3.8 Hydrology and Water Resources

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Section 3.8.2.1, Federal, was updated regarding the Federal Railroad Administration (FRA) Procedures for Considering Environmental Impacts. Footnotes were added regarding FRA's Environmental Procedures and the updated Council on Environmental Quality (CEQ) regulations issued after release of the Draft EIR/EIS.
- Section 3.8.2.1 was updated to clarify requirements of the Rivers and Harbors Act of 1899, the Santa Clara Valley Water District's (SCVWD; now known as Valley Water) responsibility as a local sponsor in the review of design plans for the Guadalupe River crossing in San Jose and the Llagas Creek crossing near San Martin, and that, to the extent required under Section 408, the California High-Speed Rail Authority (Authority) would seek a "Statement of No Objection" from Valley Water regarding the request for Section 408 permission from the U.S. Army Corps of Engineers (USACE). In addition, Section 3.8.2.1 was updated to clarify Valley Water's responsibility as a local sponsor of the Watershed Protection and Flood Prevention Act in the review of design plans for the Llagas Creek crossing near east Gilroy and West Branch Llagas Creek crossing near Gilroy.
- Text describing the 2019 groundwater sustainability plan alternative approval was added to Section 3.8.2.2, State, subsection Senate Bill 1168, Assembly Bill 1739, and Senate Bill 1319: Sustainable Groundwater Management Act. The draft North San Benito County groundwater sustainability plan was reviewed and discussed in Impact HYD#10 and added to Table 3.8-3.
- Information about the North San Benito Subbasin was added and information about the Bolsa Area Subbasin and the Hollister Area Subbasin was deleted throughout Section 3.8.5.4, Groundwater. Table 3.8-12 was updated to reflect this change.
- "Groundwater depletion" has been changed to "groundwater reduction" throughout this section.
- The text and tables of Section 3.8.5.4 were revised to account for the basin boundary modification that was approved by the California Department of Water Resources (DWR). These revisions included modifying the boundary of the resource study area (RSA) to be consistent with the North San Benito Subbasin. These changes resulted in updates to Tables 3.8-8.
- Figures 3.8-2, 3.8-5, and 3.8-12 through 3.8-15 were updated to reflect updated information about groundwater subbasins in the RSA.
- The text in the last paragraph of Section 3.8.4.5 was revised to say that there would be no increase in floodways.
- Discussions of existing percolation ponds, recharge facilities, artesian conditions, and the potential presence of abandoned groundwater wells were added to the Santa Clara Valley Basin subsection of Section 3.8.5.4. Discussions of artesian conditions and the potential presence of abandoned groundwater wells also were added to the Llagas Area Subbasin subsection of Section 3.8.5.4.
- Text was added to the Pacheco Pass Area subsection of Section 3.8.5.4 to state that the proposed tunnels are expected to pass through unconsolidated sediment and bedrock geology and not through alluvium or any alluvial aquifers.
- The Municipal Water Supply subsection of Section 3.8.5.4 was revised to clarify that Valley Water manages the Santa Clara and Llagas groundwater subbasins to provide water supply for all beneficial uses and is not limited to municipal water supply. In addition, the number of public drinking water supply wells in the RSA and the number within the project footprint were

updated to reflect the revisions to the RSA, and text was added stating that private water supply wells are present within the RSA.

- Analysis about the Diridon design variant (DDV) and tunnel design variant (TDV), which was included in Section 3.20 in the Draft EIR/EIS, has been incorporated into this Final EIR/EIS in the introduction to Section 3.8.6.2, Surface Water Hydrology, and in the discussions of Impacts HYD#1, HYD#4, HYD#7, and HYD#16. The revised text states that the DDV or TDV do not change any conclusions compared to the alternatives without the design variants.
- Table 3.8-14 was revised to include existing information for Pajaro River at several key locations within the RSA. Impact HYD#5 was updated to reflect that the Authority commits to coordinating with local agencies regarding the design, construction, and long-term maintenance of permanent stormwater treatment best management practices (BMP) that would be constructed within their jurisdiction.
- A column heading in Table 3.8-22 was corrected to state the number of waterbodies affected.
- The approach to managing subsurface contamination during construction was clarified in Impact HYD#8.
- Impact HYD#9 was updated to clarify the effect of proposed impervious surfaces and subsurface structures and avoid impacts on 51 acres of the Gilroy Wastewater Treatment Ponds, which removes a significant impact and the associated required mitigation (PUE-MM#1). Sections 3.8.8, Impact Summary for NEPA Comparison of Alternatives, and 3.8.9, CEQA Significance Conclusions, were updated to reflect these changes.
- Text was added to Impact HYD#9 describing that the Authority would replace privately owned wells within the permanent high-speed rail (HSR) right-of-way.
- The number of public drinking water supply wells in the project footprint was updated in Table 3.8-24 and the text of Impact HYD#9.
- Impact HYD#10 was updated to reflect the potential for perched water tables within unconsolidated sediment overlying bedrock formations and that these unconsolidated sediments may be encountered at tunnel portals. In addition, the discussion of intermittent and ephemeral streams was expanded in Impact HYD#10.
- Under Impact HYD#15, text was added to clarify effects on the hydrology of the Soap Lake floodplain and add West Branch Llagas Creek near Gilroy to Table 3.8-32, which lists locations that require an authorization under Section 14 of the Rivers and Harbors Act or the Watershed Protection and Flood Prevention Act. In addition, the type of proposed structure was updated for Llagas Creek, West Branch Llagas Creek, and Llagas Creek Overflow in Table 3.8-29. Table 3.8-31 was added to quantify existing and proposed peak 100-year flows of the Soap Lake floodplain.
- The Authority performed additional hydraulic analysis for downstream areas that are outside of the RSA as part of responding to public comments, and this analysis indicated there would be negligible impacts on downstream floodplains and floodways (increase of less than 0.05 foot in the 100-year water surface elevation at Sargent Pass, a Federal Emergency Management Agency [FEMA] floodway) as a result of the minimal increase in peak flow rates under Alternative 4. Impact HYD#15 was revised to include this information.
- Text was added to Impact HYD#15 discussing local floodplain manager approval prior to construction of any element of the project in a floodplain regulated by FEMA and that wildlife crossings would be designed to ensure they would not induce flooding in new areas or cause floodplains to expand substantially.
- In Table 3.8-34, text summarizing impacts for HYD#8 was revised for clarity and to conform with the analysis presented in the impact discussion.

- HYD-MM#3 was removed from the section because the proposed mitigation to avoid an increase in surface elevation has been incorporated into the project design.
- Where appropriate, the verb “would,” when used specifically to describe impact avoidance and minimization features (IAMFs) or mitigation measures, as well as their directly related activities, was changed to “will,” indicating their integration into project design.

3.8.1 Introduction

This section describes surface water hydrology, surface water quality, groundwater, and floodplains in the San Jose to Central Valley Wye Project Extent (project or project extent) RSA where hydrology and water resources are most susceptible to change as a result of project construction and operation. Critical hydrology and water resource issues along the project footprint include changes to stormwater runoff volumes, reductions in surface water and groundwater quality, loss of groundwater recharge capacity, and floodplain encroachment. In the project footprint, areas between southern and eastern Gilroy and Carlucci Road would face the greatest change to hydrology and water resources because the project alignment would require the development of new rail infrastructure after it diverges from the existing Caltrain corridor in Gilroy. In these areas, the project would require the construction and operation of new rail embankments, viaducts, tunnels, bridges, culverts, flood control basins, cut-and-fill slopes, and other permanent design features that would permanently change hydrology and water resources within the RSA. This analysis considers whether the project would negatively affect hydrology and water resources.

Primary Hydrology and Water Resources Impacts

- Drainage patterns and stormwater runoff
- Surface water quality
- Groundwater quality and volume
- Floodplain hydraulics

The *San Jose to Merced Project Section Hydrology and Water Quality Technical Report* (Hydrology and Water Quality Technical Report) (Authority 2020), which focuses on the project extent, provides additional support for this hydrology and water resources analysis. The following appendices in Volume 2 of this Final EIR/EIS provide additional details on hydrology and water resources:

- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for the project.
- Appendix 2-E, Project Impact Avoidance and Minimization Features, provides the list of all IAMFs incorporated into this project.
- Appendix 2-J, Regional and Local Plans and Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 2-K, Policy Consistency Analysis, provides a summary by resource of Project Section inconsistencies and reconciliations with local plans and policies.
- Appendix 3.8-A, Waterbodies Crossed by the Project Alternatives, provides a list of waterbodies in the RSA.
- Appendix 3.8-B, Summary of Hydraulic Modeling, provides detailed descriptions of the methods and results of all hydraulic modeling performed for the project.
- Appendix 3.8-C, Basin Plan Water Quality Impact Summary, summarizes impacts on beneficial uses, water quality objectives, and listed impairments from the project.

Hydrology and water resources, including hydrology, water quality, surface water, groundwater, and floodplains, are important to maintaining environmental quality, public health and safety, and agricultural production within the San Francisco Bay Area (Bay Area) and San Joaquin Valley, one of the most important agriculture centers in the U.S. The following five EIR/EIS resource sections provide additional information related to hydrology and water resources:

- Section 3.6, Public Utilities and Energy, evaluates impacts on public utilities, including groundwater percolation ponds and public water supply wells.
- Section 3.7, Biological and Aquatic Resources, evaluates impacts associated with construction and operations of the project alternatives on wetlands, waters, and associated habitats, including effects of tunneling on biological and aquatic resources.
- Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources, evaluates impacts of constructing the project alternatives on shallow groundwater, erosive soils, and seismicity.
- Section 3.10, Hazardous Materials and Waste, evaluates impacts of constructing the project alternatives on soil and groundwater contamination.
- Section 3.11, Safety and Security, evaluates impacts of flooding and landslides as a result of runoff, post-fire slope instability, and drainage changes.
- Section 3.13, Station Planning, Land Use, and Development, evaluates impacts of constructing the project alternatives on land use change and development patterns, including areas near floodplains.

3.8.2 Laws, Regulations, and Orders

Federal and state regulations and orders applicable to hydrology and water resources affected by the project are presented below. The Authority would implement the HSR project, including the project extent, in compliance with all federal and state regulations. Regional and local plans and policies relevant to hydrology and water resources considered in the preparation of this analysis are provided in Appendix 2-J.

3.8.2.1 Federal

Procedures for Considering Environmental Impacts (64 Federal Register 28545)

On May 26, 1999, FRA released Procedures for Considering Environmental Impacts (FRA 1999). These FRA procedures supplement the Council on Environmental Quality Regulations (40 C.F.R. Part 1500 et seq.) and describe the FRA's process for assessing the environmental impacts of actions and legislation proposed by the agency and for the preparation of associated documents (42 U.S. Code 4321 et seq.).[1,2] The FRA Procedures for Considering Environmental Impacts states that "the EIS should identify any significant changes likely to occur in the natural environment and in the developed environment. The EIS should also discuss the consideration given to design quality, art, and architecture in project planning and development as required by U.S. Department of Transportation Order 5610.4." These FRA procedures state that an EIS should consider possible impacts on water quality and flood hazards and floodplains.

Clean Water Act (33 United States Code [U.S.C.] § 1251 et seq.)

The Clean Water Act (CWA) is the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. The CWA prohibits any discharge of pollutants into the nation's waters unless specifically authorized by a permit. The following subsections discuss applicable sections of the CWA.

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[1] While this EIR/EIS was being prepared, FRA adopted new NEPA compliance regulations (23 C.F.R. 771). Those regulations only apply to actions initiated after November 28, 2018. See 23 C.F.R. 771.109(a)(4). Because this EIR/EIS was initiated prior to that date, it remains subject to FRA's Environmental Procedures rather than the Part 771 regulations.

[2] The Council on Environmental Quality issued new regulations on July 14, 2020, effective September 14, 2020, updating the NEPA implementing procedures at 40 C.F.R. Parts 1500-1508. However, this project initiated NEPA before the effective date and is not subject to the new regulations, relying on the 1978 regulations as they existed prior to September 14, 2020. All subsequent citations to Council on Environmental Quality regulations in this environmental document refer to the 1978 regulations, pursuant to 40 C.F.R. 1506.13 (2020) and the preamble at 85 Fed. Reg. 43340.

Basin Planning (33 U.S.C. § 1289)

CWA Section 102 requires the planning agency of each state (in California, the State Water Resources Control Board [SWRCB]) to prepare a basin plan to set forth regulatory requirements for protection of surface water quality, which include designated beneficial uses for surface waterbodies, as well as specified water quality objectives to protect those uses. The applicable basin plans for the regional water quality control boards (RWQCB) with jurisdiction over the project are the *Water Quality Control Plan for the San Francisco Bay Basin* (San Francisco Bay RWQCB 2017), the *Water Quality Control Plan for the Central Coastal Basin* (Central Coast RWQCB 2019), and the *Water Quality Control Plan for the Sacramento and San Joaquin River Basins* (Central Valley RWQCB 2018).

Water Quality Impairments (33 U.S.C. § 1313 (d))

Section 303(d) requires each state to develop a list of impaired surface waters that do not meet or that the state expects would not meet state water quality standards as defined by that section. It also requires each state to develop total maximum daily loads (TMDL) of pollutants for impaired waterbodies. The TMDL must account for the pollution sources causing the water to be listed by the state.

Water Quality Certification (33 U.S.C. § 1341)

Under Section 401, applicants for a federal license or permit to conduct activities that may result in a discharge into waters of the U.S. must obtain certification that the discharge would not violate water quality standards, including water quality objectives and beneficial uses. The state in which the discharge would originate or the interstate water pollution control agency with jurisdiction over affected waters issues the certification. The SWRCB would issue the Section 401 certification for the project.

Permit for Discharge of Fill Material in Wetlands and Other Waters (33 U.S.C. § 1344)

Under Section 404, USACE and the U.S. Environmental Protection Agency (USEPA) regulate the discharge of dredged or fill materials into waters of the U.S. Project sponsors must obtain a permit from USACE for discharges of dredged or fill materials into waters over which the USACE has jurisdiction. The Authority manages compliance with the USACE permitting process required for an individual permit under Section 404 through a memorandum of understanding (MOU) that establishes three checkpoint reports: one defines project purpose and need, another establishes the range of alternatives for environmental review, and the last identifies a preliminary least environmentally damaging practicable alternative (LEDPA) (FRA et al. 2010).

National Pollutant Discharge Elimination System Program (33 U.S.C. § 1342)

Under Section 402, the National Pollutant Discharge Elimination System (NPDES) Program regulates all point source discharges, including, but not limited to, construction-related runoff discharges to surface waters and some post-development. In California, project sponsors must obtain an NPDES permit from the SWRCB. Four types of the NPDES program stormwater permits are relevant to the project; these are discussed in the following subsections.

Stormwater Discharges: Construction General Permit

Under the federal CWA, entities discharging stormwater from construction sites must comply with the conditions of an NPDES permit. The SWRCB is the permit authority in California and has adopted the construction general permit (CGP) that applies to projects resulting in 1 or more acres of soil disturbance. For projects disturbing more than 1 acre of soil, the SWRCB requires permittees to prepare a stormwater pollution prevention plan (SWPPP). The SWPPP specifies site management activities that permittees or their construction contractors must implement during site development. These management activities include construction stormwater BMPs, erosion and sedimentation controls, runoff controls, and construction equipment maintenance. These BMPs are part of the IAMFs that the Authority would implement during design and construction of the project. Volume 2, Appendix 2-E, lists the IAMFs relevant to protection of hydrology and water resources. Because all four alternatives would disturb more than 1 acre of soil, the Authority would obtain coverage under the CGP.

Stormwater Discharges: Industrial General Permit

The CWA requires certain industrial facilities to comply with an NPDES permit—the California Statewide Industrial General NPDES and Waste Discharge Requirements Permit (Order 2014-0057-DWQ), known as the industrial general permit (IGP). The IGP regulates discharges associated with 10 broad categories of industrial activities. Railroad transportation facilities have standard industrial classification codes 4011 and 4013. Therefore, the project maintenance yards would be subject to the IGP. Only those portions of the facility involved in vehicle maintenance (including vehicle rehabilitation, mechanical repairs, painting, fueling, and lubrication) or other operations identified under this Permit are regulated by the permit.

Stormwater Discharges: California Department of Transportation Statewide Stormwater Permit

The California Department of Transportation (Caltrans) operates under a statewide stormwater permit (Order No. 2012-0011-DWQ, NPDES No. CAS000003) that regulates stormwater and non-stormwater discharges from Caltrans properties, facilities, and activities and requires that the Caltrans construction program comply with the adopted statewide CGP permit. The Caltrans permit is applicable to those portions of the project that would involve modifications to state highways.

Stormwater Discharges: Municipal Separate Storm Sewer System Permits

The NPDES requires that states develop and implement municipal stormwater management programs to meet the requirements for stormwater discharges from municipal separate storm sewer systems (MS4). The SWRCB and RWQCBs issue Phase I MS4 permits to groups of co-permittees encompassing an entire metropolitan area. The SWRCB adopted the Phase II MS4 General Permit (SWRCB Water Quality Order No. 2013-0001-DWQ, NPDES No. CAS000004 (SWRCB 2013) and it became effective on July 1, 2013.

The Authority is designated as a nontraditional permittee under the Phase II MS4 permit. This order is the only MS4 permit for which the Authority has obtained coverage as a discharger. The requirements of the Phase II MS4 permit apply to the Authority's right-of-way. The Authority has IAMFs for stormwater management and would design stormwater BMPs according to numeric sizing criteria.

Table 3.8-1 shows the MS4 permit requirements that apply to watersheds in the project footprint.

Table 3.8-1 MS4 Permit Requirements

Jurisdiction(s) within Project Extent	Stormwater Permit & Guidance Documents	Summary of Post-Construction Requirements
Caltrain	▪ Phase II MS4 permit ▪ Post-construction stormwater requirements are currently in development.	For planning purposes, assume general Phase II MS4 permit standards and BMPs apply: ▪ Stormwater treatment and baseline hydromodification management is required for projects that create or replace more than 5,000 square feet of impervious surface. ▪ Full hydromodification management is required for projects that create or replace 1 acre or more of impervious surface.
Authority (San Francisco Bay and Central Valley RWQCB jurisdictions)	▪ Phase II MS4 permit ▪ Construction Site BMP Manual (Caltrans 2017a) ▪ PPDG (Caltrans 2017b)	For planning purposes, assume general Phase II MS4 permit standards and BMPs apply: ▪ Stormwater treatment and baseline hydromodification management is required for projects that create or replace more than 5,000 square feet of impervious surface. ▪ Full hydromodification management is required for projects that create or replace 1 acre or more of impervious surface.

Jurisdiction(s) within Project Extent	Stormwater Permit & Guidance Documents	Summary of Post-Construction Requirements
Authority (Central Coast RWQCB jurisdictions)	▪ Phase II MS4 permit ▪ IAMFs ▪ Approving Post-Construction Stormwater Management Requirements for Development Projects in the Central Coast (2013)	▪ A majority of the project extent is in Watershed Management Zone 1. ▪ Water quality treatment is required for projects that create or replace more than 2,500 square feet of impervious surface to reduce pollutant loads and concentrations using physical, biological, and chemical removal. ▪ Runoff retention is required for projects that create or replace more than 2,500 square feet of impervious surface in Watershed Management Zone 1. In Watershed Management Zone 1, runoff retention requirements must be met using LID measures that promote infiltration over retention, storage, and evapotranspiration. ▪ Peak management is required for projects that create or replace more than 22,500 square feet of impervious surface in Watershed Management Zone 1 to maintain pre-project peak flows for the 2- through 10-year storm events.
Santa Clara, San Jose, and Santa Clara County	▪ MRP/Phase I MS4 permit ▪ SCVURPPP C.3 Stormwater Handbook (2016)	▪ Stormwater management and treatment is required for projects that create or replace more than 10,000 square feet of impervious surface. ▪ Hydromodification management is required for projects that create or replace 1 acre or more of impervious surface and are located in susceptible areas. ▪ Maintenance plans are required for regulated projects.
Santa Clara County, Gilroy, and Morgan Hill	▪ Phase II MS4 permit ▪ Stormwater Management Guidance Manual for Low Impact Development & Post-Construction Requirements (2015)	▪ Projects that create or replace 2,500 square feet or more of impervious surface must implement LID measures. ▪ Projects that create or replace 5,000 square feet or more of impervious surface must also implement water quality treatment measures. ▪ Projects that create or replace 15,000 square feet or more of impervious surface must also implement runoff retention measures. ▪ Projects that create or replace 22,500 square feet or more of impervious surface must also implement peak management measures.
Caltrans	▪ Caltrans Phase I MS4 permit ▪ Construction Site BMP Manual (Caltrans 2017a) ▪ Hydromodification Requirements Guidance (Caltrans 2015) ▪ PPDG (Caltrans 2017b)	▪ Stormwater management and treatment is required for highway projects that create 1 acre or more of new impervious surface. ▪ Stormwater management and treatment is required for non-highway projects that create 5,000 square feet or more of new impervious surface. ▪ Rapid stability assessments are required for projects that contain stream crossings or create 1 acre or more of new impervious surface to determine hydromodification management requirements.
San Benito County	N/A	▪ There are no MS4 permits in San Benito County that apply to the project.

Jurisdiction(s) within Project Extent	Stormwater Permit & Guidance Documents	Summary of Post-Construction Requirements
Merced County	N/A	▪ There are no MS4 permits in Merced County that apply to the project.

Authority = California High-Speed Rail Authority
BMP = best management practice
Caltrans = California Department of Transportation
LID = low impact development
MRP = Municipal Regional Permit
MS4 = Municipal Separate Storm Sewer System
N/A = not available
PPDG = Caltrans Project Planning and Design Guide
RWQCB = Regional Water Quality Control Board
SCVURPPP = Santa Clara Valley Urban Runoff Pollution Prevention Program

Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)

Under Section 14 of the Rivers and Harbors Act (33 U.S.C. § 408), USACE may grant permission for the use, including modifications or alterations, of any USACE civil works project provided the proposed use would not be injurious to the public interest and would not impair the usefulness of the Civil Works project. The Authority manages Section 408 compliance through an MOU among the Authority, FRA, USEPA, and USACE (FRA et al. 2010). The MOU provides a process for the Authority to submit information early in the design process to confirm that the project as designed can feasibly achieve Section 408 compliance. The Guadalupe River crossing in San Jose and the Llagas Creek crossing near San Martin would require Section 408 permission under all four alternatives. As the local sponsor, SCVWD, now known as Valley Water, would be involved in the review of the design plans for the Guadalupe River crossing in San Jose and the Llagas Creek crossing near San Martin. To the extent required under Section 408, the Authority would seek a “Statement of No Objection” from Valley Water regarding the request for Section 408 permission from USACE.

Watershed Protection and Flood Prevention Act (16 U.S.C. 1001 et seq.)

