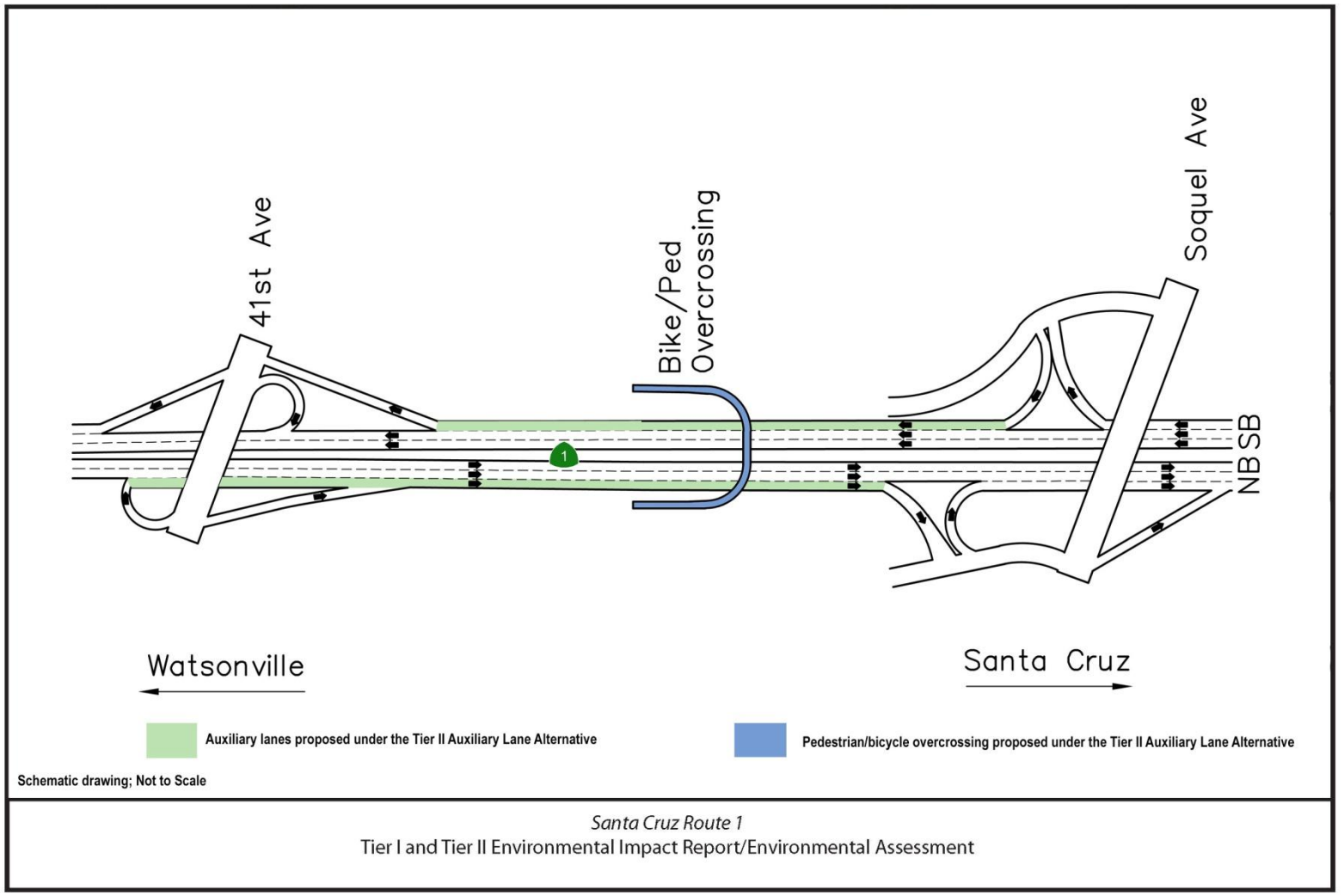


Figure 1-5: Tier II Auxiliary Lane Alternative – Project Features

Pedestrian/Bicycle Overcrossing

A new horseshoe-shaped pedestrian overcrossing is proposed over Route 1 at Chanticleer Avenue.[1] The overcrossing would vary in width from 14 feet along the ramps to 16 feet around the curves. Ramps from Chanticleer Avenue up to the overcrossing would be at approximately a 5 percent grade. Up to where the overcrossing exceeds approximately 10 feet in height, the ramp would be built on
retained fill; beyond that point, the bridge would rest on columns along the north right-of-way of Route 1, in the Route 1 median, behind the curb between Route 1 and Soquel Avenue, and along the south side of Soquel Avenue. The design of the ramps and bridge would include architectural texture or other aesthetic treatment. (See Section 2.16 for a visual simulation of the proposed Chanticleer Avenue pedestrian/bicycle overcrossing.)

In addition, a new 360-foot-long by 6-foot-wide sidewalk would be constructed along the south side of Soquel Avenue, starting at Chanticleer Avenue. The sidewalk would be separated from the street by a 4-foot-wide strip.

Retaining Walls

Retaining walls would be constructed as part of the roadway widening, with four separate walls: three on the north side of Route 1 and one on the south side. One of the retaining walls would start after the 41st Avenue on-ramp and extend approximately 150 feet; two other retaining walls on the northbound side would be 375 and 408 feet. On the southbound side, a 350-foot-long wall would be constructed along the highway mainline and Soquel Avenue, over the Rodeo Gulch culvert.

Three of the walls would be located to allow widening for an additional mainline lane on Route 1 in each direction in the future. The wall proposed along the northbound on-ramp at 41st Avenue would have to be demolished and replaced if the highway were to be widened in the future. Two of the walls would span Rodeo Creek Gulch, where there is an existing 9-foot arch concrete culvert, and one would be constructed within a narrow jurisdictional wetland area on the northbound side of Route 1, adjacent to a 39-inch culvert crossing.

No Build Alternative

The No Build Alternative offers a basis for comparing the effects of the Tier I Corridor Alternatives and the Tier II Auxiliary Lane Alternative with doing none of the proposed improvements. The No Build Alternative assumes there would be no major construction on Route 1 through the Tier I project limits other than currently planned and programmed improvements and continued routine maintenance. The following planned and programmed

[1] The overcrossing at Chanticleer is included in both the Tier I and Tier II Projects. The Tier I program of improvements encompasses the current Tier II Auxiliary Lane Project, which has been identified as the first phase of the overall program of improvements.

improvements included in the No Build Alternative are contained in the 2010 Regional Transportation Plan:

- Construction of auxiliary lanes between the Soquel Drive and Morrissey Boulevard interchanges for the Soquel to Morrissey Auxiliary Lanes Project; construction completed in December 2013.
- Replacement of the La Fonda Avenue overcrossing of Route 1, included as part of the Soquel to Morrissey Auxiliary Lanes project; construction completed in 2013.
- Reconstruction of bridges and addition of a merge lane in each direction between Highway 17 and the Morrissey/La Fonda area for the Highway 1/17 Merge Lanes Project; construction completed in 2008.
- Installation of median barrier on Route 1 from Freedom Boulevard to Rio Del Mar Boulevard.

Improvements of roadways and roadsides on Rio Del Mar Boulevard from Esplanade to Route 1, which includes the addition of bike lanes, transit turnouts, left-turn pockets, merge lanes, and intersection improvements. Roadwork includes major rehabilitation and ongoing maintenance. If the No Build Alternative is selected, it is highly likely that other improvements could be expected in the future.

Table of Contents

Executive Summary v
1 General Description 1
1.1 Project Description 1
1.2 Project History 1
1.3 Project Alternatives 2
1.3.1 Tier I Alternatives 2
1.3.2 Tier II Alternative 13
1.4 Need for Project 14
1.4.1 Tier I Project 14
1.4.2 Tier II Project 14
1.5 Creek, Stream, and River Crossings 17
1.5.1 Tier I Project 17
1.5.2 Tier II Project 18
1.6 Bridge Numbers 18
1.6.1 Tier I Project 18
1.6.2 Tier II Project 18
1.7 Geographical References 18
1.8 Traffic 19
1.9 Traffic Interruptions for Base Flood (Q_{100}) 21
2 Hydrologic and Hydraulic Data 22
2.1 Federal Emergency Management Agency Data 22
2.1.1 Tier I Project 22
2.1.2 Tier II Project 23
2.2 Map of Floodplain 23
2.2.1 Tier I Project 23
2.2.2 Tier II Project 24
2.3 Estimating Design Discharge 24
2.3.1 Tier I Project 24
2.3.2 Tier II Project 25
2.4 Hydraulic Assessment 25
2.5 Description of Flood Sources 26
3 Project Evaluation 31
3.1 Tier I Project 31
3.1.1 Nobel Creek and Rodeo Creek Gulch 31
3.1.2 Aptos Creek and Soquel Creek 31
3.1.3 Creeks Outside of Floodplain 31
3.1.4 Arana Gulch 31
3.1.5 Increase in Impervious Surfaces 33
3.1.6 Risk Associated with Implementation of the Action 35
3.1.7 Impacts on Natural and Beneficial Floodplain Values 36
3.1.8 Support of Probable Incompatible Floodplain Development 41
3.1.9 Measures to Minimize Floodplain Impacts Associated with the Action 41

3.1.10 Measures to Restore and Preserve the Natural and Beneficial Floodplain Values Impacted by this Action 45
3.1.11 Practicability of Alternatives to Any Significant Encroachments 45
3.1.12 Practicability of Alternatives to any Longitudinal Encroachments 46
3.1.13 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies 46
3.2 Tier II Project 46
3.2.1 Soquel Creek and Rodeo Creek Gulch 46
3.2.2 Arana Gulch 47
3.2.3 Increase in Impervious Surfaces 47
3.2.4 Risk Associated with Implementation of the Action 47
3.2.5 Impacts on Natural and Beneficial Floodplain Values 48
3.2.6 Support of Probable Incompatible Floodplain Development 49
3.2.7 Measures to Minimize Floodplain Impacts Associated With the Action 49
3.2.8 Measures To Restore and Preserve the Natural and Beneficial Floodplain Values Impacted By This Action 49
3.2.9 Practicability of Alternatives to Any Significant Encroachments 49
3.2.10 Practicability of Alternatives to Any Longitudinal Encroachments 49
3.2.11 Coordination with Local, State, and Federal Water Resources And Floodplain Management Agencies 49
4 References 50

Figures

Figure 1. Location Map 15
Figure 2. Vicinity Map and Waterway Crossings 16
Figure 3. Aptos Creek Watershed 28
Figure 4. Soquel Creek, Nobel Creek, and Tannery Gulch Watersheds 29
Figure 5. Arana Gulch, Rodeo Creek Gulch, and Soquel Creek Watersheds 30

Tables

Table 1. Drainage Facilities at Waterway Crossings – Tier I Project 17
Table 2. Datum Shifts 19
Table 3. Weekday Average Daily Traffic Volumes 20
Table 4. Hydraulic Data 22
Table 5. Increased Impervious Areas for the High Occupancy Vehicle Lane Alternative - Tier I Project 34
Table 6. Increased Impervious Areas for the Transportation System Management Alternative – Tier I Project 34
Table 7. Jurisdictional Waters/Wetlands within the Biological Study Area - High Occupancy Vehicle Alternative under Tier I Project 38
Table 8. Jursidictional Waters/Wetlands within the Biological Study Area - Transportation System Management Alternative under Tier I Project 39
Table 9. Designated Floodplain Areas Within Jurisdictional Areas of the Tier I Project. 40

Table 10. Undersized Culverts at Waterway Crossings – Tier I Project....41
Table 11. Surface Area of Natural and Beneficial Floodplain Encroachment - Tier I Project....44
Table 12. Increased Impervious Areas - Tier II Project....47
Table 13. Jurisdictional Waters/ Wetlands within the Tier II Project Biological Study Area....48
Table 14. Designated Floodplain Areas Within Jurisdictional Areas of the Tier II Project....48

Photos

Photo 1. Tributary to Arana Gulch at Holway Drive crossing....E-2
Photo 2. Tributary to Arana Gulch....E-2
Photo 3. Arana Gulch (downstream)....E-3
Photo 4. Arch culvert at Arana Gulch (downstream)....E-3
Photo 5. Arch culvert at Arana Gulch (downstream)....E-3
Photo 6. Rodeo Creek Gulch (downstream)....E-4
Photo 7. Rodeo Creek Gulch (upstream)....E-4
Photo 8. Rodeo Creek Gulch (downstream)....E-4
Photo 9. Concrete bags at base of bridge footing at Soquel Creek....E-4
Photo 10. Concrete bags at base of bridge footing at Soquel Creek....E-5
Photo 11. Soquel Creek....E-5
Photo 12. Bridge piers at Soquel Creek....E-6
Photo 13. Bridge at Soquel Creek....E-7
Photo 14. Soquel Creek (upstream)....E-7
Photo 15. Soquel Creek....E-7
Photo 16. Concrete box culvert at Nobel Creek (downstream)....E-8
Photo 17. Nobel Creek (downstream)....E-8
Photo 18. Nobel Creek (upstream)....E-9
Photo 19. Energy dissipater at unnamed tributary to Tannery Gulch....E-10
Photo 20. Debris at unnamed tributary to Tannery Gulch....E-10
Photo 21. Tannery Gulch (downstream)....E-11
Photo 22. Tannery Gulch (upstream)....E-11
Photo 23. Borregas Creek (downstream)....E-12
Photo 24. Storm drain leading to Borregas Creek (upstream)....E-12
Photo 25. Borregas Creek (upstream)....E-12
Photo 26. Aptos Creek....E-13
Photo 27. Scour at Aptos Creek near footing....E-13
Photo 28. Bridge 36-0011 at Aptos Creek....E-13
Photo 29. Scour at Aptos Creek....E-14
Photo 30. Aptos Creek....E-14
Photo 31. Homes adjacent to Aptos Creek....E-15
Photo 32. Valencia Channel (at outlet)....E-16
Photo 33. Valencia Lagoon....E-17

Appendices

Appendix A Summaries of Floodplain Encroachment
- Appendix A.1 High Occupancy Vehicle Lane Alternative – Tier I Project
- Appendix A.2 Transportation System Management Alternative – Tier I Project
- Appendix A.3 Build Alternative – Tier II Project

Appendix B Federal Emergency Management Agency Flood Insurance Rate Maps

Appendix C Hydrologic Data
- Appendix C.1 Rainfall Intensity Curve
- Appendix C.2 Isopleths

Appendix D Arana Gulch HEC-RAS Summary

Appendix E Project Photographs

Executive Summary

The purpose of the State Route (Route) 1 High Occupancy Vehicle Lane Widening Project is to improve safety, reduce congestion, encourage carpooling, and increase the use of alternative transportation modes as a means of increasing transportation system capacity. The Route 1 High Occupancy Vehicle Lane Widening Project will be separated into Tier I and Tier II portions in the Environmental Document. The Tier I portion of the document analyzes two build alternatives and a no-build alternative for the 8.9-mile (14.3-kilometer) corridor at a program level. The Tier II portion analyzes a build alternative and a no-build alternative for a construction level project on Route 1 between 41st Avenue and Soquel Drive.

Tier I Project

The proposed Tier I Project limits begin on the southerly end of the Larkin Valley Road/San Andreas Road interchange and extend to the northerly end at the Morrissey Boulevard interchange, between Route 1 post miles R7.24 and 16.13 in Santa Cruz County. Two build alternatives are currently under consideration under the Tier I Project: the Transportation System Management Alternative and the High Occupancy Vehicle Lane Alternative. The High Occupancy Vehicle Lane Alternative includes all elements of the Transportation System Management Alternative, but it also proposes to widen the existing highway by adding new high occupancy vehicle lanes in the median.

The Tier I project encompasses 15 creek crossings, two of which are bridges and 13 of which are culverts. Within the Tier I project limits, five areas are within delineated floodplains defined by the Federal Emergency Management Agency: Aptos Creek, Nobel Creek, Soquel Creek, Rodeo Creek Gulch, and Arana Gulch. Impacts to the floodplains will depend on the amount and nature of widening for the two alternatives. Under both build alternatives, the Aptos and Soquel creek bridges would be widened, and the culverts at Arana Gulch, the tributary to Tannery Gulch, and at the tributary to Arana Gulch would need to be replaced with larger sizes or parallel systems. The culverts at the tributary to Arana Gulch and the tributary to Tannery Gulch are both outside of floodplain areas. In general, impacts to the floodplains would be greater for the High Occupancy Vehicle Lane Alternative than for the Transportation System Management Alternative because there would be more roadway widening for the High Occupancy Vehicle Lane Alternative. However, the Tier I project, under both build alternatives, would not pose a significant risk by widening Route 1. The increase in roadway runoff will be minimal in comparison to the overall watersheds of the creeks for both build alternatives (less than 0.96%). Therefore, there would be an insignificant change in the water surface elevation to the five identified floodplain areas due to the widening proposed for both build alternatives. The roadway elevations are higher than the 100-year water surface elevation at the crossings, except at Arana Gulch. Under both alternatives, the impacts to the 100-year water surface elevation at Arana Gulch would be insignificant. There would be no traffic interruptions on Route 1 due to base flooding at Aptos Creek, Nobel Creek, Soquel Creek, and Rodeo Creek Gulch. The Flood Insurance Rate Map indicates that the base flood would overtop Route 1 at the Arana Gulch crossing, which could cause traffic interruptions. However, traffic could utilize frontage

roads and local streets (such as La Fonda Avenue) that are not inundated by the base flood.

It is anticipated that the Tier I project would impact the natural and beneficial floodplain values at three locations within the Tier I project limits: Aptos Creek, Soquel Creek, and Arana Gulch. Impacts to the floodplain would depend on the amount and nature of widening for the two alternatives. In general, impacts to the natural and beneficial floodplain values would be greater for the High Occupancy Vehicle Lane Alternative than the Transportation System Management Alternative because there would be more roadway widening for the High Occupancy Vehicle Lane Alternative. The measures to restore and preserve the natural and beneficial floodplain values are common to both build alternatives. Environmental impacts could result from activities during construction as well as after construction. Design Pollution Prevention and Permanent Treatment Best Management Practices, if needed, would be included as design features to address environmental impact concerns. Examples of these measures include, but are not limited to, revegetation or protection with environmentally sensitive fencing, implementation of best management practices, and compliance with the requirements of the Tier I project permit conditions.

To further minimize impacts of the Tier I project to the existing floodplains, the design of the bridge widenings at Aptos and Soquel creeks and the culvert improvements at Arana Gulch, the tributary to Arana Gulch, and the tributary to Tannery Gulch would be such that the loss of local floodplain storage would be minimized. Cross culverts would be upsized, as necessary, to accommodate increased peak storm water runoff from the roadway. The use of better end treatments, such as wingwalls and rock slope protection, would be considered at culvert crossings where culvert improvements are proposed to improve hydraulics.

Appropriate best management practices are proposed for the Tier I project to minimize storm water impacts during construction and permanently by reducing storm water runoff velocities and promoting infiltration. Permanent stormwater treatment, design pollution prevention, and construction site best management practices were considered for this Tier I project.

The goal of the Tier I project is to reduce congestion and delay and encourage ridesharing and transit use. The Tier I project has considered practicable alternatives to minimize environmental impacts while trying to accomplish its purpose. Both build alternatives under the Tier I project would maintain the existing alignment and profile to minimize environmental impacts, while also minimizing cost and accomplishing transportation goals.

Tier II Project

The Tier II project is located on Route 1 between 41st Avenue and Soquel Avenue, between Route 1 post miles 13.5 and 14.9 in Santa Cruz County. The Tier II portion of

the environmental documentation examines a project-level build alternative and a no build alternative.
The proposed features of the Tier II project that would have the potential to impact the floodplains would be the widening that is associated with the addition of the auxiliary lanes, and the retaining walls that would also be constructed as part of the roadway widening.

There is one waterway crossing within the Tier II project limits: the Rodeo Creek Gulch crossing, which is a 106-inch concrete arch culvert. Although they are outside of the Tier II project limits, Soquel Creek and Arana Gulch would also receive runoff from the Tier II project because of the existing topography. The Tier II project would add impervious areas that would affect three streams: Soquel Creek, Rodeo Creek Gulch, and Arana Gulch. Floodplains are associated with these three streams. Based on available information, the improvements proposed for the Tier II project would not result in an encroachment on the floodplains at Soquel Creek, Rodeo Creek Gulch, or Arana Gulch.

The increase in roadway runoff resulting from the Tier II project would be minimal in comparison to the overall watersheds of the creeks. Therefore, there would be an insignificant change in the water surface elevation to the three identified floodplain areas as a result of the Tier II project. The level of risk associated with the Tier II project is low. The Tier II project is not anticipated to have significant impacts because the added impervious areas resulting from the Tier II project would not significantly increase the flow, or raise the water surface elevations of the base floodplains. The Tier II project would not support incompatible floodplain development.

The Tier II project would not have the potential to impact natural and beneficial floodplain values because the widening would be outside of the floodplains. Because impacts to natural and beneficial floodplain values are not anticipated, measures to restore and preserve these areas are not proposed.

Because impacts to the floodplains are not anticipated, measures to minimize floodplain impacts are not proposed.

The Tier II project would not modify the extents and elevation of the 100-year base floodplain within the Tier II project vicinity. Because the Tier II project is not considered a significant encroachment, other alternatives were not considered.

Because the Tier II project improvements would be perpendicular to the direction of flow and not considered a longitudinal encroachment, other alternatives were not considered.

Floodplain map revisions are not anticipated due to the low level of risk associated with the Tier II project and because the increases in the base floodplain elevations are negligible.

1 GENERAL DESCRIPTION

This Location Hydraulic Study Report presents the floodplain risk assessment resulting from the Route 1 High Occupancy Vehicle Lane Widening Project. The purpose of this report is to assess the environmental consequences and propose avoidance, minimization and mitigation measures for the Tier I/II project portions.

1.1 Project Description

The California Department of Transportation, in cooperation with the Federal Highway Administration and the Santa Cruz County Regional Transportation Commission, proposes to improve State Route 1 (Route 1) in Santa Cruz County for a distance of approximately 8.9 miles, from approximately 0.4 miles south of the San Andreas-Larkin Valley Road Interchange through the Morrissey Boulevard Interchange. Figure 1 provides a project location map. Figure 2 displays the project limits.

1.2 Project History

Route 1 is the primary route connecting communities in Santa Cruz County and is the only continuous commuter route linking Watsonville, Capitola, Aptos, Cabrillo College, Santa Cruz and the University of California at Santa Cruz. Approximately one quarter of commuters using Route 1 continue on Route 17 to jobs in Santa Clara County. Route 1 also is the southern terminus for Routes 9 and 17, which bring heavy tourist traffic to coastal destinations in Santa Cruz and Monterey Counties. Route 1 between San Andreas Road and the Route 1/Route 17 interchange is a four-lane divided freeway with a median varying in width from 8.2 to 62.6 feet. Within the project limits there are nine interchanges, two overcrossings, and two Santa Cruz Branch Rail Line overpass bridge structures.

The population of Santa Cruz County has doubled in the last 30 years to approximately 270,000. During this time, operational improvements have been made to the route within the Project limits, but no capacity enhancements, and this segment of Route 1 has become heavily congested during morning and evening commute times. Heavy congestion is now experienced on weekdays on Route 1 for three and a half hours in the morning from 6:30 a.m. to 10 a.m. and for four and a half hours in the evening from 2 p.m. to 6:30 p.m. Traffic projections for the No-Build scenario in design year 2035 show that from 6:00 a.m. to noon, the corridor would operate at Level of Service (LOS) F in the northbound direction. From 2:00 p.m. to 8:00 p.m., the corridor would operate at LOS F in both directions. The average northbound travel time in the AM peak hour would be as high as 59 minutes, up from 23 minutes under existing conditions. Travel time for the southbound direction during the PM peak hour would average 61 minutes, up from 27 minutes under existing conditions. In the peak commute direction in 2035 for the No-Build scenario, the average travel speed would drop from 44 mph to 18 mph in the AM and from 39 mph to 15 mph in the PM (*State Route 1 HOV Lane Project [From Morrissey Boulevard to San Andreas Road] Traffic Operations Report*, April 2012, Wilbur Smith Associates).

This project uses a "tiered" approach to its environmental documentation. Tiering is a staged approach that addresses broad programs and issues related to the entire corridor in the Tier I analysis. As specific projects within the corridor are ready for implementation, impacts of that action are evaluated in subsequent Tier II studies. The tiered process supports decision making on issues that are ripe for decision and provides a means to preserve those decisions. The Tier I portion of the project documentation provides fact-based analyses that supports informed decision making on the 8.9-mile corridor and discloses issues associated with the selection of a Tier I Corridor alternative. Identification of a Tier I Corridor alternative will not result directly in construction; however, it will provide the basis for decision makers to select a program of transportation improvements within the corridor.

The Tier II portion of the environmental documentation examines a project-level Auxiliary Lane Alternative and a No-Build Alternative. The Tier II corridor segment is within the project limits of the Tier I corridor and would represent the first implementation phase of transportation improvements for the 8.9-mile corridor. As mentioned above, all Tier II corridor projects will be subject to separate environmental review.

1.3 Project Alternatives

1.3.1 Tier I Alternatives

The three Tier I alternatives currently under consideration are the High Occupancy Vehicle Lane Alternative, the Transportation System Management Alternative, and the No-Build Alternative.

Common Design Features of the Build Alternatives
The High Occupancy Vehicle Lane Alternative shares three primary sets of features with the Transportation System Management Alternative: new auxiliary lanes, new pedestrian/bicycle overcrossings of Route 1, and Transportation Operations System electronic equipment. These common design features are highlighted here, but the auxiliary lanes are discussed in detail within the separate description of each alternative, since specifics vary.

Auxiliary Lanes
Auxiliary lanes would be constructed in the following locations under either the High Occupancy Vehicle Lane or Transportation System Management Alternative:

- Freedom Boulevard and Rio Del Mar Boulevard – northbound and southbound.
- Rio Del Mar Boulevard and State Park Drive – northbound and southbound.
- State Park Drive and Park Avenue – both directions in the Transportation System Management Alternative; southbound only in the High Occupancy Vehicle Alternative.

- Park Avenue and Bay Avenue/Porter Street – northbound and southbound.
- 41st Avenue and Soquel Avenue/Soquel Drive – northbound and southbound.

New Bicycle/Pedestrian Overcrossings
Both build alternatives include construction of new bicycle/pedestrian overcrossings of Route 1 at Mar Vista Drive and Trevethan Avenue, as described under the High Occupancy Vehicle Lane Alternative.

Other Common Features of the Build Alternatives
Both the High Occupancy Vehicle Lane and Transportation System Management alternatives include installation of ramp metering and construction of High Occupancy Vehicle bypass lanes on the Route 1 on-ramps within the project limits. Under the Transportation System Management Alternative, however, no new High Occupancy Vehicle lanes would be incorporated into the freeway mainline. Highway Patrol enforcement areas would be included with the new High Occupancy Vehicle bypass lanes.

Both build alternatives would include reconstruction of the Santa Cruz Branch Rail Line bridges over Route 1 and the State Park Drive, Capitola Avenue, 41st Avenue and Soquel Avenue overcrossings. Also, under both alternatives, the Aptos Creek and Soquel Creek bridges would be widened.

Both the High Occupancy Vehicle Lane and Transportation System Management alternatives also would include Transportation Operations System equipment, described in detail within each alternative description.

1.3.1.1 High Occupancy Vehicle Lane Alternative

The High Occupancy Vehicle Lane Alternative would widen the existing four-lane highway to a six-lane facility by adding a High Occupancy Vehicle lane next to the median in both the northbound and southbound directions. Along the southern portion of the project, the existing median generally is wide enough to add the new High Occupancy Vehicle lanes within the existing right-of-way. A mandatory standard median width (22 feet) would be used through most of the corridor, north of Freedom Boulevard. Where existing frontage roads would be impacted, non-standard inside shoulder widths of 5 feet are proposed to reduce right-of-way requirements and impacts. Such non-standard design features will require design exceptions when they are part of Tier II project. In some locations, widening would extend outside the existing state right-of-way.

The High Occupancy Vehicle Lane Alternative would modify or reconstruct all nine interchanges within the project limits to improve merging operations and ramp geometrics, lengthen acceleration and deceleration lanes, and improve sight distances. The Bay Avenue/Porter Street and 41st Avenue interchanges would be modified to operate as one interchange with a frontage road connecting the two interchanges. Where feasible, design deficiencies on existing ramps would be corrected to meet current design

standards. Ramp metering and High Occupancy Vehicle bypass lanes would be provided on all Route 1 on-ramps. The High Occupancy Vehicle Lane Alternative would include auxiliary lanes between interchange ramps and Transportation Operations System electronic equipment, such as changeable message signs, closed-circuit television, microwave detection systems and vehicle detection systems as also described under the Transportation System Management Alternative – with the exception that an auxiliary lane would not be constructed northbound between State Park Drive and Park Avenue.

Bridge structures and the Capitola Avenue Overcrossing would be modified or replaced to accommodate the new High Occupancy Vehicle lanes. New and widened highway crossing structures would include shoulder and sidewalk facilities to accommodate pedestrians and bicycles. The High Occupancy Vehicle Lane Alternative would include two new pedestrian/bicycle overcrossings of Route 1. The existing Santa Cruz Branch Rail Line structures would be replaced, not relocated or raised, to minimize environmental impacts. The Route 1 bridge over Aptos Creek would be widened on the outside to accommodate the new High Occupancy Vehicle lanes.

Retaining walls would be constructed to minimize right-of-way acquisition and reduce or avoid environmental impacts. At locations where frontage roads are adjacent to Route 1, concrete barriers would be constructed to separate the two facilities and minimize right-of-way acquisition. The project also would include demolition and disposal, excavation, borrow and fill, sound walls, right-of-way acquisition, and temporary easements.

Mainline Improvements with the High Occupancy Vehicle Lane Alternative

- Route 1 would be widened to allow for two standard width (12 feet) mixed-flow lanes, one standard width (12 feet) High Occupancy Vehicle lane and standard outside (10 foot) shoulders.
- The proposed widening would be constructed into the median where the existing median width is over 45 feet. Where the existing median width is less than 45 feet, the required widening would be both into the median and at the outside shoulder, but generally within the existing Route 1 right-of-way.
- Where auxiliary lanes are proposed, widening to the outside would be increased by approximately 12 feet.
- A mandatory standard median width of 22 feet is proposed through most of the corridor.
- The highway centerline would be shifted northward in the vicinity of the Santa Cruz Branch Rail Line crossings to reduce impacts to wetlands. The bridge over Aptos Creek would be widened.
- Route 1 would be lowered to obtain vertical clearance at the Santa Cruz Branch Rail Line crossings in Aptos. A mandatory standard median width of 22 feet is proposed to minimize impacts to the Union Pacific Railroad.

- Median and inside shoulder width would be non-standard to reduce impacts to adjacent streets: McGregor Drive, Cabrillo College Drive, Kennedy Drive and Soquel Avenue. At these four constrained locations, the inside shoulder would be a non-standard 5 feet and the median a non-standard 17 feet.

Auxiliary Lane Improvements with the High Occupancy Vehicle Lane Alternative
Auxiliary lanes are designed to reduce conflicts between traffic entering and exiting the highway by connecting from the on-ramp of one interchange to the off-ramp of the next; they are not designed to serve through traffic. Auxiliary lanes would be added at the following locations:

- Northbound and southbound between Freedom Boulevard and Rio Del Mar Boulevard;
- Northbound and southbound between Rio Del Mar Boulevard and State Park Drive;
- Southbound between State Park Drive and Park Avenue;
- Northbound and southbound from Park Avenue to Bay Avenue/Porter Street; and
- Northbound and southbound from 41st Avenue to Soquel Drive/Soquel Avenue.

Interchange Improvements with the High Occupancy Vehicle Lane Alternative
All interchanges within the project limits would be modified to improve merging operations and ramp geometrics, and to improve accessibility and safety for pedestrians and bicyclists.

Interchange improvements would generally include the following:

- Ramp metering and High Occupancy Vehicle bypass lanes would be provided on all on-ramps.
- Ramps would be widened and their geometrics improved where feasible.
- California Highway Patrol enforcement areas would be provided at all on-ramps except Park Avenue, southbound.
- Intersections of freeway ramps with local roads would be modified to provide less-skewed intersections with crosswalks for pedestrians and bicycles; free right-turns would be eliminated where feasible and traffic signals installed.
- Local roadways would be widened at the interchanges to serve anticipated travel demand.
- Retaining walls would be constructed to minimize impacts to local roadways, development, wetlands, and waterways.
- Drainage facilities would be provided for adequate drainage and treatment of storm water runoff.

- Other specific improvements are identified by interchange area.

Changes at San Andreas/Larkin Valley Roads Interchange

- The existing northbound cloverleaf off-ramp free right-turn onto Larkin Valley Road would be eliminated in favor of a signalized 90 degree intersection.
- A signalized intersection would be provided at the San Andreas Road ramps and the free right-turns eliminated.
- The existing on-ramps would be widened to accommodate High Occupancy Vehicle bypass lanes.
- The southbound Route 1 bridge over San Andreas/Larkin Valley Road would be widened approximately 16.4 feet into the median to accommodate the High Occupancy Vehicle lanes.
- San Andreas/Larkin Valley Roads would be widened within the project limits to add turn lanes.
- New sidewalks would be added along San Andreas/Larkin Valley Roads within the project limits.
-

Changes at Freedom Boulevard Interchange

- The existing ramp termini at Freedom Boulevard would be modified to provide less-skewed intersections with Freedom Boulevard. These intersections would be signalized, and free right-turns eliminated.
- The southbound off-ramp would be widened to two exit lanes.
- The existing on-ramps would be widened to accommodate High Occupancy Vehicle bypass lanes.
- Freedom Boulevard would be widened within the project limits to add turn lanes.
- The Freedom Boulevard/Bonita Drive intersection would be enlarged to add turn lanes and achieve acceptable level of service.
- The Freedom Boulevard bridge would be replaced with a wider structure that would accommodate a new turn lane on Freedom Boulevard and the new High Occupancy Vehicle lane on Route 1.
- New sidewalks would be added along Freedom Boulevard within the project limits.

Changes at Rio Del Mar Boulevard Interchange

- The northbound on-ramp would be realigned to form the north leg of a four-way intersection with Rio Del Mar Boulevard and the northbound off-ramp. This intersection would be signalized, and free right turns eliminated.

- The northbound off-ramp would be widened to two exit lanes.
- The southbound ramps would be widened, the intersection with Rio Del Mar Boulevard signalized, and free right-turns eliminated.
- The existing on-ramps would be widened to accommodate High Occupancy Vehicle bypass lanes.
- Soquel Drive would be shifted northward to accommodate the roadway widening along the northbound off-ramp.
- Rio Del Mar Boulevard would be widened within the project limits to add turn lanes and a through lane in each direction.
- The Rio Del Mar Boulevard bridge over Route 1 would be replaced with a longer, wider bridge to accommodate a new turn lane and a through lane in each direction on Rio Del Mar and the new High Occupancy Vehicle lane on Route 1.
- Sidewalk would be added along eastbound Rio Del Mar Boulevard within the project limits; sidewalk on westbound Rio Del Mar Boulevard is existing.

Changes at State Park Drive Interchange

- The existing northbound cloverleaf on-ramp free-right would be changed to a signalized right turn.
- The existing northbound off-ramp terminus would be modified to form, together with the realigned northbound on-ramp terminus, the south leg of a signalized intersection with State Park Drive.
- The northbound and southbound off-ramps would be widened to two exit lanes.
- The existing on-ramps would be widened to accommodate High Occupancy Vehicle bypass lanes.
- State Park Drive would be widened within the project limits to add turn lanes and a through lane in each direction.
- The State Park Drive bridge over Route 1 would be replaced with a longer, wider bridge to accommodate a new through lane in each direction on State Park Drive, and the new High Occupancy Vehicle lane on Route 1.
- Sidewalk would be added along eastbound State Park Drive within the project limits; sidewalk along westbound State Park Drive is existing.

Changes at Park Avenue Interchange

- The existing diamond interchange ramp design would be retained and ramps would be widened.
- The northbound and southbound off-ramps would be widened to two exit lanes.

- The existing on-ramps would be widened to accommodate High Occupancy Vehicle bypass lanes.
- Park Avenue would be widened within the project limits to add turn lanes.
- The two Route 1 bridges over Park Avenue would be replaced with one, wider structure to accommodate the new High Occupancy Vehicle lanes on Route 1.
- Sidewalk would be added within the project limits along westbound Park Avenue; sidewalk along eastbound is existing.

Changes at Bay Avenue/Porter Street and 41st Avenue Interchanges

- Improvements at the Bay Avenue/Porter Street and 41st Avenue interchanges are designed so that these two interchanges would work as a single interchange connected by a collector/frontage road running between the interchanges.
- The ramps at Bay Avenue/Porter Street would be reconstructed to form less skewed intersections with Bay Avenue/Porter Street.
- The existing southbound Route 1 off-ramp to Bay Avenue/Porter Street would be eliminated. Southbound traffic bound for Bay Avenue/Porter Street would exit at 41st Avenue two-lane ramp and continue on a new southbound collector/frontage road to Bay Avenue/Porter Street.
- The existing on-ramp from Porter Street to northbound Route 1 on a two-lane ramp would be modified to become a northbound collector/frontage road serving traffic bound for 41st Avenue or northbound Route 1.
- Northbound traffic exiting Route 1 would bear right to access Bay Avenue/Porter Street, or stay left and continue on a new structure over Bay Avenue/Porter Street, join the northbound collector/frontage road, and end at a new signalized intersection at 41st Avenue.
- At 41st Avenue, southbound on- and off-ramps would be eliminated and replaced with a diagonal off-ramp and a collector/frontage road serving traffic bound for Bay Avenue/Porter Street or southbound Route 1. The new ramp and collector/frontage road would form a signalized intersection with 41st Avenue.
- At 41st Avenue, the northbound on-ramps would include a realigned loop and realigned diagonal.
- New on-ramps would include High Occupancy Vehicle bypass lanes.
- 41st Avenue would be widened within the project limits to add turn lanes and eastbound though lanes over Route 1.
- Bay Avenue/Porter Street would be widened to add right-turn lanes at the on-ramps.

- A new bridge over Soquel Creek and Soquel Wharf Road would be constructed for the new southbound collector/frontage road from 41st Avenue to Bay Avenue/Porter Street.
- The 41st Avenue bridge over Route 1 would be replaced with a longer, wider bridge to accommodate the new eastbound through lane and turn lanes on 41st Avenue, and the new High Occupancy Vehicle lanes on Route 1.
- Class I bike paths would be constructed between 41st Avenue and Bay Avenue/Porter Street adjacent to the new collector/frontage roads.

Changes at Soquel Drive/Soquel Avenue Interchange

- The northbound off-ramp would be realigned to a signalized 90 degree intersection with Soquel Drive. The existing access to Commercial Way would be eliminated.
- The westbound Soquel Drive on-ramp to northbound Route 1 would be modified to eliminate the free right-turn access.
- The existing northbound loop on-ramp from eastbound Soquel Avenue would be realigned and its free-right terminus would become a signalized 90 degree intersection.
- A new, wider southbound diagonal off-ramp that adds turn lanes at its terminus and a new loop on-ramp would form the north leg of a signalized intersection at Soquel Avenue.
- The existing southbound hook on-ramp would be widened to add a High Occupancy Vehicle bypass lane and realigned to be made standard.
- The northbound and southbound off-ramps would be widened to two exit lanes.
- New on-ramps would include High Occupancy Vehicle bypass lanes.
- Soquel Avenue within the project limits would be widened to add an eastbound though lane and turn lanes.
- Salisbury Lane would be shifted eastward to form an intersection with the realigned northbound off-ramp and loop on-ramp.
- The Soquel Drive/Soquel Avenue bridge over Route 1 would be replaced with a longer, wider bridge to add an eastbound through lane and a turn lane to Soquel Drive and accommodate the new High Occupancy Vehicle lane on Route 1.
- The culvert at Arana Gulch would be extended underneath the widened Route 1 and new southbound off-ramp.
- Sidewalk would be added along eastbound Soquel Drive/Soquel Avenue within the project limits; sidewalk along westbound Soquel Drive/Soquel Avenue is existing.

Changes at Morrissey Boulevard Interchange

- The southbound exit would be realigned to terminate at a new signalized intersection with Morrissey Boulevard.
- The existing southbound on-ramp would be eliminated and replaced with a new, wider diagonal ramp with a signalized terminus.
- The existing southbound exit and on-ramp at Elk Street would be eliminated.
- The existing northbound loop on-ramp would be eliminated, as would access to Rooney Street from this northbound loop
- The northbound off-ramp would be widened to two exit lanes.
- New on-ramps would include High Occupancy Vehicle bypass lanes.
- Morrissey Boulevard within the project limits would be widened to add an eastbound through lane and turn lanes, and realigned to form a straight line between its intersections with Fairmont Avenue and Rooney Street.
- The Morrissey Boulevard bridge would be replaced with a longer, wider bridge to accommodate a new eastbound through lane and turn lanes on Morrissey Boulevard and new High Occupancy Vehicle lanes on Route 1.
- Sidewalk would be added along eastbound Morrissey Boulevard within the project limits; sidewalk along westbound Morrissey Boulevard is existing.

Transit-Related Facilities

In addition to the mainline High Occupancy Vehicle through-lanes on the highway and High Occupancy Vehicle bypass lanes on the ramps, the High Occupancy Vehicle Lane Alternative could include the following features to facilitate freeway-oriented transit services and operations:

- Both on-ramps and off-ramps at the reconfigured Park Avenue interchange include options for bus pads and bus shelters.
- Ramps and collectors at the Bay Avenue/Porter Street and 41st Avenue interchange include options for bus pads and shelters.
- A future Park and Ride lot is under consideration at the 41st Avenue interchange, to be coordinated with the bus facilities.
- Feasibility for a Park and Ride lot in the Bay Avenue/Porter Street interchange area would be investigated.

These improvements would be considered as part of the detailed Tier II design/ environmental analysis of those respective facilities in the future.

New Bicycle/Pedestrian Overcrossings

The High Occupancy Vehicle Lane Alternative would construct new bicycle/pedestrian overcrossings of Route 1 at the following locations:

- Mar Vista Drive – the crossing would start on the north side of Route 1 and parallel the highway eastward for about 600 feet, doubling back westward as it climbs before crossing the highway at a right angle and then descending by switchbacks to and along Mar Vista Drive for about 550 feet; multiple configurations are under consideration the final design will be determined as part of the Tier II design/environmental analysis of this facility.
- Chanticleer Avenue – the crossing would start at the Chanticleer cul-de-sac on the north side of Highway 1 and parallel the highway for about 400 feet to the west before crossing it on a curved alignment, returning to terminate just west of Chanticleer on the south side of the highway.
- Trevethan Avenue – the crossing would start on the north side of Route 1 at Trevethan Avenue and parallel the highway about 600 feet before crossing on an angle and continuing along the banks of the western tributary to Arana Gulch to terminate close to Harbor High School; multiple configurations are possible with the final design to be determined as part of the Tier II design/environmental analysis of this facility.

1.3.1.2 Transportation System Management Alternative

The Transportation System Management Alternative proposes to add ramp metering and construct High Occupancy Vehicle bypass lanes on existing interchange on-ramps, improve existing nonstandard geometric elements at various ramps, and add auxiliary lanes along the mainline between major interchange pairs within the project limits, as described below and summarized under Common Design Features of the Build Alternatives.

It would not construct High Occupancy Vehicle lanes or any additional through lanes on the mainline.

The common design features of the Build Alternatives section describes other features included in the Transportation System Management Alternative.

Auxiliary Lanes

Auxiliary lanes are designed to reduce conflicts between traffic entering and exiting the highway by connecting from the on-ramp of one interchange to the off-ramp of the next; they are not designed to serve through traffic. Auxiliary lanes to be constructed on Route 1 with the Transportation System Management Alternative consist of the following:

- Northbound and southbound between Freedom Boulevard and Rio Del Mar Boulevard.
- Northbound and southbound between Rio Del Mar Boulevard and State Park Drive.
- Northbound and southbound between State Park Drive and Park Avenue.
- Northbound and southbound between Park Avenue and Bay Avenue/Porter Street.

- Northbound and southbound from 41st Avenue to Soquel Drive/Soquel Avenue.

New Bicycle/Pedestrian Overcrossings

The Transportation System Management Alternative would construct new bicycle/pedestrian overcrossings of Route 1 at Mar Vista Drive, Chanticleer Avenue, and Trevethan Avenue as described under the High Occupancy Vehicle Lane Alternative.

Other Improvements

- At Freedom Boulevard, the southbound off-ramp would be widened to two exit lanes.
- At State Park Drive, the northbound and southbound off-ramps would be widened to two exit lanes.
- At Park Avenue, the northbound and southbound off-ramps would be widened to two exit lanes.

Like the High Occupancy Vehicle Lane alternative, the Transportation System Management alternative would widen the Soquel Avenue northbound and southbound off-ramps to provide two exit lanes, but the southbound ramp would not be realigned and the northbound ramp realignment would not be as significant as in the High Occupancy Vehicle alternative. Also as in the High Occupancy Vehicle alternative, the realigned northbound off-ramp would eliminate access to Commercial Way.

1.3.1.3 No-Build Alternative

The No-Build Alternative offers a basis of comparison with the Transportation System Management and High Occupancy Vehicle Lane Alternatives in the future analysis year of 2035. It would not address the project purpose and need. It assumes no major construction on Route 1 through the project limits other than currently planned and programmed improvements and continued routine maintenance. Planned and programmed improvements included in the No-Build Alternative are the following improvements contained in the 2010 Regional Transportation Plan:

- Installation of median barrier on Route 1 from Freedom Boulevard to Rio Del Mar Boulevard.
- Construction of auxiliary lanes between the Soquel Avenue-Soquel Drive and Morrissey Boulevard interchanges (EA 05-0F6500, completed May 2013).
- Replacement of the La Fonda Avenue overcrossing of Route 1, included as part of the Soquel-Morrissey Auxiliary Lanes project.