The Watershed Protection and Flood Prevention Act allows the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS) to provide planning assistance and funding to local sponsors, often flood control districts, for the implementation of flood protection projects. The use, modification, or alteration of any flood protection project constructed under this act requires coordination and permission from the local sponsor and the NRCS. The permitting process under the Watershed Protection and Flood Prevention Act is similar to the process of obtaining Section 408 permission under the Rivers and Harbors Act.

The Llagas Creek crossing near east Gilroy under Alternative 3 would be subject to the permitting process by NRCS under the Watershed Protection and Flood Prevention Act. As the local sponsor, the SCVWD would be involved in the review of the design plans for the Llagas Creek crossing near east Gilroy and West Branch Llagas Creek crossing near Gilroy. Once the SCVWD is satisfied that the proposed design would not impair the hydraulics, operation, or maintenance of the facility as originally designed, the SCVWD would ask the NRCS for concurrence, which typically takes approximately 4 weeks.

Protection of Wetlands (U.S. Presidential Executive Order [USEO] 11990)

USEO 11990 aims to avoid direct or indirect impacts on wetlands from federal or federally approved projects when a practicable alternative is available. If wetland impacts cannot be avoided, all practicable measures to minimize harm must be included.

Safe Drinking Water Act of 1974 (42 U.S.C. § 300 et seq.)

The Safe Drinking Water Act was originally passed by Congress in 1974 to protect public health by regulating the nation’s public drinking water supply. The act authorizes USEPA to set national health-based standards for drinking water to protect against both naturally occurring and human-produced contaminants that may be found in drinking water. The Safe Drinking Water Act applies to every public water system in the United States.

The Sole Source Aquifer Protection Program is authorized by Section 1424(e) of the act. The sole source aquifer designation protects groundwater drinking water supplies where there are few or no alternative sources and where, if contamination occurred, using an alternative source would be extremely expensive. All proposed projects receiving federal funds are subject to USEPA review so they do not endanger a water source.

Floodplain Management and Protection (USEO 11988)

USEO 11988 directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Requirements for compliance are outlined in 23 Code of Federal Regulations (C.F.R.) Part 650(a).

If the State's Preferred Alternative involves significant encroachment onto the floodplain, the final environmental document (final EIS or finding of no significant impact) must include the following specific discussion of the floodplain:

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

National Flood Insurance Act (42 U.S.C. § 4001 et seq.) and Flood Disaster Protection Act (42 U.S.C. § 4001 to 4128)

The purpose of the Flood Disaster Protection Act is to identify flood-prone areas and provide insurance. The act requires purchase of insurance for buildings in special flood-hazard areas. The act is applicable to any federally assisted acquisition or construction project in an area identified as having special flood hazards. Projects should avoid construction in, or develop a design to be consistent with, FEMA-identified special flood-hazard areas.

To be eligible for federally backed flood insurance, a community must participate in the National Flood Insurance Program. Participating communities must adopt and enforce floodplain management ordinances meeting or exceeding FEMA requirements for reducing the risks of future flood damage. According to the 44 C.F.R, Emergency Management and Assistance, FEMA has set a minimum national standard, allowing no more than a 1-foot increase in base flood elevations (BFE) (whether mapped or not mapped) from the cumulative impact of local development and no increases in the BFE of regulatory floodways.

If a project substantially alters the extent or depth of the base flood, the owner must submit supporting documentation and modeling. If the development proposal is approved by FEMA, FEMA issues a Conditional Letter of Map Revision. After construction is complete, as-built construction plans and modeling are submitted to FEMA, and FEMA issues a Letter of Map Revision, which officially updates the flood insurance rate map (FIRM).

3.8.2.2 State

Porter-Cologne Water Quality Control Act (California Water Code § 13000 et seq.)

The Porter-Cologne Water Quality Control Act provides for the regulation of all pollutant discharges, including wastes in project runoff and the placement of fill in waters of the state. Any entity proposing to discharge waste must file a Report of Waste Discharge with the appropriate RWQCB or the SWRCB. The RWQCBs are responsible for implementing CWA Sections 401, 402, and 303(d). Because the California HSR System is a project of statewide importance, any Reports of Waste Discharge would be filed with the SWRCB. The Porter-Cologne Water Quality Control Act also provides for the development and periodic reviews of basin plans that designate beneficial uses of California's major rivers and groundwater basins and establish water quality objectives for those waters.

Streambed Alteration Agreement (California Fish and Game Code §§ 1601–1603)

The California Fish and Game Code requires the Authority to notify the California Department of Fish and Wildlife (CDFW) prior to implementing any HSR project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream (including intermittent streams), or lake.

Senate Bill 1168, Assembly Bill 1739, and Senate Bill 1319: Sustainable Groundwater Management Act

On September 16, 2014, Governor Edmund G. Brown Jr. signed historic legislation to strengthen local management and monitoring of groundwater basins most critical to the state's water needs. The three bills, Senate Bill 1168 (Pavley), Assembly Bill 1739 (Dickinson), and Senate Bill 1319 (Pavley), together makeup the Sustainable Groundwater Management Act. The act establishes phased requirements for high and medium priority basins to adopt groundwater sustainability plans, depending on whether or not a basin is in critical overdraft. The act requires locally controlled groundwater sustainability agencies to adopt groundwater sustainability plans by January 31, 2020, for all high or medium priority basins in overdraft condition and by January 31, 2022, for all other high and medium priority basins unless the basin is legally adjudicated or otherwise managed sustainably.

The SCVWD is the designated groundwater sustainability agency for the Santa Clara and Llagas Area subbasins. The SCVWD's 2016 *Groundwater Management Plan*, adopted on November 22, 2016 (SCVWD 2016a), addresses the long-term sustainability of the Santa Clara and Llagas Area subbasins, and the DWR has determined that it meets the intent of the Sustainable Groundwater Management Act. In 2019, the DWR approved the SCVWD's *Groundwater Management Plan* for the Santa Clara and Llagas subbasins as an alternative to a groundwater sustainability plan. The *Groundwater Management Plan* was reviewed during preparation of this document.

The San Benito County Water District is the designated groundwater sustainability agency for the Bolsa Area and Hollister Area subbasins. The San Benito County Water District began the process of preparing groundwater sustainability plans for the Bolsa Area and Hollister Area subbasins in 2018. A complete draft of the groundwater sustainability plan was not available to review during preparation of this document; however, several draft chapters of the groundwater sustainability plan were available and reviewed during preparation of this document.

There are numerous groundwater sustainability agencies with jurisdiction over the project within the Delta-Mendota subbasin: Northwestern Delta-Mendota Water District, Del Puerto Water District, North & Central Delta-Mendota Region, San Joaquin River Exchange Contractors, Merced County Delta Mendota, and Grassland Water District. At this time, all groundwater sustainability agencies within the subbasin are in the process of preparing a single groundwater sustainability plan for the subbasin. A draft of the groundwater sustainability plan was not available to review during preparation of this document.

Cobey-Alquist Floodplain Management Act (California Water Code § 8400 et seq.)

The Cobey-Alquist Floodplain Management Act encourages local governments to adopt and enforce land use regulations to accomplish floodplain management. It also provides state assistance and guidance for flood control.

Central Valley Flood Protection Board (California Code Regs. Title 23, Division 1)

The Central Valley Flood Protection Board (CVFPB) exercises regulatory authority within its jurisdiction to maintain the integrity of the existing flood control system and designated floodways by issuing permits for encroachments. The CVFPB has mapped designated floodways along more than 60 streams and rivers in the Central Valley. In addition, Table 8.1 of the California Code of Regulations, Title 23, shows several hundred stream reaches and waterways that are regulated streams. Projects that encroach in a designated floodway or regulated stream, or within

10 feet of the toe of a state-federal flood control structure (levee), require an encroachment permit and the submission of an associated application, including an environmental assessment questionnaire. A project must demonstrate that it will not reduce the channel flow capacity and that it will comply with channel and levee safety requirements.

In cooperation with USACE, the CVFPB enforces standards for the construction, maintenance, and protection of adopted flood control plans that will protect public lands from floods. The jurisdiction of the CVFPB includes the Central Valley, including all tributaries and distributaries of the Sacramento River, the San Joaquin River, and designated floodways (23 California Code of Regulations § 2). The CVFPB has all the responsibilities and authorities necessary to oversee future modifications as approved by USACE pursuant to assurance agreements with USACE and the USACE Operation and Maintenance Manuals under 33 C.F.R. Section 208.10 and 33 U.S.C. Section 408. The project extent does not cross any flood control systems or floodways under the jurisdiction of the CVFPB.

Central Valley Flood Protection Act of 2008 (California Water Code, § 9600)

The Central Valley Flood Protection Act of 2008 establishes the 200-year flood event as the minimum level of flood protection for urban and urbanizing areas. As part of the state's FloodSafe program, those urban and urbanizing areas protected by flood control project levees must receive protection from the 200-year flood event level by 2025. The DWR and CVFPB collaborated with local governments and planning agencies to prepare the Central Valley Flood Protection Plan, which was adopted on June 29, 2012. The objective of the plan is to create a systemwide approach to flood management and protection improvements for the Central Valley and San Joaquin Valley. The project extent does not cross any flood control systems or floodways under the jurisdiction of the CVFPB. Therefore, the project uses the 100-year floodplain as the basis for design.

3.8.2.3 Regional and Local

Regional and local plans relevant to hydrology and water resources include water district management plans, county and city general plans, zoning codes, and specific plans. Appendix 2-J lists the regional and local plans and describes the policies adopted by the cities and counties in the RSA that were identified and considered in the preparation of this analysis.

3.8.3 Consistency with Plans and Laws

As indicated in Section 3.1.6.3, Consistency with Plans and Laws, the California Environmental Quality Act (CEQA) and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. Accordingly, this Final EIR/EIS describes the inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

Several federal and state laws and implementing regulations, listed in Section 3.8.2.1, Federal, and Section 3.8.2.2, State, direct the use and treatment of waters, including surface water quality, stormwater runoff, storm sewer systems, groundwater, and protection from floods. There are also several adopted federal and state management plans and programs that pertain to hydrology and water resources and are applicable to this Final EIR/EIS. The federal and state requirements considered in this analysis can be summarized as follows:

- Federal and state acts and laws that provide comprehensive requirements for water quality maintenance or improvement, including treatment and management of stormwater runoff, and preventing pollutants from entering waters, including the federal CWA, the Rivers and Harbors Act, and the state Porter-Cologne Water Quality Control Act.
- Federal and state acts and laws that provide comprehensive requirements for flood protection and floodplain management, including the federal Flood Insurance Act, the Floodplain Management Executive Order, and the state Central Valley Flood Protection Act.
- The California Sustainable Groundwater Management Act, which mandates improved local and regional management of groundwater improvements.

- Local urban water management plans from the Cities of San Jose, Morgan Hill, and Gilroy.
- Local groundwater management plans from the SCVWD (2016c), Water Resources Association of San Benito County (2004), and the San Luis and Delta-Mendota Water Authority (2011a, 2011b).
- Federal and state permit processes that require an applicant to demonstrate compliance with these acts, laws, and plans prior to, during, and post construction, including obtaining permits associated with the NPDES program, MS4 authorizations, and the state's Construction General Permit processes.

The Authority, as the lead agency proposing to construct and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies between the project alternatives and these federal and state laws and regulations.

The Authority is not required to comply with local land use and zoning regulations; however, it has endeavored to design and construct the HSR project so that it is consistent with land use and zoning regulations. For example, the project alternatives incorporate IAMFs to control stormwater and stormwater pollution and to minimize impacts on hydrology and water resources. The Authority reviewed 283 local and regional policies, goals, objectives, ordinances, and stormwater management programs. The project would be consistent with 279 local and regional policies, goals, objectives, ordinances, and stormwater management programs, and inconsistent with 4 policies and ordinances in the following regional and local plans and laws:

- City of Morgan Hill General Plan (2016)—Policy NRE-8.6. The project extent is located in groundwater recharge areas, which are susceptible to contamination from hazardous waste. The project would be inconsistent with the City of Morgan Hill General Plan's restrictions regarding storage of hazardous materials in areas with high percolation rates.
- City of Gilroy General Plan (2002)—Policy 25.18. The project extent is located along an existing railroad corridor that crosses existing floodplains in Gilroy. Therefore, the project would be inconsistent with Policy 25.18, which restricts urban development in floodplains.
- The Santa Clara Valley Greenprint (2014)—Strategy 1b. The project includes development in groundwater recharge areas in Coyote Valley. Such development would be inconsistent with preventing urban development in groundwater recharge areas in Coyote Valley.
- The Santa Clara Valley Greenprint (2014)—Strategy 4a. Constructing the project would require the relocation or modification of existing irrigation and drainage features in agricultural lands, which could result in the degradation of water resources.

Appendix 2-K, Policy Consistency Analysis, provides further discussion of consistency with plans and laws. As a state agency, the Authority is not required to obtain local grading permits for earthmoving activities or local stormwater permits for construction, but the Authority would seek concurrence with the local agencies for these construction activities. Appendix 2-K also describes the approaches the Authority has committed to take to reconcile any inconsistency, as well as the rationale for carrying the project forward where it remains inconsistent with the policy despite these approaches.

3.8.4 Methods for Evaluating Impacts

The evaluation of impacts on hydrology and water resources is a requirement of the National Environmental Policy Act (NEPA) and CEQA. The following sections summarize the RSAs and the methods used to analyze hydrology and water resources. As summarized in Section 3.8.1, Introduction, five other resource sections in this EIR/EIS also provide additional information related to hydrology and water resources.

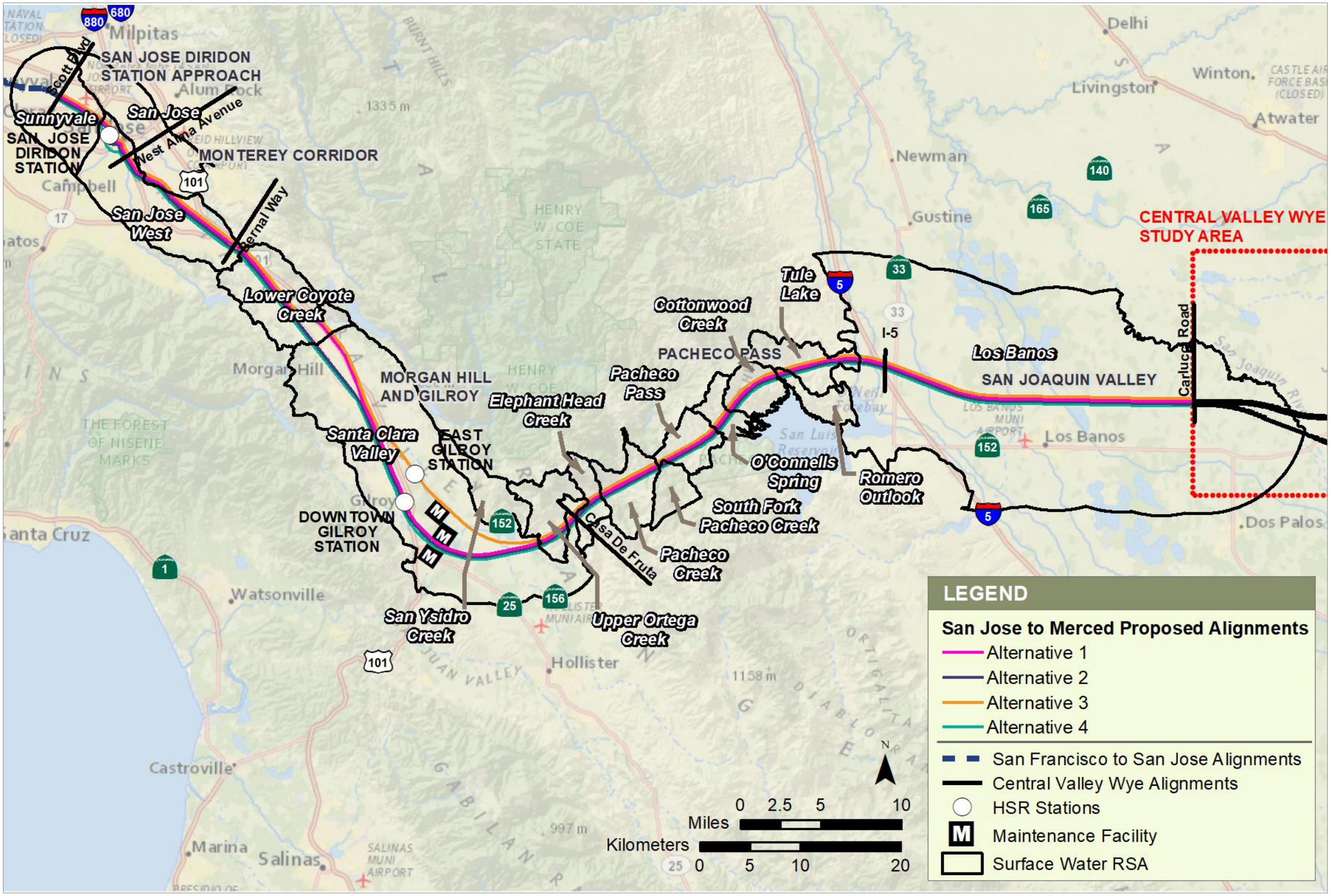
3.8.4.1 Definition of Resource Study Areas

As defined in Section 3.1, Introduction, RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic were conducted. The RSA for impacts on hydrology and water resources encompasses the areas that would potentially be affected by project construction and operations. The surface water hydrology and surface water quality RSA and floodplain RSA share the same outermost boundary, which was defined by the CalWater Planning Watersheds crossed by the project extent. Because these RSAs share the same boundary, they are collectively referred to as the surface water RSA. The groundwater RSA includes all DWR Bulletin 118 groundwater basins and subbasins crossed by the project extent. Both the surface water and groundwater RSAs were further defined by limiting the RSAs to specific distances from the project footprint, as described in Table 3.8-2. Figure 3.8-1 and Figure 3.8-2 illustrate the RSAs for the project.

Table 3.8-2 Definition of Hydrology and Water Resources Resource Study Areas

Type	Boundary Definition
Surface Water Hydrology and Water Quality	
Construction and operations	CalWater Planning Watersheds crossed by the project extent. The RSA was further defined by limiting it to locations within 3 to 6.5 miles of the project footprint depending on the planning watershed, in general conformance with the Caltrans Hydromodification Guidance (2015) (Figure 3.8-1).
Groundwater	
Construction and operations	All subsurface areas within 1 mile of the project footprint, as well as portions of DWR Bulletin 118 groundwater basins and subbasins crossed by the project extent that are within 2 miles of the project footprint (Figure 3.8-2).
Floodplains	
Construction and operations	All FEMA floodplains in the surface water RSA (Figure 3.8-1). The surface water hydrology and water quality RSA is defined as the CalWater Planning Watersheds crossed by the project extent. The RSA was further defined by limiting it to locations within 3 to 6.5 miles of the project footprint depending on the planning watershed, in general conformance with the Caltrans Hydromodification Guidance (2015).

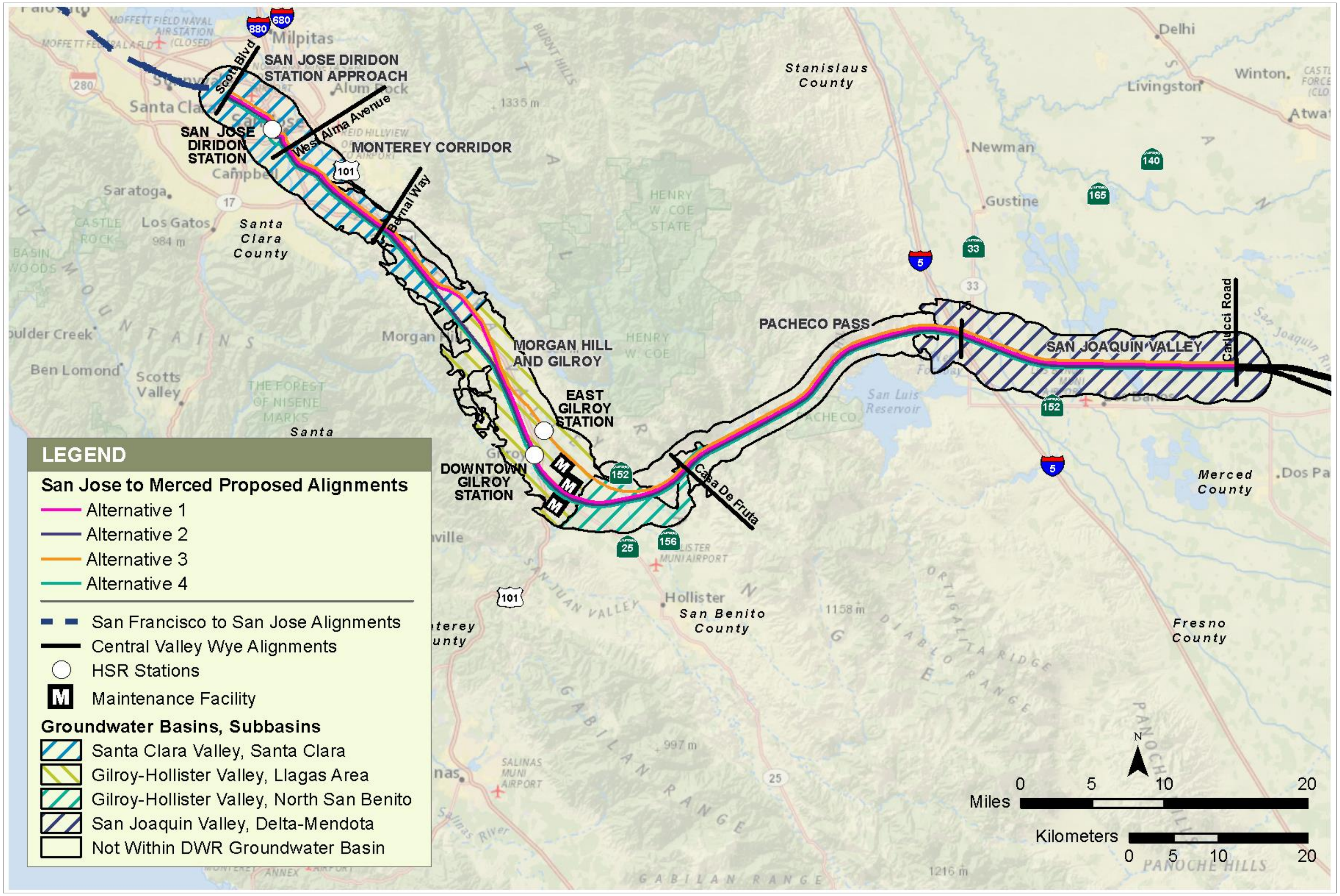
DWR = Department of Water Resources
FEMA = Federal Emergency Management Agency
RSA = resource study area



Sources: CAL FIRE 2013; Authority 2019a; USGS 2007–2014, 2016; CDFW 2016; SCVWD 2012, 2016b; Sowers et al. 2005

JANUARY 2019

Figure 3.8-1 Planning Watersheds in the Surface Water Resource Study Area



Source: Authority 2019a; DWR 2020

SEPTEMBER 2020

Figure 3.8-2 Groundwater Subbasins in the Groundwater Resource Study Area

3.8.4.2 Impact Avoidance and Minimization Features

IAMFs are project features considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. Appendix 2-E, Project Impact Avoidance and Minimization Features, provides the full text of the IAMFs that are applicable to the project. The following IAMFs are applicable to the hydrology and water resources analysis:

- HYD-IAMF#1: Storm Water Management
- HYD-IAMF#2: Flood Protection
- HYD-IAMF#3: Prepare and Implement a Construction Stormwater Pollution Prevention Plan
- HYD-IAMF#4: Prepare and Implement an Industrial Stormwater Pollution Prevention Plan
- HYD-IAMF#5: Tunnel Design Features and Construction Methods
- GEO-IAMF#1: Geologic Hazards
- GEO-IAMF#10: Geology and Soils
- BIO-IAMF#4: Operation and Maintenance Period WEAP Training
- BIO-IAMF#5: Prepare and Implement a Biological Resources Management Plan
- AQ-IAMF#1: Fugitive Dust Emissions
- HMW-IAMF#1: Property Acquisition Phase I and Phase II Environmental Site Assessments
- HMW-IAMF#4: Undocumented Contamination
- HMW-IAMF#6: Spill Prevention
- HMW-IAMF#7: Transport of Materials
- HMW-IAMF#8: Permit Conditions
- HMW-IAMF#9: Environmental Management System
- HMW-IAMF#10: Hazardous Materials Plans
- PUE-IAMF#4: Utilities and Energy

This environmental impact analysis considers these IAMFs as part of the project design. In Section 3.8.6, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts.