Also included in the No-Build Alternative are a number of locally-sponsored projects for improving the local arterial network and constructing or improving bicycle lanes.

1.3.2 Tier II Alternative

The Tier II project purpose matches that of the Santa Cruz County Route 1 High Occupancy Vehicle project, that is, reducing congestion and encouraging use of alternative transportation modes as a means to increase system capacity, except that encouraging carpooling is not a part of the Tier II project purpose.

Auxiliary Lanes

It is proposed to widen Route 1 by adding an auxiliary lane to both the northbound and southbound sides between the 41st Avenue and Soquel Drive interchanges. The total roadway widening would be approximately 1.2 miles in length. Southbound, the auxiliary lane would begin at the existing Soquel Drive on-ramp, and end at the existing off-ramp at 41st Avenue. Northbound, the auxiliary lane would begin just south of the 41st Avenue overcrossing, at the existing loop on-ramp to northbound 41st Avenue. West of the overcrossing, the on-ramp from southbound 41st Avenue to northbound Route 1 would merge with the new auxiliary lane, approximately 1,000 feet downstream from its beginning at the bottom of the loop ramp.

As part of the widening in the northbound direction, the project proposes to repair the pavement failure in the outside lane and shoulder by improving the pavement section, installing a retaining wall, and if necessary, replacing the underlying county-owned sanitary sewer.

Pedestrian Features

A new horseshoe-shaped pedestrian overcrossing at Chanticleer Avenue is proposed, and approximately 400 feet of sidewalk would be constructed along the south side of Soquel Avenue, starting at Chanticleer Avenue.

Retaining Walls

Retaining walls would be constructed as part of the roadway widening, with a total of four separate walls: three on the northbound side of the highway and one on the southbound side. Three of the walls would be located to allow widening for a future lane on the highway, in both directions. The wall proposed along the northbound on-ramp at 41st Avenue would require demolition in the event the highway was widened in the future. Two of the walls would span Rodeo Creek Gulch, where there is an existing 9 foot arch concrete culvert, and one would be constructed within a narrow jurisdictional area on the northbound side of Route 1, adjacent to a 39 inch culvert crossing.

Right-of-Way

Right-of-way would be acquired along Soquel Avenue west of Chanticleer Avenue and at the Chanticleer Avenue cul-de-sac north of the highway, along with temporary construction easements on both sides of Route 1 near the proposed overcrossing.

1.4 Need for Project

The need for the project is summarized by these deficiencies on Route 1 within the project limits:

- Several bottlenecks along Route 1 in the southbound and northbound directions cause recurrent congestion during peak hours;
- Travel time delays due to congestion and related accidents are experienced by commuters, commerce, and emergency vehicles;
- "Cut-through" traffic, or traffic on local streets, occurs and is increasing because drivers seek to avoid congestion on the highway;
- Limited opportunities for pedestrians and bicyclists to safely get across Route 1 within the project limits;
- Insufficient support facilities and incentives to increase transit service that operates in the Route 1 corridor because congestion threatens reliability and cost-effective transit service delivery; and
- Inadequate facilities to support carpooler and rideshare vehicles over single-occupancy vehicles; therefore, incentives, such as travel time savings, and reliability are difficult to achieve.

1.4.1 Tier I Project

The purpose of the proposed project is to achieve the following within the Tier I project limits:

- Reduce congestion; and
- Encourage carpooling and use of alternative transportation modes as a means to increase transportation system capacity.

1.4.2 Tier II Project

The Tier II project purpose matches that of the Tier I project, except that encouraging carpooling is not a part of the Tier II project purpose.

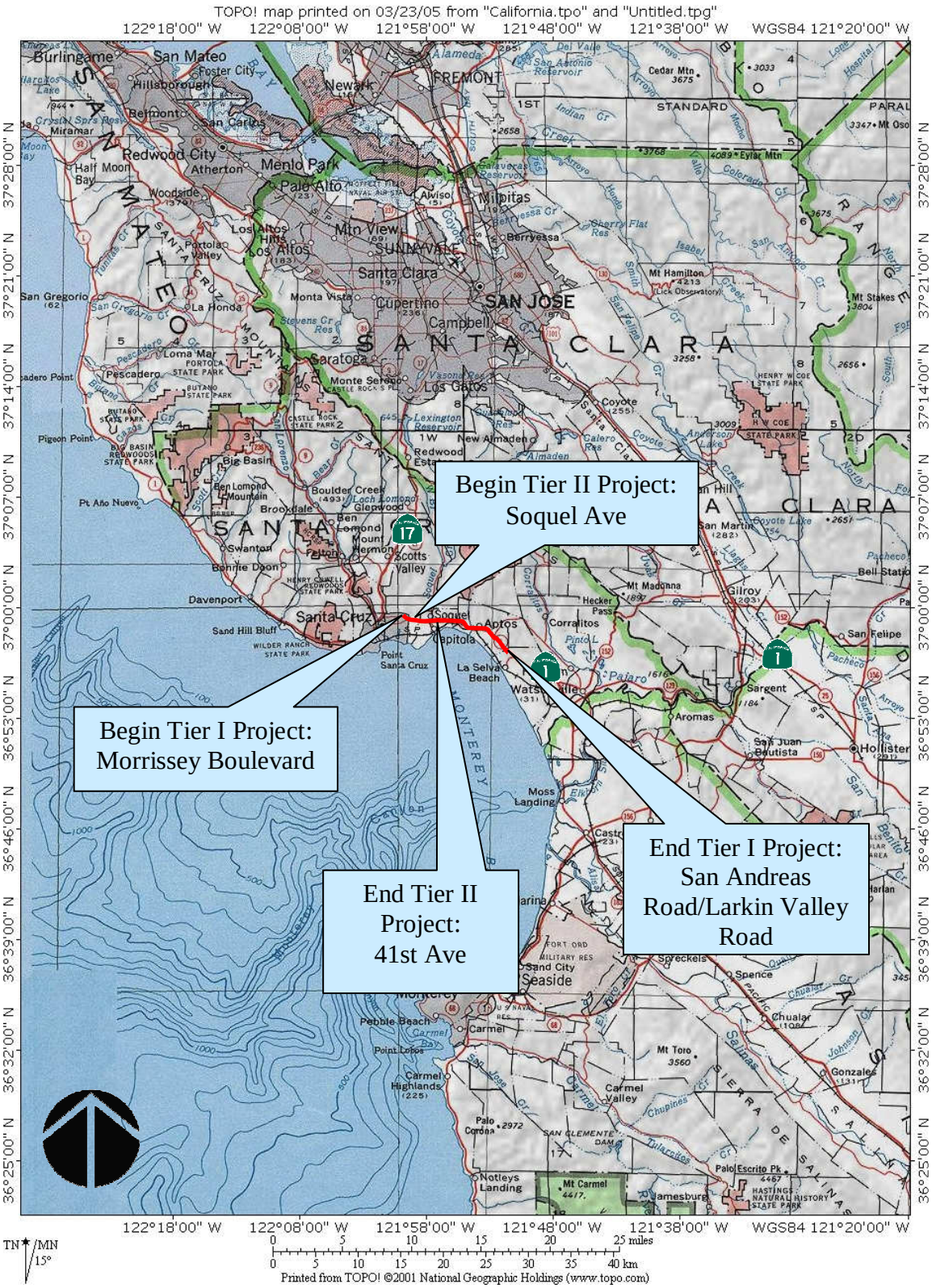


Figure 1. Location Map

Source: United States Geological Survey

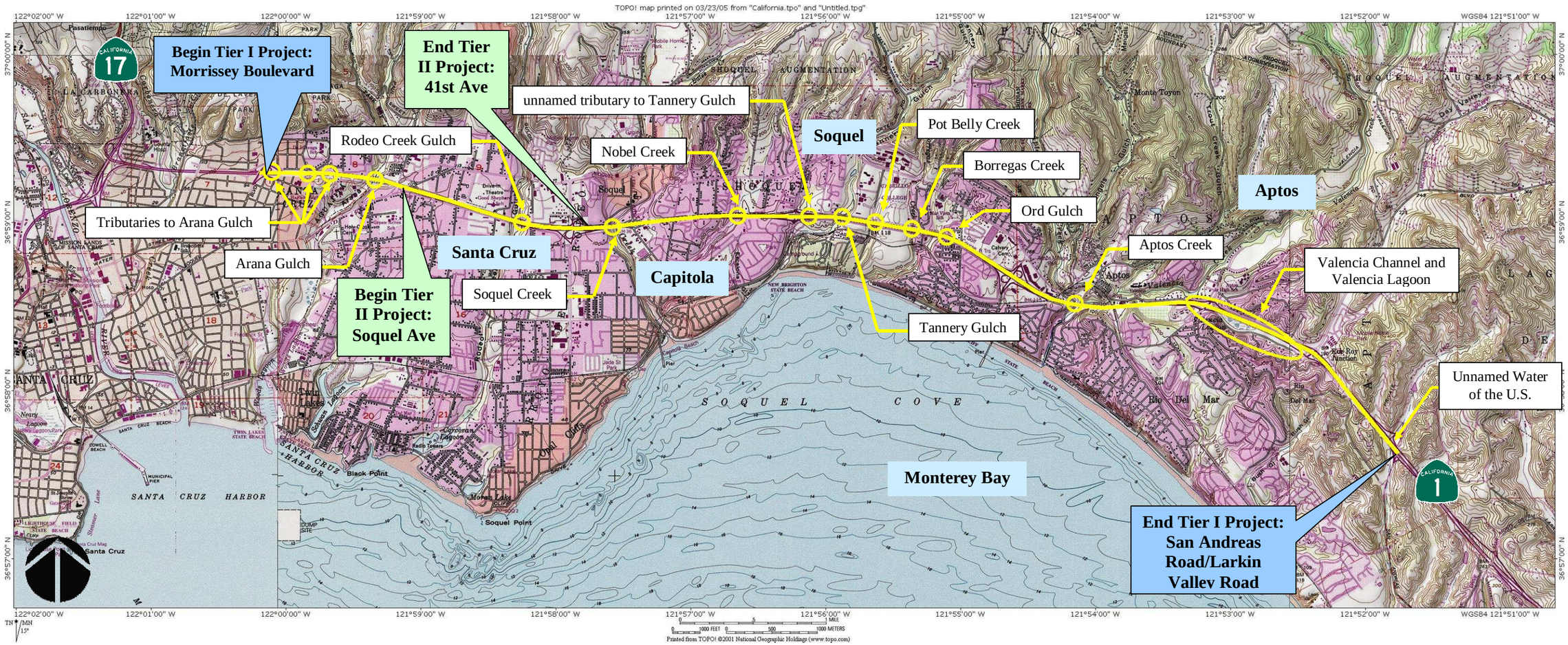


Figure 2. Vicinity Map and Waterway Crossings

Source: United States Geological Survey

1.5 Creek, Stream, and River Crossings

Creek crossing drainage systems were located from As-Built Record Drawings and site visits. Drainage systems for some creek crossings were not located. These systems were identified in the *Wetland Assessment* report (Wetland Assessment, 2008).

1.5.1 Tier I Project

Fifteen waterways cross Route 1 within the Tier I project limits (see Figure 2). The sizes and types of these crossings are listed in Table 1.

Table 1. Drainage Facilities at Waterway Crossings – Tier I Project

Waterway	Station at Route 1 Crossing	Drainage Facility	
		English	Metric
Unnamed Waters of the U.S.	49+65	84 in. corrugated steel pipe	2100 mm corrugated steel pipe
Valencia Channel	75+30	culvert size unknown	culvert size unknown
Aptos Creek[1,2]	90+00	concrete bridge	concrete bridge
Ord Gulch	107+85	48 in. concrete culvert	1200 mm concrete culvert
Borregas Creek	110+69	48 in. concrete culvert	1200 mm concrete culvert
Pot Belly Creek	114+90	30 in. reinforced concrete pipe culvert	760 mm reinforced concrete pipe culvert
Tannery Gulch	118+64	6 ft x 6 ft reinforced concrete box culvert	1830 mm x 1830 mm reinforced concrete box culvert
unnamed tributary to Tannery Gulch	122+66	48 in. reinforced concrete pipe culvert	1200 mm reinforced concrete pipe culvert
Nobel Creek	130+08	6 ft x 6 ft reinforced concrete box culvert	1830 mm x 1830 mm reinforced concrete box culvert
Soquel Creek[2]	143+60	98 ft wide, 323 ft span concrete arch span bridge	29.9 m wide, 98.5 m span concrete arch span bridge
Rodeo Creek Gulch	154+24	9 ft concrete arch culvert	2700 mm concrete arch culvert
Arana Gulch	171+03	72 in. (height) concrete arch culvert	1800 mm (height) concrete arch culvert
tributary to Arana Gulch	175+98	36 in. reinforced concrete pipe culvert	900 mm reinforced concrete pipe culvert
tributary to Arana Gulch	177+92	4 ft x 4 ft reinforced concrete box culvert	1220 mm x 1220 mm reinforced concrete box culvert
tributary to Arana Gulch	183+01	30 in. reinforced concrete pipe culvert	760 mm reinforced concrete pipe culvert

Notes: 1. WRECO staff observed that scour from Aptos Creek resulted in loss of bed material at the Aptos bridge piers.

2. Concrete bags at the pier footings are deteriorating due to scour from Soquel Creek. Scouring at the Aptos Creek crossing and the deterioration of gravel bags at the Soquel Creek crossing will be addressed in the Tier I project. When the projects that include those creeks' bridges move forward as Tier II projects, further studies of the hydraulic modifications required will be part of their project approval and documentation.

1.5.2 Tier II Project

There is one waterway crossing within the Tier II project limits: the Rodeo Creek Gulch crossing flows through a 106-inch concrete arch culvert. Although they are outside of the Tier II project limits, Soquel Creek and Arana Gulch would also receive runoff from the Tier II project because of the existing topography. The Tier II project would add impervious areas that would affect three streams: Soquel Creek, Rodeo Creek Gulch, and Arana Gulch. Floodplains are associated with these three streams.

1.6 Bridge Numbers

1.6.1 Tier I Project

Thirteen of the 15 water crossings within the Tier I project limits are cross culverts. The other two are bridges with assigned bridge numbers. These bridges are Aptos Creek bridge (Bridge Number 36-0011) and Soquel Creek Bridge (Bridge Number 36-0013).

1.6.2 Tier II Project

The Rodeo Creek Gulch crossing within the Tier II project limits is a cross culvert.

1.7 Geographical References

Project maps were based on the following quadrangles from the United States Geological Survey: Santa Cruz, Soquel, Watsonville West, Laurel, Loma Prieta, and Felton.

The Federal Emergency Management Agency Flood Insurance Rate Maps and flood profiles from the *Flood Insurance Study* for Santa Cruz County, CA and Incorporated Areas were reviewed for base flood elevations at the waterway crossings at Route 1 (2006). The base flood is a flood that has a one percent chance of occurrence in any given year.

The vertical control for the elevations in the Flood Insurance Rate Map and *Flood Insurance Study* is based on the National Geodetic Vertical Datum of 1929. The survey for this project is based on the North American Vertical Datum of 1988.

Using the Orthometric Height Conversion from the National Geodetic Survey website, the datum shift (from North American Vertical Datum of 1988 to National Geodetic Vertical Datum of 1929) was calculated based on the locations of each waterway crossing along Route 1. The calculated datum shifts are summarized in Table 2.

Table 2. Datum Shifts

Location	Latitude	Longitude	Datum Shift	
			(ft)	(m)
Aptos Creek	36.97527° N	121.90088° W	2.74	0.836
Nobel Creek	36.98416° N	121.94322° W	2.76	0.840
Soquel Creek	36.98298° N	121.95897° W	2.75	0.838
Rodeo Creek Gulch	36.98333° N	121.96992° W	2.75	0.837
Arana Gulch	36.98767° N	121.98811° W	2.74	0.834

Elevations from the Federal Emergency Management Agency *Flood Insurance Study* and Flood Insurance Rate Maps were adjusted by adding the datum shift to convert from the National Geodetic Vertical Datum of 1929 to the North American Vertical Datum of 1988. For example, the base flood elevations at Aptos Creek were adjusted by adding 2.74 feet to convert from the National Geodetic Vertical Datum of 1929 to the North American Vertical Datum of 1988.

1.8 Traffic

Traffic data is available between Rio Del Mar Boulevard and Morrissey Boulevard interchanges for spring 2001 conditions, between Rio Del Mar Boulevard and Morrissey Boulevard interchanges for summer 2001 conditions, and between San Andreas/Larkin Valley Road and State Park Drive interchanges for fall 2003 conditions. Table 3 summarizes traffic conditions for spring 2001, summer 2001, and fall 2003 (Wilbur Smith Associates, 2004).

Ramp counts were conducted in March and April 2001 for spring 2001 conditions, in July 2001 for summer 2001 conditions, and in October 2003 for fall 2003 conditions.

Based on available data, there may be traffic interruptions at the Arana Gulch crossing of Route 1 in the existing condition. However, traffic could utilize frontage roads and local streets (such as La Fonda Avenue) that are not inundated by the base flood.

Emergency Supply or Evacuation Route: Yes
Emergency Vehicle Access: Yes
Practical Detour Route: Yes
School Bus or Mail Route: Yes

Table 3. Weekday Average Daily Traffic Volumes

Spring 2001 Conditions		
Segment	**NB WADT**	**SB WADT**
San Andreas Road / Larkin Valley Road to Freedom Boulevard	N/A	N/A
Freedom Boulevard to Rio Del Mar Boulevard	N/A	N/A
Rio Del Mar Boulevard to State Park Drive	46,300	42,400
State Park Drive to Park Avenue	49,000	44,800
Park Avenue to Bay Avenue / Porter Street	53,300	48,000
Bay Avenue / Porter Street to 41st Avenue	59,000	52,300
41st Avenue to Soquel Avenue	56,000	47,100
Soquel Avenue to Morrissey Boulevard	58,800	52,200
Summer 2001 Conditions		
Segment	**NB WADT**	**SB WADT**
San Andreas Road / Larkin Valley Road to Freedom Boulevard	N/A	N/A
Freedom Boulevard to Rio Del Mar Boulevard	N/A	N/A
Rio Del Mar Boulevard to State Park Drive	42,600	53,000
State Park Drive to Park Avenue	49,600	55,900
Park Avenue to Bay Avenue / Porter Street	52,400	56,600
Bay Avenue / Porter Street to 41st Avenue	57,200	60,400
41st Avenue to Soquel Avenue	54,000	54,600
Soquel Avenue to Morrissey Boulevard	59,800	58,000
Fall 2003 Conditions		
Segment	**NB WADT**	**SB WADT**
San Andreas Road / Larkin Valley Road to Freedom Boulevard	36,400	34,000
Freedom Boulevard to Rio Del Mar Boulevard	42,000	39,200
Rio Del Mar Boulevard to State Park Drive	44,200	41,000
State Park Drive to Park Avenue	N/A	N/A
Park Avenue to Bay Avenue / Porter Street	N/A	N/A
Bay Avenue / Porter Street to 41st Avenue	N/A	N/A
41st Avenue to Soquel Avenue	N/A	N/A
Soquel Avenue to Morrissey Boulevard	N/A	N/A

NB WADT = Northbound weekday average daily traffic volumes
SB WADT = Southbound weekday average daily traffic volumes

1.9 Traffic Interruptions for Base Flood (Q_{100})

The base flood is a flood that has a one percent chance of occurrence in any given year (also known as a 100-year flood, or Q_{100}). Potential flooding conditions for the proposed project were evaluated using water surface elevations calculated using Regional Flood-Frequency Equations or from Federal Emergency Management Agency Flood Insurance Rate Maps. Based on available data, there may be traffic interruptions on Route 1 at the Arana Gulch crossing due to the base flood. The Flood Insurance Rate Map depicts the base flood overtopping Route 1 at the Arana Gulch crossing with a base flood elevation of 68 feet (21 m) at the upstream side (see Section 2.2). Based on the project topography, the existing roadway elevation is 68 feet (21 m). The roadway, in both directions of travel, could experience traffic interruptions. However, traffic could utilize frontage roads and local streets (such as La Fonda Avenue) that are not inundated by the base flood.

2 HYDROLOGIC AND HYDRAULIC DATA

2.1 Federal Emergency Management Agency Data

The Federal Emergency Management Agency, *Flood Insurance Study*, Santa Cruz County, CA and Incorporated Areas (2006), was used to obtain existing floodplain information within the project area.

2.1.1 Tier I Project

The *Flood Insurance Study* shows that there are delineated floodplains associated with five of the 15 crossings within the Tier I project limits: Aptos Creek, Nobel Creek, Soquel Creek, Rodeo Creek Gulch, and Arana Gulch. The 100-year base floodplain water surface elevations (see Table 4) for these crossings were obtained from Federal Emergency Management Agency Flood Insurance Rate Maps and adjusted to account for the datum shift (see Section 1.7). The existing capacity for the creek crossings was determined by comparing the elevation of the roadway to the water surface elevations corresponding to a 100-year peak discharge. Upstream and downstream water surface elevations were available for Aptos Creek, Soquel Creek, Rodeo Creek Gulch, and Arana Gulch, while only the downstream water surface elevation was available for Nobel Creek. The upstream water surface elevation for Nobel Creek was calculated, as described in Section 2.3 of this report.

Table 4. Hydraulic Data

Reach	100-Year Peak Discharge		Drainage Area		Water Surface Elevation				Roadway Elevation	
					Upstream		Downstream			
	[ft^3/s]	[m^3/s]	[mi^2]	[km^2]	[ft]	[m]	[ft]	[m]	[ft]	[m]
Aptos Creek [1, 3, C]	8,281.3	234.5	24	62.2	26.9	8.2	24.6	7.5	59.1	18
Nobel Creek [4]	505	14.3	0.96	2.5	88.6	27	78.7	24	101.7	31
Soquel Creek [2, 3]	12,095.3	342.5	43	111.4	32.8	10	31.8	9.7	68.9	21
Rodeo Creek Gulch [1, 3, B]	1,539.7	43.6	2.5	6.5	82	25	68.9	21	108.2	33
Arana Gulch [1, 3, A]	1,649.2	46.7	3.5	9.1	68.9	21	49.2	15	68.9	21

Notes:[1] Peak discharge was obtained in the Federal Emergency Management Agency Flood Insurance Studies for the following: City of Capitola, California, Santa Cruz County, California (June 03, 1986); City of Santa Cruz, California, Santa Cruz County, California (June 17, 1986); and Santa Cruz County, California (Unincorporated Areas) (April 15, 1986).

[2] Peak discharge was calculated using the Log-Pearson method using United States Geological Survey peak flood flows.

[3] Water surface elevations were obtained from Federal Emergency Management Agency Flood Insurance Rate Maps, unless otherwise noted. Datum was adjusted to account for the datum shift (see Section 1.7).