3.8.4.3 Methods for Impact Analysis

This section describes the sources and methods used to analyze potential project impacts on surface water hydrology, surface water quality, groundwater, and floodplains. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Refer to Section 3.1.6.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Project inconsistencies and conflicts with regional and local plans and policies that regulate hydrology and water resources (as presented in Volume 2, Appendix 2-K, Policy Consistency Analysis) also were considered in this analysis.

Data collected from local municipalities such as local and regional land use plans, transportation plans, subarea plans, and other relevant planning documents established the planned development along the project corridor and around HSR station sites.

The Authority used the information sources (and associated geographic information system [GIS] data) shown in Table 3.8-3 to describe existing conditions in the RSAs.

Table 3.8-3 Summary of Data Sources

Data Source	Name and Description
Climate, Precipitation, and Topography	
California Geological Survey	Note 36: California Geomorphic Provinces (CGS 2002)
U.S. Geological Survey	The National Map Viewer (USGS 2016)
Western Regional Climate Center	Climate summaries (WRCC 2016a, 2016b)
Surface Water Hydrology	
California Department of Fish and Wildlife	California Streams GIS Data (CDFW 2016)
California Department of Forestry and Fire Protection	CalWater 2.2.1 Watershed Boundaries GIS Data (CAL FIRE 2013)
Authority	San Jose to Merced Project Section: Aquatic Resources Delineation Report (Authority 2019b)
Oakland Museum of California	Watershed maps (Sowers et al. 2005)
Santa Clara Valley Water District	Creeks and canals in Santa Clara County GIS database (SCVWD 2016a); Watching Our Watersheds Interactive Map Layers, Central Santa Clara County (SCVWD 2012)
U.S. Geological Survey	National Hydrography Dataset (USGS 2007–2014), includes locations of springs and seeps
Surface Water Quality	
Natural Resources Conservation Service	Web Soil Survey (NRCS 2019)
Regional Water Quality Control Boards	San Francisco Bay Basin (Region 1) Water Quality Control Plan (San Francisco Bay RWQCB 2017), Water Quality Control Plan for the Central Coast Basin (Central Coast RWQCB 2019), and Sacramento River and San Joaquin River Basins (Central Valley RWQCB 2018)
State Water Resources Control Board	CWA Section 303(d) lists of water quality-impaired reaches (SWRCB 2017)
Groundwater	
Authority	Conceptual tunnel design report (Authority 2011a)
California Department of Water Resources	Bulletin 118 and GIS Data (DWR 2004a, 2004b, 2004c, 2004d, 2006, 2020); Water Management Planning Tool (DWR 2015)
ENGEO	Groundwater monitoring data collected for the project (ENGEO 2018)
Regional Water Quality Control Boards	San Francisco Bay Basin (Region 1) Water Quality Control Plan (San Francisco Bay RWQCB 2017), Water Quality Control Plan for the Central Coast Basin (Central Coast RWQCB 2019), and Sacramento River and San Joaquin River Basins (Central Valley RWQCB 2018)
San Benito County Water District	Annual Groundwater Report (SBCWD 2015); North San Benito County Groundwater Sustainability Plan Draft: Introduction and Plan Area (San Benito County Water District 2018); North San Benito County Groundwater Sustainability Plan Draft: Hydrogeologic Conceptual Model and Groundwater Conditions (San Benito County Water District 2019)

Data Source	Name and Description
San Luis and Delta-Mendota Water Authority	Groundwater management plans (SLDMWA 2011a, 2011b)
Santa Clara Valley Water District	Santa Clara County Groundwater Subbasins GIS Layer (SCVWD 2016c); Groundwater Management Plan (SCVWD 2016a)
State Water Resources Control Board	Groundwater Ambient Monitoring and Assessment (SWRCB 2016)
Water Resources Association of San Benito County	Groundwater Management Plan Update for the San Benito County Part of the Gilroy-Hollister Groundwater Basin (WRASBC 2004)
Floodplains	
Federal Emergency Management Agency	Flood Insurance Studies for Santa Clara County (FEMA 2014), San Benito County (FEMA 2009a), and Merced County (FEMA 2010)
California Department of Conservation	Tsunami Inundation Maps for Emergency Planning (DOC 2009a, 2009b)

CWA = Clean Water Act
GIS = geographic information system
RWQCB = Regional Water Quality Control Board

To evaluate potential impacts on hydrology and water resources, the Authority performed the following quantitative and qualitative analyses:

- Reviewed conceptual-level plans for each alternative and compared the plans with information on existing jurisdictional waterbodies within the Aquatic RSA, general locations of waterbodies within the Surface Water RSA and Habitat Study Area, groundwater basins, and floodplains. Refer to Section 3.7 for more information on the Aquatic RSA and Habitat Study Area.
- Identified and considered federal and state statutes regulating water resources as part of the analysis of potential flooding, hydrology, and water quality impacts. The applicable statutes establish water quality standards, regulate discharges and pollution sources, and protect drinking water systems, aquifers, and floodplain and floodway values. The Authority also reviewed county and city general plans and ordinances for applicable policies and regulations to determine if implementation of the project would result in potential impacts.
- Researched available documents from various federal, state, regional, and local agencies to determine whether the project would affect water quality and water resources.

Potential impacts on hydrology, water quality, groundwater, and floodplains were subdivided into three main categories:

- Temporary construction impacts: impacts resulting from project construction activities
- Permanent construction impacts: impacts pertaining to the physical presence of the project and associated infrastructure in the environment
- Operations impacts: impacts from interim, intermittent, or continuous routine maintenance activities

Additional details on the methods used to analyze impacts on hydrology and water resources resulting from the project can be found in the Hydrology and Water Resources Technical Report (Authority 2020).

3.8.4.4 Method for Evaluating Impacts under NEPA

CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project impacts (Section 3.1.6.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context—**For this analysis, the *context* for hydrology and water resources includes the volume and timing of existing surface water flows; extent of impervious surface and density of drainage systems in affected watersheds; existing levels of biological, chemical, and physical contaminants in surface water and groundwater; beneficial uses and water quality standards of surface water and groundwater; depth to the groundwater table; the footprint, water surface elevation, and peak flow of existing floodplains; and the regulatory setting pertaining to hydrology and water resources.
- **Intensity—**For this analysis, *intensity* is determined by the severity of the impact for hydrology and water resources, such as changes in local and regional drainage patterns, stormwater runoff rates and volumes, capacities of existing or planned drainage systems, concentrations of pollutants in surface waterbodies and groundwater aquifers, elevation of the groundwater table, and 100-year floodplain and floodway water surface elevations, footprints, and peak flows.

3.8.4.5 Method for Determining Significance under CEQA

CEQA requires that an EIR identify the significant environmental impacts of a project (CEQA Guidelines § 15126). One of the primary differences between NEPA and CEQA is that CEQA requires a threshold-based impact analysis. Significant impacts are determined by evaluating whether project impacts would exceed the significance threshold established for the resource (as presented in Section 3.1.6.4). For this analysis, the project would result in a significant impact on hydrology and water resources if it would:

- Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality.
- Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner that would:
  - Result in substantial erosion or siltation on- or off-site;
  - Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;
  - Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or
  - Impede or redirect flood flows.
- Risk release of pollutants due to project inundation in flood hazard, tsunami, or seiche zones.
- Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

As discussed above, state and federal agencies, including USEPA, SWRCB, and the RWQCBs, have established Basin Plans, water quality standards, and waste discharge requirements that are relevant to the project. These standards and requirements have been developed to prevent the degradation of water quality pursuant to the CWA, including changes in hydrology associated with additions of impervious surfaces (hydromodification) as well as erosion and sedimentation that may result from hydromodification, and thus serve as appropriate thresholds for determining the significance of water quality impacts as well as hydrology impacts related to hydromodification. The analysis of risk associated with release of pollutants from project inundation was focused on materials storage areas rather than non-point sources.

In 2014, California adopted the Sustainable Groundwater Management Act, which provides a regulatory framework for the management and use of groundwater in a manner that can be maintained through the planning horizon without causing undesirable results. Under this act, undesirable results are defined as the chronic lowering of the groundwater table, reduction of storage capacity, intrusion of seawater, degradation of groundwater quality, subsidence of land, and depletions of interconnected surface water; these conditions must be both significant and unreasonable to be considered an undesirable result. Therefore, compliance with the Sustainable Groundwater Management Act and avoidance of undesirable results are appropriate thresholds for determining the significance of groundwater impacts.

For impacts related to flood hazards, the analysis relies on standards established by FEMA and local agencies. FEMA oversees federal floodplain management policies and runs the National Flood Insurance Program adopted under the National Flood Insurance Act of 1968. FEMA prepares FIRMs that delineate the regulatory floodplain to assist local governments with land use and floodplain management decisions to avoid flood-related hazards. To avoid impacts related to flooding, FEMA and the local agencies require that an encroachment into a floodplain not increase the water surface elevation of the 100-year flood by more than 1 foot in floodplains and no increase in floodways.

3.8.5 Affected Environment

The surface water hydrology, surface water quality, groundwater, and floodplains in the RSA are described from north to south, by subsection, and, where applicable, by facility. This information provides the context for the environmental analysis and the evaluation of impacts.

3.8.5.1 Climate, Precipitation, and Topography

The RSAs are located in the Coast Ranges and Great Valley geomorphic provinces (California Geological Survey 2002). Topographic relief in the RSA is low, consisting of flat or gently sloped terrain, except for Pacheco Pass and some areas in San Jose, Morgan Hill, and Gilroy. Ground elevations in San Jose, Morgan Hill, and Gilroy range from 150 to 500 feet. Ground elevations in the Pacheco Pass area range from 230 to 1,300 feet. The highest railbed elevation along the project extent would be in the Pacheco Pass Subsection at approximately 625 feet; however, at this location, the rail would be in a tunnel below the ground surface.

The RSAs are characterized by warm, dry summers, and moderate to cool, moist winters. Rain from Pacific storms is rare during summers. Snow falls very infrequently in the RSA (Western Regional Climate Center [WRCC] 2016a). Table 3.8-4 summarizes climatic conditions in the RSAs.

Table 3.8-4 Climate Summary

Climate Summary	January	February	March	April	May	June	July	August	September	October	November	December	Annual
San Jose, California (1981–2010)													
Mean max temp. (°F)	58.8	62.4	66.6	70.5	75.1	79.9	82.6	82.3	80.7	74.8	63.1	58.7	71.5
Mean min. temp. (°F)	42.4	45.0	47.1	49.0	52.6	56.1	58.4	58.5	57.1	52.9	45.3	42.4	50.7
Mean total rainfall (inches)	2.97	3.23	2.42	1.19	0.54	0.13	0.02	0.03	0.19	0.80	1.71	2.63	15.83
Mean total snowfall (inches)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Climate Summary	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Gilroy, California (1981–2010)													
Mean max temp. (°F)	60.3	63.9	68.2	72.9	78.3	83.7	87.7	87.5	85.0	78.5	65.7	60.4	74.5
Mean min. temp. (°F)	38.6	41.5	44.0	45.9	49.8	53.0	55.1	55.0	53.3	49.0	41.7	38.4	47.2
Mean total rainfall (inches)	4.19	4.18	3.23	1.30	0.51	0.13	0.03	0.03	0.23	1.00	2.36	3.75	20.93
Mean total snowfall (inches)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacheco Pass, California (1949–1977)													
Mean max temp. (°F)	54.3	60.5	65.7	71.1	79.0	85.6	92.0	91.1	86.8	78.0	64.4	54.8	73.6
Mean min. temp. (°F)[1]	37.9	41.9	45.9	49.1	54.3	59.0	64.0	63.7	60.4	53.7	45.1	37.9	51.1
Mean total rainfall (inches)	2.64	1.76	1.46	0.65	0.14	0.03	0.01	0.11	0.33	0.86	2.34	2.44	12.77
Mean total snowfall (inches)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Los Banos, California (1981–2010)													
Mean max temp. (°F)	55.8	62.6	68.6	74.5	82.4	89.5	95.1	94.3	89.4	79.7	64.2	55.9	76.2
Mean min. temp. (°F)	37.4	41.2	44.6	47.8	53.7	58.4	61.9	60.9	57.7	51.2	41.8	37.1	49.6
Mean total rainfall (inches)	1.94	1.97	1.42	0.72	0.44	0.09	0.03	0.03	0.17	0.54	1.10	1.65	10.10
Mean total snowfall (inches)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

Source: WRCC 2016b
[1] Temperature data from station 047846 located at the B.F. Sisk Dam (San Luis Dam) between 1963 and 2007.
°F = degrees Fahrenheit
Max. = maximum
Temp. = temperature
Min. = minimum

Climate change has the potential to increase air temperatures and modify precipitation patterns in ways that would affect snowpack and runoff, and thus the hydrology of the project footprint. Climate change projections indicate that temperatures could increase by 3 to 9 degrees Fahrenheit (°F) (California Natural Resources Agency 2009) and the snowpack in the Sierra Nevada could be reduced by at least 25 percent by 2050 (Luers and Mastrandrea 2008). Climate change may also create more variable weather patterns throughout California, which can lead to decreased rainfall totals and longer, more severe droughts (DWR 2018). Groundwater pumping would likely increase under climate change to augment reduced surface water supplies (DWR 2009). Sea level rise caused by climate change is not currently expected to affect the project because the topography and existing track are higher than the sea level rise projections (California Natural Resources Agency and California Ocean Protection Council 2018). Section 3.3, Air Quality and Greenhouse Gases, provides more information on greenhouse gases and climate change.

3.8.5.2 *Surface Water Hydrology*

Hydrology is the study of the distribution, movement, and properties of water. In this analysis, *surface water hydrology* refers to the paths and flow rates of water flowing over the surface of the earth.

Regional Hydrology

DWR has subdivided California into areas according to their hydrologic characteristics: climate, topography, land cover type, soil, and water supply infrastructure. These hydrologic boundaries include hydrologic regions, units, and areas. The project extent is in the San Francisco Bay, Central Coast, and San Joaquin River Hydrologic Regions. In the San Francisco Bay Hydrologic Region, the project extent is located in the Santa Clara Hydrologic Unit. In the Central Coast Hydrologic Region, the project extent is located in the Pajaro River Hydrologic Unit. In the San Joaquin Valley Hydrologic Region, the project extent passes through the Middle West Side and Delta-Mendota Canal Hydrologic Units. Table 3.8-5 shows these hydrologic boundaries.

Definitions:

Hydrologic regions typically follow the drainage basin of a major river or the combined drainage areas of a series of rivers, such as a bay or coastline.

Hydrologic units encompass the area drained by a river system, a reach of a river and its tributaries in that reach, or a group of streams forming a coastal drainage area.

Hydrologic areas subdivide the hydrologic unit according to major tributary areas.

Table 3.8-5 Hydrologic Regions, Units, and Areas

Hydrologic Region(s)	Hydrologic Unit(s)	Hydrologic Area(s)	Planning Watershed(s)*
San Jose Diridon Station Approach			
San Francisco Bay	Santa Clara	Palo Alto	Sunnyvale
		Guadalupe River	San Jose West
		Coyote Creek	San Jose
Monterey Corridor			
San Francisco Bay	Santa Clara	Guadalupe River	San Jose West
		Coyote Creek	San Jose
Morgan Hill and Gilroy			
San Francisco Bay	Santa Clara	Guadalupe River	San Jose West
		Coyote Creek	Lower Coyote Creek
Central Coast	Pajaro River	South Santa Clara Valley	Santa Clara Valley
		Pacheco-Santa Ana Creek	San Ysidro Creek, Upper Ortega Creek
Pacheco Pass			
Central Coast	Pajaro River	South Santa Clara Valley	Santa Clara Valley
		Pacheco-Santa Ana Creek	Elephant Head Creek, Pacheco Creek, South Fork Pacheco Creek, Pacheco Pass
San Joaquin River	Middle West Side	Pacheco Pass	O'Connells Spring, Cottonwood Creek, Romero Overlook, Tule Lake
	Delta-Mendota Canal	Los Banos	Los Banos

Hydrologic Region(s)	Hydrologic Unit(s)	Hydrologic Area(s)	Planning Watershed(s)*
San Joaquin Valley			
San Joaquin River	Delta-Mendota Canal	Los Banos	Los Banos

Source: CAL FIRE 2013
* Super Planning Watersheds are comprised of multiple planning watersheds. For unnamed Planning Watersheds, the Super Planning Watershed name is given for ease of reference within this document.

Santa Clara Hydrologic Unit

The Santa Clara Hydrologic Unit comprises the southern portion of the San Francisco Bay Hydrologic Region. In this hydrologic unit, streams generally flow from south to north, eventually discharging into San Francisco Bay. The largest streams that pass through the project footprint are Guadalupe River and Coyote Creek; other streams include Los Gatos Creek and Fisher Creek. The Santa Clara Hydrologic Unit includes the following Hydrologic Areas in which the project extent is located: Palo Alto, Coyote Creek, and Guadalupe River.

Pajaro River Hydrologic Unit

The Pajaro River Hydrologic Unit comprises the northeast corner of the Central Coast Hydrologic Region. All waterbodies in this hydrologic unit eventually discharge into Monterey Bay via the Pajaro River. The largest streams in the Pajaro River Hydrologic Unit that cross the project footprint are Llagas Creek, Pajaro River, and Pacheco Creek. The project intersects the South Santa Clara Valley and Pacheco-Santa Ana Creek Hydrologic Areas of the Pajaro River Hydrologic Unit. A significant hydrologic feature of the Pajaro River Hydrologic Unit is referred to as Soap Lake, an extensive and dynamic floodplain system that extends between San Felipe Lake in the east and Gilroy in the west, portions of which were once in the historic Soap Lake. See Section 3.8.5.5, Floodplains, for more information on the Soap Lake floodplain.

Middle West Side Hydrologic Unit

The Middle West Side Hydrologic Unit is in the southwestern corner of the San Joaquin River Hydrologic Region. Surface water in the rural Middle West Side Hydrologic Unit generally flows east to northeast out of the mountains toward the San Joaquin River. The San Joaquin River eventually discharges into San Francisco Bay after passing through the inland delta formed by the confluence of the San Joaquin and Sacramento Rivers. The Middle West Side Hydrologic Unit contains the following Hydrologic Areas that the project extent intersects: Pacheco Pass. Many of the streams in this hydrologic unit only flow during heavy winter storms and for short durations afterward.

Delta-Mendota Canal Hydrologic Unit

The Delta-Mendota Canal Hydrologic Unit is also located in the southwestern portion of the San Joaquin River Hydrologic Region, immediately east of the Middle West Hydrologic Unit. This hydrologic unit occupies the San Joaquin Valley floor. Like the Middle West Side Hydrologic Unit, all surface water flows eventually discharge into San Francisco Bay, after passing through the inland delta formed by the confluence of the San Joaquin and Sacramento Rivers. Streams in this hydrologic unit are intersected by canals and highways and have been diverted, modified, channelized, and relocated; agriculture has reclaimed many wetlands and lakes. Surface water flow in this unit is primarily controlled by diversion structures and agricultural operations. In the Delta-Mendota Canal Hydrologic Unit, the project footprint intersects the Los Banos Hydrologic Area.

Waterbodies

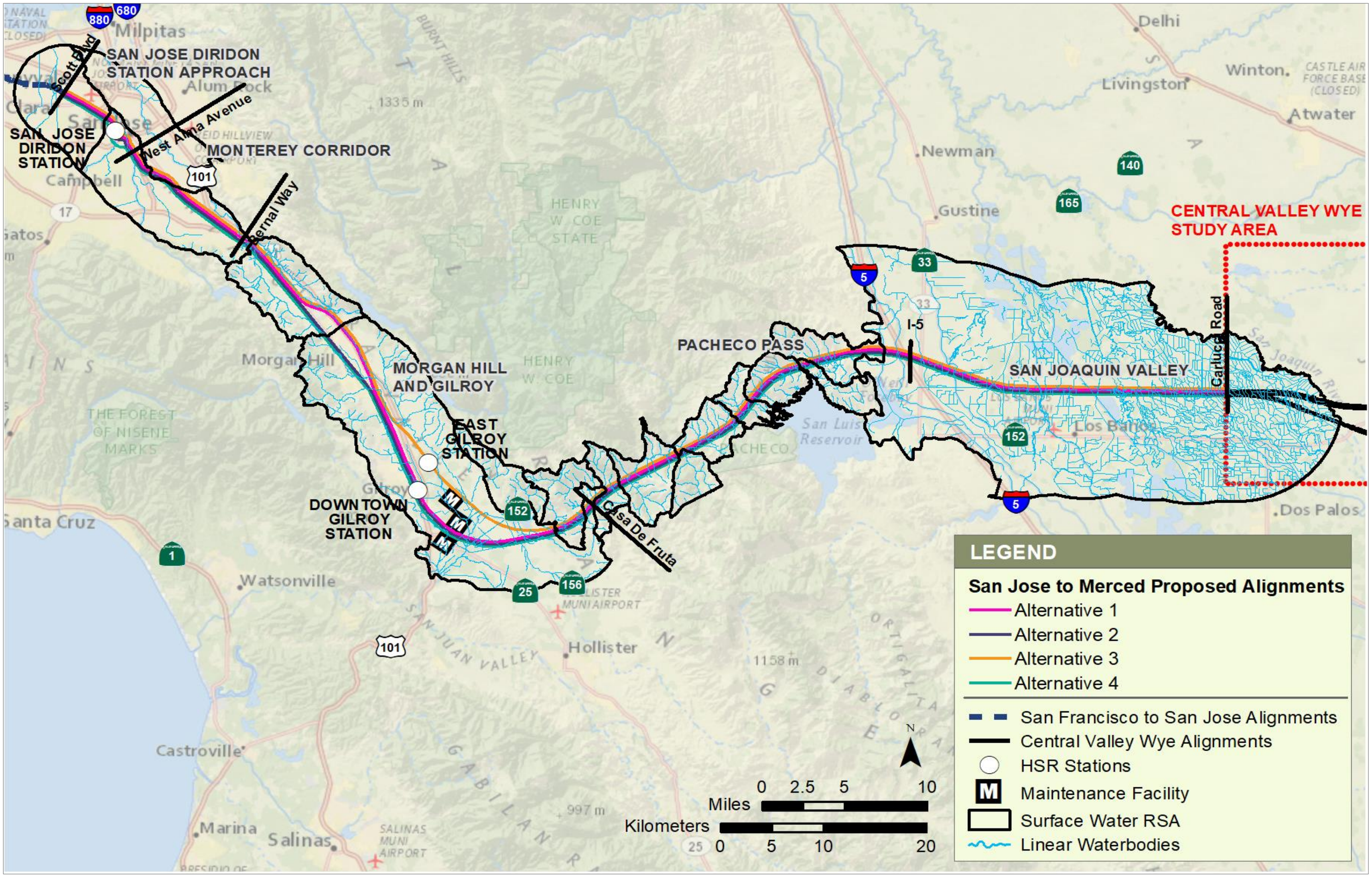
The RSA contains numerous surface waterbodies, including creeks, streams, rivers, sloughs, artificial conveyances such as canals and drainage channels, ponds, lakes, wetlands, reservoirs, and water storage and percolation basins. In the RSA, impacts on surface water hydrology would generally occur in the project footprint, where construction activities would affect surface waterbodies. Table 3.8-6 shows the aquatic resources by subsection. Figure 3.8-3 illustrates these waterbodies in relation to the project alignment. Volume 2, Appendix 3.8-A, Waterbodies Crossed by the Project Alternatives, contains a table that quantifies each waterbody in the project extent by subsection and alternative as well as more detailed figures of the waterbodies that would be crossed by the alternatives. Section 3.7, Biological and Aquatic Resources, contains additional information on wetlands and jurisdictional aquatic resources.

Water and Irrigation Districts

A number of water and irrigation districts operate in the RSA. These entities own and operate facilities such as canals, pumps, and percolation basins to provide water for domestic and agricultural uses as well as groundwater management. Water and irrigation districts pump surface water and groundwater to and from rivers, creeks, and the numerous canals that deliver municipal water to individual water users and irrigation water to agricultural fields and other agricultural uses. In addition, many drainage channels, often simply called *drains*, convey agricultural return flows.

Table 3.8-6 Aquatic Resources by Subsection

Resource	San Jose Diridon Station Approach	Monterey Corridor	Morgan Hill and Gilroy	Pacheco Pass	San Joaquin Valley
Alkali marsh	–	–	–	–	Yes
Alkali scrub wetland	–	–	–	–	Yes
Alkali vernal pool	–	–	–	Yes	Yes
Constructed basin	–	Yes	Yes	Yes	Yes
Constructed watercourse	Guadalupe River	Yes	Cochran Channel, Madrone Channel, West Little Llagas Creek, Butterfield Channel, West Branch Llagas Creek Channel, Upper Miller Slough, San Ysidro Creek, Pajaro River, Millers Canal, Tequisquita Slough, Pacheco Creek Side Channel, Ortega Creek Tributaries	California Aqueduct, Delta-Mendota Canal, Outside Canal	Main Canal, San Luis Wasteway, Santa Fe Canal, San Luis Canal, San Luis Drain, San Pedro Canal, Boundary Drain, Lone Tree Canal, Devon Drain, Midway Swamp Ditch, West Delta Canal, Delta Canal, East Delta Canal, Poso Drain, Belmont Drain, Delta No.1 Canal, San Juan Drain, West San Juan No.1 Canal
Freshwater marsh	–	Yes	Yes	Yes	Yes
Freshwater pond	–	–	Yes	Yes	Yes
Natural watercourse	Guadalupe River, Los Gatos Creek	Guadalupe River, Coyote Creek	Coyote Creek, Fisher Creek, Little Llagas Creek, Llagas Creek, West Branch Llagas Creek, Dexter Creek, Jones Creek, Uvas-Carnadero Creek, Pajaro River, Upper and Lower Miller Slough, Pacheco Creek, Ortega Creek, Pacheco Creek Tributaries	Pacheco Creek and Tributaries, Elephant Head Creek, Harper Canyon Creek, San Luis Reservoir Tributaries, Cottonwood Creek and Tributaries, Romero Creek	San Luis Creek, Los Banos Creek, Mud Slough
Palustrine forested wetland	Yes	Yes	Yes	Yes	Yes
Reservoir	–	–	Yes	Yes	–
Seasonal wetland	Yes	Yes	Yes	Yes	Yes
Vernal pool	–	–	–	Yes	Yes



Note: Volume 2, Appendix 3.8-A, Waterbodies Crossed by the Project Alternatives, contains a table that quantifies each waterbody in the project extent by subsection and alternative as well as more detailed figures of the waterbodies that would be crossed by the alternatives.
Sources: CAL FIRE 2013; Authority 2019a; USGS 2007–2014 and 2016; CDFW 2016; SCVWD 2016b; Sowers et al. 2005

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Figure 3.8-3 Waterbodies in the Resource Study Area

The Authority is required to coordinate with these districts if there is potential for the project to affect any of their facilities. These entities often have design standards for structures that cross their facilities, such as minimum freeboard requirements. SCVWD, Pacheco Pass Water District, Centinella Water District, Del Puerto Water District, Central California Irrigation District, Grassland Water District, and San Luis Canal Company operate in the RSA (DWR 2015). Additionally, the Authority would coordinate with water and irrigation districts regarding any planned releases from reservoirs located upstream of the project alternative footprints.

3.8.5.3 Surface Water Quality

Between San Jose and Gilroy and within the Central Valley, the project is located within watersheds where existing railroads, such as Caltrain and UPRR, are currently in operation. In these areas, the project would not be a source of new pollutants in the landscape. Within the Pacheco Pass area between Gilroy and Los Banos, the project would be a new source of pollutants in the landscape because there are no existing railroads in this area. However, existing transportation facilities like SR 152 and local roadways likely generate and contribute pollutants associated with urban runoff and transportation corridors to receiving waterbodies, like Pacheco Creek.

The San Francisco Bay, Central Coast, and Central Valley RWQCBs have developed watershed planning documents, or Basin Plans, to protect waterbodies from adverse changes in water quality (San Francisco Bay RWQCB 2017; Central Coast RWQCB 2019; Central Valley RWQCB 2018). These basin plans establish a list of beneficial uses for waterbodies in each RWQCB's jurisdiction. Beneficial uses are the useful resources, services, and qualities that waterbodies provide, such as drinking water supply, wildlife habitat, and recreational activities like fishing, swimming, and kayaking. In addition, basin plans lay out water quality standards (*water quality objectives*) that protect these beneficial uses. When waterbodies consistently fail to meet a water quality objective, the RWQCB must develop and implement a program designed to control sources of pollution through regulatory mechanisms that allow the waterbody to attain water quality objectives and support its beneficial uses. The following sections describe the beneficial uses, water quality objectives, and listed impairments for all waterbodies in the RSA. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, for a complete inventory of the beneficial uses, water quality objectives, and impairments of each waterbody identified in the surface water RSA.

Beneficial Uses

Beneficial uses must be protected to preserve high water quality in surface waters, aquatic ecosystems, and underground aquifers; see Section 3.8.5.4, Groundwater, for more information on beneficial uses of groundwater (San Francisco Bay RWQCB 2017; Central Coast RWQCB 2019; Central Valley RWQCB 2018). Due to the vast number of waterbodies within the jurisdiction of the San Francisco Bay, Central Coast, and Central Valley RWQCBs, the RWQCBs do not identify beneficial uses for each waterbody in their respective Basin Plans. Existing beneficial uses that have not been formally designated in a Basin Plan are protected whether or not they are identified in a Basin Plan. Generally, the RWQCBs designate beneficial uses for unlisted waterbodies on a case-by-case basis. The San Francisco Bay RWQCB Basin Plan identifies beneficial uses for 22 waterbodies in the RSA, the Central Coast RWQCB Basin Plan identifies beneficial uses for 12 waterbodies in the RSA, and the Central Valley RWQCB Basin Plan identifies beneficial uses for 14 waterbodies in the RSA. The Hydrology and Water Quality Technical Report (Authority 2020) gives more information about the beneficial uses of waterbodies in the RSA.

Definitions:

Bioaccumulation is a process wherein chemicals become concentrated in the bodies of living organisms.

Biostimulatory substances cause microorganisms to reproduce more quickly.

Methylmercury is a poisonous form of mercury.

Population and community ecology refers to alterations of water quality that result in mortality or changes in wildlife.

pH measures the acidity (low pH) or alkalinity (high pH) of water.

Turbidity is the cloudiness of a liquid.

Water Quality Objectives

Water quality objectives are the control and management criteria necessary to preserve the beneficial uses of a waterbody or groundwater aquifer (see Section 3.8.5.4, Groundwater, for more information on beneficial uses of groundwater). They are measured and analyzed through qualitative and quantitative factors. Table 3.8-7 shows the water quality parameters that are regulated by the respective jurisdictional RWQCB to protect the existing beneficial uses of surface water features in the project extent and its subsections. See Volume 2, Appendix 3.8-C, for a detailed description of the water quality objectives associated with each of the parameters shown in Table 3.8-7.

Table 3.8-7 Water Quality Objectives

Jurisdiction	Water Quality Parameters
San Francisco Bay Regional Water Quality Control Board	Bacteria, bioaccumulation, biostimulatory substances, color, dissolved oxygen, floating materials, oil and grease, population and community ecology, pH, radioactivity, salinity, sediment, settleable material, suspended material, sulfide, tastes and odors, temperature, toxicity, turbidity, un-ionized ammonia, and chemical constituents
Central Coast Regional Water Quality Control Board	Color, tastes and odors, floating material, suspended material, settleable material, oil and grease, biostimulatory substances, sediment, turbidity, pH, dissolved oxygen, temperature, toxicity, pesticides, organic chemicals, other organics, phenol, radioactivity, bacteria, chemical constituents, and cadmium
Central Valley Regional Water Quality Control Board	Bacteria, biostimulatory substances, chemical constituents, color, dissolved oxygen, floating material, methylmercury, oil and grease, pH, pesticides, radioactivity, salinity, sediment, settable material, suspended material, taste and odors, temperature, toxicity, and turbidity

Sources: San Francisco Bay RWQCB 2017; Central Coast RWQCB 2019; Central Valley RWQCB 2018

Clean Water Act Section 303(d) List and Total Maximum Daily Loads

A TMDL is a regulatory response initiated by an RWQCB to quantify and enforce the maximum amount of a pollutant that may be discharged to a waterbody such that it continues to meet water quality objectives and support its beneficial uses. If an RWQCB can address the impairment through other regulatory means, a TMDL may not be developed and implemented. Figure 3.8-4 illustrates the impaired waterbodies in the RSA and identifies the impaired waterbodies that intersect the project footprint.

In the Santa Clara Valley, water quality impairments are generally associated with urban development and, to a lesser degree, historic mining operations. Residential, commercial, industrial, and other urban development along the valley floor has contributed to the accumulation of trash, diazinon (a pesticide), and other toxic compounds in nearby creeks. The historic mining of mercury in the hills of the Santa Clara Valley has contaminated several streams.

Moving south through the RSA and into the Pajaro River watershed, where land uses include both agriculture and urban uses, water quality impairments include pesticides from agricultural operations, fertilizers and sediment from agricultural and urban areas, and bacteria from urban storm drain systems. The Pajaro River itself has a number of impairments, including pesticides like chlordane, chlorpyrifos, dichlorodiphenyldichloroethane,

Definitions:

Mercury and **selenium** are metals that occur naturally in soils and rocks in the RSA. Mercury impairments may also be related to the historic use of this metal.

Turbidity and **sedimentation** impairments are caused by excessive sediment in a waterbody from upstream land uses. Soil disturbance during construction may accelerate erosion and sediment transport.

Escherichia coli **(*E. coli*)** and **fecal coliform** refer to bacterial pathogens.

Nitrate and **nutrients** are biostimulatory substances.

Low dissolved oxygen can cause aquatic organisms to suffocate from a lack of oxygen.

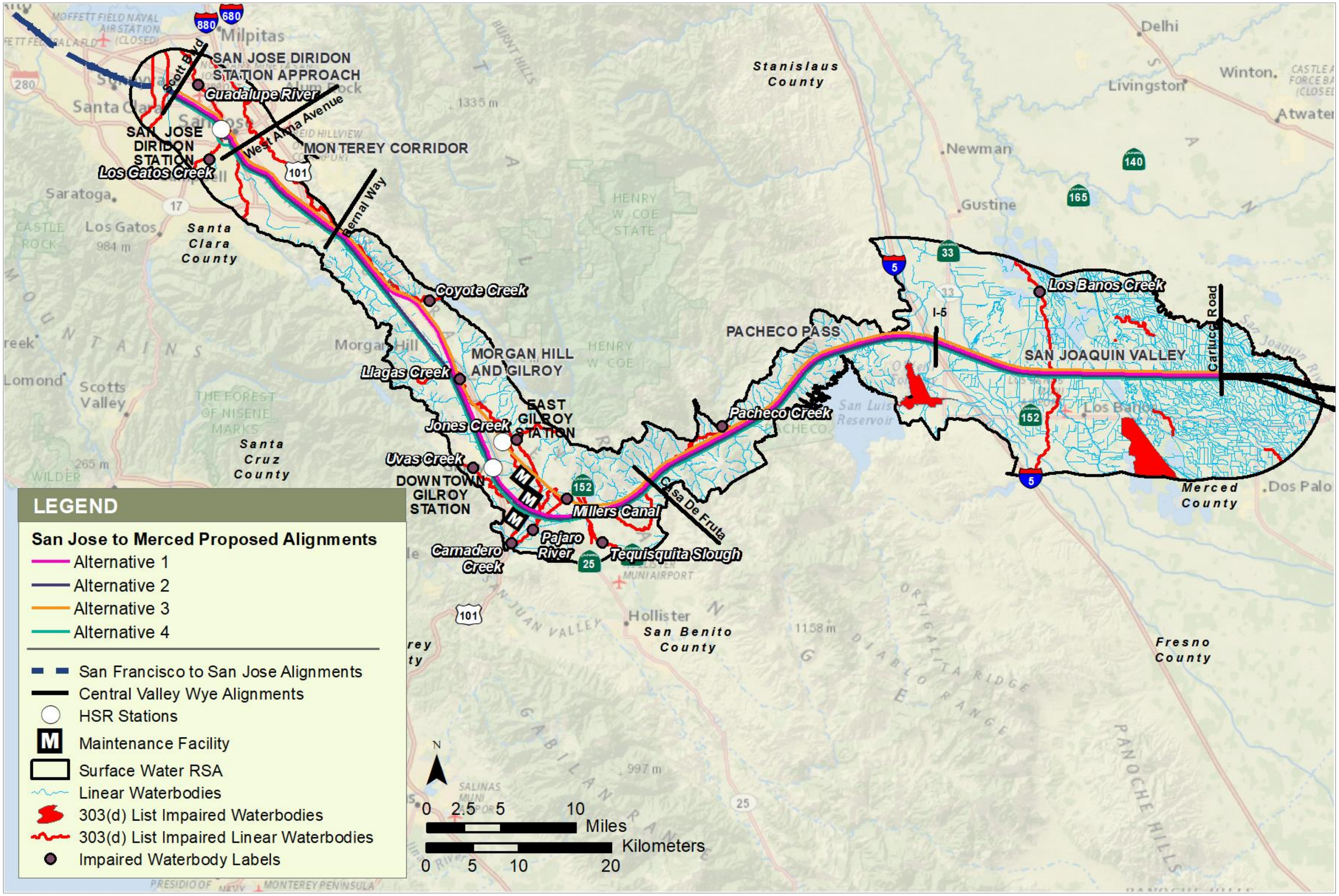
dichlorodiphenyldichloroethylene, and dichlorodiphenyltrichloroethane, diazinon, and dieldrin, as well as certain metals and minerals, sediment, low dissolved oxygen, pH, fertilizers (e.g., nitrates and nutrients), bacteria (e.g., *Escherichia coli* and fecal coliform), and polychlorinated biphenyls, a synthetic compound.

In the San Joaquin Valley, the predominance of agriculture is the primary source of water quality impairments. Because soils naturally contain selenium in this area, drainage water from irrigated croplands often has elevated levels of this metal. As a result, drainage from croplands is diverted into San Luis Drain rather than allowed to flow into the marshes and wetlands comprising the Grasslands Ecological Area, including the portions of Mud Slough and its associated alkali marshes in the project footprint.

Soil Erosion Potential

Highly erodible soils are defined as those with soil erodibility factors, or K factors, above 0.4 in value. The K factor represents a soil’s susceptibility by erosion and the amount and rate of runoff. Fine-textured soils high in clay have low K factors of about 0.02 to 0.15 because their cohesive particles resist detachment by water (the tearing loose of soil particles by water). Coarse-textured soils, such as sandy soils, have low K factors of about 0.05 to 0.2 because they have low runoff potential. Medium-textured soils, such as silt loams, have moderate K factors of about 0.25 to 0.4 because they are moderately susceptible to erosion and produce moderate runoff. Soils with high silt content are the most erodible and typically have K factors greater than 0.4. These easily eroded soils produce large amounts and rates of runoff.

Highly erodible soils occur throughout the RSA and in each subsection. Although widespread throughout the RSA, these soils generally occur in relatively small, localized areas. Highly erodible soils are present west of the San Jose Diridon Station, to the north and south of the Monterey Corridor Subsection, and in the Upper Coyote and Llagas Creek watersheds near Morgan Hill, San Martin, and Gilroy. The prevalence of these soils increases along the slopes of the hilly terrain near Pacheco Creek and Romero Creek. In the San Joaquin Valley, few locations contain highly erodible soils; however, such soils are present near Mercy Springs Road/State Route (SR) 165 (NRCS 2019). See the Hydrology and Water Quality Technical Report (Authority 2020) for a list of highly erodible soils within the RSA.



Sources: California Department of Forestry and Fire Protection 2013; SWRCB 2017

DECEMBER 2018

Figure 3.8-4 Water Quality Impairments in the Resource Study Area

3.8.5.4 Groundwater

In this RSA, most groundwater occurs in alluvial aquifers at various depths. Groundwater also may occur in fractured bedrock in the Pacheco Pass Subsection. Natural recharge in the RSA occurs primarily on coarse alluvial fans located where streams exit their montane headwaters and enter the valley floor. Los Gatos Creek, Coyote Creek, Llagas Creek, Uvas Creek, Carnadero Creek, Pacheco Creek, Romero Creek, and San Luis Creek all have well-developed alluvial fans and coarse channel substrate with high infiltration rates. However, some of the valley areas along the project extent also have particularly high infiltration rates critical to maintaining groundwater recharge, including southern Santa Clara Valley near Morgan Hill and Gilroy.

Definitions:

Alluvium, or alluvial material, consists of coarse sediment, such as sand and gravel, as well as finer-grained particles, such as clay and silt, deposited in layers by a river or stream. Layers of alluvium may alternative between coarse and fine-grained materials.

Aquifers are deposits of coarse alluvium wherein water is stored within the spaces between grains of sediment. Although most aquifers within the RSA are alluvial, groundwater may also be found within fractured rocks in the Pacheco Pass Subsection.

Aquitards, or confining layers, are deposits of fine-grained alluvium, such as clay and silt. These deposits of fine material impede the movement of water deeper into the subsurface. Consequently, aquitards may isolate aquifers into separate layers when viewing the subsurface as a cross section.

Groundwater Basins and Subbasins

The groundwater RSA is located in the Santa Clara Valley, Gilroy-Hollister Valley, and San Joaquin Valley groundwater basins. Table 3.8-8 shows the total area of each groundwater subbasin as well as the area of each subbasin in the RSA. Table 3.8-8 also shows the area of each groundwater subbasin in the project footprint for each alternative.

Table 3.8-8 Groundwater Basins and Subbasins (acres)

Basin	Subbasin	Total Area of Subbasin	Area in RSA	Area in Alt. 1	Area in Alt. 2	Area in Alt. 3	Area in Alt. 4
Santa Clara Valley	Santa Clara	189,564.6	49,698.6	931.0	1,180.6	960.3	497.0
Gilroy-Hollister Valley	Llagas Area	47,371.4	41,567.9	784.9	1,237.9	860.5	617.5
	North San Benito	131,046.4	17,260.1	474.3	474.3	464.4	475.9
San Joaquin Valley	Delta-Mendota	746,977.3	70,068.8	1,217.8	1,217.8	1,217.8	1,217.8
Total		**925,395.1**	**178,595.4**	**3,408.0**	**4,110.6**	**3,503.0**	**2,808.2**

Sources: DWR 2020; Authority 2019a
Alt. = Alternative
RSA = resource study area

Santa Clara Valley Basin

The Santa Clara Valley groundwater basin is subdivided into four distinct subbasins: Niles Cone, San Mateo Plain, East Bay Plain, and Santa Clara. A portion of the Santa Clara subbasin is in the RSA. The primary water-bearing formations in the Santa Clara subbasin consist of unconsolidated to semi-consolidated alluvial deposits of Pliocene to Holocene age—specifically, the Santa Clara Formation and younger alluvium. The combined thickness of these units likely exceeds 1,500 feet. The northern portion of the subbasin is a confined zone, while the southern portion of the subbasin is generally unconfined. Artesian conditions may be encountered in confined portions of the subbasin. The SCVWD has designated the unconfined portion of the subbasin as a groundwater recharge zone (Figure 3.8-4); this area contains

Definitions:

Confined aquifers contain layers of clay that impede the vertical movement of water. These layers of clay are also known as aquitards.

Unconfined aquifers do not contain any aquitards that limit the vertical movement of water deeper into the subsurface.

percolation ponds and in-stream managed (artificial) recharge facilities, and it is more sensitive to groundwater contamination than the confined portion of the subbasin. Groundwater in the Santa Clara subbasin typically flows according to ground surface topography, toward the interior of the subbasin and northerly toward San Francisco Bay (SCVWD 2010). Abandoned groundwater wells may exist in the Santa Clara subbasin due to the area's history of agricultural production.