[4] Peak discharge and watershed drainage area were calculated using Regional Flood-Frequency Equations from California Department of Transportation: Highway Design Manual.

[A] Peak discharge is given at the mouth of the creek: 1.7 mi (2.7 km) from the Route 1 crossing.

[B] Peak discharge is given at the mouth of the creek: 2.06 mi (3.32 km) from the Route 1 crossing.

[C] Peak discharge is given at the mouth of the creek: 0.53 mi (0.86 km) from the Route 1 crossing.

2.1.2 Tier II Project

The Federal Emergency Management Agency, *Flood Insurance Study,* Santa Cruz County, CA and Incorporated Areas (2006) shows that there are delineated floodplains associated with the three streams affected by the Tier II project: Soquel Creek, Rodeo Creek Gulch, and Arana Gulch. The existing 100-year peak discharges and drainage areas of these waterways are specified in Table 4.

2.2 Map of Floodplain

2.2.1 Tier I Project

Within the Tier I project limits, five areas are within the delineated floodplains defined by the Federal Emergency Management Agency. The 100-year base floodplains are identified as flood hazard zone designation Zone AE, which corresponds to the one percent annual chance floodplains that are determined in the *Flood Insurance Study* by detailed methods of analysis. Base flood elevations are shown upstream and downstream of each crossing; at Nobel Creek, only the downstream base flood elevation is shown and is the limit of the detailed study by the Federal Emergency Management Agency.

According to Flood Insurance Rate Map Number 06087C0357D, a floodplain exists at the Aptos Creek crossing of Route 1. The water surface elevation is 27 feet (8.2 meters) upstream of the crossing and 25 feet (7.5 meters) downstream of the crossing. The existing ground elevation at the Aptos Creek crossing is approximately 59 feet (18 meters) and is higher than the 100-year water surface elevation.

According to Flood Insurance Rate Map Number 06087C0352D, a floodplain exists at the Nobel Creek crossing of Route 1. The approximate water surface elevation is 78 feet (24 meters) downstream of the crossing. The water surface elevation upstream of the crossing was estimated to be 88 feet (27 meters) using the method described in Section 2.3. The existing ground elevation at the Nobel Creek crossing is approximately 102 feet (31 meters).

According to Flood Insurance Rate Map Number 06087C0352D, a floodplain exists at the Soquel Creek crossing of Route 1. The approximate water surface elevation is 33 feet (10 meters) upstream of the crossing and 32 feet (9.7 meters) downstream of the crossing. The Soquel Creek floodplain also exists at the Porter Street/Bay Avenue interchange. The existing ground elevation at the Soquel Creek crossing is approximately 69 feet (21 meters).

According to Flood Insurance Rate Map Number 06087C0351D, a floodplain exists at the Rodeo Creek Gulch crossing of Route 1. The approximate water surface elevation is 81 feet (25 meters) upstream of the crossing and 70 feet (21 meters) downstream of the crossing. The Federal Emergency Management Agency indicates that the 500-year flood is contained in the culvert at the crossing. The existing ground elevation at the Rodeo Creek Gulch crossing is approximately 107 feet (32.5 meters).

According to Flood Insurance Rate Map Number 06087C0351D, a floodplain exists at the Arana Gulch crossing of Route 1. The approximate water surface elevation is 68 feet (21 meters) upstream of the Route 1 crossing and 49 feet (15 meters) downstream of the Route 1 crossing. The Flood Insurance Rate Map depicts flooding at Route 1; preliminary calculations also show overtopping at the Route 1 crossing.

These floodplain maps are included in Appendix B of the Tier I/II Project *Location Hydraulic Study Report*.

Based on available information, there are no associated floodplains at Valencia Channel, Ord Gulch, Borregas Creek, Pot Belly Creek, Tannery Gulch, unnamed tributary to Tannery Gulch, and the tributaries to Arana Gulch.

2.2.2 Tier II Project

Within the Tier II project limits, three areas are within the delineated floodplains defined by the Federal Emergency Management Agency: the Soquel Creek crossing, the Rodeo Creek Gulch crossing, and the Arana Gulch crossing. The 100-year base floodplains are identified as flood hazard zone designation Zone AE, which corresponds to the one percent annual chance floodplains that are determined in the *Flood Insurance Study* by detailed methods of analysis. Base flood elevations are shown upstream and downstream of each crossing.

The floodplain information for Soquel Creek, Rodeo Creek Gulch, and Arana Gulch is listed in Section 2.2.1. The floodplain maps are included in Appendix B of the Tier I/II Project *Location Hydraulic Study Report*.

2.3 Estimating Design Discharge

2.3.1 Tier I Project

Water surface elevations for the remaining crossings with culverts of known dimensions were ascertained using design charts from Waananen and Crippen (1977), where the diameter of the culvert (D) and design discharge (Q) are required.

Design discharge was calculated using Regional Flood-Frequency Equations (Waananen & Crippen, 1977). The Regional Flood-Frequency Equation for the Central Coast Region is expressed as:

$$Q_{100} = 19.7 A^{0.88} p^{0.84} H^{-0.33}$$

Where:

- Q = Peak discharge in cubic feet per second, with subscript indicating recurrence interval, in years
- A = Drainage area in square miles
- p = Mean annual precipitation in inches
- H = Altitude index in thousands of feet: the average of the elevations at the locations 10% and 85% of the distance from the project site to the basin divide, measured along the main channel of the stream and the overland travel path to the basin divide

Drainage area and altitude index were determined by delineating watersheds for each crossing of interest. The delineated watersheds for Aptos Creek, Nobel Creek, Soquel Creek, Rodeo Creek Gulch, and Arana Gulch are shown in Figure 3, Figure 4, and Figure 5. Mean annual precipitation values were obtained from Spatial Climate Analysis Service PRISM mapping data (Oregon State University, 2003).

Headwater depths were determined using culvert design charts (Waananen & Crippen, 1977) with design discharges and known culvert sizes. The upstream water surface elevation is the sum of this value and the estimated elevation of the culvert at the inlet.

Culvert soffit elevations were not available and were approximated based on topographic survey. This information will need to be updated in the design phase as more detailed information becomes available.

2.3.2 Tier II Project

The Rational Method was utilized to estimate additional flow from the added impervious surfaces. Refer to Section 3.2.3 for estimated additional flows.

2.4 Hydraulic Assessment

WRECO's calculations show that the roadway would be inundated if the upstream water surface elevation is greater than the elevation of the roadway.

The hydraulic regime for most creek crossings at Route 1 is upstream controlled. During severe storm events, debris builds up, and ponding could occur at the upstream end of the culverts.

2.5 Description of Flood Sources

The rainy season for the project area is generally between October 15 and April 15, but most flooding occurs from December through March (Caltrans, 2000).

The following information on flood sources in Santa Cruz County is from the Draft Flood Hazard Mitigation Plan (County of Santa Cruz, California: Office of Emergency Services, 2002).

The Soquel Creek basin experienced major flooding in December 1955 and January 1982. Obstacles and major log jams near the Soquel Avenue bridge downstream of the Route 1 crossing can cause severe backwater. The estimated peak flow at the Soquel gage station was 15,800 cubic feet per second (447 cubic meters per second) (which corresponds to a 70-year storm) for the December 1955 storm and 9,700 cubic feet per second (275 cubic meters per second) (which corresponds to a 15-year storm) for the January 1982 storm. The Aptos Creek basin experienced similar flooding with an estimated peak discharge of 3,500 cubic feet per second (99 cubic meters per second) for the December 1955 storm and 3,950 cubic feet per second (112 cubic meters per second) for the January 1982 storm (Federal Emergency Management Agency, 2006).

Westerly exposure to Pacific weather systems promotes intense precipitation from storms. Mountains and hills bordering the eastern boundaries of Santa Cruz County squeeze moisture out of arriving Pacific weather systems and provide watershed areas to funnel precipitation into runoff tributaries. Flood stage can swell to flood peaks in a few hours with high velocities in the main channel.

Flooding along the Pacific Coast of Santa Cruz County is typically associated with the simultaneous occurrence of very high tides, large waves, and storm swells during the winter. Flood hazards along the coast are generated by swell waves from offshore storms, by wind waves from land-falling storms, and by tsunamis. Other hazards, which present potential damage to structures, exposure to erosion, and impacts to channels, are landslides, earthquakes, and wild fires. Areas in Santa Cruz County would be significantly impacted from a tsunami created by an earthquake on the San Gregorio fault, which is located offshore in Monterey Bay and roughly parallels the coastline. A tsunami created by such an earthquake would arrive without warning, minutes after the initial shock (Federal Emergency Management Agency, 2006).

These flooding sources have had significant impacts on ocean-front development. Severe storms in January 1978 accelerated erosion and weakened foundations of existing beachfront homes. Seawalls and temporary barriers, intended to protect the beach shoreline, were either damaged or destroyed. In addition, storm centers from the southwest produce storm flow patterns toward the coast that have caused the majority of the serious coastal floods; strong winds and high tides create storm surges that back up river flows, and this leads to flooding at the river mouths (Federal Emergency Management Agency, 2006).

Early denizens of Santa Cruz County built homes on higher ground, avoiding the floodplains at the lower lying ground areas. Over time, these floodplain areas were developed. High intensity precipitation would likely cause flooding in these lower-lying ground areas. The drainage basins in Santa Cruz County are short and steep with short flow durations.

The mean annual precipitation at or near the project area is between 64 and 74 centimeters (25 and 29 inches) (United States Department of Agriculture, Natural Resources Conservation Service, 1976). The major drainage basins in the project area are: San Lorenzo River, Soquel Creek, Aptos Creek, and the Pajaro Valley Basins. Information on flood sources is available for the Soquel Creek and Aptos Creek watersheds.

The Soquel Creek watershed, which is located in the northern end of the project limits, drains 42 mi^2 (108.8 km^2) with a steep elevation drop of nearly 3,000 feet (914 meters). Soquel Creek collects the flow from many tributaries, including Rodeo Creek Gulch, Nobel Creek, Tannery Gulch, and Borregas Creek (Figure 4) (County of Santa Cruz, 2002). Flooding occurs due to fast volume increases during heavy rainfall, additional volumes from joining tributaries, and natural obstacles in the watershed. Flood events have occurred in the past as a result of obstacles and jams at roadway bridges.

The flood of record occurred in December 1955 with peak flow for Soquel Creek at the Soquel gage at 15,800 cfs (447 m^3/s). A log jam at the Soquel Avenue bridge caused severe backwater conditions, and eight city blocks in Soquel were inundated. Minor damage was experienced in the Aptos Creek basin in the December 1955 storm with 56 ha (140 ac) of land inundated by floodwaters (Federal Emergency Management Agency, 1986).

The Aptos Creek watershed drains 25 mi^2 (64.7 km^2) with an elevation drop of 2,000 feet (610 meters). The Aptos Creek watershed includes tributaries to Aptos Creek, shown in Figure 3. Like the Soquel Creek watershed, inundation in the Aptos Creek watershed occurs with heavy rain. The steep elevation drops and narrow canyons contribute to the rapid increase in runoff volume. Physical barriers in the watershed cause backwater flooding (County of Santa Cruz, 2002).

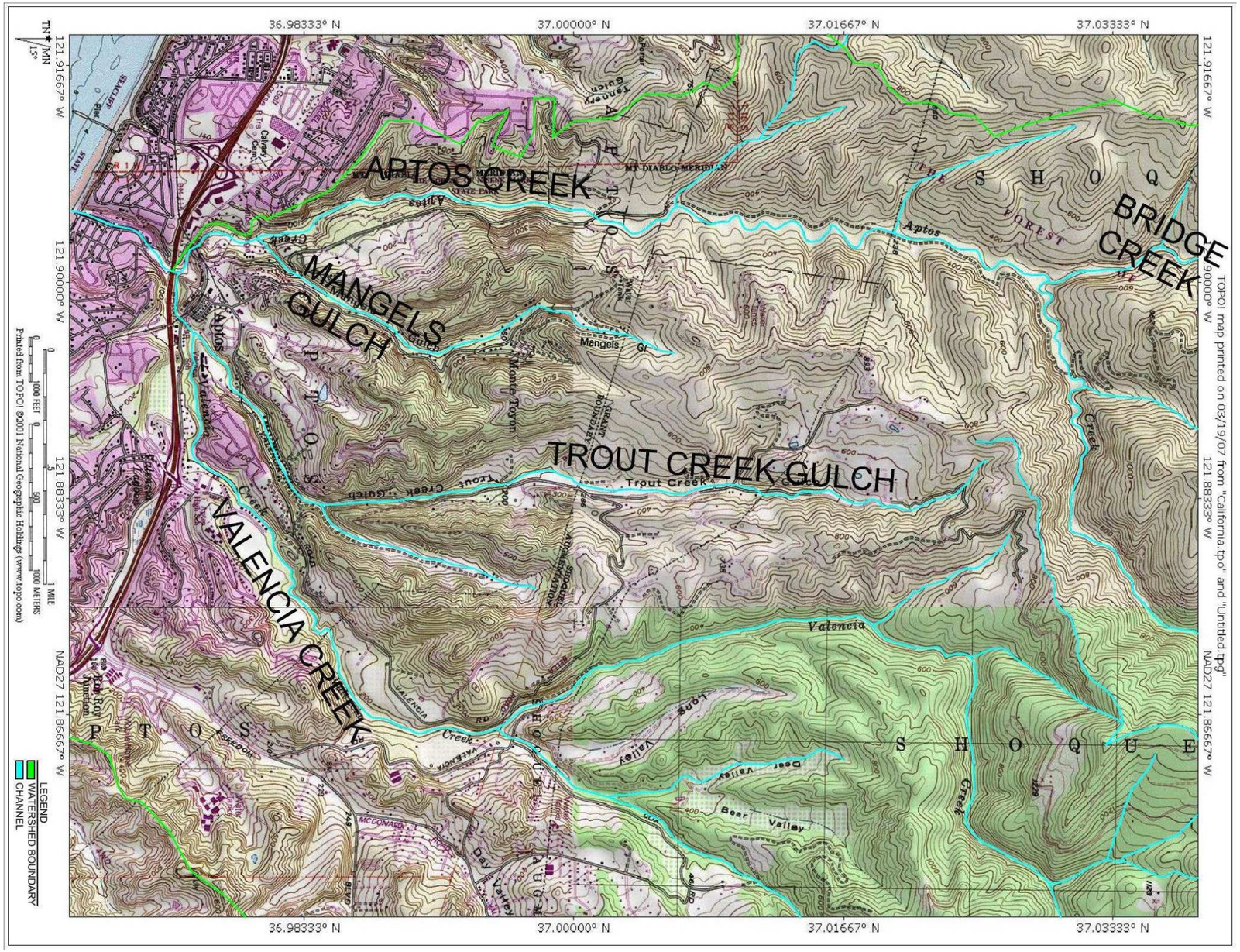


Figure 3. Aptos Creek Watershed

Source: United States Geological Survey

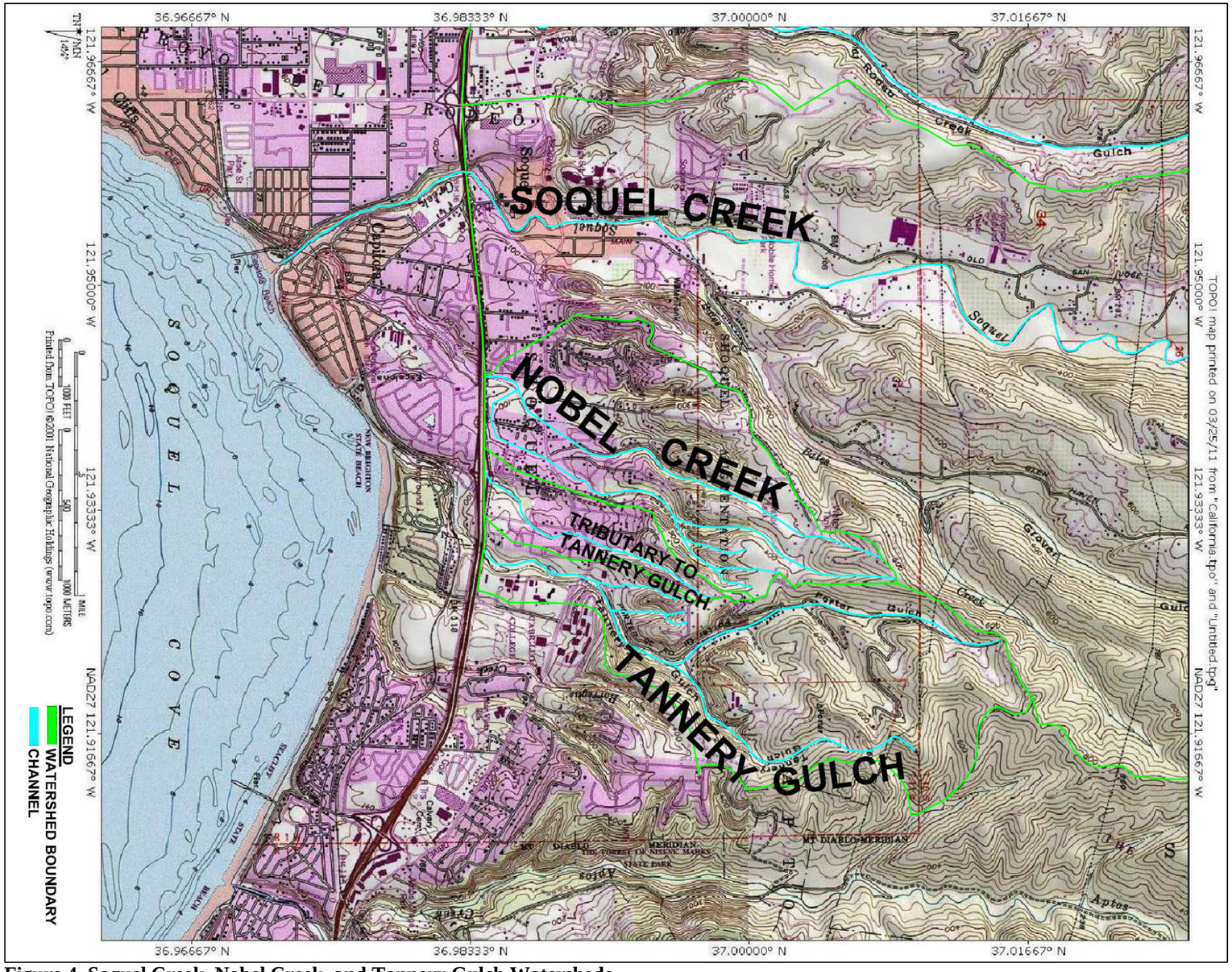


Figure 4. Soquel Creek, Nobel Creek, and Tannery Gulch Watersheds

Source: United States Geological Survey

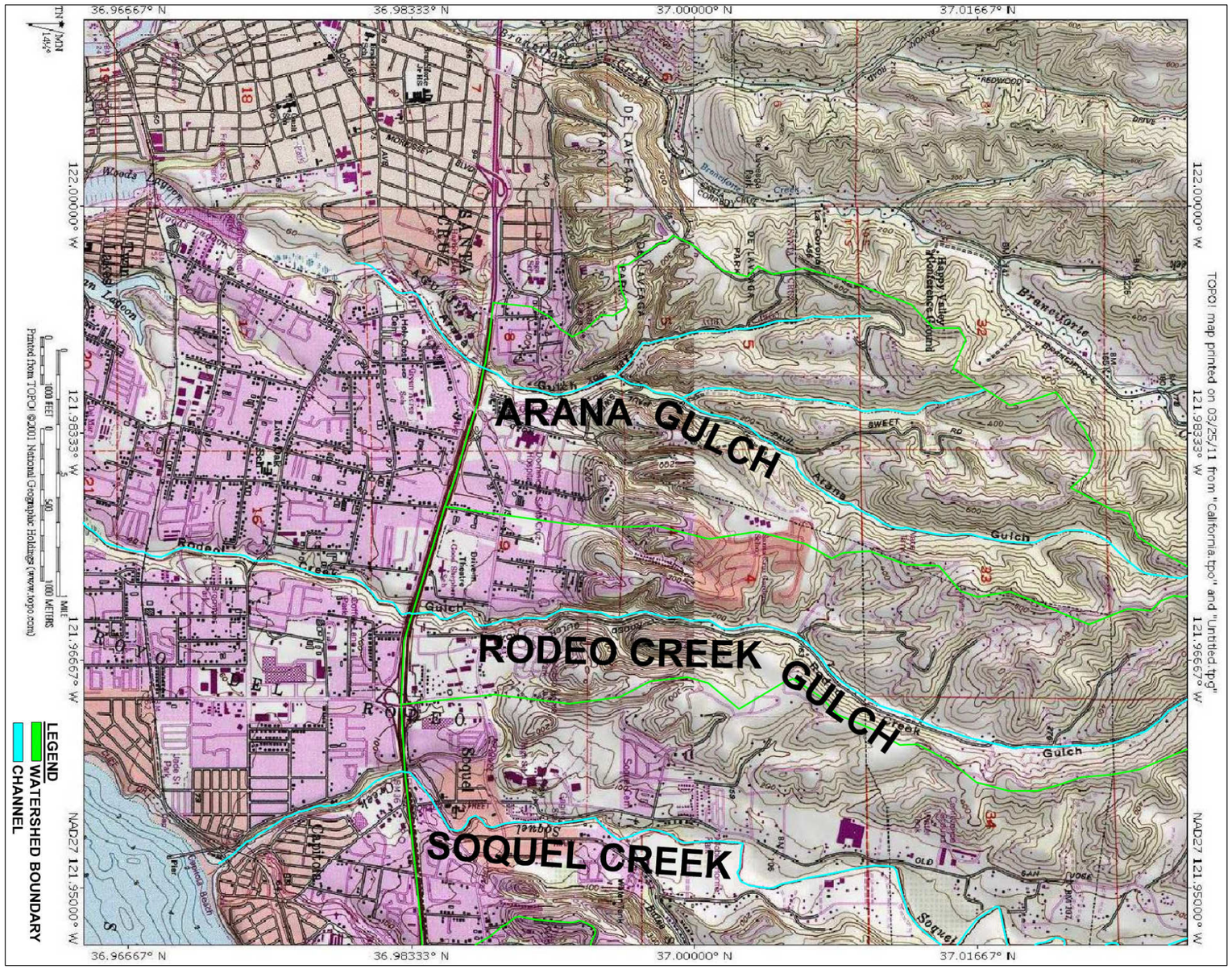


Figure 5. Arana Gulch, Rodeo Creek Gulch, and Soquel Creek Watersheds

Source: United States Geological Survey

3 PROJECT EVALUATION

3.1 Tier I Project

Route 1 is proposed to be widened in both directions of travel for a distance of 8.5 mi (13.7 km) between the San Andreas-Larkin Valley Road interchange and the Morrissey Boulevard interchange. The two build alternatives under the Tier I Project are the High Occupancy Vehicle Lane Alternative and the Transportation System Management Alternative.