Definitions:

Artesian conditions occur in confined aquifers that are under pressure. When confined aquifers are recharged, the hydrostatic pressure, or the pressure exerted by water, increases. In artesian aquifers, water in wells rise above the natural elevation of the groundwater table because of the hydrostatic pressure. In some cases, the hydrostatic pressure is great enough to cause water in the well to rise above the ground surface, resulting in free-flowing groundwater.

Gilroy-Hollister Valley Basin

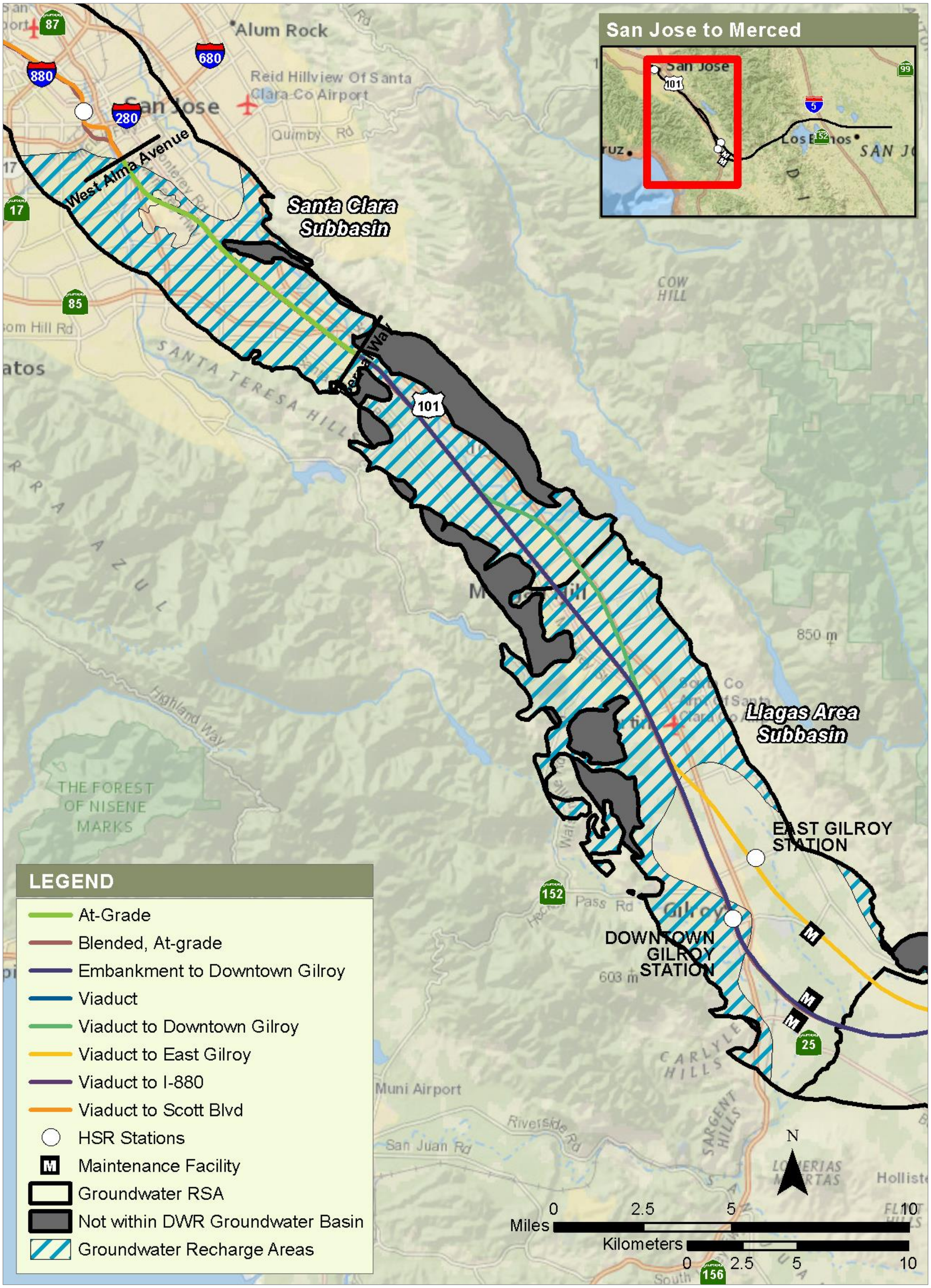
The Gilroy-Hollister Valley groundwater basin is subdivided into two distinct subbasins: Llagas Area and North San Benito subbasins. Portions of the Llagas Area and North San Benito subbasins are in the RSA.

Llagas Area Subbasin

The Llagas Area subbasin is located south of Coyote Valley and drains toward Monterey Bay. In the Llagas Area subbasin, groundwater generally flows from the northern extent of the subbasin near Cochran Road to the southeast toward Pajaro River, roughly in the same direction as surface water flow. Groundwater occurs under both unconfined and confined conditions. The unconfined areas are found in the northern portion of the subbasin; the SCVWD has designated these unconfined areas as groundwater recharge areas (Figure 3.8-5). Accordingly, the northern portion of the subbasin is hydrogeologically sensitive to groundwater contamination compared with the confined portion of the subbasin (SCVWD 2010). The confined areas are mainly found in the central and southern areas of the subbasin, and these areas may contain artesian conditions (SCVWD 2016a). Several artificial recharge facilities are located in the subbasin: Madrone Channel; Main Avenue Percolation Ponds; and in-stream percolation ponds in Uvas Creek, Carnadero Creek, and Llagas Creek (DWR 2004b). Abandoned groundwater wells may exist in the Llagas Area subbasin due to the area's history of agricultural production.

North San Benito Subbasin

The North San Benito subbasin is located south of the Llagas Area subbasin and occupies most of the Gilroy-Hollister Valley Basin. The primary water-bearing alluvial deposits in the subbasin consist of clay, silt, sand, and gravel (San Benito County Water District 2018). Groundwater occurs in both unconfined and confined conditions. Within the northerly portion of the subbasin, there are noncontinuous clay confining layers that create artesian conditions (County of San Benito 2015). Artesian conditions also occur within the northern Hollister Valley and San Juan Valley, including an area near Lovers Lane and Tequisquita Slough (San Benito County Water District 2015, 2019). Natural groundwater recharge in the North San Benito subbasin occurs from percolation along streams, including Pacheco Creek; water from the Central Valley Project reservoirs; and local wastewater treatment plants (San Benito County Water District 2018).



Sources: DWR 2020; SCVWD 2016c

SEPTEMBER 2020

Figure 3.8-5 Groundwater Recharge in the Santa Clara and Llagas Area Subbasins

Pacheco Pass Area

A portion of the Pacheco Pass Subsection is not located in a groundwater basin or subbasin defined by the DWR. While the DWR has not defined a groundwater basin in this area, existing documentation generated during tunneling activities through the Diablo Range near the Pacheco Pass Subsection indicates that groundwater is present. The Pacheco Pass Subsection traverses the alluvial valley of Pacheco Creek as well as various types of bedrock geology. In the alluvial valley areas of the Pacheco Pass Subsection, groundwater may be encountered in an alluvial aquifer below the ground surface. In addition, fractured bedrock in the Pacheco Pass Subsection may contain groundwater in cracks and sheared zones (Authority 2011). The proposed tunnels are expected to pass through unconsolidated sediment and bedrock geology. They would not pass through alluvium or any alluvial aquifers.

The Central Valley Project required construction of tunnels through the Diablo Range within a few miles of the proposed tunnels in the Morgan Hill and Gilroy Subsection and the Pacheco Pass Subsection. It is expected that similar groundwater conditions would be encountered during construction of the project. Table 3.8-9 shows the groundwater conditions experienced during construction of the Central Valley Project tunnels by geologic unit.

Table 3.8-9 Potential Tunnel Groundwater Conditions by Geologic Unit

Geologic Unit	Groundwater Conditions
Great Valley Sequence (Panoche Formation)	Mostly dry or moist conditions, with local higher heading flush flows of less than 100 gallons per minute. High groundwater inflows are expected at sheared zones or intensely fractured rocks with open joints.
Franciscan mélange	Mostly dry to moist conditions, with local high heading flush flows of up to 200 gallons per minute. Groundwater heads of up to 500 feet may be encountered during tunneling in sheared zones or intensely fractured rock with open joints, resulting in temporary inflows of more than 200 gallons per minute.
Cleaved metagraywacke	Mostly dry to moist, with local high heading flows up to 100 gallons per minute. High groundwater inflows are expected at sheared zones or intensely fractured rocks with open joints.
Uncleaved metagraywacke	It is anticipated that this unit has geologic characteristics similar to those of cleaved metagraywacke.

Source: Authority 2011

San Joaquin Valley Basin

The San Joaquin Valley groundwater basin is subdivided into 16 distinct subbasins: Kern County, Pleasant Valley, Tule, Tulare Lake, Kaweah, Westside, Kings, Chowchilla, Madera, Merced, Turlock, Delta-Mendota, Modesto, Tracy, Eastern San Joaquin, and Cosumnes. A portion of the Delta-Mendota subbasin is in the RSA. The Delta-Mendota subbasin is in the western portion of the San Joaquin Valley groundwater basin. In the Delta-Mendota subbasin, groundwater occurs in three aquifers: lower Tulare Formation zone, upper Tulare Formation and younger deposit zone, and a shallow zone within approximately 25 feet of the ground surface. Near the Diablo Range foothills, groundwater is generally located more than 100 feet below ground surface. Moving east through the San Joaquin Valley, depth to groundwater generally decreases near managed wetlands in the Grasslands Ecological Area. Shallow, saline groundwater conditions are present throughout a significant portion of the subbasin. Often, this saline groundwater occurs within 10 feet of the ground surface (DWR 2006). Groundwater recharge occurs by infiltration of surface water into the alluvial fans of Los Banos Creek and Orestimba Creek, percolation of surface water, agricultural irrigation, and rainfall.

Depth to Groundwater

Groundwater levels vary in the RSA. In the San Jose Diridon Station Approach, Monterey Corridor, and San Joaquin Valley Subsections, groundwater may be encountered within 20 feet of the ground surface. In the Morgan Hill and Gilroy Subsection, groundwater may be found near the ground surface but may also be encountered at depths of up to 50 feet. Groundwater depths in the Pacheco Pass Subsection are poorly defined (Authority 2019c). Table 3.8-10 shows depth to groundwater in the RSA for each subsection.

Table 3.8-10 Approximate Groundwater Depth below Ground Surface

San Jose Diridon Station Approach	Monterey Corridor	Morgan Hill and Gilroy	Pacheco Pass	San Joaquin Valley
Near surface to 20 feet	10 to 20 feet	Near surface to 50 feet	Poorly defined	Near surface to 10 feet

Source: Authority 2019c

Beneficial Uses

The San Francisco Bay, Central Coast, and Central Valley RWQCB beneficial uses for groundwater subbasins in the RSA are shown in Table 3.8-11. In the RSA, groundwater basins are identified as having up to four beneficial uses: municipal and domestic water supply (MUN), industrial process water supply (PROC), industrial service water supply (IND), and agricultural water supply (AGR).

Table 3.8-11 Beneficial Uses of Groundwater Subbasins in the RSA

		Beneficial Uses			
Basin	Subbasin	Municipal and Domestic Water Supply	Industrial Process Water Supply	Industrial Service Water Supply	Agricultural Water Supply
Santa Clara Valley	Santa Clara	Existing	Existing	Existing	Existing
Gilroy-Hollister Valley	Llagas Area	Suitable	Suitable	Suitable	Suitable
	North San Benito	Suitable	Suitable	Suitable	Suitable
San Joaquin Valley	Delta-Mendota	Suitable/ potentially suitable	Suitable/ potentially suitable	Suitable/ potentially suitable	Suitable/ potentially suitable

Sources: San Francisco Bay RWQCB 2017; Central Coast RWQCB 2019; Central Valley RWQCB 2018

Groundwater Quality Objectives

Groundwater quality objectives are the control and management criteria necessary to preserve the beneficial uses of groundwater basins and subbasins. They are measured and analyzed through qualitative and quantitative factors. In the RSA, the RWQCBs have established groundwater quality objectives for bacteria, organic and inorganic chemical constituents, radioactivity, taste, odor, and toxicity (San Francisco Bay RWQCB 2017; Central Coast RWQCB 2019; Central Valley RWQCB 2018). Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, provides a detailed description of the groundwater quality objectives in the RSA.

Municipal Water Supply

The SCVWD manages the Santa Clara and Llagas Area groundwater subbasins for all groundwater beneficial uses, including municipal water supply. San Jose receives approximately one-third of its water supply from the Santa Clara groundwater subbasin. Morgan Hill's water supply is exclusively derived from the Santa Clara and Llagas Area subbasins (City of Morgan Hill 2013), while Gilroy pumps all of its water supply from the Llagas Area subbasin (City of Gilroy 2011).

In San Benito County, the project extent is in the Bolsa Area and Hollister Area subbasins. In the Bolsa Area subbasin, water supply is derived completely from groundwater. Other areas in San Benito County use a mix of local groundwater supplies and imported water from the Central Valley Project. In Merced County, water supply predominantly relies on imported water from the Central Valley Project.

There are 311 public drinking water supply wells in the RSA (SWRCB 2016; City of Morgan Hill 2020: Attachment F, page 2). Of these 311 wells, 20 are located in the project footprint. Minimum well depths range between 15 and 302 feet, maximum well depths range between 690 and 1,186 feet, and average well depths range between 263 feet and 600 feet. DWR Bulletin 118 provides the maximum, minimum, and average depth of municipal, domestic, and irrigation supply wells in the RSA (Table 3.8-12). Private water supply wells are also present within the RSA; however, the precise locations and quantities of private water supply wells within the project footprint would be determined during the final design phase.

Table 3.8-12 Depths of Drinking Water Supply Wells by Groundwater Subbasin

Basin	Subbasin	Bulletin 118 Production Well Depth Characteristics	
		Domestic Wells (Range/Average)	Municipal/Irrigation Wells (Range/Average)
Santa Clara Valley	Santa Clara	15 to 800 feet/263 feet	17 to 1,186 feet/278 feet
Gilroy-Hollister Valley	Llagas Area	54 to 690 feet/256 feet	302 to 920 feet/589 feet
	North San Benito	Not provided	Not provided
San Joaquin Valley	Delta-Mendota	Not provided	50 to 800 feet/400 to 600 feet

Sources: DWR 2004a, 2004b, 2004c, 2004d, 2006

3.8.5.5 Floodplains

Creeks and streams in the project extent periodically overtop their banks and flood adjacent low-lying land. These low-lying areas, known as floodplains, temporarily store excess water during high flows. As the agency with oversight of the National Flood Insurance Program, FEMA identifies this risk of flooding in any given area. A number of floodplains delineated by FEMA are located in the RSA. These floodplains include areas that are susceptible to flooding during the 100-year flood, areas between the limits of the 100-year and 500-year flood, and areas with unknown but possible flood risks. In general, 100-year floodplains include flat areas adjacent to creeks, streams, and other waterbodies and isolated floodplains in low-lying areas. FEMA also identifies areas that are protected from flooding during the 100-year flood by levees.

FEMA Floodplains

Table 3.8-13 shows the FEMA flood hazard zones in the RSA as well as the total area of each flood zone in the RSA. As shown in Table 3.8-13, most of the RSA would not experience flooding during the 100-year flood, as indicated by the large areas of Zones X (unshaded) and D floodplains. However, a substantial portion of the RSA is in floodplains that become inundated during the 100-year flood. These areas, indicated as Zones A, AE, AE (floodway), AH, AO, have a 1 percent chance of getting flooded each year. The different types of 100-year floodplains (i.e., zones) in the RSA and project footprint indicate that certain areas experience different types of flooding (riverine flows versus ponding versus shallow sheet flow) or that detailed studies have been performed to determine specific hydraulic characteristics of the floodplain (depth and elevation of flooding). There are no coastal flood hazards in the RSA. Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Modeling, for detailed descriptions of the existing 100-year floodplains in the RSA and project footprint.

Table 3.8-13 FEMA Flood Hazard Zones

Zone	Description of Flood Hazard	Area in RSA (acres)
High-Risk Areas		
A	Areas with a 1% chance of flooding annually. Because detailed analyses are not performed for such areas, no depths or BFEs are shown in these zones.	80,963.2
AE	Areas with a 1% chance of flooding annually where BFEs are provided.	5,145.5
AE (floodway)	The description of Zone AE above applies. In addition, these areas must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. These areas are regulated to ensure that there are no increases in upstream flood elevations.	2,550.3
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. BFEs derived from detailed analyses are shown at selected intervals in these zones.	2,412.5
AO	River or stream flood-hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses are shown in these zones.	3,031.5
Moderate- to Low-Risk Areas		
X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. This zone is also used to designate base floodplains of lesser hazards, such as areas protected by levees from the 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.	26,296.7
X (unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 500-year flood level.	118,860.5
Undetermined Risk Areas		
D	Areas with possible, but undetermined flood risks. No analysis of flood hazards has been performed in these zones.	190,150.3

Sources: FEMA 1998, 2009a, 2010, 2014
FEMA = Federal Emergency Management Agency
BFE = base flood elevation
FIRM = flood insurance rate map

The Authority used existing hydraulic models and the peak 100-year flows, as specified in Technical Memorandum 2.6.5, *Hydraulics and Hydrology Design Guidelines* (Authority 2011b), to conduct hydraulic analyses of the waterway crossings. Table 3.8-14 shows the waterbodies in the project footprint for which existing hydraulic models were available. In addition, Table 3.8-14 shows whether existing bridges and overbank areas in the project footprint are under pressure or are overtopped by floodwaters during the 100-year flood, as indicated by existing hydraulic models. Where existing bridges are under pressure or overtopped and the project would use the existing structure, the project would not include measures to improve floodplain hydraulics. Furthermore, impacts of existing hydraulic conditions on project construction and operations are not considered to be impacts under CEQA; therefore, this information is provided for informational purposes only.

Table 3.8-14 Hydraulic Conditions of Existing Bridges and Overbank Areas in the Project Footprint

Waterbody	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Flood Zone Main Channel	Flood Zone Overbank Areas	Locations under Pressure or Overtopped
Los Gatos Creek	Yes	Yes	Yes	Yes	A	D	Existing railroad bridge
Guadalupe River	Yes	Yes	Yes	Yes	A	AH and AO	Overbank areas between Almaden Expressway and Curtner Ave
Coyote Creek	Yes	Yes	Yes	Yes	AE and AE (floodway)	AE, AH, and AO	Coyote Ranch Rd, Coyote Creek Gold Dr, Barndart Ave, and private roads
Fisher Creek	Yes	Yes	Yes	Yes	AE (floodway)	AE	Monterey Rd
West Little Llagas Creek*	No	Yes	No	No	X (shaded)	X (shaded)	N/A
West Little Llagas Creek, Middle Avenue Overflow*	No	Yes	No	No	X (shaded)	X (shaded)	N/A
Llagas Creek (near San Martin)*	Yes	Yes	Yes	Yes	AE (floodway)	D and X (shaded)	N/A
Llagas Creek (near San Martin)*	No	Yes	No	No	AE	D and X (shaded)	N/A
Llagas Creek (East of Gilroy)*	No	No	Yes	No	AE and AE (floodway)	D	N/A
Llagas Overbank*	No	No	Yes	No	X (shaded)	X (shaded)	N/A
West Branch Llagas Creek	No	Yes	No	No	AE and AE (floodway)	D and X (shaded)	N/A
Uvas-Carnadero Creek	Yes	Yes	No	Yes	AE	A, AE, AH, AO, and X (shaded)	N/A
Pajaro River/Soap Lake Floodplain	Yes	Yes	Yes	Yes	A	D and X (unshaded)	Existing railroad and SR 25 bridges

Sources: SCVWD 2016d, 2018a, 2018b; FEMA 2009a–I, 2018
* Existing condition assumed to be after completion of the Upper Llagas Flood Protection Project (PL-566).
Alt. = alternative; N/A = not applicable; SR = State Route

Soap Lake Floodplain

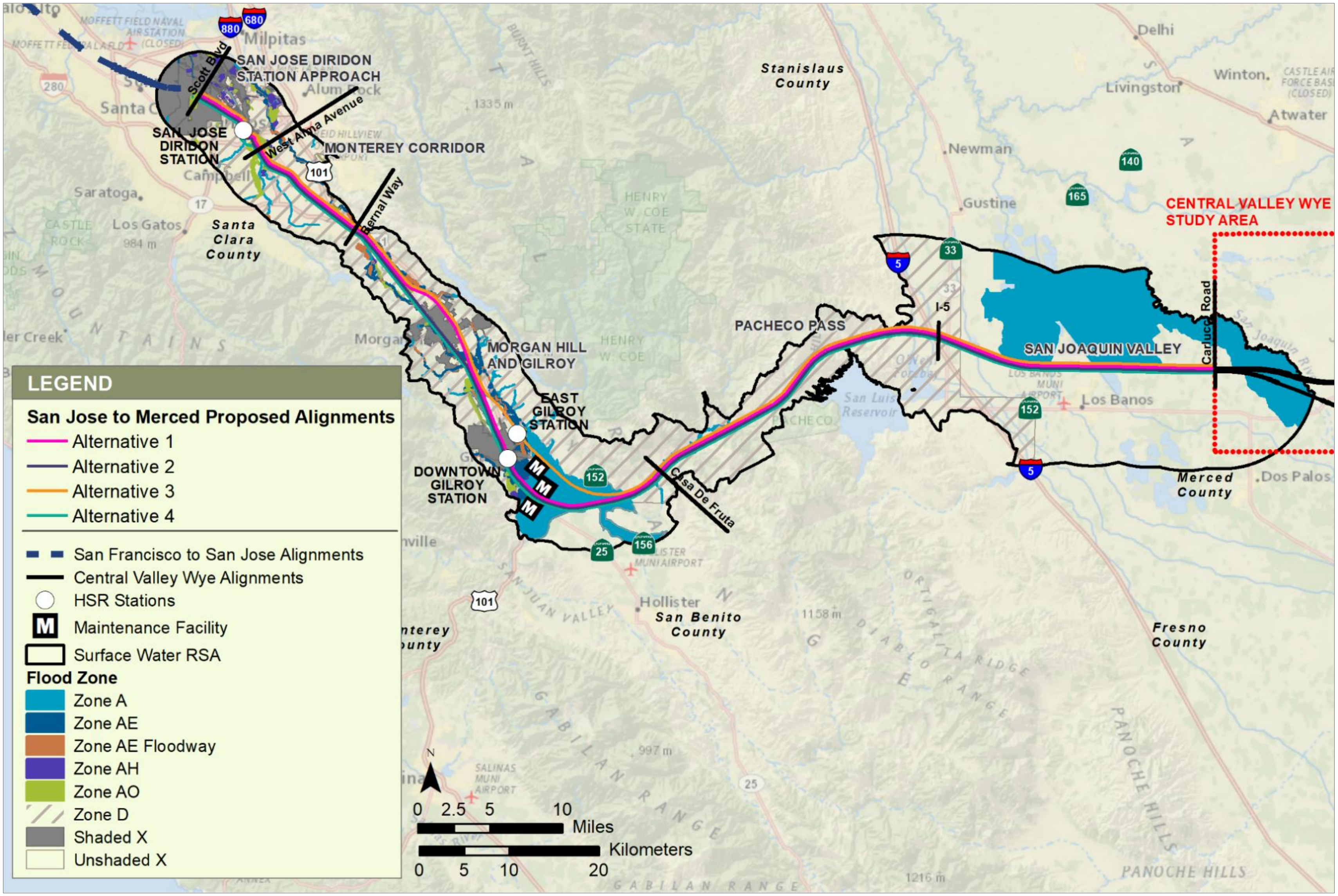
The project extent crosses a large floodplain area south of Gilroy in Santa Clara and San Benito Counties known as the Soap Lake floodplain. The Soap Lake floodplain is located in the upper reaches of the Pajaro River near its confluence with Llagas Creek, Jones Creek, Uvas Creek, Carnadero Creek, Pacheco Creek, and Tequisquita Slough. During the 100-year flood, flooding in the Soap Lake area has the potential to submerge approximately 9,000 acres. Figure 3.8-6 illustrates the FEMA-designated floodplains. Figure 3.8-7 illustrates the extent of flooding in the Soap Lake area, as determined by FEMA; in the figure, the limits of flooding in Soap Lake according to FEMA’s Digital FIRM are shaded in gray.