3.1.1 Nobel Creek and Rodeo Creek Gulch

Based on available information, proposed improvements for both build alternatives would not encroach onto the floodplains at Nobel Creek and Rodeo Creek Gulch.

3.1.2 Aptos Creek and Soquel Creek

For both build alternatives, Route 1 is proposed to be widened in the floodplain areas at Aptos Creek and Soquel Creek. The widening would occur with the addition of the auxiliary lanes and the widening of the Aptos Creek and Soquel Creek bridges.

For both build alternatives, impacts to the floodplain from the bridge widening at the Aptos Creek bridge and Soquel Creek bridge would be from the proposed footings of the widened section of the bridges.

3.1.3 Creeks Outside of Floodplain

Other drainage improvements are proposed that are outside the delineated 100-year base floodplains defined by the Federal Emergency Management Agency. There are no available Federal Emergency Management Agency floodplain studies or available historic information for Valencia Channel, Ord Gulch, Borregas Creek, Pot Belly Creek, Tannery Gulch, unnamed tributary to Tannery Gulch, and the tributaries to Arana Gulch.

3.1.4 Arana Gulch

For both build alternatives, Route 1 is proposed to be widened in the floodplain area at Arana Gulch. Under the High Occupancy Vehicle Lane Alternative, the widening would occur with the addition of a high occupancy vehicle lane in both directions of travel. Under the Transportation System Management Alternative, the widening would occur with the addition of the auxiliary lanes. Under both alternatives, impacts to the floodplain at the Arana Gulch crossing would be due to a loss of floodplain storage because of the extended culvert. The impacts of the proposed alternatives were analyzed to determine potential impacts to the floodplain.

3.1.4.1 Estimating Design Discharge at Arana Gulch

The Rational Method was utilized to estimate additional flow from the added impervious surfaces from the two build alternatives. The added impervious area reaching Arana

Gulch was estimated to be 220,660 square feet (20,500 square meters) for the proposed Transportation System Management Alternative, and 326,351 square feet (30,319 square meters) for the proposed High Occupancy Vehicle Alternative. The rainfall intensity at the Arana Gulch crossing of Route 1 was estimated using the P_{60} Isopleths and Rainfall Intensity-Duration Curves provided by Santa Cruz County as 4.25 in/hr (108 mm/hr) for a time of concentration of 5 minutes; see Appendix C. A runoff coefficient of 1.0 was used for the added impervious areas. The additional flow was estimated to be 21.53 cubic feet per second (0.61 cubic meters per second) for the Transportation System Management Alternative and 31.84 cubic feet per second (0.90 cubic meters per second) for the High Occupancy Vehicle Alternative. Thus, the 100-year design discharge is 1,671 cubic feet per second (47.31 cubic meters per second) for the Transportation System Management Alternative and 1,681 cubic feet per second (47.60 cubic meters per second) for the High Occupancy Vehicle Alternative.

3.1.4.2 Stream and Site

Arana Gulch is heavily vegetated upstream of the Route 1 crossing. Arana Gulch is conveyed under Route 1 through a concrete arch culvert with a height of 6 feet (1.8 meters). The span of the culvert was estimated to be 5.7 feet (1.7 meters). Downstream of the Route 1 crossing is a concrete lined channel that has gravel along the bottom. Arana Gulch crosses Route 1 at 29° from perpendicular.

3.1.4.3 Design Tool

The effects of the increased flow resulting from the roadway widening at the Arana Gulch crossing at Route 1 were evaluated using the U.S. Army Corps of Engineers Hydrologic Engineering Centers-River Analysis System modeling software (Version 4.1.0). Hydraulic analyses were performed for the existing and proposed conditions.

3.1.4.4 Cross Section Data

Cross sections were based on aerial survey. A total of 11 cross sections were cut over a distance of 492 feet (150 meters) along Arana Gulch. For the existing conditions and the proposed Transportation System Management Alternative conditions, seven of these cross sections are located upstream of Route 1, and four are downstream of the crossing. Route 1 is located between River Stations 210 and 290. The proposed High Occupancy Vehicle Alternative conditions include widening on both sides of the highway, resulting in six cross sections upstream of Route 1 and two cross sections downstream of the crossing. Route 1 is located between River Stations 195 and 295. The cross section locations are shown in Appendix D.

3.1.4.5 Manning's n

Manning's n values were used in the hydraulic model to estimate energy losses in the flow due to friction. Upstream of the Route 1 crossing, a Manning's n value of 0.06 was used to depict friction characteristics of a floodplain with trees. The Manning's n value for cross-sections downstream of the Route 1 crossing was 0.017 to represent a concrete

channel with gravel bottom. These Manning's n values were selected based on observations from field visits to the site.

3.1.4.6 Expansion and Contraction Coefficients

An expansion coefficient of 0.3 and a contraction coefficient of 0.1 were used to represent the creek. These values describe creek geometry with gradual transitions between cross sections. An expansion coefficient of 0.5 and a contraction coefficient of 0.3 were used to represent the bridge.

3.1.4.7 Arana Gulch Water Surface Elevations

Based on preliminary calculations, the estimated water surface elevation for the 100-year peak discharge at the cross section immediately upstream of Route 1 was 70.16 ft (21.39 meters) for the existing condition, 70.19 feet (21.40 meters) for the Transportation System Management Alternative condition, and 70.09 feet (21.37 meters) for the High Occupancy Vehicle Alternative condition. The Transportation System Management Alternative would result in a water surface elevation increase of 0.03 feet (0.01 meters), and the High Occupancy Vehicle Alternative would result in a decrease of 0.06 feet (0.02 meters) in the water surface elevation. According to Flood Insurance Rate Map Number 06087C0351D, the 100-year water surface elevation overtops Route 1 at the Arana Gulch crossing. The Hydrologic Engineering Centers-River Analysis System results indicate that the roadway is overtopped in both the existing and proposed conditions, which is consistent with the Flood Insurance Rate Map. See Appendix D for summary output results from the existing and two alternative condition models.

3.1.5 Increase in Impervious Surfaces

For all five locations where there are defined floodplains, there would be an increase in impervious surface areas from the widened pavement areas, resulting in increases to peak storm water runoff and a reduction in the amount of pervious surfaces available for infiltration of storm water runoff. The Tier I project design goal will be to maintain pre-construction storm water flows, as discussed in Section 3.1.9. Doing so would help to ensure that storm water runoff from the Tier I project would minimize downstream effects.

In general, impacts to the floodplain would differ for the two build alternatives depending on the amount, and nature, of widening. For the High Occupancy Vehicle Lane Alternative, the increase in roadway runoff would be from the roadway widening of the auxiliary lanes and the high occupancy vehicle lanes. For the Transportation System Management Alternative, the increase in roadway runoff would be from the roadway widening of the auxiliary lanes.

In comparing the two build alternatives, the High Occupancy Vehicle Lane Alternative would increase the roadway runoff more than the Transportation System Management Alternative. Table 5 and Table 6 summarize the proposed increases in impervious surface areas contributing to the creeks with associated floodplains. The increase in area

is greater for the High Occupancy Vehicle Lane Alternative than the Transportation System Management Alternative at each crossing, for a total 38.6-acre increase in area for the High Occupancy Vehicle Lane Alternative and a total 15.7-acre increase in area for the Transportation System Management Alternative for the five locations. These increases in area are compared to the overall watershed drainage areas at each crossing.

Table 5. Increased Impervious Areas for the High Occupancy Vehicle Lane Alternative - Tier I Project

Location	Increased Impervious Area	Increased Impervious Area	Watershed Area	Watershed Area	Percentage Increase in Overall Watershed Area
	(acres)	(square meters)	(acres)	(square meters)	(%)
Aptos Creek	10.56	42726	15,360	62,160,000	0.07%
Nobel Creek	5.90	23880	614	2,483,660	0.96%
Soquel Creek	13.79	55803	27,520	111,370,000	0.05%
Rodeo Creek Gulch	2.39	9673	1,572	6,360,241	0.15%
Arana Gulch	6.30	25508	2,239	9,060,000	0.28%

Note: For locations where there are defined floodplains only.

Table 6. Increased Impervious Areas for the Transportation System Management Alternative – Tier I Project

Location	Increased Impervious Area	Increased Impervious Area	Watershed Area	Watershed Area	Percentage Increase in Overall Watershed Area
	(acres)	(square meters)	(acres)	(square meters)	(%)
Aptos Creek	5.32	21540	15,360	62,160,000	0.03%
Nobel Creek	1.71	6910	614	2,483,660	0.28%
Soquel Creek	2.27	9200	27,520	111,370,000	0.01%
Rodeo Creek Gulch	1.35	5460	1,572	6,360,241	0.09%
Arana Gulch	4.49	18180	2,239	9,060,000	0.20%

Note: For locations where there are defined floodplains only.

As shown in Table 5 and Table 6, the Tier I project under either alternative would not pose a significant risk by widening Route 1. The increase in roadway runoff would be minimal, in comparison to the overall watersheds of the creeks for both build alternatives (less than 0.96% on average at each crossing). Therefore, there would be an insignificant change in the water surface elevation to the five identified floodplain areas due to the widening proposed for both build alternatives. In addition, the roadway elevations are higher than the 100-year water surface elevation at these crossings, so there would not be a significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles due to the Tier I project's proposed improvements. The exception is at the Arana Gulch crossing where the 100-year base flood water surface

elevation currently overtops the existing roadway elevation. In the existing condition, the Bay Avenue/Porter Street interchange encroaches onto the Soquel Creek floodplain through the roadway on- and off-ramps, which are also higher than the floodplain. Proposed improvements at this interchange should be such that the on- and off-ramps remain above the 100-year water surface elevation (see Section 2.1).

It should be noted, however, that at the Aptos Creek and Soquel Creek crossings, properties exist within the floodplain adjacent to the creeks that are at a much lower elevation than the elevation of Route 1.

3.1.6 Risk Associated with Implementation of the Action

The Federal Highway Administration 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) a significant potential for interruption or termination of a transportation facility which 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 (Federal Highway Administration, 1994).

1. For both build alternatives, the Tier I Project does not have any impact on the existing potential for interruption or termination of a transportation facility that is needed for emergency vehicles, nor does it provide a community's only evacuation route. Other local roads can be utilized for emergency vehicles or as evacuation routes. Based on available data, there may be traffic interruptions at the Arana Gulch crossing of Route 1 in the existing condition. However, traffic could utilize frontage roads and local streets (such as La Fonda Avenue) that are not inundated by the base flood. FEMA flood profile shows that Route 1 is overtopped in the existing condition at the Arana Gulch crossing during 100-year storm events. Preliminary models with the additional runoff due to the Tier I Project indicate that the Transportation System Management Alternative would result in a slight water surface elevation increase of 0.03 feet (0.01 meters), and the High Occupancy Vehicle Alternative would result in a decrease of 0.06 feet (0.02 meters) in the water surface elevation. Therefore, there would be negligible impacts to the water surface elevation and floodplain extents due to the Tier I Project

2. The level of risk associated with the Tier I project is low. It is not anticipated that the Tier I Project would have significant impacts because the added impervious areas resulting from the Tier I Project would not significantly increase the flow, or raise the water surface elevations of the base floodplains.

3. The Tier I project would impact natural and beneficial floodplain values. For the High Occupancy Vehicle Lane Alternative, natural and beneficial floodplain values would be impacted at Aptos Creek, Soquel Creek, and Arana Gulch. For the Transportation System Management Alternative, natural and beneficial

floodplain values would be impacted at Arana Gulch. Environmental impacts can be minimized with measures such as revegetation, Best Management Practices, or other requirements anticipated as part of the Tier I project permit conditions. Impact areas were tabulated for each crossing and are summarized in Section 3.1.7.

3.1.7 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 ground water recharge.

Impacts on natural and beneficial floodplain values were assessed by evaluating Areas of Potential Effects to the U.S. Army Corps of Engineers wetlands, California Coastal Commission wetlands, and California Department of Fish and Wildlife jurisdictional areas. These areas of potential effects were identified in the *Wetlands Assessment Report* (Wetland Assessment, 2008).

The U.S. Army Corps of Engineers wetland definition is a three-parameter definition. In order for a location to be designated "wetland," all three criteria must be met: vegetation, soil, and hydrology. The California Coastal Commission definition requires that only one of the three conditions is present.

The U.S. Army Corps of Engineers definition reads as follows:

"The following definition, diagnostic environmental characteristics, and technical approach comprise a guideline for the identification and delineation of wetlands.

a. Definition: The U.S. Army Corps of Engineers (Federal Register, Section 328.3(b), 1991) and the EPA (Federal Register, Section 230.4(t), 1991) jointly define wetlands as: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

b. Diagnostic environmental characteristics: Wetlands have the following general diagnostic environmental characteristics:

    1. Vegetation: The prevalent vegetation consists of macrophytes that are typically adapted to areas having hydrologic and soil conditions described in (a) above. Hydrophytic species, due to morphological, physiological, and/or reproductive adaptation(s), have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions.

2. Soil: Soils are present and have been classified as hydric, or they possess characteristics that are associated with reducing soil conditions.
3. Hydrology: The area is inundated either permanently, or periodically at mean water depths <6.6 feet. (~ 2 meters), or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation. The period of inundation or soil saturation varies according to the hydrologic/soil moisture regime and occurs in both tidal and non-tidal situations.

c. Technical approach for the identification and delineation of wetlands: Except in certain situations defined in this manual, evidence of a minimum of one positive wetland indicator from each parameter (hydrology, soil, and vegetation) must be found in order to make a positive wetland determination."

Source: U.S. Army Corps of Engineers, 1987

Jurisdictional waters and wetlands within the biological study area are summarized in Table 7 for the High Occupancy Vehicle Alternative and Table 8 for the Transportation System Management Alternative. Approximately 0.26 ac (5,108 m²) of U.S. Army Corps of Engineers jurisdictional areas and approximately 10.40 ac (42,072 m²) of California Department of Fish and Wildlife jurisdictional areas are present within the Tier I project limits (Jurisdictional Areas within the Biological Study Area, 2010).

The Tier I project would impact natural and beneficial floodplain values under both alternatives. For the High Occupancy Vehicle Lane Alternative, natural and beneficial floodplain values would be impacted at Aptos Creek, Soquel Creek, and Arana Gulch. For the Transportation System Management Alternative, natural and beneficial floodplain values would be impacted at Arana Gulch. In general, impacts to the natural and beneficial floodplain values would differ for the two alternatives depending on the amount, and nature, of widening. For both build alternatives, the amount of impact to the natural and beneficial floodplain values would be from the bridge widening and culvert extensions proposed for the Tier I project.

Designated wetlands and waters of the United States areas have been identified at other locations but do not have associated floodplains. Designated wetland areas are present within all creeks crossed by the Tier I project except at the tributary to Tannery Gulch. Designated wetland areas within the Tier I project limits, identified by SWCA, which are also within delineated floodplain areas defined by the Federal Emergency Management Agency are identified in Table 9. These areas are common to both build alternatives.

Table 7. Jurisdictional Waters/Wetlands within the Biological Study Area - High Occupancy Vehicle Alternative under Tier I Project

Site No.	Jurisdictional Area (WITHIN COASTAL ZONE)		ACOE Jurisdiction				Impacts to CCC/CDFG Jurisdiction[1]	
			Impacts to Wetlands		Impacts to Other Waters			
			Acre	Sq. Meter	Acre	Sq. Meter	Acre	Sq. Meter
1a, 1b	Valencia Channel and Lagoon	Permanent	0	0			0	0
		Temporary	0	0			0	0
2a	Valencia Creek roadside ditches	Permanent			0.03	128	0.03	128
		Temporary			0.00	0	0.00	0
2b	Valencia Creek/ Aptos Creek	Permanent	0.15	592			1.38	5,592
		Temporary	0.02	67			0.26	1,048
3	Ord Gulch	Permanent	0.09	378	0.01	50	1.50	6,058
		Temporary	0	0	0	0	0.06	246
4	Borregas Creek	Permanent	0	0			0.03	127
		Temporary	0	0			0.04	166
5	Potbelly Creek	Permanent	0	0			0.04	175
		Temporary	0	0			0.01	30
6	Tannery Gulch	Permanent	0	0			0	0
		Temporary	0	0			0	0
7	Tannery Gulch Tributary	Permanent						
		Temporary						
8	Monterey Avenue /Nobel Creek	Permanent	0.00	5	0	0	0.24	983
		Temporary	0.01	56	0	0	0.09	368
SUBTOTAL			*0.27*	*1,098*	*0.04*	*178*	*3.69*	*14,921*

Site No.	Jurisdictional Area (OUTSIDE COASTAL ZONE)		ACOE Jurisdiction				Impacts to CDFG Jurisdiction[2]	
			Impacts to Wetlands		Impacts to Other Waters			
			Acre	Sq. Meter	Acre	Sq. Meter	Acre	Sq. Meter
6	Tannery Gulch	Permanent	0	0			0	0
		Temporary	0	0			0	0
8	Monterey Avenue /Nobel Creek	Permanent			0	0	0	0
		Temporary			0	0	0	0
9	Soquel Creek	Permanent	0.30	1,228			1.01	4,086
		Temporary	0.07	301			0.21	831
10a	Rodeo Gulch	Permanent	0	0			0.15	596
		Temporary	0	0			0.08	308
10b	Soquel Drive-Inn roadside ditch	Permanent			0.04	179	0.04	179
		Temporary			0.04	166	0.04	166
11	Arana Gulch	Permanent	0.20	797			3.34	13,517
		Temporary	0.12	469			0.36	1,473
12	La Fonda Road Shoulder	Permanent	0.04	163				
		Temporary	0.00	0				
13	Arana Gulch Tributary	Permanent			0.07	288	1.22	4,938
		Temporary			0.06	241	0.26	1,057
SUBTOTAL			*0.73*	*2,958*	*0.22*	*874*	*6.71*	*27,151*

ACOE Jurisdiction – Impact Totals		1.00	4,056	0.26	1,052		
CDFG Jurisdiction – Impact Total						10.40	42,072
CCC Jurisdiction – Impact Total						3.69	14,921

[1] *CDFG/CCC jurisdiction includes ACOE areas.*

[2] *CDFG jurisdiction includes ACOE areas.*

Source: Jurisdictional Areas within the Biological Study Area. (March 2010)

Table 8. Jurisdictional Waters/Wetlands within the Biological Study Area - Transportation System Management Alternative under Tier I Project

Site No.	Jurisdictional Area (WITHIN COASTAL ZONE)		ACOE Jurisdiction				Impacts to CCC/CDFG Jurisdiction[1]	
			Impacts to Wetlands		Impacts to Other Waters			
			Acre	Sq. Meter	Acre	Sq. Meter	Acre	Sq. Meter
1a, 1b	Valencia Channel and Lagoon	Permanent	0	0			0	0
		Temporary	0.00	14			0.00	14
2a	Valencia Creek roadside ditches	Permanent			0.02	65	0.02	65
		Temporary			0.00	1	0.00	1
2b	Valencia Creek/ Aptos Creek	Permanent	0.05	190			0.31	1,257
		Temporary	0.02	92			0.22	904
3	Ord Gulch	Permanent	0.09	378	0.06	251	1.56	6,296
		Temporary	0.00	0	0.00	0	0.06	236
4	Borregas Creek	Permanent	0	0			0.06	241
		Temporary	0	0			0.01	56
5	Potbelly Creek	Permanent	0	0			0.07	274
		Temporary	0	0			0.04	165
6	Tannery Gulch	Permanent	0	0			0	0
		Temporary	0	0			0	0
7	Tannery Gulch Tributary	Permanent						
		Temporary						
8	Monterey Avenue /Nobel Creek	Permanent	0	0	0	0	0.18	712
		Temporary	0.00	0	0	0	0.00	12
SUBTOTAL			*0.17*	*674*	*0.08*	*317*	*2.53*	*10,233*

Site No.	Jurisdictional Area (OUTSIDE COASTAL ZONE)		ACOE Jurisdiction				Impacts to CDFG Jurisdiction[2]	
			Impacts to Wetlands		Impacts to Other Waters			
			Acre	Sq. Meter	Acre	Sq. Meter	Acre	Sq. Meter
6	Tannery Gulch	Permanent	0	0			0	0
		Temporary	0	0			0	0
8	Monterey Avenue /Nobel Creek	Permanent			0	0	0.01	21
		Temporary			0	0	0	0
9	Soquel Creek	Permanent	0.06	242			0.27	1,091
		Temporary	0.01	39			0.03	113
10a	Rodeo Gulch	Permanent	0	0			0.11	443
		Temporary	0	0			0.00	0
10b	Soquel Drive-Inn roadside ditch	Permanent			0.01	56	0.01	56
		Temporary			0.02	95	0.02	95
11	Arana Gulch	Permanent	0.00	6			0.47	1,883
		Temporary	0.00	20			0.33	1,351
12	La fonda Road Shoulder	Permanent	0.03	133				
		Temporary	0.00	0				
13	Arana Gulch Tributary	Permanent			0.01	32	0.51	2,070
		Temporary			0.00	7	0.24	986
SUBTOTAL			*0.11*	*440*	*0.05*	*190*	*2.00*	*8,109*
ACOE Jurisdiction – Impact Totals			0.28	1,114	0.13	507		
CDFG Jurisdiction – Impact Total							4.53	18,342
CCC Jurisdiction – Impact Total							2.53	10,233

[1] *CDFG/CCC jurisdiction includes ACOE areas.*

[2] *CDFG jurisdiction includes ACOE areas.*

Source: Jurisdictional Areas within the Biological Study Area. (March 2010)

Table 9. Designated Floodplain Areas Within Jurisdictional Areas of the Tier I Project

Waterway Crossing	Station at Route 1 Crossing	ACOE Jurisdiction (square feet)	CCC Jurisdiction1 (square feet)	CDFW Jurisdiction[2] (square feet)
Valencia Channel	75+30	---	---	---
Aptos Creek	90+00	6,232	38,352	38,352
Ord Gulch	107+85	---	---	---
Borregas Creek	110+69	---	---	---
Pot Belly Creek	114+90	---	---	---
Tannery Gulch	118+64	---	---	---
Unnamed tributary to Tannery Gulch	122+66	---	---	---
Nobel Creek	130+08	---	5,393	5,393
Soquel Creek	143+60	24,789	---	70,127
Rodeo Creek Gulch	154+24	1,787	---	12,152
Arana Gulch	171+03	11,959	---	91,149
tributary to Arana Gulch	175+98	---	---	---
tributary to Arana Gulch	177+92	---	---	---
tributary to Arana Gulch	183+01	---	---	---
Total Floodplains Within ACOE Jurisdiction		**44,767**	---	---
Total Floodplains within CCC Jurisdiction		---	---	---
Total Floodplains within CDFW Jurisdiction		---	**43,744**	**217,172**

Source: Jurisdictional Areas within the Biological Study Area (March 2010)

Notes:
1. CCC Jurisdiction includes ACOE areas.
2. CDFW jurisdiction includes ACOE areas.

In general, the impacts to the natural and beneficial floodplain values would be greater for the High Occupancy Vehicle Lane Alternative than the Transportation System Management Alternative because there is more widening proposed for the High Occupancy Vehicle Lane Alternative.

For both alternatives, habitats for special status species have the potential to occur within the Tier I project corridor. The Tier I project would be designed to minimize impact to waters of the U.S., including jurisdictional wetlands.

A summary of the estimated surface area of natural and beneficial floodplain encroachments is listed in Table 11 for both alternatives. The encroachments represent loss of wetland areas that are also within floodplain areas, as a result of improvements from the Tier I project construction within the Biological Study Area, as delineated by SWCA.

3.1.8 Support of Probable Incompatible Floodplain Development

As defined by Federal Highway Administration, 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.

Portions of the Tier I project site are located in the fringe of the floodplain, and there are unavoidable impacts to the floodplain associated with the widening for both build alternatives. However, as mentioned previously, these impacts are insignificant because the encroachment is minimal; the added impervious areas would not significantly raise the water surface elevation in the floodplains. In addition, new access to developed or undeveloped lands would not be added. Therefore, this Tier I project, under both build alternatives, would not support any incompatible floodplain development.

3.1.9 Measures to Minimize Floodplain Impacts Associated with the Action

It is important that measures be taken to minimize floodplain impacts for the Tier I project. The design of the bridge widening at Aptos and Soquel creeks and other drainage improvements will be such that the loss of local floodplain storage will be minimized. Better end treatments, such as wingwalls, would be considered at culvert crossings where culvert improvements are proposed to improve hydraulics. Preliminary calculations indicate that the culverts at Arana Gulch, the tributary to Arana Gulch, and the tributary to Tannery Gulch are undersized and would need to be replaced with larger sizes (or parallel systems). The undersized systems at the tributary to Arana Gulch and the tributary to Tannery Gulch, listed in Table 10, are not within base floodplains. The undersized system at Arana Gulch is within a base floodplain.

Table 10. Undersized Culverts at Waterway Crossings – Tier I Project

Waterway Crossing	Station	Existing Culvert Size	Proposed Action
Arana Gulch	171+03	72-in (1800-mm) (height) concrete arch culvert	Replacement with larger sizes or parallel systems
tributary to Arana Gulch	177+92	4-ft by 4-ft (1200-mm by 1200-mm) reinforced concrete box culvert	Replacement with larger sizes or parallel systems
tributary to Tannery Gulch	122+66	48-in (1200 mm) reinforced concrete pipe culvert	Replacement with larger sizes or parallel systems

Drainage design improvements are proposed to accommodate increased peak storm water runoff from the roadway. The Tier I project design goal will be to maintain pre-construction storm water flows by metering or detaining post-construction flows to pre-construction rates prior to discharge to a receiving water body or municipal separate storm sewer system. Retaining walls are proposed adjacent to the roadway widening to

minimize encroachment into environmentally sensitive areas. The proposed retaining wall at the Soquel Creek crossing and at the north end of the Arana Gulch crossing would be within 100-year base floodplains for the High Occupancy Vehicle Lane Alternative. The proposed retaining wall at the north end of the Arana Gulch crossing would be within 100-year base floodplains for the Transportation System Management Alternative.

Appropriate best management practices are proposed to minimize storm water quality impacts by reducing storm water runoff velocities and promoting infiltration to the maximum extent practicable. Both temporary and permanent best management practices are proposed and will be incorporated into the contract documents of this Tier I project, as required by the Caltrans' National Pollutant Discharge Elimination System permit and the Construction General Permit. The Caltrans *Storm Water Handbooks*, including the *Project Planning and Design Guide* (2010 with May 2012 revisions), provide guidance for evaluating projects to determine the need for and feasibility of construction site, design pollution prevention, and permanent treatment best management practices. Design pollution prevention best management practices are permanent measures to improve storm water quality by reducing erosion, stabilizing disturbed soil areas, and maximizing vegetated surfaces. Treatment best management practices are permanent devices and facilities that treat storm water runoff. This evaluation is detailed further in the project *Water Quality Study* (2013).

The Tier I project is scheduled to begin construction after July 1, 2010 and is thereby subject to the adopted "National Pollutant Discharge Elimination System General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities" (NPDES Number CAS000002). Under this permit, projects are required to complete a risk assessment to determine the combined sediment and receiving water risk. Based on these two risk factors, a project is given a risk level of 1, 2, or 3, with associated construction requirements increasing with the risk level number. Based on a preliminary assessment, the Tier I project would be classified as Risk Level 2 (medium risk) or Risk Level 3 (high risk), depending on the location along the Tier I project corridor. The requirements for Risk Level 2 and Risk Level 3 projects are presented in Attachment D of the National Pollutant Discharge Elimination System Permit.

Mitigation for impacts to wetlands and Waters of the United States will be addressed through consultation with appropriate regulatory agencies. Short-term impacts generally result from construction activities such as grading work or dewatering. Temporary best management practices will be considered for this Tier I project to prevent potential water quality degradation during construction. Long-term impacts from the Tier I project could result from floodplain and wetland fill, and potential increases to velocity and volume of downstream flows due to added impervious areas. Storm water runoff from the Route 1 corridor has the potential to carry pollutants into natural flowing streams as well as into adjacent jurisdictional biotic/aquatic areas. Permanent best management practices will be considered to address these impacts and try to reduce erosion and collect and treat roadway runoff.

The original treatment best management practice strategy for this Tier I project was developed according to the procedures presented in the California Department of Transportation *Project Planning and Design Guide* (2010 with May 2012 revisions), which considered treatment based on the targeted design constituents and general purpose pollutant removal. The *Project Planning and Design Guide* provides guidance for determination of preferred treatment best management practices based on the estimated ability of a treatment best management practice to infiltrate the water quality volume.

The following is a list of permanent Treatment Best Management Practices that were considered for this Tier I project:

- Biofiltration Devices
- Infiltration Devices
- Media Filters
- Detention Devices
- Wet Basins
- Multi-Chambered Treatment Trains

Treatment best management practices that are feasible for this Tier I project include biofiltration devices, infiltration devices, media filters and detention devices. The other treatment best management practices were considered infeasible due to, but not limited to, site restrictions, limited right-of-way, protection of wetlands or vegetation, vector control and limited hydraulic head. The preferred treatment Best management practices for this Tier I project would be biofiltration devices or infiltration devices.

Table 11. Surface Area of Natural and Beneficial Floodplain Encroachment - Tier I Project

High Occupancy Vehicle Lane Alternative

Waterway Crossing	Station at Highway 1 Crossing	Total Floodplain Area Within BSA and Jurisdictional Areas						Floodplain Area within BSA			Percentage of Affected Floodplain Within BSA					
		ACOE Jurisdiction		CCC Jurisdiction		CDFG Jurisdiction					ACOE Jurisdiction		CCC Jurisdiction		CDFG Jurisdiction	
		Temporary (ft^2)	Permanent (ft^2)	Temporary (ft^2)	Permanent (ft^2)	Temporary (ft^2)	Permanent (ft^2)	ACOE Jurisdiction (ft^2)	CCC Jurisdiction (ft^2)	CDFG Jurisdiction (ft^2)	Temporary %	Permanent %	Temporary %	Permanent %	Temporary %	Permanent %
Unnamed Waters of the U.S.	49+65	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Valencia Channel	75+30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Aptos Creek	90+00	441	3,563	2,227	18,900	2,227	18,900	11,377	141,922	141,922	4%	31%	2%	13%	2%	13%
Ord Gulch	107+85	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Borregas Creek	110+69	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pot Belly Creek	114+90	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tannery Gulch	118+64	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
unnamed tributary to Tannery Gulch	122+66	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Nobel Creek	130+08	---	---	---	---	---	---	1,862	38,718	38,718	---	---	---	---	---	---
Soquel Creek	143+60	3,235	12,574	---	---	4,903	23,775	27,028	---	55,606	12%	47%	---	---	9%	43%
Rodeo Creek Gulch	154+24	---	---	---	---	---	---	9,023	---	48,653	---	---	---	---	---	---
Arana Gulch	171+03	2,072	2,196	---	---	4,941	20,137	62,291	---	180,992	3%	4%	---	---	3%	11%
tributary to Arana Gulch	175+98	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
tributary to Arana Gulch	177+92	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
tributary to Arana Gulch	183+01	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Note: CCC and CDFG jurisdiction includes ACOE areas

Transportation System Management Alternative

Waterway Crossing	Station at Highway 1 Crossing	Total Floodplain Area Within BSA and Jurisdictional Areas						Floodplain Area within BSA			Percentage of Affected Floodplain Within BSA					
		ACOE Jurisdiction		CCC Jurisdiction		CDFG Jurisdiction					ACOE Jurisdiction		CCC Jurisdiction		CDFG Jurisdiction	
		Temporary (ft^2)	Permanent (ft^2)	Temporary (ft^2)	Permanent (ft^2)	Temporary (ft^2)	Permanent (ft^2)	ACOE Jurisdiction (ft^2)	CCC Jurisdiction (ft^2)	CDFG Jurisdiction (ft^2)	Temporary %	Permanent %	Temporary %	Permanent %	Temporary %	Permanent %
Unnamed Waters of the U.S.	49+65	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Valencia Channel	75+30	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Aptos Creek	90+00	---	---	---	---	---	---	6,228	38,356	38,356	---	---	---	---	---	---
Ord Gulch	107+85	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Borregas Creek	110+69	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pot Belly Creek	114+90	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tannery Gulch	118+64	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
unnamed tributary to Tannery Gulch	122+66	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Nobel Creek	130+08	---	---	---	---	---	---	---	5,389	5,389	---	---	---	---	---	---
Soquel Creek	143+60	---	---	---	---	---	---	24,791	---	70,129	---	---	---	---	---	---
Rodeo Creek Gulch	154+24	---	---	---	---	---	---	1,790	---	12,157	---	---	---	---	---	---
Arana Gulch	171+03	2,854	3,262	---	---	4,517	19,269	11,955	---	91,144	24%	27%	---	---	5%	21%
tributary to Arana Gulch	175+98	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
tributary to Arana Gulch	177+92	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
tributary to Arana Gulch	183+01	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Note: CCC and CDFG jurisdiction includes ACOE areas

3.1.10 Measures to Restore and Preserve the Natural and Beneficial Floodplain Values Impacted by this Action

The measures to restore and preserve the natural and beneficial floodplain values are common to both build alternatives under the Tier I project.

The Tier I project, under both build alternatives, would result in a loss of wetland area and vegetation (see Section 3.1.7). Environmental impacts would be a result of construction activities and can be mitigated with measures such as revegetation, Best Management Practices, or other requirements anticipated as part of the Tier I project permit conditions. Refer to the *Wetland Assessment* report for this Tier I project for wetland mitigation measures (Wetland Assessment, 2008).

The Santa Cruz County Regional Transportation Commission should obtain, as necessary, permits or approvals from the United States Army Corps of Engineers, California Department of Fish and Wildlife, the United States Fish and Wildlife Service, the Regional Water Quality Control Board, and the National Oceanic and Atmospheric Administration National Marine Fisheries Service.

3.1.11 Practicability of Alternatives to Any Significant Encroachments

As defined by the Federal Highway Administration, 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 increase in risk associated with the Tier I project is negligible. Of the two build alternatives, the Transportation System Management Alternative has the least amount of impacts to floodplains because the footprint is not as extensive as the High Occupancy Vehicle Lane Alternative, which involves the widening of outside lanes. Facilities under consideration for this build alternative include High Occupancy Vehicle bypass lanes on interchange on-ramps and auxiliary lanes between interchanges. The Transportation System Management Alternative does not include the addition of new through-lanes.

The Tier I project, under both build alternatives, would maintain the existing profile. The effects to the floodplain would be minimal because storm drainage systems would be upsized to accommodate the increased flow from these roadway improvements. Refer to Sections 3.1.6, 3.1.7, and 3.1.8 for the discussion of risks associated with the Tier I project.

The goals of the Tier I project are to reduce congestion, to reduce delay, and to encourage ridesharing and transit use. The Tier I project has considered practicable alternatives to minimize environmental impacts while trying to accomplish its purpose. Both build alternatives would maintain the existing alignment and profile to minimize environmental impacts while also minimizing costs and accomplishing the Tier I project's goals.

3.1.12 Practicability of Alternatives to any Longitudinal Encroachments

As defined by the Federal Highway Administration, 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.

This Tier I project, under both build alternatives, would be perpendicular to the direction of flow, which is a transverse encroachment, and not considered a longitudinal encroachment into the 100-year base floodplains. Therefore, other alternatives were not considered.

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

Gregor Blackburn, Senior Natural Hazards Program Specialist with the Federal Emergency Management Agency, and Jessica DeGrassi, Resource Planner for the Santa Cruz County Planning Department, were contacted to discuss Tier I project impacts to the watershed and floodplain. Due to the encroachment on the regulatory floodways, the Santa Cruz County Planning Department will review this report to determine if floodplain map revisions are necessary. Revisions are not anticipated because the increases in the base floodplain elevations are minimal. Once the Environmental Document is finalized, copies will be distributed to the Santa Cruz County Planning Department.

3.2 Tier II Project

The Tier II project does not propose additional fill or change in roadway grade within the floodplain. The proposed features of the Tier II project that would have the potential to impact the floodplains would be the added impervious areas from the roadway widening upstream of the floodplains. The added impervious areas would result in an increase in roadway runoff within the drainage areas to the floodplains.

3.2.1 Soquel Creek and Rodeo Creek Gulch

The Rodeo Creek Gulch crossing flows through a 106-inch concrete arch culvert within the Tier II project limits, and therefore would receive runoff from the Tier II project. Although outside of the Tier II project limits, Soquel Creek would also receive runoff from the Tier II project because of the existing topography.

Based on available information, the improvements proposed for the Tier II project would not result in an encroachment into the floodplains at Soquel Creek or Rodeo Creek Gulch.

3.2.2 Arana Gulch

As with the Tier I project, the 100-year water surface elevation overtops Route 1 at the Arana Gulch crossing in the existing condition. A hydraulic model was prepared for the Tier I project, which showed that with an added impervious area of 0.3%, there would be negligible impacts to the water surface elevation and floodplain extents. Therefore, because the added impervious area of 0.08% with the Tier II project is less than the added impervious area from the Tier I project, the Tier II project should have negligible impacts to the water surface elevation and floodplain extent at Arana Gulch.

3.2.3 Increase in Impervious Surfaces

The Rational Method was utilized to estimate additional flow from the added impervious surfaces. The additional flow reaching the three streams was estimated to be 5.3 cfs for Soquel Creek, 7.9 cfs for Rodeo Creek Gulch, and 7.6 cfs for Arana Gulch for the 100-year recurrence interval flow. The additional flow reaching the three streams for the 25-year recurrence interval storm was estimated to be 4.2 cfs for Soquel Creek, 6.3 cfs for Rodeo Creek Gulch, and 6.1 cfs for Arana Gulch.

The increase in roadway runoff resulting from the Tier II project would be minimal in comparison to the overall watersheds of the creeks. Therefore, there would be an insignificant change in the water surface elevation to the three identified floodplain areas as a result of the Tier II project; see Table 12.

Table 12. Increased Impervious Areas - Tier II Project

Location	Increased Impervious Area from Tier II Project	Existing Watershed Area	Percentage Increase in Overall Watershed Area
	(sq mi)	(sq mi)	(%)
Soquel Creek	0.0019	43	0.005
Rodeo Creek Gulch	0.0029	2.5	0.12
Arana Gulch	0.0028	3.5	0.08

3.2.4 Risk Associated with Implementation of the Action

The level of risk associated with the Tier II project is low. It is not anticipated that the Tier II project would have significant impacts because the added impervious areas resulting from the Tier II project would not significantly increase the flow, or raise the water surface elevations of the base floodplains. The roadway profile would not change. New access to developed or undeveloped lands would not be added. Therefore, the Tier II project would not support incompatible floodplain development.

At the Soquel Creek and Rodeo Creek Gulch crossings, the roadway elevations are higher than the 100-year water surface elevations, so there would not be a significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles due to the Tier II project's improvements. At the Arana Gulch crossing, the 100-year water surface elevation overtops Route 1 in the existing condition. However, with an

added impervious area of 0.08%, the Tier II project should have negligible impacts to the water surface elevation and floodplain extent at Arana Gulch.

The Summary Floodplain Encroachment Reports for the Tier II project are included as Appendix A.3.

3.2.5 Impacts on Natural and Beneficial Floodplain Values

The Tier II project was evaluated for the potential to impact natural and beneficial floodplain values. As with the Tier I project, the impacts to these areas would be as a result of the proposed widening. Areas of designated wetlands and waters of the United States have been identified by SWCA, which are also within designated floodplain areas defined by the Federal Emergency Management Agency.

For the Tier II project, the impacts on natural and beneficial floodplain values were assessed by evaluating the Areas of Potential Effects to U.S. Army Corps of Engineers wetlands, California Coastal Commission wetlands, and California Department of Fish and Wildlife jurisdictional areas. Jurisdictional waters and wetlands within the biological study area were identified by SWCA and are shown in Table 7. The sites within the Tier II project are shown in Table 13. The *Wetland Assessment* report discusses the additional mitigation proposed to address these additional Tier II project impacts. A floodplain has not been delineated for the Soquel Drive-In roadside ditch. Designated wetland areas that are also within designated floodplain areas, which were defined by the Federal Emergency Management Agency, are identified in Table 14.

Table 13. Jurisdictional Waters/ Wetlands within the Tier II Project Biological Study Area

Site No.	Jurisdictional Area	Impacts to CDFW Jurisdiction	
	(Outside Coastal Zone)	Permanent (Acre)	Temporary (Acre)
10a	Rodeo Creek Gulch	0.13	0.09
10b	Soquel Drive-In Roadside Ditch	0.02	0.06
CDFW Jurisdiction- Impact Totals		0.15	0.15

Table 14. Designated Floodplain Areas Within Jurisdictional Areas of the Tier II Project

Waterway Crossing	Station at Route 1 Crossing	USACE Jurisdiction	CCC Juridiction	CDFW Jurisdiction
Rodeo Creek Gulch	506+04 ft	1,787 sq ft	--	12,152 sq ft

The Tier II project would not have the potential to impact natural and beneficial floodplain values because the widening would be outside of the floodplains.

3.2.6 Support of Probable Incompatible Floodplain Development

The Tier II project would not support incompatible floodplain development. The Tier II project widening would not encroach onto the Rodeo Creek Gulch floodplain. The added impervious areas would not significantly raise the water surface elevation in the floodplains. Furthermore, new access to developed or undeveloped lands would not be added. Therefore, the Tier II project would not support incompatible floodplain development.

3.2.7 Measures to Minimize Floodplain Impacts Associated With the Action

Because impacts to the floodplains are not anticipated, measures to minimize floodplain impacts are not proposed for the Tier II project.

3.2.8 Measures To Restore and Preserve the Natural and Beneficial Floodplain Values Impacted By This Action

Because impacts to natural and beneficial floodplain values are not anticipated, measures to restore and preserve these areas are not proposed for the Tier II project.

Section 3.1.10 lists the agencies from which permits are anticipated for the Tier I project. Although the Tier II project has a smaller footprint, the same agencies are expected to require permits for the Tier II project.

3.2.9 Practicability of Alternatives to Any Significant Encroachments

The Tier II project would not modify the extents and elevation of the 100-year base floodplain within the Tier II project vicinity. Because the Tier II project is not considered a significant encroachment, other alternatives were not considered.

3.2.10 Practicability of Alternatives to Any Longitudinal Encroachments

Because the Tier II project improvements would be perpendicular to the direction of flow and not considered a longitudinal encroachment, other alternatives were not considered.

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

Floodplain map revisions are not anticipated due to the low level of risk associated with the Tier II project and because the increases in the base floodplain elevations are negligible. However, the Santa Cruz County Planning Department should review this report to determine whether floodplain map revisions are necessary. Once the Environmental Document is finalized, copies would be distributed to the Santa Cruz County Planning Department.

4 REFERENCES

Arana Gulch Watershed Alliance. (2004). "Site Description." Retrieved March 31, 2004 from: http://www.aranagulch.org/Watershed/description.html.

As-Built Plans. (1961). Contract No. 62-4T13C6.

California Coastal Commission. (1994). "Chapter Three: Protection and Management of Wetlands in the California Zone: A Review of Relevant Agencies and Processes." From *California Coastal Commission: Procedural Guidance For the Review of Wetland Projects in California's Coastal Zone*. Retrieved May 25, 2005 from: <http://www.coastal.ca.gov/wetrev/wetch3.html>

California Department of Transportation (Caltrans). (2003). *Caltrans Storm Water Quality Handbooks: Construction Site Best Management Practices Manual*.

California Department of Transportation. (2010 with May 2012 revisions). *Project Planning and Design Guide*.

Cassano, R.C. (1960). As-Built Plans: 41st Avenue Overcrossing, Located About ¼ Mile West of the West City Limit of Capitola. Contract No. 62-4T13C6.

Chartrand, S., et al. (2002). *Arana Gulch Watershed Enhancement Plan Phase 1: Steelhead and Sediment Assessments, Santa Cruz County, California*. From Balance Hydrologics, Inc., in association with D.W. Alley and Associates, Coastal Watershed Council, and Toni Danzig. Retrieved March 31, 2005 from: <http://www.aranagulch.org/Projects/99005%20Arana%20Final%20Rpt%2003-14-02%20.pdf>

County of Santa Cruz, California: Department of Public Works. (2004). *Status Report on the Highway 1 Construction Authority Budget and Transition Plan*. Retrieved March 22, 2005, from County of Santa Cruz: <http://sccounty01.co.santa-cruz.ca.us/bds/Govstream/BDSvData/non_legacy/agendas/2004/20040420/PDF/059.pdf>

County of Santa Cruz, California: Office of Emergency Services. (2002). *Draft Flood Hazard Mitigation Plan*. Retrieved April 13, 2005, from County of Santa Cruz. Website: <http://sccounty01.co.santa-cruz.ca.us/oes/FINAL_FMP.htm>

Federal Emergency Management Agency. (2004). "Flood Hazard Mapping: Frequently Asked Questions (Flood Hazard Zone Designations)." Retrieved March 23, 2005: <http://www.fema.gov/fhm/fq_gen13.shtm.>

Federal Emergency Management Agency. (2006). Flood Insurance Rate Map, Santa Cruz County and Incorporated Areas, California Panel 351 of 470, (Map Number 06087C0351D)

Federal Emergency Management Agency. (2006). Flood Insurance Rate Map, Santa Cruz County and Incorporated Areas, California Panel 352 of 470, (Map Number 06087C0352D)

Federal Emergency Management Agency. (2006). Flood Insurance Rate Map, Santa Cruz County and Incorporated Areas, California Panel 357 of 470, (Map Number 06087C0357D)

Federal Emergency Management Agency. (2006). *Flood Insurance Study, Santa Cruz County, California (Unincorporated and Incorporated Areas)*, (Flood Insurance Study Number 06087CV000A).

Federal Emergency Management Agency. (1986). *Flood Insurance Study, City of Capitola, California, Santa Cruz County* (Community Number 060354).