The Authority conducted hydrologic and hydraulic modeling to assess the existing limits of flooding in the Soap Lake floodplain during the 100-year flood event as well as impacts of the project alternatives. The goal was to develop a model that closely represented the extent of flooding that was determined by FEMA and shown on their Digital FIRMs. To do this, the Authority combined existing hydrologic and hydraulic data from local floodplain managers and previous floodplain studies performed by FEMA, the SCVWD, and the Pajaro River Watershed Flood Prevention Authority near the Soap Lake floodplain with topographic information for the Soap Lake area. The limit of flooding in Soap Lake, according to the hydraulic model developed for the project, is shaded in red on Figure 3.8-7. See Volume 2, Appendix 3.8-B, Summary of Hydraulic Modeling, for technical descriptions of the hydrologic and hydraulic analyses performed on the Soap Lake floodplain.

Figure 3.8-8 illustrates the existing limits and water surface elevations of flooding in the Soap Lake floodplain during the 100-year flood as determined by the hydraulic model. Areas susceptible to flooding in the existing condition are shaded in a variety of colors, indicating the water surface elevation during the 100-year flood in the North American Vertical Datum of 1988 (NAVD 88). During the 100-year flood, the surface of floodwaters in areas shaded brown would be above 210 feet NAVD 88, whereas the surface of floodwaters in areas shaded white would be less than 145 feet NAVD 88. The water surface elevations during the 100-year flood in areas shaded in oranges, greens, blues, and purples would be intermediate compared to the areas shaded in brown and white.

Tsunami and Seiche

Tsunamis are created when water is displaced from oceans and other large bodies of water by seismic activities. Seiches are a type of wave created when strong winds, rapid changes in atmospheric pressure, landslides, or earthquakes cause water levels to build up on one side of an enclosed waterbody (National Oceanic Atmospheric Administration 2020 and Pacific Northwest Seismic Network 2020). When the wind stops, the water rushes back toward the opposite side of the enclosed waterbody. The RSA is not susceptible to inundation by a tsunami or seiche (State of California 2009; PCJPB 2015).



Sources: FEMA 2009a, 2014

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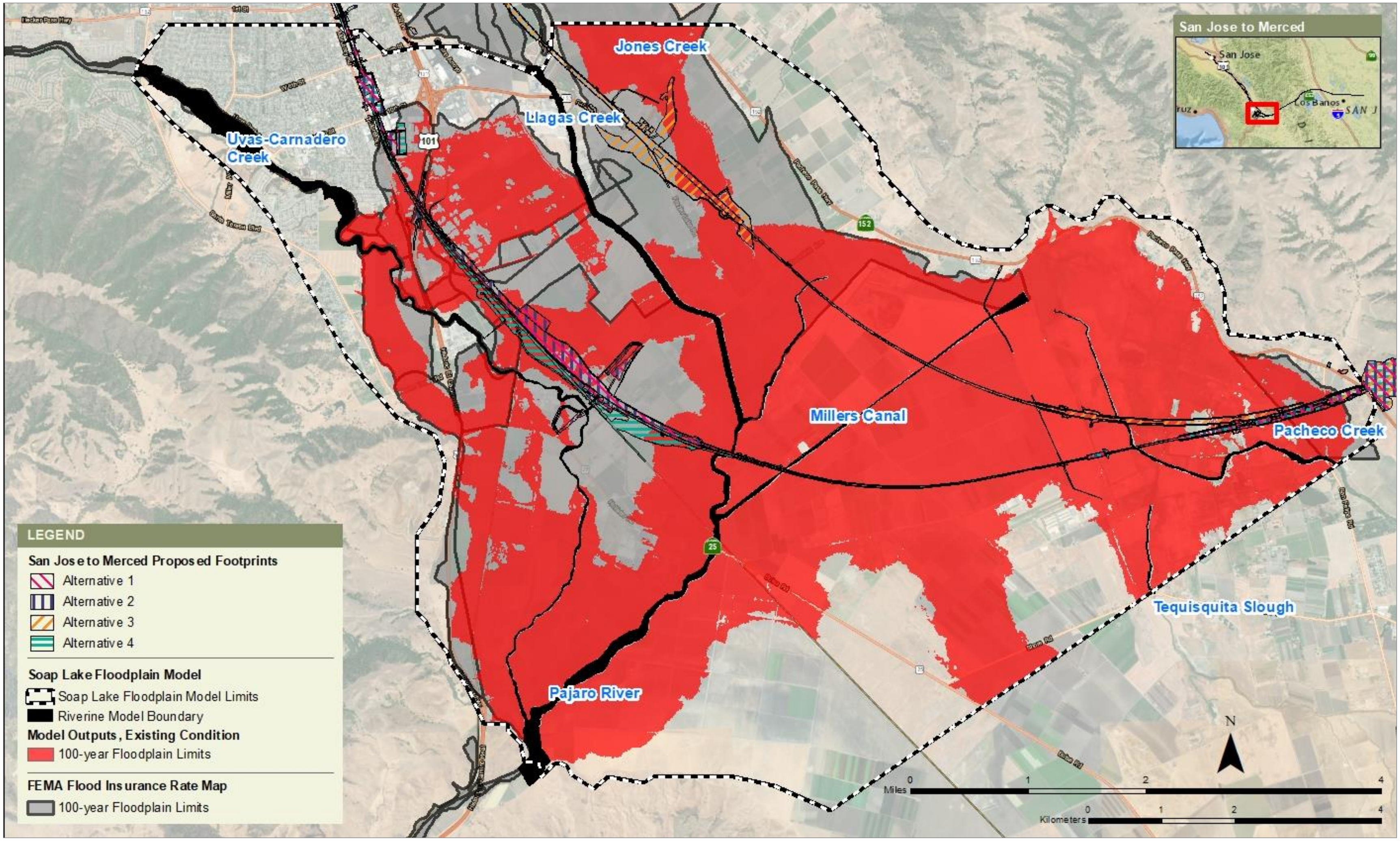
Figure 3.8-6 FEMA Floodplains in the Resource Study Area



Note: See Volume 2, Appendix 3.8-B, Summary of Hydraulic Modeling, for technical descriptions of the hydrologic and hydraulic analyses performed on the Soap Lake floodplain.
Sources: FEMA 2009a, 2014

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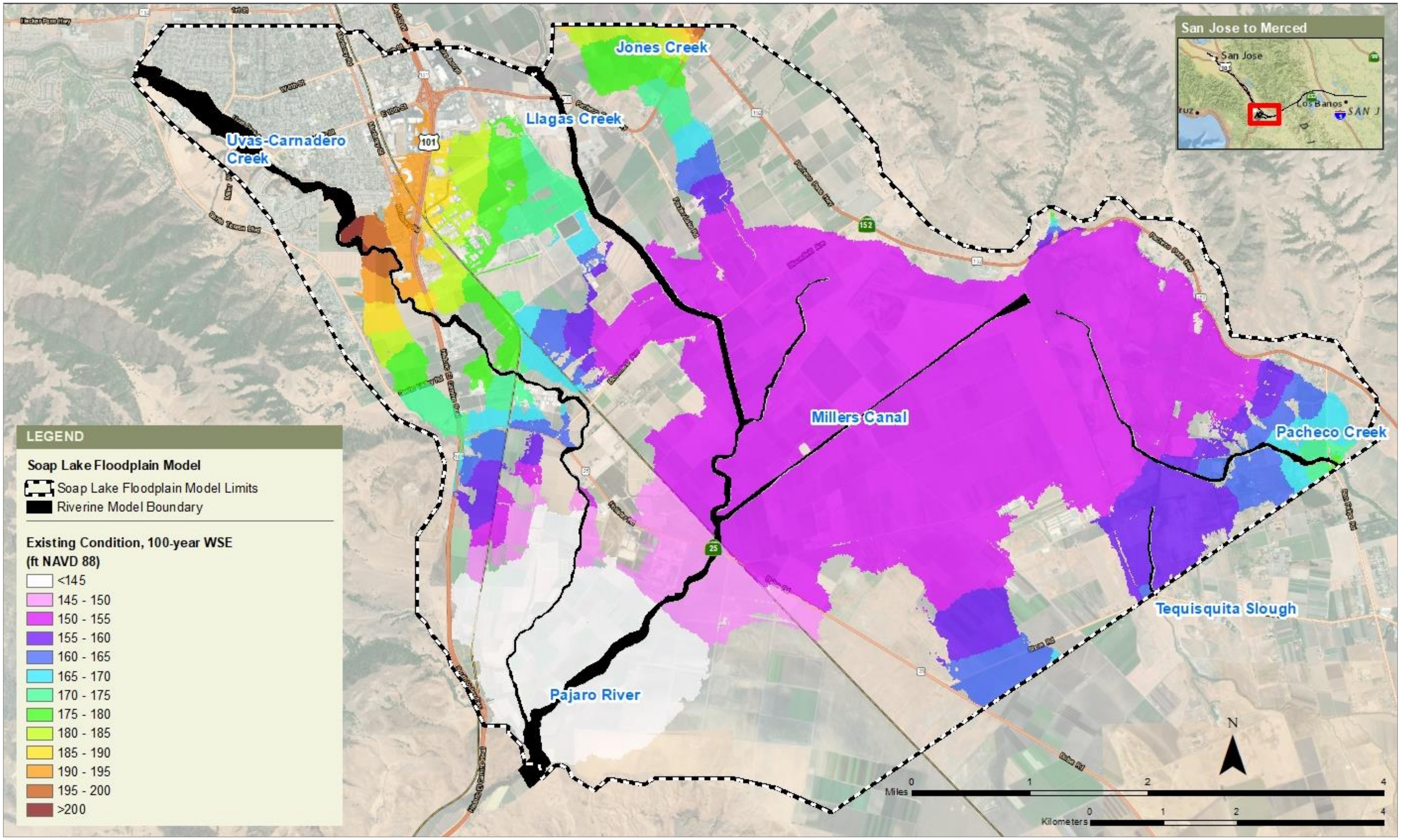
Figure 3.8-7 Comparison of the Existing FEMA 100-Year Floodplain and Existing 100-Year Floodplain from Hydraulic Model



Note: See Volume 2, Appendix 3.8-B, Summary of Hydraulic Modeling, for technical descriptions of the hydrologic and hydraulic analyses performed on the Soap Lake floodplain.

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Figure 3.8-8 Existing 100-Year Water Surface Elevations from ICM Hydraulic Model

3.8.6 Environmental Consequences

3.8.6.1 Overview

This section discusses the impacts on hydrology and water resources that would result from project construction and operations. The ensuing discussions are arranged by topic: surface water hydrology, surface water quality, groundwater, and floodplains. Each topic area discusses potential impacts from the No Project Alternative and the project. The Authority has incorporated project features (IAMFs) into the project design to avoid and minimize potential impacts on hydrology and water resources (Appendix 2-E, Project Impact Avoidance and Minimization Features). These IAMFs would be implemented to manage and control stormwater runoff, non-stormwater runoff, and erosion; minimize and manage groundwater seepage into tunnels; minimize development in floodplains and increases in flood elevations; limit increases in sediment transport and the release of materials and waste; and manage and control pollution from stormwater discharges. The Authority would develop and implement a stormwater management and treatment plan and flood protection plan to comply with federal, state, regional, and local permits and design criteria, including CWA Section 402 NPDES permits and the National Flood Insurance Act. The stormwater management and treatment plan would include an evaluation of each receiving stormwater drainage system's capacity to accommodate project runoff, the identification of stormwater BMPs designed to capture runoff from impervious surfaces and provide for treatment prior to discharge, and the measures to maintain pre-project hydrologic conditions. The flood protection plan would identify how the project would remain operational during a 100-year flood event to the extent feasible and practicable while minimizing impacts from floodplain development. Additionally, SWPPPs developed for the project would comply with the CGP and IGP. The SWPPPs would require the application of stormwater and non-stormwater BMPs to construction and operations activities to control the quality of runoff from the project.

With the incorporation of these features into project design, the project alternatives would generally avoid or minimize impacts on hydrology and water resources. Temporary construction impacts on hydrology and water resources, however, would result from grading, work in waterbodies, temporary stream diversion, construction staging areas, temporary roadways, temporary waterbody crossings, temporary drainage systems, excavations, dewatering, tunnel construction, and leaks or spills from equipment and materials that would be mobilized to a waterbody or groundwater aquifer. Permanent construction impacts on hydrology and water resources would result from the presence of project improvements in the RSA, such as new impervious surfaces; new or modified culverts, bridges, and other waterbody and floodplain crossings; realignment, modification, or filling of waterbodies; cut-and-fill slopes; relocated groundwater wells; and subsurface structures, including tunnels. Operations impacts on hydrology and water resources would result from intermittent maintenance activities on bridges and other maintenance activities conducted in or near surface waters such as vegetation management. Operation impacts on hydrology and water resources would also result from the release of contaminants from trains such as brake dust and polycyclic aromatic hydrocarbons (PAH) or the use of potentially toxic materials such as pesticides, grease, and lubricants.

The construction of bridges, culverts, viaducts, and maintenance facilities in floodplains would permanently affect floodplains. All four alternatives would cross numerous floodplains, including those along Coyote Creek and Llagas Creek, as well as a large floodplain in the upper reaches of the Pajaro River south of Gilroy called the Soap Lake floodplain. A maintenance of way facility (MOWF) of approximately 50 to 75 acres would also be constructed in the Soap Lake floodplain. During the 100-year flood, Soap Lake has the potential to submerge approximately 9,000 acres of land. However, the project would be designed to remain operational during flood events, to the extent feasible, and also to avoid or minimize permanent impacts on all floodplains, including Soap Lake. The project design is based on current floodplain design criteria required by the National Flood Insurance Act and Flood Disaster Protection Act.

3.8.6.2 Surface Water Hydrology

Construction and operations would cause impacts on surface water hydrology, including altered drainage patterns and stormwater runoff rates and volumes. Construction impacts would result from grading, temporary stream diversion, construction staging areas, temporary infrastructure such as access roadways, waterbody crossings, and drainage systems, new impervious surfaces, new or modified culverts and bridges, modification of waterbodies, and cut-and-fill slopes. The changes to project alignments and footprints associated with the DDV would not result in impacts on waterbodies. Similarly, the TDV would not affect new surface waterbodies.

Operations impacts would be caused by bridge or culvert maintenance activities or other HSR-related activities conducted in or near waterbodies. Section 3.8.6.4, Groundwater, discusses impacts on surface water hydrology resulting from the construction and operation of tunnels.

No Project Impacts

The No Project Alternative considers the effects of conditions forecasted by current plans for hydrology and water resources near the project extent, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon for the environmental analysis if the proposed project were not built. The population of the Bay Area and San Joaquin Valley is expected to grow through 2040 (Section 2.6.1.1, Projections Used in Planning). The population in the San Joaquin Valley is projected to grow at a higher rate than any other region in California. Residential development and transportation improvements in the Bay Area and San Joaquin Valley to accommodate the population increase would continue under the No Project Alternative.

Planned residential, industrial, commercial, and transportation-related development in the RSA would likely require grading, temporary stream diversion, and the construction of new impervious surfaces, like rooftops, roadways, and driveways. New impervious surfaces may also result from projects that widen or extend existing roadways (Coleman Avenue and Autumn Street in San Jose; U.S. [US] Highway 101 and Hale Avenue in Morgan Hill; US 101, SR 152, and Luchessa Avenue in Gilroy; and SR 152, SR 165, Pioneer Road, and Ingomar Grade in Merced County) and modify existing roadway interchanges (SR 86, US 101, SR 237, Interstate [I-] 280, I-680, and I-880 in San Jose; US 101 in Morgan Hill; US 101 and Las Animas Avenue in Gilroy; and Volta Road in Merced County). Terminal improvements at Mineta San Jose International Airport, in addition to the construction of roofs on structures and parking lots, would also lead to new impervious surfaces. The impervious surfaces associated with these developments would increase the total volume of runoff generated during storm events and potentially result in erosion or sedimentation in receiving waterbodies.

Planned passenger rail projects and roadway projects, such as the SR 152 median barrier project in Merced County, would require the construction of new bridges and culverts in the surface water RSA, which could require temporary stream diversions. Roadway widening projects in Merced County (SR 152, SR 165, Pioneer Road, and Ingomar Grade) could require the realignment of irrigation canals and drainage channels in agricultural lands adjacent to the roadways. These projects could also require temporary stream diversions to relocate irrigation and drainage facilities. Furthermore, developments could require grading and the creation of new or modified landforms, resulting in changes to overland flow patterns.

Under the No Project Alternative, these developments would be built, potentially resulting in impacts on drainage patterns and stormwater runoff in the surface water RSA. However, it is assumed that these planned developments would comply with existing laws and regulations that protect surface water hydrology, including various CWA Section 402 NPDES permits.

Project Impacts

Construction Impacts

Project construction would include grading; temporary stream diversion; construction staging areas; temporary infrastructure such as access roadways, waterbody crossings, and drainage systems; temporary and permanent hydrological disruption from the tunnels; new impervious surfaces; new or modified culverts and bridges; modification of waterbodies; and cut-and-fill slopes. Construction activities are further described in Chapter 2, Alternatives. Impacts on surface water hydrology resulting from the construction of tunnels are discussed in Section 3.8.6.4.

Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction

All four alternatives would require earthwork; temporary drainage facilities; minor disturbances to waterbodies; and the construction of new bridges, culverts, and viaduct piers in waterbodies. The amount of construction effort for the design variants would be approximately the same as for the alternatives without the DDV and TDV; therefore, the potential for erosion/sedimentation/construction material spills that may occur during construction of the variants would be approximately the same. Prior to construction, the contractor would prepare and implement a SWPPP under the CGP that would incorporate BMPs, including erosion control, stormwater management, and channel dewatering for affected stream crossings (HYD-IAMF#3).

The construction period for earthwork and civil infrastructure—bridges, culverts, viaducts, tunnels, and embankments for the railbed and grade-separated roadways—would span several years. Because earthwork is anticipated to occur over several years, temporary landforms like materials stockpiles and cut-and-fill slopes may be created during one construction season and modified during a following construction season, resulting in temporary changes to drainage patterns from soil grading and cut-and-fill slopes. Temporary grading and cut-and-fill slopes would be restored to pre-construction conditions to avoid permanent impacts on drainage patterns. The largest volumes of earthwork are associated with cuts in the Pacheco Pass Subsection and fill to construct embankments in the Morgan Hill and Gilroy and San Joaquin Valley Subsections; earthwork requirements are discussed in more detail in Impact HYD#2.

Temporary drainage systems would be provided for cut-and-fill slopes and other soil disturbances, including embankments for the railbed and roadways, temporary roadways, temporary construction easements, construction staging areas, pre-casting sites, and batch plants in each of the alternatives as applicable, to convey water through the construction site and avoid the erosive forces of water flowing over disturbed soil surfaces. Additionally, temporary drainage facilities would be provided for all construction elements of the alternatives that have the potential to block the path of flowing water, such as embankments for the railbed and grade-separated roadways, to maintain overall drainage patterns during construction. These temporary drainage systems would be designed and described in a staging plan or drainage report. Providing temporary drainage systems for the construction site would minimize the impact of altered drainage patterns on erosion and sedimentation.

Waterbodies in each alternative's footprint are susceptible to different temporary impacts on hydrology, such as minor disturbances near the waterbody, and performing construction activities in a waterbody. Table 3.8-15 shows the number of waterbodies in the project footprint that are anticipated to experience only minor disturbances from soil disturbances near the banks of a stream or the edge of wetlands as well as the trimming or removal of nearby vegetation. Direct impacts on these waterbodies are not anticipated at this time. However, depending on the construction means and methods of the design-build contractor, construction activities may need to be performed within some of the waterbodies quantified in Table 3.8-15 or impacts on some of these waterbodies may be avoided entirely. Refer to Volume 2, Appendix 3.8-C, Basic Plan Water Quality Impact Summary, for a detailed description of impacts on individual waterbodies and Section 3.8.6.4, Groundwater, for a discussion of surface water impacts from groundwater inflows into the proposed tunnels.

Table 3.8-15 Waterbodies Anticipated to Experience Minor Disturbances

Subsection	Design Option	Waterbodies with Minor Disturbances
San Jose Diridon Station Approach	Viaduct to I-880 (Alternative 1)	3
	Viaduct to Scott Blvd (Alternatives 2 and 3)	3
	Blended (Alternative 4)	1
Monterey Corridor	Viaduct (Alternatives 1 and 3)	1
	At-grade (Alternative 2)	1
	Blended (Alternative 4)	1
Morgan Hill and Gilroy	Viaduct to downtown Gilroy (Alternative 1)	41
	Embankment to downtown Gilroy (Alternative 2)	39
	Viaduct to east Gilroy (Alternative 3)	41
	Blended (Alternative 4)	41
Pacheco Pass	Tunnel (Alternatives 1, 2, 3, and 4)	21
San Joaquin Valley	Henry Miller Road (Alternatives 1, 2, 3, and 4)	28
Totals	Alternative 1	94
	Alternative 2	92
	Alternative 3	94
	Alternative 4	92

All four alternatives would require construction activities in waterbodies to build new bridges and culverts, modify existing bridges and culverts, and fill waterbodies or relocate waterbodies to flow around viaduct piers and embankments for the railbed, grade-separated roadways, and HSR access roadways and easements. Performing work in waterbodies would be required in the Monterey Corridor, Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections under all four alternatives; Alternative 4 would also require performing work in a waterbody in the San Jose Diridon Station Approach Subsection. Temporary impacts associated with construction activities in a waterbody would include destabilizing the bed and banks through foot traffic by the contractor's personnel, the operation of equipment in the waterbody, and modifications to the banks of a waterbody to gain access to the channel. Some of these waterbodies would be dry during the summer when construction activities in the waterbodies are anticipated to occur, but a portion would contain water year-round (perennially). Temporary stream diversions and dewatering would be needed to complete these construction activities in perennial waterbodies. Temporary stream diversions would result in temporary changes in drainage patterns in the vicinity and downstream of the construction activity, including fluctuations in water surface elevation and flow velocity. Table 3.8-16 shows the number of waterbodies in which the contractor is anticipated to perform construction activities with and without temporary stream diversions and dewatering. Refer to Impact HYD#2 and Volume 2, Appendix 3.8-C, Basic Plan Water Quality Impact Summary, for detailed information regarding the construction of culverts and bridges and relocation and filling of waterbodies.

Definition:

Dewatering refers to lowering the water level in an area to facilitate construction and may involve pumping, diversion, impounding, or gravity flow systems. Dewatering would be performed for excavations that extend into the groundwater table, as well as work within the channel or banks of waterbodies that contain water year-round.

Table 3.8-16 Waterbodies in Which Construction is Anticipated to Occur

Subsection	Design Option	Work in Waterbodies		
		With Stream Diversion and Dewatering	Without Stream Diversion and Dewatering	Total
San Jose Diridon Station Approach	Viaduct to I-880 (Alternative 1)	0	0	0
	Viaduct to Scott Blvd (Alternatives 2 and 3)	0	0	0
	Blended (Alternative 4)	1	0	1
Monterey Corridor	Viaduct (Alternatives 1 and 3)	2	0	2
	At-grade (Alternative 2)	2	0	2
	Blended (Alternative 4)	1	0	1
Morgan Hill and Gilroy	Viaduct to downtown Gilroy (Alternative 1)	34	35	69
	Embankment to downtown Gilroy (Alternative 2)	44	39	83
	Viaduct to east Gilroy (Alternative 3)	32	35	67
	Blended (Alternative 4)	28	34	62
Pacheco Pass	Tunnel (Alternatives 1, 2, 3, and 4)	8	44	52
San Joaquin Valley	Henry Miller Road (Alternatives 1, 2, 3, and 4)	95	14	109
Totals	Alternative 1	139	93	232
	Alternative 2	149	97	246
	Alternative 3	137	93	230
	Alternative 4	133	92	225

As shown in Table 3.8-16, little work would be performed in waterbodies in the San Jose Diridon Station Approach and Monterey Corridor Subsections compared to other subsections. Alternatives 1, 2, and 3 would span Los Gatos Creek and Guadalupe River with viaducts in the San Jose Diridon Station Approach Subsection and fill or realign Constructed Watercourse 1 and Constructed Basin 1 in the Monterey Corridor Subsection. Alternative 4 would use the existing Los Gatos Creek bridge, build a new bridge over Guadalupe River, and avoid impacts on Constructed Watercourse 1 and Constructed Basin 1. However, Alternative 4 would fill Constructed Basin 10 in the Monterey Corridor Subsection for curve straightening. The largest difference among the alternatives is in the Morgan Hill and Gilroy Subsections where the alignments would diverge near the upper reaches of Coyote and Llagas Creeks in Morgan Hill before converging just west of the Tunnel 1 portal near Ortega Creek, Tequisquita Slough, Pacheco Creek, and nearby wetlands. Alternative 2 would require the most work in waterbodies in the Morgan Hill and Gilroy Subsection because a long embankment section and associated grade separations would require bridges and culverts to cross the waterbodies relative to the embankment in Alternative 3, whereas Alternative 4 would require the fewest because it would utilize a blended corridor along existing Caltrain infrastructure. Alternative 1 would span waterbodies in this subsection with a viaduct. Work in waterbodies would be the same for all four alternatives in the Pacheco Pass and San Joaquin Valley Subsections because these design options are shared among all four alternatives. The San Joaquin Valley Subsection would require the most work in waterbodies because of the density of water conveyance and drainage infrastructure associated with agricultural operations that either would be crossed by bridges or culverts or would be filled or relocated.

Acronyms:

SWPPP = Stormwater Pollution Prevention Plan

CGP = Construction General Permit

BMP = Best Management Practice

RWQCB = Regional Water Quality Control Board

SWRCB = State Water Resources Control Board

Prior to construction, the contractor will develop and implement a SWPPP compliant with the CGP (HYD-IAMF#3). The construction contractor's Qualified SWPPP Developer will prepare the SWPPP, which will identify stormwater BMPs to minimize erosion and sedimentation that may result from temporary changes in drainage patterns, including BMPs for temporary drainage systems and temporary stream diversion and dewatering. All Qualified SWPPP Developers must be trained so that SWPPPs are prepared according to the requirements of the permit. The construction contractor's Qualified SWPPP Practitioner will be responsible for implementing the SWPPP. As part of their responsibility, the effectiveness of construction BMPs will be monitored before, during, and after storm events. Records of these inspections and monitoring results will be submitted to the RWQCBs as part of the annual report required by the permit. The SWRCB and RWQCBs will have the opportunity to review these documents, which will also be publicly available on the SWRCB's Stormwater Multiple Application and Report Tracking System.

As mentioned previously, the SWPPP will include BMPs for temporary stream diversions and dewatering in accordance with the Caltrans *Field Guide to Construction Dewatering* (Caltrans 2014) (GEO-IAMF#10). The BMPs for dewatering operations, erosion control, and soil stabilization will avoid discharging water in a manner and at rates that cause substantial changes in stream hydrology by controlling pumping rates and using velocity dissipation devices or similar methods that minimize impacts on the flow rates of streams.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because project activities would not result in a substantial alteration of the existing drainage patterns or substantially increase the rate or amount of surface runoff. Temporary impacts on drainage patterns and stormwater runoff would result from the following activities: grading, construction staging areas, temporary roadways, temporary stream diversion, temporary dewatering, and temporary drainage systems. Project features include maintaining existing drainage patterns to the extent feasible and developing and implementing a SWPPP that would prescribe the BMPs necessary to effectively control erosion and sedimentation. Through effective management and control measures and compliance with the CGP, project features will minimize potential temporary impacts on drainage patterns and stormwater runoff. Therefore, CEQA does not require mitigation.

Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff during Construction

Permanent changes to drainage patterns and stormwater runoff would result from earthwork and grading, new impervious surfaces, new drainage systems, drainage system improvements, and the filling or relocation of waterbodies. Earthwork and grading are required to modify existing ground surfaces, including the creation of level surfaces for structures and cut-and-fill slopes; minimization of landslide risk in hilly terrain in the Morgan Hill and Gilroy and Pacheco Pass Subsections; realignment of existing creeks, canals, and drainage channels; and track and roadway embankments. In addition, the project would require construction of new impervious surfaces, new drainage systems, and improvements to existing drainage systems. The stormwater management and treatment plan (HYD-IAMF#1) will evaluate the capacity of receiving stormwater drainage systems, determine improvements and/or upgrades required to maintain or improve existing drainage capacity, and specify BMPs for infiltration, retention, or detention from new and reconstructed impervious surfaces. The project design would also include a flood protection plan that incorporates design standards to minimize impacts of culverts and bridges on existing drainage patterns and stream flow (HYD-IAMF#2).

Permanent changes in topography from earthwork would permanently alter the path, speed, and volume of water flowing over the ground surface. These permanent impacts on drainage patterns and hydrology would be similar for each alternative, with differences among them defined by earthwork quantities. Earthwork includes all soil and subsurface materials that would be excavated during construction of roadways, structures, structure piles, and tunnels, as well as material used to build proposed embankments. The largest volume of earthwork for all four alternatives would take place in the Pacheco Pass Subsection, where the construction of tunnel portals and minimization of landslide risk would require large cuts to reduce the steepness of the slopes in Pacheco Creek valley. The next largest volume of earthwork for all four alternatives is associated with fill for the construction of embankments, some of which would be spoils generated by tunneling. This fill would mostly be placed in the Pacheco Pass Subsection where the embankment travels along the side slopes of the Pacheco Creek and Romero Creek valleys, and in the San Joaquin Valley Subsection where the primary profile type in each alternative is embankment. Alternative 3 would require the most earthwork because construction of the East Gilroy MOWF and associated embankments would require considerably more earthwork than the South Gilroy MOWFs under Alternatives 1, 2, and 4. Alternative 4 would require the least earthwork due to providing blended services along the Caltrain corridor.

Table 3.8-17 shows the earthwork required to build each alternative that would result in changes to the ground surface. The earthwork described above would maintain overall drainage patterns within the RSA because they would not result in large-scale diversions or impoundments of water. However, the proposed earthwork under each alternative would result in local changes in how runoff flows over the ground surface.

Table 3.8-17 Earthwork Quantities

Alternative	Excavated Material (cubic yards)	Embankment (cubic yards)	Total (cubic yards)
Alternative 1	35,498,217	17,446,155	52,944,372
Alternative 2	32,779,193	20,402,311	53,181,504
Alternative 3	34,513,474	21,011,334	55,524,808
Alternative 4	32,207,767	20,466,866	52,674,633

Source: Authority 2019a

The project design would provide crossings for rivers, creeks, ditches, conveyances, and other sources of concentrated flows that pass through the project, as needed. However, bridge approach embankments, abutments, piers, and installation of new culverts would also alter the geometry of a drainage channel, resulting in localized changes to flow characteristics such as velocities, erosion, and sedimentation. For viaduct profiles, piers and footings would be designed to avoid being placed in a waterbody to the extent practicable. Where placing viaduct piers and footings in a waterbody would be unavoidable, the contractor would consider relocating the waterbody to flow around the pier or studies would be performed to minimize changes in hydrology resulting from backwater and scour. These project design features will avoid or minimize permanent impacts on drainage patterns. Table 3.8-18 shows the number of waterbodies with new or modified embankment, viaduct, and roadway crossings. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, for the locations of the waterbodies affected by new structure crossings.

Table 3.8-18 Waterbodies with New Crossings and Waterbodies Modified, Realigned, or Otherwise Affected

Subsection	Design Option	Waterbodies with New Rail and Roadway Crossings	Waterbodies Modified, Realigned, or Otherwise Affected
San Jose Diridon Station Approach	Viaduct to I-880 (Alternative 1)	3	0
	Viaduct to Scott Blvd (Alternatives 2 and 3)	2	0
	Blended (Alternative 4)	1	0
Monterey Corridor	Viaduct (Alternatives 1 and 3)	0	2
	At-grade (Alternative 2)	0	2
	Blended (Alternative 4)	0	1
Morgan Hill and Gilroy	Viaduct to downtown Gilroy (Alternative 1)	34	39
	Embankment to downtown Gilroy (Alternative 2)	35	50
	Viaduct to east Gilroy (Alternative 3)	28	35
	Blended (Alternative 4)	25	29
Pacheco Pass	Tunnel (Alternatives 1, 2, 3, and 4)	36	30
San Joaquin Valley	Henry Miller Road (Alternatives 1, 2, 3, and 4)	79	61
Totals	Alternative 1	152	132
	Alternative 2	152	143
	Alternative 3	145	128
	Alternative 4	141	121

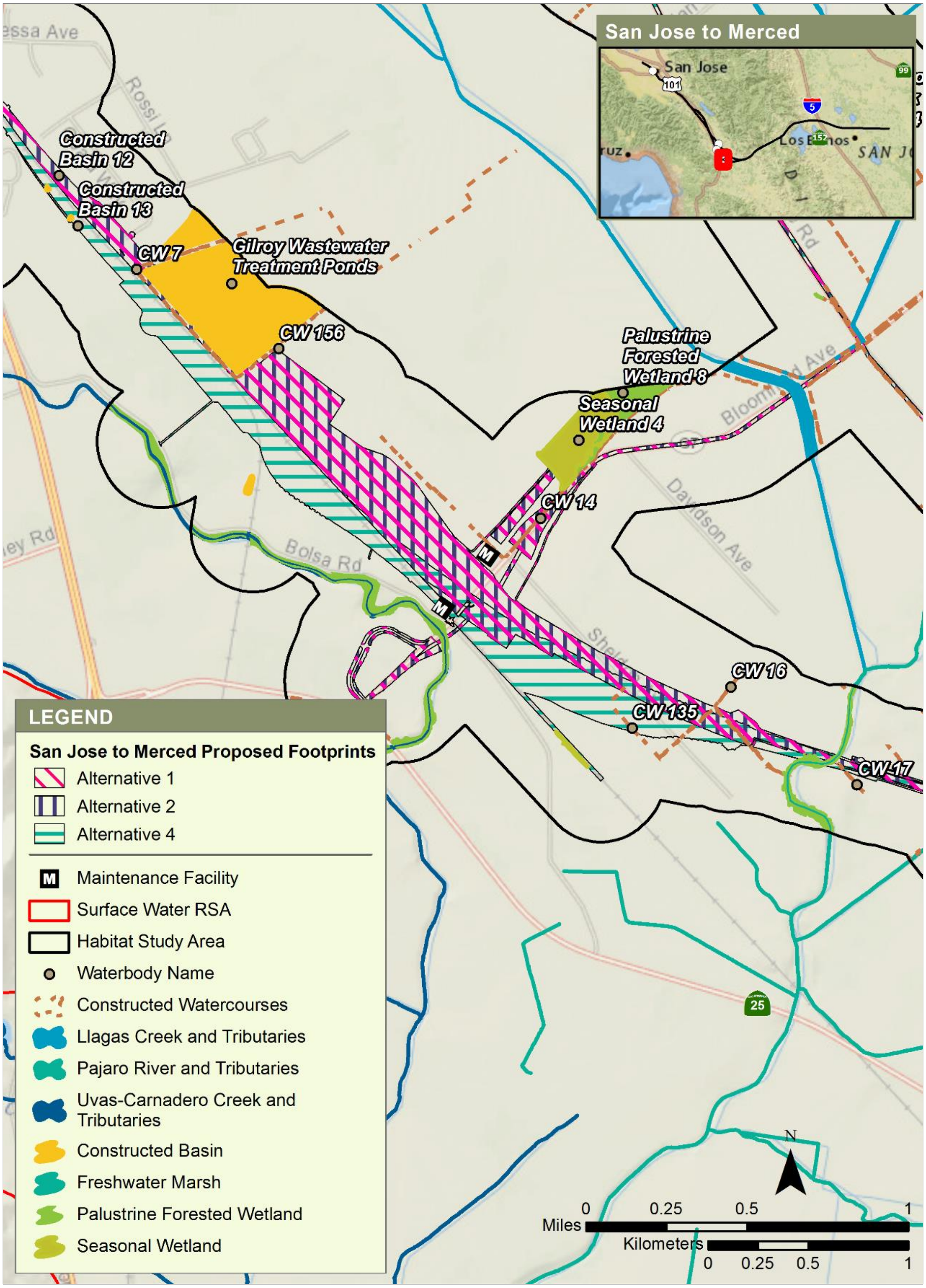
Some of the earthwork associated with construction of all four alternatives would include permanently modifying, realigning, or otherwise permanently affecting waterbodies (Table 3.8-18). Where bridges and culverts are not feasible or viaduct piers cannot be relocated, waterbodies would be realigned to flow around project improvements, including embankments for the railbed, grade separations with roadways, viaduct piers, the MOWFs, and the maintenance of way siding (MOWS). Additionally, some of these permanent modifications would include the placement of fill, like rock and soil, in waterbodies to support project improvements, primarily embankments for the railbed and local roadways but also for the MOWFs in Gilroy. Modifications to these channels would change the channel length and slopes, affecting the path, speed, and volume of existing discharges to and existing flows within the waterbodies. Permanent modifications to waterbodies would only occur where necessary to comply with engineering standards for the design of the HSR system, such as horizontal and vertical curve requirements, and to provide safe public transportation facilities, including both the HSR system and local roadways. Channel modifications would also affect the natural habitats within or near the waterbodies. Refer to Section 3.7, Biological and Aquatic Resources, for additional information on the impacts of channel modifications to wetlands and other jurisdictional aquatic resources. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, for the locations of the waterbodies affected by channel modifications.

As described in Volume 2, Appendix 3.8-C, these permanent impacts on waterbodies would mostly occur in the Morgan Hill and Gilroy, Pacheco Pass, and San Joaquin Valley Subsections, although Constructed Watercourse 1 and Constructed Basin 1 in the Monterey Corridor would be either partially filled or relocated under Alternatives 1, 2, and 3 to build the railbed embankment and Constructed Basin 10 in the Monterey Corridor Subsection would be filled for curve straightening under Alternative 4. Construction of the South Gilroy MOWF and Bloomfield Avenue grade separation under Alternatives 1 and 2 would require realigning several constructed watercourses and filling portions of the Gilroy Wastewater Treatment Ponds (at the South County Regional Wastewater Authority [SCWRA] Wastewater Treatment Plant) and Seasonal Wetland 4, whereas Alternative 4 would avoid these impacts but require filling Constructed Basins 12 and 13 (Figure 3.8-9). The East Gilroy MOWF in Alternative 3 is proposed where Dexter Creek, San Ysidro Creek, and Jones (Furlong) Creek converge, requiring these creeks to be relocated along the northeastern side of the MOWF and cross below a viaduct section southeast of the MOWF (Figure 3.8-10). Additionally, the MOWF in Alternative 3 would require filling Marsh 1 and realigning Constructed Watercourse 4. Refer to Impact HYD#13 for information on how flood risk would be managed at the Gilroy MOWFs.

Another location in the RSA requiring several permanent modifications to waterbodies is where the alignments converge near the Tunnel 1 portal in the Morgan Hill and Gilroy Subsection (Figure 3.8-11). In this area, the alignments would cross a low-lying area in the upper Pajaro River watershed and Soap Lake floodplain. The hydrologic conditions in this area, which include shallow and artesian groundwater conditions, have led to the creation of numerous wetlands, marshes, and watercourses. Waterbodies that would be permanently affected by at least one of the alternatives in this area include Tequisquita Slough, Tequisquita Slough Ponds 1 and 2, Tequisquita Slough Marsh, Tequisquita Slough Seasonal Wetland 1, Marsh 2, Seasonal Wetland 8, and Palustrine Forested Wetland 2. Refer to Section 3.7, Biological and Aquatic Resources, and Volume 2 Appendix 3.8-C for additional information on impacts on wetlands and other aquatic resources in the upper Pajaro River watershed.

As described previously, large cuts would be required in the Morgan Hill and Gilroy and Pacheco Pass Subsections to build tunnel portals and minimize landslide risk under all four alternatives (Figure 3.8-11). These cuts would flatten the sloping terrain that drains into the intermittent and ephemeral creeks feeding into Pacheco Creek. These cuts may require altering the physical dimensions or locations of waterbodies. Depending on the final grading plan, waterbodies that may be affected by these cuts may include Ortega Creek Tributaries 5, 6, and 8 through 11; Ponds 2, 4 through 9, and 13; Pacheco Creek Tributaries 4 through 6, 10, 20, 31 through 36, 38 through 40, 45, and 46; and Harper Canyon Creek Tributary 3. Furthermore, the proposed railbed between Tunnel 1 and Tunnel 2 in the Pacheco Pass Subsection would slightly encroach into the channel of Pacheco Creek. In the San Joaquin Valley Subsection, the project would be designed to avoid the Grasslands Ecological Area, a network of sloughs and marshes on the north side of Henry Miller Road. However, viaducts piers would be constructed within Mud Slough and associated wetlands on the south side of Henry Miller Road. Additionally, water conveyance and drainage infrastructure would need to be relocated around the rail embankment, roadway embankments at grade separations, and at the MOWS where culverts are not feasible, as well as around viaduct piers.

To maintain existing drainage patterns, relocated waterbodies would be situated as near to the original location as safety and operational constraints allow. The project would not detain or impound relocated waterbodies. Additionally, wetlands provide natural flow attenuation to downstream waterbodies. Because all four alternatives would relocate waterbodies and fill wetlands, there would be permanent impacts on hydrology from earthwork and relocating existing creeks and channels, as well as impacts from a decrease in the flow attenuation provided by wetlands. However, as described below, the stormwater treatment and management plan would include flow-control devices to maintain pre-project hydrology and prevent substantial increases in runoff. Refer to Section 3.7 for additional information on permanent hydrology impacts on wetlands and jurisdictional aquatic resources.