Federal Emergency Management Agency. (1986). *Flood Insurance Study, City of Santa Cruz, California, Santa Cruz County* (Community Number 060355).

Federal Emergency Management Agency. (1986). *Flood Insurance Study, Santa Cruz County, California (Unincorporated Areas)*, Volume 1 of 2, (Community Number 060353).

Federal Highway Administration. (1994). *Federal-Aid Policy Guide*, December 7, 1994, Transmittal 12, 23 CFR 650 A.

Morro Group, Inc. (2008). *Highway 1 HOV Lane Widening Project*. *Wetland Assessment*. Prepared for Parsons Transportation Group, 120 Howard Street, Suite 850, San Francisco, CA 94105.

Nolte Associates, Inc. Revised June 4, 2003. Highway 1 Widening/HOV Project Scope of Services.

Nolte Associates, Inc. (2004). SJ086000 Route 1 HOV Lane Widening Project Alternatives Memorandum.

Normann, J.M.; Houghtalen, R.J., and Johnston, W.J. (1985). "Hydraulic Design of Highway Culverts." *Hydraulic Design Series* No. 5 (Report No. FHWA-IP-85-15). U.S. Department of Transportation, Federal Highway Administration.

Santa Cruz Association of Realtors. (2003). "City of Capitola Water Conservation Ordinance September Watch". Retrieved March 22, 2005 from <http://www.scaor.org/archives/lw-sept03.htm.>

Santa Cruz County Regional Transportation Commission. *Major State Highway Projects in Santa Cruz County*. Retrieved March 25, 2005 from: <http://www.sccrtc.org/highway.html>

Santa Cruz County Regional Transportation Commission. (2004). "Highway 1 HOV Lane Widening Project: Fact Sheet". Retrieved March 25, 2005 from <http://www.sccrtc.org/pdf/hwy1facts.pdf>

Saunders, S. (2001). As-Built Plans: Project Plans for Construction on State Highway in Santa Cruz County in and near Capitola and Santa Cruz from Rio Del Mar Boulevard to Emeline Avenue Undercrossing (Portions), Contract No. 04-135334.

Spatial Climate Analysis Service (SCAS) Oregon State University. (2003). 1961-1990 Average Annual Precipitation: California.

SWCA Environmental Consultants. Table 7 and Table 8: Jurisdictional Areas within the Biological Study Area, HOV Lane Widening Project and TSM Alternative – SWCA, 03-10-2010.

United States Geological Survey. (2001). *California: Seamless U.S.G.S. Topographic Maps* [CDROM, Version 2.6.8, 2001, Part Number: 113-100-004]. National Geographic Holdings, Inc.

U.S. Geological Survey: National Water Information System. Calendar Year Streamflow Statistics for the Nation: U.S.G.S. 11159700 Aptos CA. Retrieved April 01, 2005 from http://nwis.waterdata.usgs.gov/nwis.

U.S. Geological Survey: National Water Information System. Calendar Year Streamflow Statistics for the Nation: U.S.G.S. 11160000 Soquel C A Soquel CA. Retrieved April 01, 2005 from http://nwis.waterdata.usgs.gov/nwis.

Waller, J. Santa Cruz Streets: History and Recent Developments in Highway 1 Widening Proposal. Retrieved March 23, 2005 from http://we.got.net/~mapman/streets/SantaCruz/SC.html.

Waananen, A.O. and Crippen, J.R. (1977). *Magnitude and Frequency of Floods in California*. (pp. 4-19). Menlo Park, CA: U.S. Geological Survey, Water Resources Division.

Wilbur Smith Associates. (2004). *Highway 1 Weekday Mainline Average Daily Traffic Volumes*.

WRECO. (2013). *Water Quality Study Report: State Route 1 High Occupancy Vehicle Lane Widening Project*. Walnut Creek, CA.

Appendix A Summaries of Floodplain Encroachment

Appendix A.1 High Occupancy Vehicle Lane Alternative – Tier I Project

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Bridge No.: 36-0011
Limits: Bridge across Aptos Creek
Floodplain Description: 100-year flood will be contained in Aptos Creek

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

7/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: RCB crossing at Nobel Creek
Floodplain Description: 100-year flood will be contained in Nobel Creek

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

07/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Bridge No.: 36-0013
Limits: Bridge across Soquel Creek
Floodplain Description: 100-year flood will be contained in Soquel Creek

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

07/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: Concrete arch culvert crossing at Rodeo Creek Gulch
Floodplain Description: 100-year flood will be contained in Rodeo Creek Gulch

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

07/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: Concrete arch culvert crossing at Arana Gulch
Floodplain Description: 100-year flood will not be contained in Arana Gulch

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

7/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

Appendix A.2 Transportation System Management Alternative – Tier I Project

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Bridge No.: 36-0011
Limits: Bridge across Aptos Creek
Floodplain Description: 100-year flood will be contained in Aptos Creek

		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:

Signature - Hydraulic Engineer — Date: 8/7/2013

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer — Date: 4/5/13

Signature - Dist. Environmental Branch Chief — Date: 7/25/13

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: RCB crossing at Nobel Creek
Floodplain Description: 100-year flood will be contained in Nobel Creek

		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:

Signature - Hydraulic Engineer — Date: 3/7/2013

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer — Date: 4/5/2013

Signature - Dist. Environmental Branch Chief — Date: 07/25/13

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Bridge No.: 36-0013
Limits: Bridge across Soquel Creek
Floodplain Description: 100-year flood will be contained in Soquel Creek

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

07/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: Concrete arch culvert crossing at Rodeo Creek Gulch
Floodplain Description: 100-year flood will be contained in Rodeo Creek Gulch

		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:

Signature - Hydraulic Engineer — Date: 3/7/2013

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer — Date: 4/5/2013

Signature - Dist. Environmental Branch Chief — Date: 07/25/13

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: Concrete arch culvert crossing at Arana Gulch
Floodplain Description: 100-year flood will not be contained in Arana Gulch

		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:

Signature - Hydraulic Engineer — Date: 3/7/2013

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer — Date: 4/5/2013

Signature - Dist. Environmental Branch Chief — Date: 07/25/13

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

Appendix A.3 Build Alternative – Tier II Project

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Bridge No.: 36-0013
Limits: Bridge across Soquel Creek
Floodplain Description: 100-year flood would be contained in Soquel Creek

		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:

Signature - Hydraulic Engineer — Date: 3/7/2013

CONCURRENCE FROM:

Signature - Dist. Hydraulic Engineer — Date: 4/5/2013

Signature - Dist. Environmental Branch Chief — Date: 07/25/13

N/A - Oversight Project

Signature - Dist. Project Engineer Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: Concrete arch culvert crossing at Rodeo Creek Gulch
Floodplain Description: 100-year flood would be contained in Rodeo Creek Gulch

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

4/5/2013

Signature - Dist. Hydraulic Engineer — Date

07/25/13

Signature - Dist. Environmental Branch Chief — Date

N/A - Oversight Project

Signature - Dist. Project Engineer — Date

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

District: 05
County: Santa Cruz
Route: Route 1
Limits: Concrete arch culvert crossing at Arana Gulch
Floodplain Description: 100-year flood would not be contained in Arana Gulch

		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:

3/7/2013

Signature - Hydraulic Engineer — Date

CONCURRENCE FROM:

Thomas E Fuller — 4/5/2013

Signature - Dist. Hydraulic Engineer — Date

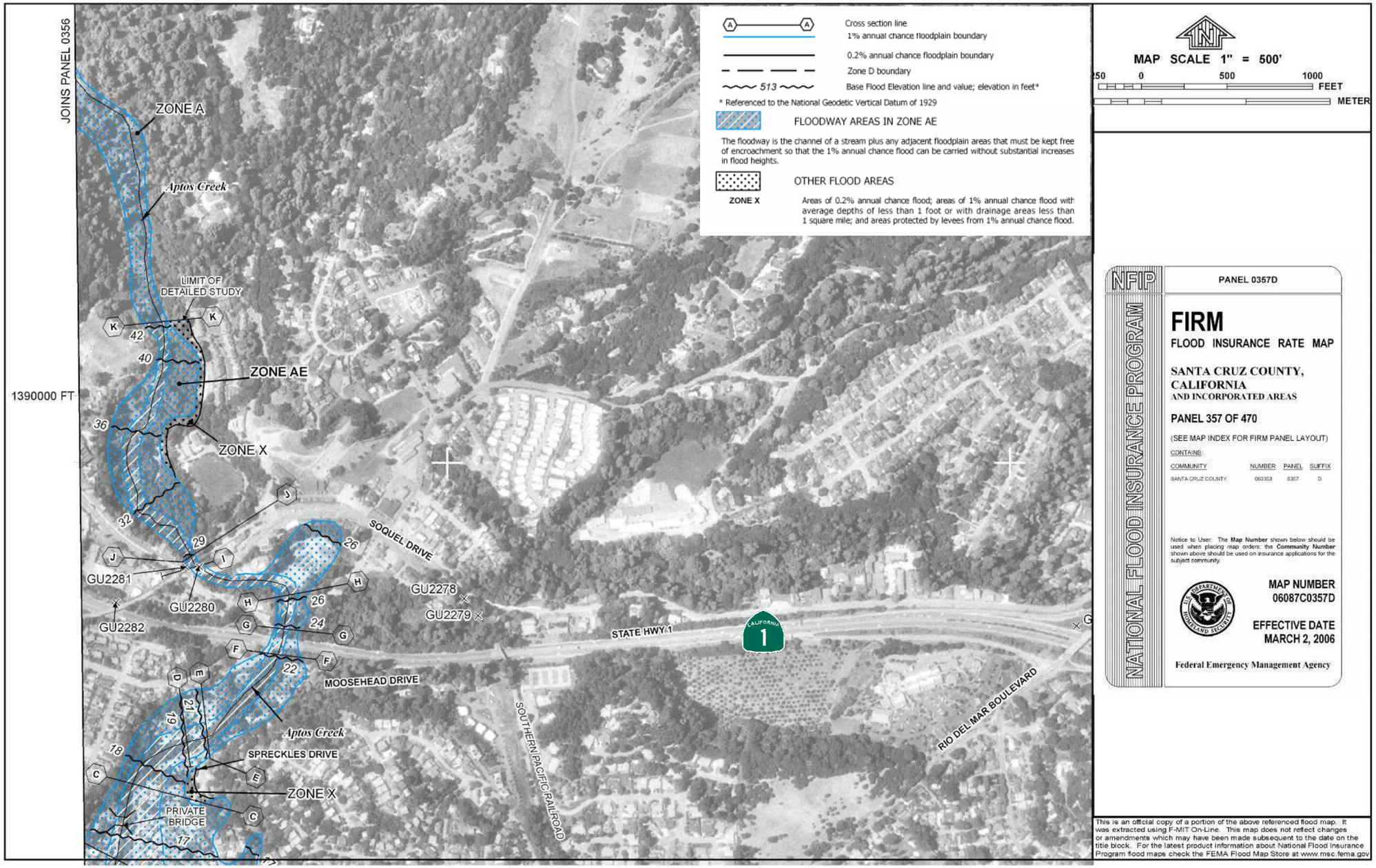
07/25/13

Signature - Dist. Environmental Branch Chief — Date

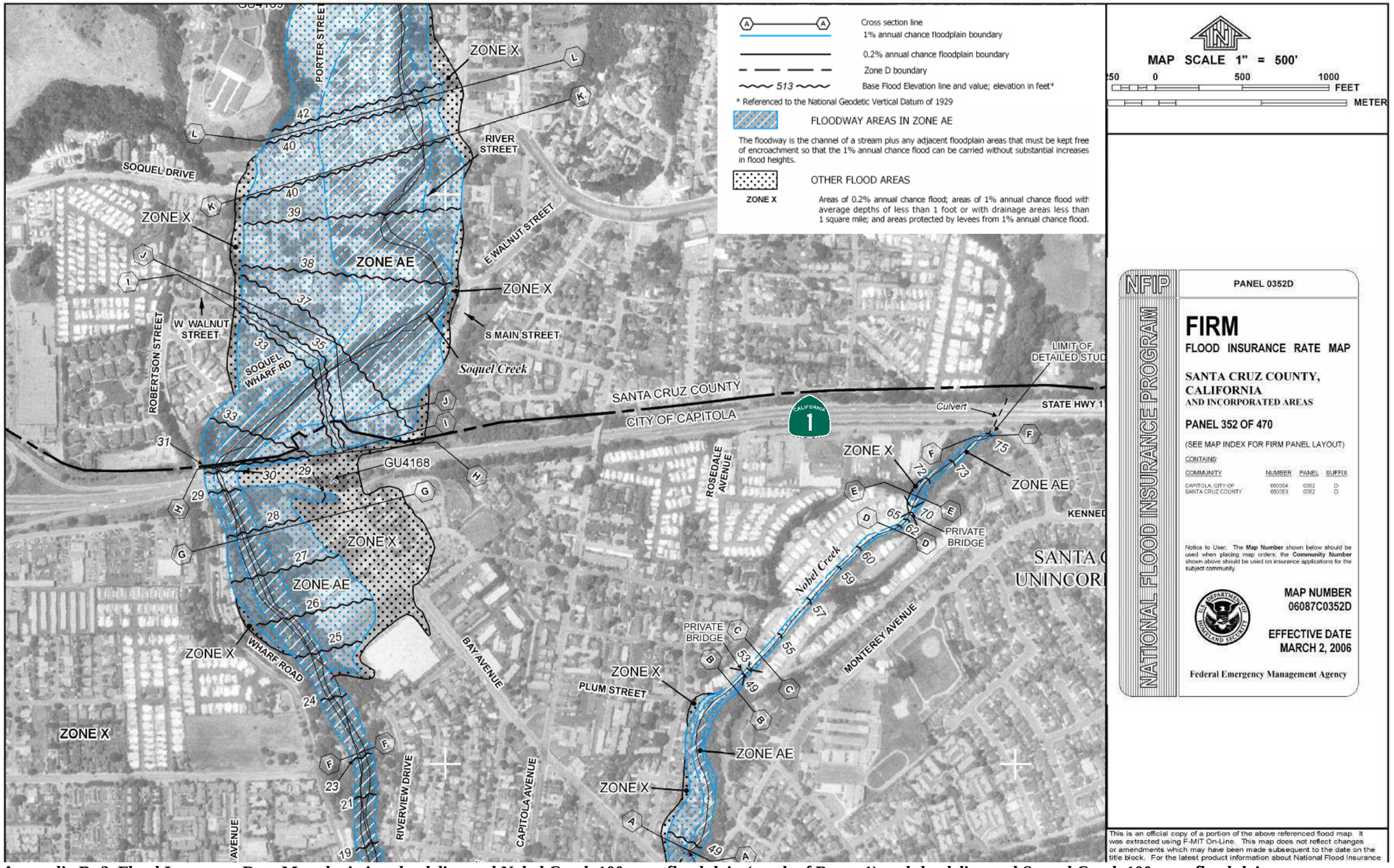
N/A - Oversight Project

Signature - Dist. Project Engineer — Date

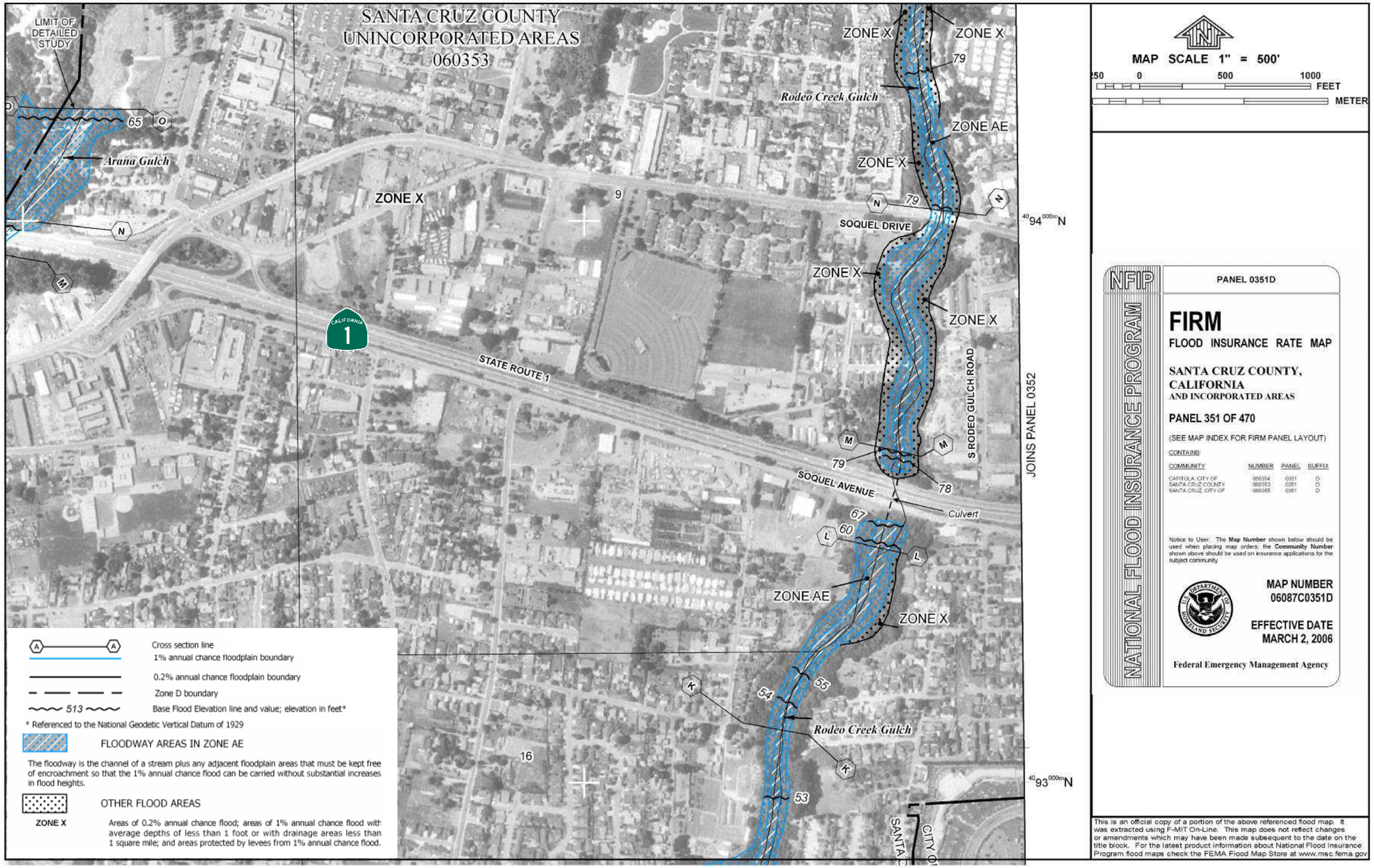
Appendix B Federal Emergency Management Agency Flood Insurance Rate Maps



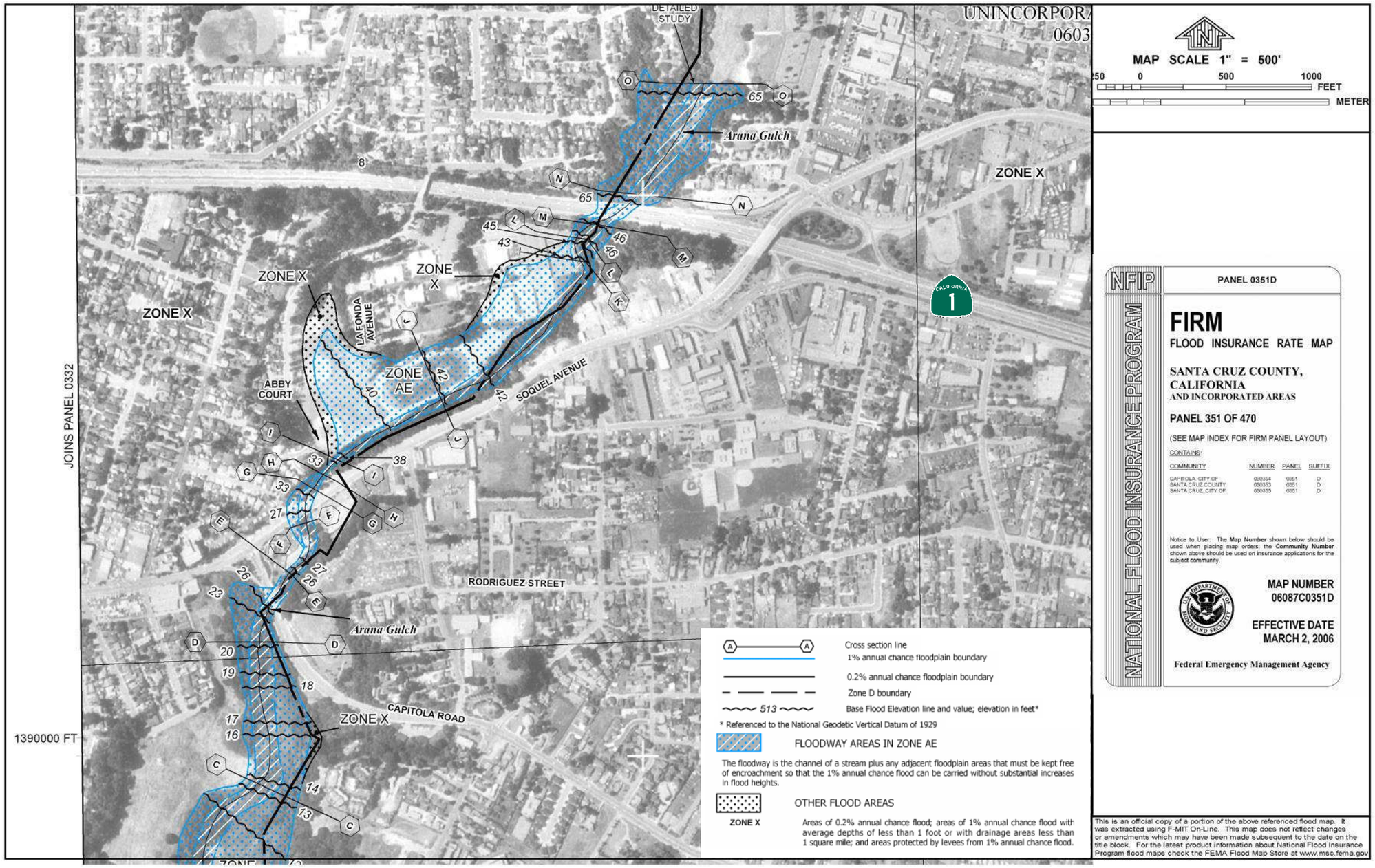
Appendix B-1. Flood Insurance Rate Map depicting the delineated Aptos Creek 100-year floodplain



Appendix B- 2. Flood Insurance Rate Map depicting the delineated Nobel Creek 100-year floodplain (south of Route 1) and the delineated Soquel Creek 100-year floodplain



Appendix B- 3. Flood Insurance Rate Map depicting the delineated Rodeo Creek Gulch 100-year floodplain



Appendix B- 4. Flood Insurance Rate Map depicting the delineated Arana Gulch 100-year floodplain

Appendix C Hydrologic Data

Appendix C.1 Rainfall Intensity Curve

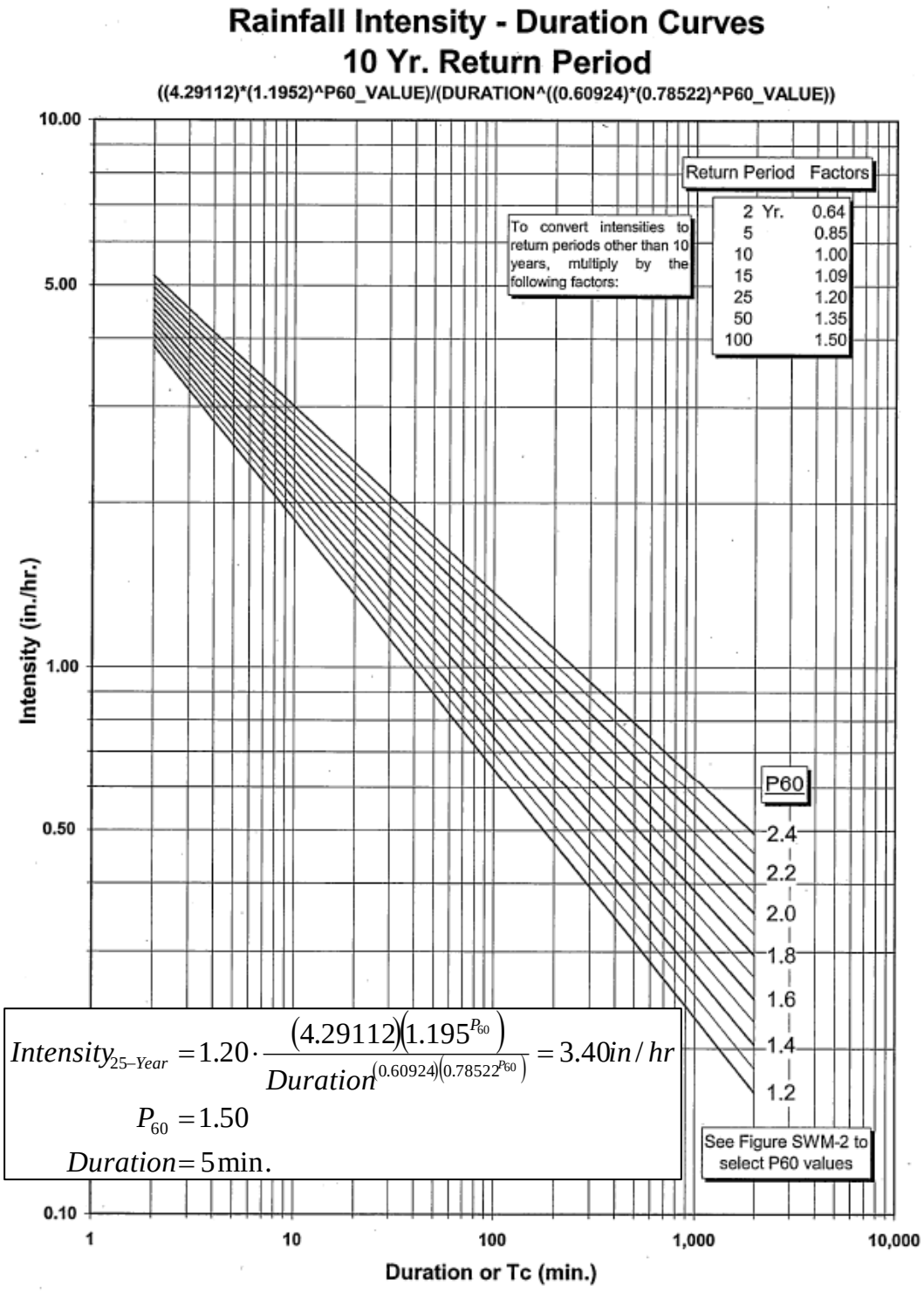


Figure SWM-3 Rainfall Intensity-Duration Curves

Source: County of Santa Cruz

Appendix C.2 Isopleths

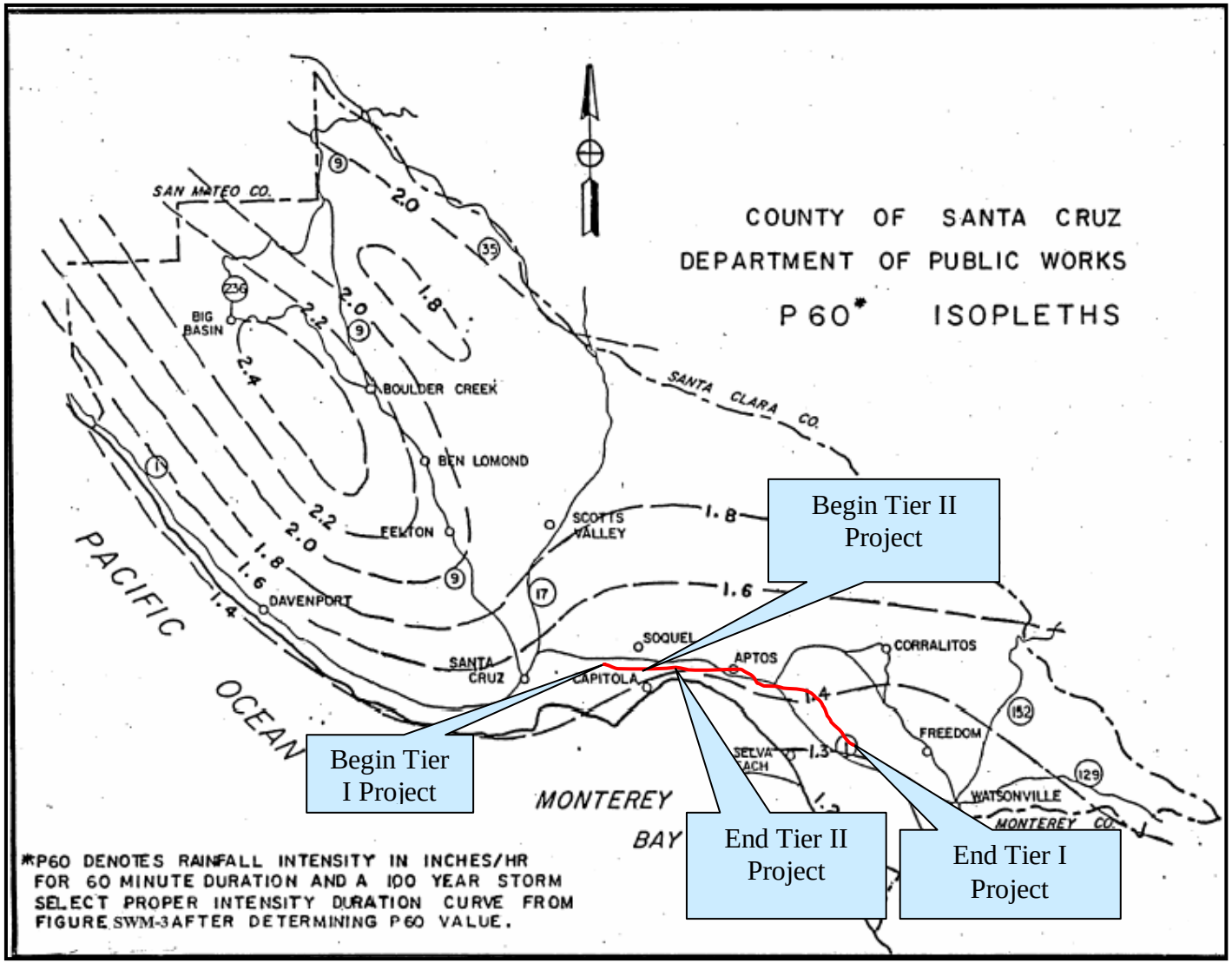
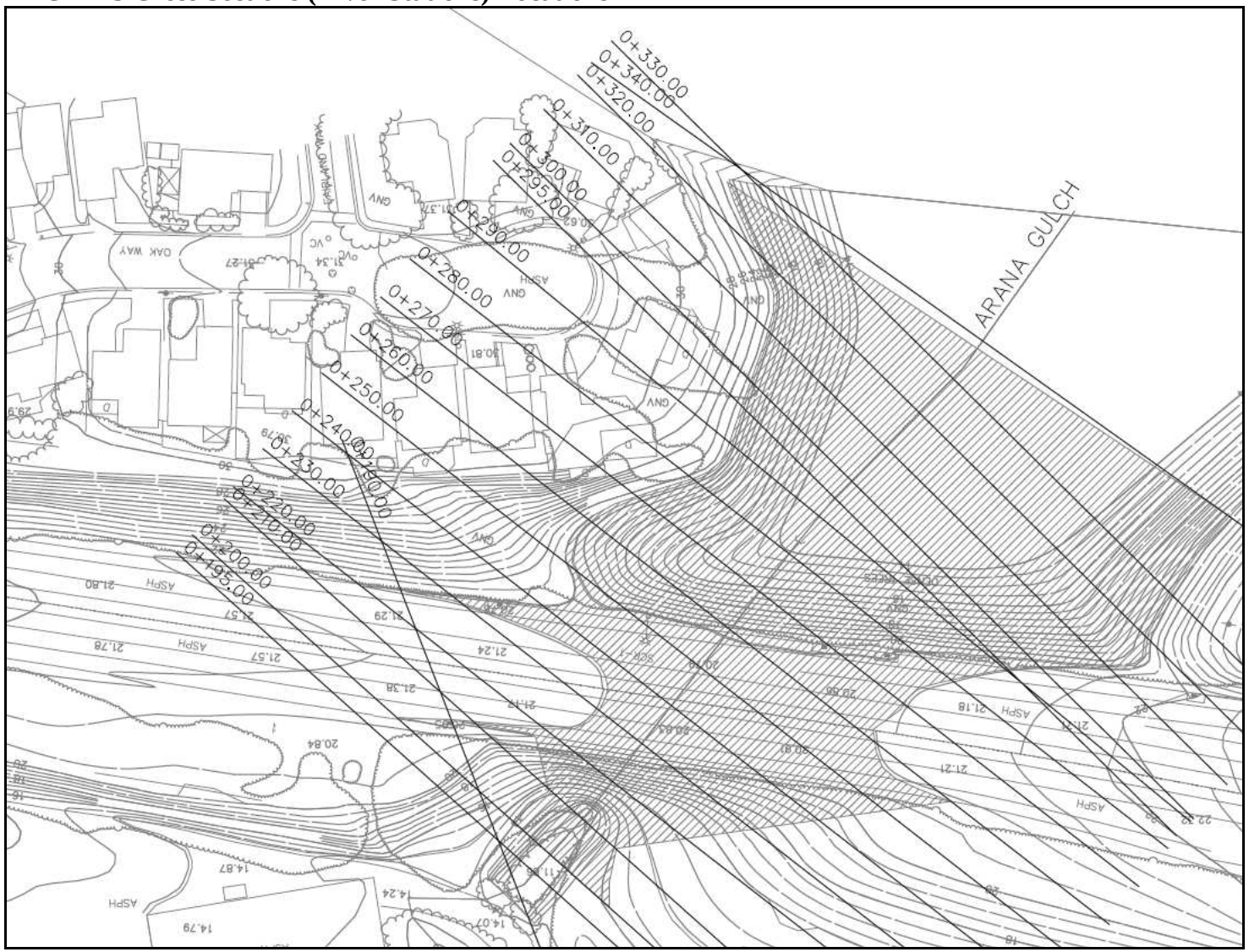


Figure SWM-2 P60 Isopleths

Appendix D Arana Gulch HEC-RAS Summary

HEC-RAS Cross Sections (River Stations) Locations



Summary Table – Arana Gulch Existing Conditions

HEC-RAS Plan: Existing River: Arana Gulch Reach: Arana Gulch Profile: Q100

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
			(ft^3/s)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft^2)	(ft)	
Arana Gulch	340	Q100	1649.2	46	70.18	46.98	70.18	0.000001	0.20	8602.29	416.86	0.01
Arana Gulch	330	Q100	1649.2	46	70.18		70.18	0.000001	0.20	8338.36	419.91	0.01
Arana Gulch	320	Q100	1649.2	46	70.18		70.18	0.000002	0.23	7170.59	385.27	0.01
Arana Gulch	310	Q100	1649.2	46	70.18		70.18	0.000002	0.26	6340.26	334.68	0.01
Arana Gulch	300	Q100	1649.2	46	70.18		70.18	0.000004	0.33	5131.15	302.69	0.01
Arana Gulch	295	Q100	1649.2	46	70.18		70.18	0.000006	0.36	4508.78	287.73	0.02
Arana Gulch	290	Q100	1649.2	46	70.18	48.59	70.18	0.00001	0.46	3611.61	242.62	0.02
Arana Gulch	241.14											
Arana Gulch	210	Q100	1649.2	39	49.28		49.31	0.000074	1.84	894.80	227.62	0.16
Arana Gulch	200	Q100	1649.2	38	49.28		49.31	0.00002	1.08	1526.54	324.70	0.09
Arana Gulch	195	Q100	1649.2	38	49.28		49.31	0.000012	0.95	1745.47	317.26	0.07
Arana Gulch	190	Q100	1649.2	38	49.21	42.52	49.31	0.000104	2.36	702.56	159.32	0.2

Summary Table – Arana Gulch Proposed Transportation System Management Alternative Conditions under Tier I Project

HEC-RAS Plan: Proposed TSM River: Arana Gulch Reach: Arana Gulch Profile: Q100

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
			(ft^3/s)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft^2)	(ft)	
Arana Gulch	340	Q100	1670.7	46	70.21	47.01	70.21	0.000001	0.20	8618.44	417.03	0.01
Arana Gulch	330	Q100	1670.7	46	70.21		70.21	0.000001	0.20	8354.62	420.05	0.01
Arana Gulch	320	Q100	1670.7	46	70.21		70.21	0.000002	0.23	7185.55	385.50	0.01
Arana Gulch	310	Q100	1670.7	46	70.21		70.21	0.000002	0.26	6353.18	334.84	0.01
Arana Gulch	300	Q100	1670.7	46	70.21		70.21	0.000004	0.33	5142.88	303.02	0.01
Arana Gulch	295	Q100	1670.7	46	70.21		70.21	0.000006	0.36	4519.87	288.58	0.02
Arana Gulch	290	Q100	1670.7	46	70.21	48.62	70.21	0.00001	0.46	3621.08	243.37	0.02
Arana Gulch	241.14											
Arana Gulch	210	Q100	1670.7	39	49.28		49.31	0.000076	1.87	895.13	227.72	0.17
Arana Gulch	200	Q100	1670.7	38	49.28		49.31	0.00002	1.08	1527.29	324.70	0.09
Arana Gulch	195	Q100	1670.7	38	49.28		49.31	0.000013	0.95	1746.12	317.26	0.07
Arana Gulch	190	Q100	1670.7	38	49.21	42.52	49.31	0.000107	2.36	702.56	159.32	0.2

Summary Table – Arana Gulch Proposed High Occupancy Vehicle Alternative Conditions under Tier I Project

HEC-RAS Plan: Proposed HOV River: Arana Gulch Reach: Arana Gulch Profile: Q100

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
			(ft^3/s)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(ft^2)	(ft)	
Arana Gulch	340	Q100	1681.0	46	70.11	47.01	70.11	0.000001	0.20	8576.24	416.63	0.01
Arana Gulch	330	Q100	1681.0	46	70.11		70.11	0.000001	0.20	8312.10	419.65	0.01
Arana Gulch	320	Q100	1681.0	46	70.11		70.11	0.000002	0.23	7146.48	384.84	0.01
Arana Gulch	310	Q100	1681.0	46	70.11		70.11	0.000002	0.26	6319.27	334.35	0.01
Arana Gulch	300	Q100	1681.0	46	70.11		70.11	0.000004	0.33	5112.10	302.10	0.01
Arana Gulch	295	Q100	1681.0	46	70.11	48.06	70.11	0.000006	0.36	4490.70	286.45	0.02
Arana Gulch	241.14											
Arana Gulch	195	Q100	1681.0	38	49.31		49.31	0.000013	0.95	1746.44	317.29	0.07
Arana Gulch	190	Q100	1681.0	38	49.21	42.55	49.31	0.000108	2.40	702.56	159.32	0.2

Appendix E Project Photographs

Photo 1. Tributary to Arana Gulch at Holway Drive crossing

Photo 2. Tributary to Arana Gulch

Photo 3. Arana Gulch (downstream)

Photo 4. Arch culvert at Arana Gulch (downstream)

Photo 5. Arch culvert at Arana Gulch (downstream)

Photo 6. Rodeo Creek Gulch (downstream)

Photo 7. Rodeo Creek Gulch (upstream)

Photo 8. Rodeo Creek Gulch (downstream)

Photo 9. Concrete bags at base of bridge footing at Soquel Creek

Photo 10. Concrete bags at base of bridge footing at Soquel Creek

Photo 11. Soquel Creek

Photo 12. Bridge piers at Soquel Creek

Photo 13. Bridge at Soquel Creek

Photo 14. Soquel Creek (upstream)

Photo 15. Soquel Creek

Photo 16. Concrete box culvert at Nobel Creek (downstream)

Photo 17. Nobel Creek (downstream)

Photo 18. Nobel Creek (upstream)

Photo 19. Energy dissipater at unnamed tributary to Tannery Gulch

Photo 20. Debris at unnamed tributary to Tannery Gulch

Photo 21. Tannery Gulch (downstream)

Photo 22. Tannery Gulch (upstream)

Photo 23. Borregas Creek (downstream)

Photo 24. Storm drain leading to Borregas Creek (upstream)

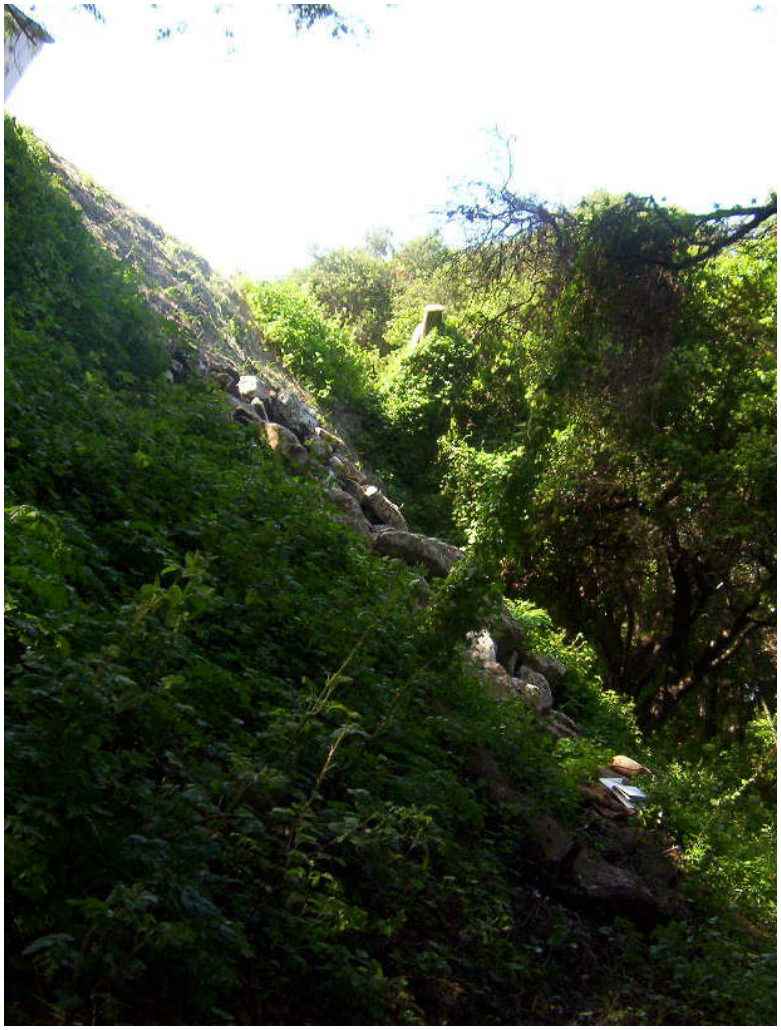


Photo 25. Borregas Creek (upstream)

Photo 26. Aptos Creek

Photo 27. Scour at Aptos Creek near footing

Photo 28. Bridge 36-0011 at Aptos Creek

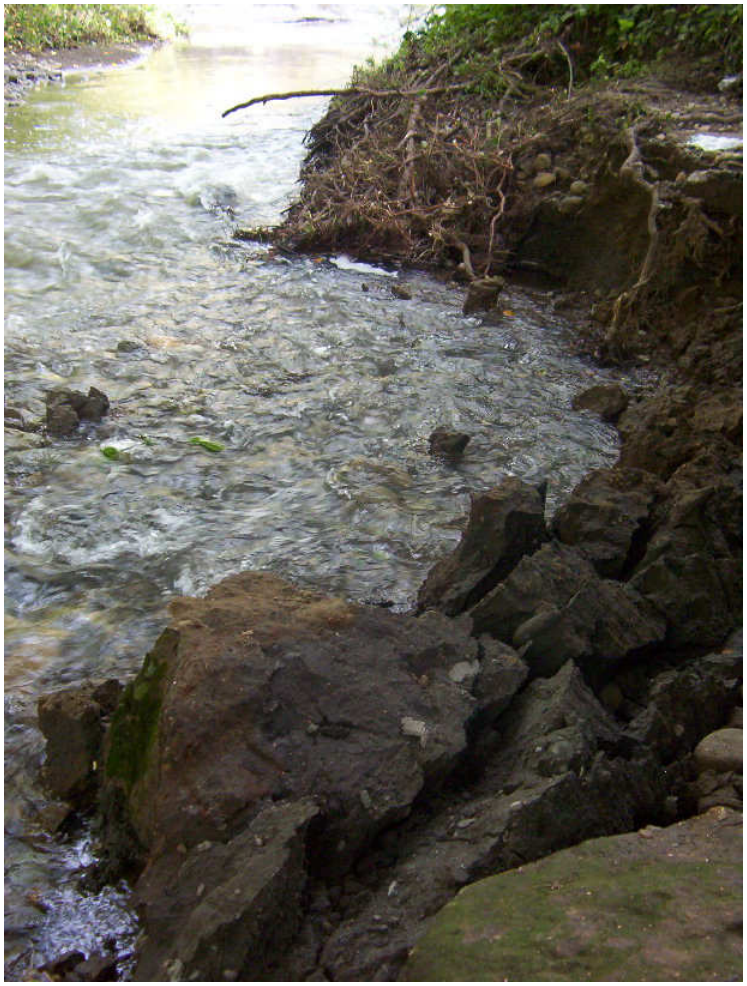


Photo 29. Scour at Aptos Creek

Photo 30. Aptos Creek

Photo 31. Homes adjacent to Aptos Creek

Photo 32. Valencia Channel (at outlet)

Photo 33. Valencia Lagoon