Sources: Authority 2019a; USGS 2007–2014 and 2016; CDFW 2016; SCVWD 2016b; Sowers et al. 2005

JANUARY 2020

Figure 3.8-9 Permanent Impacts of South Gilroy MOWFs on Existing Waterbodies and Wetlands—Alternatives 1, 2, and 4

Sources: Authority 2019a; USGS 2007–2014 and 2016; CDFW 2016; SCVWD 2016b; Sowers et al. 2005

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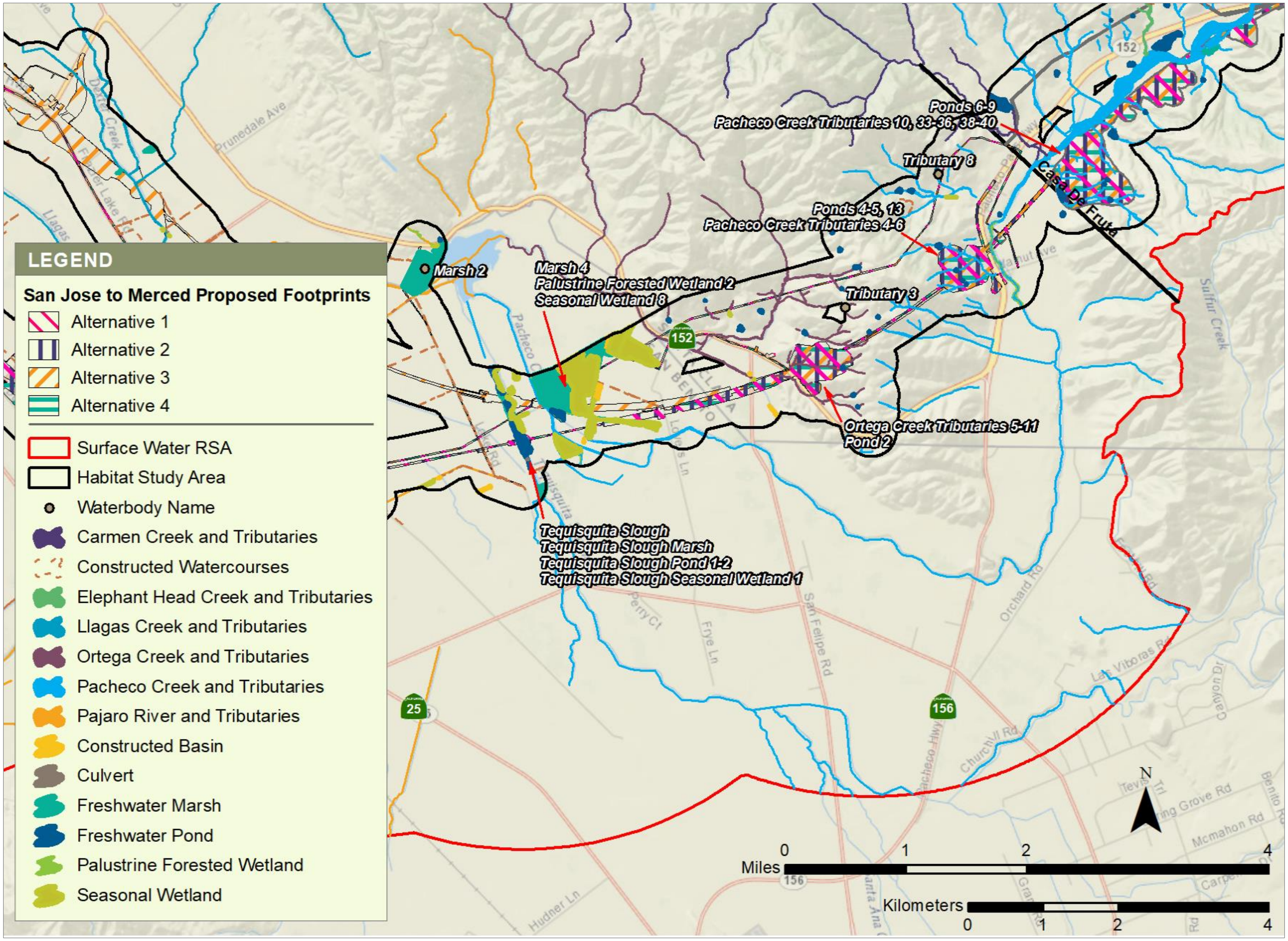
Figure 3.8-10 Permanent Impacts of East Gilroy MOWF on Existing Waterbodies and Wetlands—Alternative 3



Sources: Authority 2019a; USGS 2007–2014 and 2016; CDFW 2016; SCVWD 2016b; Sowers et al. 2005

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Figure 3.8-11 Permanent Impacts on Existing Waterbodies and Wetlands near Tunnel 1—Alternatives 1, 2, 3, and 4

All four project alternatives would require the construction of new impervious surfaces as well as the replacement of existing impervious surfaces. While net additions of impervious surfaces have the potential to affect the hydrology of receiving waters by generating additional runoff during storms, reconstructing existing impervious surfaces would not affect surface water hydrology. Alternative 2 would require adding or replacing the largest area of impervious surfaces, followed by Alternative 1, 3, and 4. Although more of the railbed would be pervious under Alternative 2 when compared to Alternative 1, the pervious embankment under Alternative 2 would require more impervious surface improvements associated with providing grade separations for local roadways. Potential changes in stormwater runoff volumes would be the greatest under Alternative 2. Alternative 4 would involve adding or replacing the smallest area of impervious surfaces because it would use existing Caltrain infrastructure to provide blended services between San Jose and Gilroy. Thus, Alternative 4 would avoid the large additions of impervious surfaces associated with Alternatives 1, 2, and 3 in the Sunnyvale, San Jose West, San Jose, and Lower Coyote Creek watersheds and potential changes in stormwater runoff volumes would be the smallest under Alternative 4. Table 3.8-19 shows the estimated area of impervious surfaces that would be newly constructed or reconstructed by alternative. These conservative estimates will continue to be refined as the design of the project advances.

Table 3.8-19 Estimates of New and Replaced Impervious Surfaces

Planning Watershed*	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach				
Sunnyvale	18.8 acres	44.2 acres	Same as Alternative 2	9.2 acres
San Jose West	84.3 acres	79.5 acres	Same as Alternative 2	25.0 acres
Monterey Corridor				
San Jose West	151.4 acres	142.6 acres	Same as Alternative 1	15.6 acres
San Jose	44.2 acres	40.1 acres	Same as Alternative 1	2.9 acres
Morgan Hill and Gilroy				
San Jose West	8.6 acres	11.7 acres	Same as Alternative 1	0.4 acre
Lower Coyote Creek	114.0 acres	182.7 acres	Same as Alternative 1	17.8 acres
Santa Clara Valley	516.6 acres	660.0 acres	435.7 acres	367.2 acres
San Ysidro Creek	Less than 0.1 acre	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Upper Ortega Creek	34.2 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Pacheco Pass				
Santa Clara Valley	9.4 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Elephant Head Creek	30.9 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Upper Ortega Creek	4.8 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Pacheco Creek	53.7 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
South Fork Pacheco Creek	0 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Pacheco Pass	0.2 acre	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
O'Connells Spring	0.1 acre	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Cottonwood Creek	0.2 acre	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Planning Watershed*	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Romero Overlook	0 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Tule Lake	91.7 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Los Banos	51.0 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
San Joaquin Valley				
Los Banos	205.0 acres	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Total	**1,419.2 acres**	**1,642.1 acres**	**1,358.9 acres**	**919.3 acres**

Source: Authority 2019a
* Super Planning Watersheds are comprised of multiple planning watersheds. For unnamed Planning Watersheds, the Super Planning Watershed name is given for ease of reference within this document.

The project would require the construction of new drainage systems and the modification of existing drainage systems to prevent standing water on the impervious surfaces shown in Table 3.8-19 and along the railbed. New drainage systems would be required for station areas in San Jose and Gilroy as well as new or reconstructed parking lots at stations; roadways such as proposed grade separations and realignments; new sections of railbed including viaduct, embankment, at-grade, tunnel, and trench sections; the South and East Gilroy MOWFs; and the MOWS in the San Joaquin Valley Subsection. These drainage systems are anticipated to be connected to existing local drainage systems, whether underground pipes or surface ditches, requiring the Authority to coordinate with owners of these drainage systems during the design phase. The design of these drainage systems, including sizing calculations, would be documented in a drainage report. Drainage systems at systems sites, including radio antenna sites and traction power facilities, are not proposed; instead, runoff would sheet flow into nearby pervious areas. Where the railbed is in an existing railroad corridor, such as in the blended system from San Jose to Gilroy under Alternative 4, existing drainage systems would be maintained to the extent practicable. Although new drainage systems would be installed and existing drainage systems would be modified, the project would maintain overall drainage patterns.

Prior to construction, the contractor will develop a stormwater management and treatment plan consistent with applicable CWA Section 402 NPDES permits to avoid potential permanent impacts on hydrology, such as increased flows in receiving waterbodies and hydromodification (HYD-IAMF#1). A stormwater management and treatment plan that complies with the Phase II MS4 permit will maintain pre-project hydrology with respect to the volume, flow rate, and duration of runoff. Development of the stormwater management and treatment plan will include evaluating the capacity of the receiving drainage systems during the design phase to design drainage systems that can handle anticipated flows. This evaluation will take into consideration new impervious surfaces that would result in potentially increased stormwater runoff volumes. If anticipated flows were to exceed the capacity of existing drainage systems, on-site stormwater management measures, such as detention, or selected upgrades to the receiving drainage system will be designed to maintain existing drainage capacity. These project features will maintain pre-project hydrology and minimize the potential for hydromodification impacts in receiving waterbodies.

Project features also provide design standards for bridges, culverts, and channels (HYD-IAMF#2). These design standards include provisions to design site crossings to be as perpendicular to the channel as feasible to minimize bridge length and orient piers to be parallel to the flow direction to minimize flow disturbances. Additionally, these design standards require the provision of adequate clearance for floating debris, analysis of potential scour depths to evaluate the depth for burying the bridge piers and abutments, implementation of scour-control measures to reduce erosion potential, use of natural materials stabilized with riparian plantings for erosion control, and placement of bedding materials under riprap at locations where the underlying soils require stabilization as a result of streamflow velocity. A drainage report would document the designs of all bridges, culverts, and drainage systems. These design standards would be applied, as necessary, to minimize potential impacts on surface water hydrology resulting from new or modified bridges and culverts and relocated channels.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because grading, cut-and-fill slopes, new impervious surfaces, new or reconstructed culverts and bridges, and modified waterbodies would not substantially change drainage patterns or substantially increase the rate or amount of surface runoff. Changes to overland flow patterns associated with new landforms, such as bridge and roadway embankments and cut-and-fill slopes, would be similar to existing conditions. The project design would maintain existing drainage patterns by providing culverts and bridges for concentrated flows to pass through the project or realigning waterbodies to flow around the project. Realigned channels would be located close to the original waterbody and changes in drainage patterns would be similar to existing conditions. The stormwater management and treatment plan (HYD-IAMF#1) will evaluate the capacity of receiving stormwater drainage systems; determine improvements and/or upgrades required to maintain or improve existing drainage capacity; and specify BMPs for infiltration, retention, or detention from new and reconstructed impervious surfaces. Therefore, CEQA does not require mitigation.

Operations Impacts

Operations and maintenance activities would include bridge or culvert maintenance and other maintenance activities conducted in or near waterbodies, such as repairing overcrossings or bridges, drainage channels, and drainage infrastructure and managing vegetation within the HSR right-of-way. Chapter 2, Alternatives, describes project operations and maintenance activities. Impacts on surface water hydrology resulting from the operation of tunnels are discussed in Section 3.8.6.4, Groundwater.

Impact HYD#3: Impacts on Drainage Patterns and Stormwater Runoff from Intermittent Maintenance Activities during Operations

Operations of all four alternatives would involve routine maintenance activities, such as repairing overcrossings or bridges, drainage channels, or drainage infrastructure. The project design includes preparation of a SWPPP under the IGP (HYD-IAMF#4) and an operations and maintenance plan under the Phase II MS4 permit to control stormwater runoff during operations.

Although the project would include the construction of either the South or East Gilroy MOWFs and the MOWS in the San Joaquin Valley, intermittent maintenance activities at the MOWS would not likely affect drainage patterns or flow rates in receiving waterbodies. However, stockpiles of ballast and other bulk materials would be stored at the South and East Gilroy MOWFs. These stockpiles would locally affect drainage patterns within the MOWF, but would not affect overall drainage patterns in the RSA.

Operations of all four alternatives would require intermittent maintenance of drainage infrastructure, bridges, and culverts as well as vegetation trimming and clearing near waterbodies to maintain adequate horizontal clearance. Because Alternative 4 would use a blended corridor between San Jose and Gilroy, there would be no change in the maintenance activities required to operate HSR in these areas compared to existing conditions. However, Alternatives 1, 2, and 3 would construct a new dedicated HSR railbed with dedicated bridges and culverts between San Jose and Gilroy and all four alternatives would construct a new railbed between Gilroy and Carlucci Road. Where the project alternatives would travel along a new railbed dedicated to HSR services, additional intermittent bridge, culvert, and vegetation maintenance activities would be introduced to the RSA.

During intermittent maintenance on drainage facilities, bridges, and culverts and vegetation trimming, maintenance personnel would implement standard BMPs included in an operations and maintenance plan prepared under the Phase II MS4 permit. The operations and maintenance plan would require the use of standard BMPs during bridge and culvert maintenance activities, which may include channel/vegetation maintenance and other right-of-way maintenance activities that may alter erosion and sedimentation patterns in receiving waters. Some of the temporary BMPs used during these activities would include, as applicable, sediment control BMPs, such as silt fences and fiber rolls, which retain destabilized sediment. These BMPs would ensure there would be minimal impacts on surface water hydrology by minimizing sediment and siltation in receiving waters during intermittent bridge, culvert, or channel maintenance activities. Routine maintenance activities to maintain original line and grade, hydraulic capacity, or original purpose of the facility are exempt from the CGP even if the activity disturbs more than 1 acre of soil. However, maintenance activities that disturb soil may trigger the need to develop an erosion control or similar plan pursuant to the Phase II MS4 permit to minimize surface water impacts.

Considering these project features, Table 3.8-20 shows the number of waterbodies in which intermittent impacts from bridge and culvert maintenance and vegetation management during operations would occur. It is assumed that all waterbodies crossed by project facilities may require intermittent activities related to bridge or culvert maintenance and vegetation management. Alternative 2 would have the greatest intermittent operations impacts on surface water hydrology, because it would require the construction of more bridges and culverts in the Morgan Hill and Gilroy Subsection requiring intermittent maintenance. Likewise, Alternative 4 would intermittently affect the fewest waterbodies during operations, because it would use more existing infrastructure with a blended alignment between San Jose and Gilroy. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, for a detailed description of impacts on individual waterbodies.

Table 3.8-20 Waterbodies with Intermittent Bridge, Culvert, and/or Vegetation Maintenance

Subsection	Design Option	Bridge, Culvert, and/or Vegetation Maintenance
San Jose Diridon Station Approach	Viaduct to I-880 (Alternative 1)	2
	Viaduct to Scott Blvd (Alternatives 2 and 3)	2
	Blended (Alternative 4)	1
Monterey Corridor	Viaduct (Alternatives 1 and 3)	1
	At-grade (Alternative 2)	1
	Blended (Alternative 4)	0
Morgan Hill and Gilroy	Viaduct to downtown Gilroy (Alternative 1)	40
	Embankment to downtown Gilroy (Alternative 2)	42
	Viaduct to east Gilroy (Alternative 3)	37
	Blended (Alternative 4)	35
Pacheco Pass	Tunnel (Alternatives 1, 2, 3, and 4)	54
San Joaquin Valley	Henry Miller Road (Alternatives 1, 2, 3, and 4)	75
Totals	Alternative 1	172
	Alternative 2	174
	Alternative 3	169
	Alternative 4	165

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because intermittent maintenance of bridges, culverts, and drainage systems as well as vegetation management would not substantially alter the drainage pattern of the RSA. Project features will minimize potential impacts by implementing a SWPPP under the IGP (HYD-IAMF#4) and implementing an operations and maintenance plan in compliance with the Phase II MS4 permit that would prescribe the BMPs necessary to prevent altering surface water hydrology from intermittent maintenance activities during operations. Therefore, CEQA does not require mitigation.

3.8.6.3 Surface Water Quality

Project construction and operations would result in temporary and permanent changes to surface water quality, including increased sediment and pollutant concentrations in waterbodies. Construction impacts would result from the removal of riparian vegetation, relocation and filling of waterbodies, new impervious surfaces, and leaks or spills from equipment and materials that could be discharged to surface waterbodies. Operations impacts would be caused by maintenance of drainage facilities, bridges, and culverts or other activities conducted in or near waterbodies, as well as the release of contaminants from trains and the use of potentially toxic materials.

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.8.6.2, Surface Water Hydrology. The same planned development and transportation projects would generally result in increases in vehicle miles traveled, construction of new impervious surfaces, and work in waterbodies, all of which would affect surface water quality.

Vehicle miles traveled in the RSA will increase by 2040 (Caltrans 2016). An increase in vehicular travel on roadways would lead to increased concentrations of particulate matter, petroleum hydrocarbons, heavy metals, and other contaminants in roadway runoff and waterbodies in the RSA. Presumably, the increase in vehicle miles traveled by 2040 would be greater under the No Project Alternative than the project because no alternative method of transportation is currently planned that would provide the equivalent capacity of the project along the rail alignment. On this basis, the No Project Alternative would likely result in more roadway, airport, and other public transportation projects that would affect surface water quality than the project alternatives. Additionally, the project would result in less pollutant loading in roadway runoff than the No Project Alternative.

The planned industrial, commercial, and transportation projects would construct new impervious surfaces in the RSA. New impervious surfaces would result from widened or extended existing roadways (Coleman Avenue and Autumn Street in San Jose; US 101 and Hale Avenue in Morgan Hill; US 101, SR 152, and Luchessa Avenue in Gilroy; and SR 152, SR 165, Pioneer Road, and Ingomar Grade in Merced County), interchange modifications (SR 86, US 101, SR 237, I-280, I-680, and I-880 in San Jose; US 101 in Morgan Hill; US 101 and Las Animas Avenue in Gilroy; and Volta Road in Merced County), and terminal improvements at Mineta San Jose International Airport. In addition, new impervious surfaces would include roofs on structures and parking lots. The impervious surfaces associated with these developments would accumulate contaminants (e.g., sediment and hydrocarbons) during the summer. In the winter, these contaminants could be discharged to a waterbody as runoff during storms, contributing to increased pollutant loads in the surface water RSA. Additionally, impervious surfaces would increase the total volume of runoff generated during storm events. Increased flows in surface waterbodies could result in increased turbidity and suspended sediment concentrations in receiving waterbodies and habitat loss, negatively affecting habitat for aquatic species.

Planned passenger rail projects and roadway projects, such as the SR 152 median barrier project in Merced County, would require the construction of new bridges and culverts in the surface water RSA. These developments could require work in waterbodies and temporary stream diversions. These activities have an inherent potential for construction equipment, materials, and waste to be accidentally discharged into a waterbody. In addition, roadway widening projects in Merced County (SR 152, SR 165, Pioneer Road, and Ingomar Grade) could require the realignment of irrigation canals and drainage channels in agricultural lands adjacent to the roadways. Permanently realigning or modifying these irrigation and drainage facilities in Merced County could affect beneficial uses protected by the Central Valley RWQCB Basin Plan.

Under the No Project Alternative, vehicle miles traveled would increase, new impervious surfaces would be built, and work in waterbodies could occur. These developments would result in impacts on surface water quality in the RSA. These developments would likely comply with existing laws and regulations that protect surface water hydrology, including various CWA Section 402 NPDES permits, and could require various forms of mitigation to address impacts on water quality and jurisdictional habitats. A full list of anticipated future development is provided in Appendix 3.19-A, Nontransportation Plans and Projects, and Appendix 3.19-B, Transportation Plans and Projects.

Project Impacts

Construction Impacts

Project construction activities include grading, excavation, in-water and over-water work, and various other activities that require the use of materials or generate waste, such as the demolition of bridges, disposal of concrete wash water, and equipment maintenance and fueling. In addition, constructing the project would result in new and replaced impervious surfaces and the realignment, modification, and filling of waterbodies. Chapter 2, Alternatives, describes these construction activities.

Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction

The project design incorporates features that will control runoff from disturbed soils and prevent the pollution of runoff and receiving waters with sediment and non-stormwater. Project features include the development and implementation of a SWPPP under the CGP (HYD-IAMF#3), proper waste disposal and cleaning of construction equipment, appropriate management of hazardous material consistent with state and federal regulations, and worker environmental awareness program (WEAP) training during the construction period. Any work outside the Authority's right-of-way would implement temporary BMPs set forth in the local jurisdictions' MS4 permits. Nevertheless, temporary impacts on water quality would result from work in waterbodies that requires physically disturbing the bed and banks of waterbodies.

Project construction would require grading, excavation, work in waterbodies, and other activities that would disturb, destabilize, and stockpile soil. These activities would occur throughout the project corridor. However, the construction of certain project elements would concentrate these activities in specific areas, such as grade separations and roadway realignments in the Morgan Hill and Gilroy Subsection for Alternative 2 near Fisher Creek, Llagas Creek, West Branch Llagas Creek, and several seasonal wetlands, constructed watercourses, and constructed basins; the South Gilroy MOWFs near Uvas-Carnadero Creek and Pajaro River under Alternatives 1, 2, and 4; the East Gilroy MOWF near the confluence of Dexter, San Ysidro, and Jones (Furlong) Creeks under Alternative 3; tunnel portals, embankments, and landslide minimization along Pacheco Creek, Romero Creek, their tributaries, and associated wetlands under all alternatives; and grade separations and the embankment in the San Joaquin Valley near a number of water conveyance and drainage facilities associated with agricultural operations under all alternatives.

Cut-and-fill slopes, embankments, stockpiles, realigned channels, and other temporarily disturbed soil areas associated with all four alternatives are potential sources of sediment that would be controlled during the construction phase to prevent sediment-laden runoff from discharging into receiving waterbodies. The area of soil that is anticipated to be disturbed by construction activities can be used to estimate the relative magnitude of temporary water quality impacts of a construction project. Table 3.8-21 shows the area of the project footprint for each project alternative; it was assumed that all soil in the project footprint would have the potential to be disturbed. As shown in Table 3.8-21, potential surface water quality impacts related to turbidity, sedimentation, and erosion would be the greatest under Alternative 2 and the least under Alternative 4. The amount of construction effort for the design variants would be approximately the same as the alternatives without the DDV and TDV; therefore, the construction period potential for erosion/sedimentation/construction material spills would be approximately the same.

Table 3.8-21 Estimated Disturbed Soil Area

Alternative	Disturbed Soil Area (acres)
Alternative 1	4,936
Alternative 2	5,642
Alternative 3	5,031
Alternative 4	4,336

Source: Authority 2019a

As shown in Table 3.8-21, all four project alternatives would disturb more than 1 acre of soil and would therefore need to comply with the CGP (HYD-IAMF#3). Potential temporary impacts on water quality from soil disturbance and in-water and over-water construction activities, as well as the use, storage, and disposal of construction materials and wastes would be avoided or minimized by implementing a SWPPP and standard BMPs recommended for a particular construction activity. The construction contractor would develop and implement a SWPPP compliant with the conditions of the CGP. A Qualified SWPPP Developer would prepare the SWPPP and identify stormwater BMPs to minimize potential water quality impacts. The latest edition of the Caltrans Project Planning and Design Guide (2017b) and Construction Site BMP Manual (2017a) would be used to evaluate, select, and design temporary construction site BMPs for the project. The temporary BMPs selected for implementation by the Qualified SWPPP Developer would be consistent with the practices required under the CGP and achieve compliance with its requirements. Evaluation of the BMPs necessary to comply with the CGP and minimize potential water quality impacts during construction would be detailed during the design phase. Compliance with the requirements of the CGP would reduce or avoid substantial construction-related impacts on water quality.

The contractor's Qualified SWPPP Practitioner would be responsible for implementing the SWPPP, including sediment and erosion control BMPs, as well as non-stormwater and waste management BMPs. As part of their responsibility, the Qualified SWPPP Practitioner would monitor the effectiveness of temporary construction site BMPs before, during, and after storm events. The construction site water quality monitoring program would identify areas subject to poor runoff water quality during storm events where additional BMPs would be implemented to improve runoff water quality. Under the CGP, stormwater discharge sampling and analysis would be required for projects with risk levels greater than 1 (i.e., risk levels 2 and 3). As part of the water quality monitoring process, the Qualified SWPPP Practitioner would compare the quality of runoff from the construction site to numeric action levels for turbidity and pH in the CGP. If numeric action levels are trigged for turbidity and pH, the Qualified SWPPP Practitioner would oversee implementation of necessary BMP corrective actions and, where necessary, the by the Qualified SWPPP Developer would prescribe additional BMPs until the levels are no longer exceeded. Thus, the monitoring program would evaluate compliance with and prevent violations of water quality standards during construction, including construction activities conducted in or near waterbodies. Records of these inspections and monitoring results would be submitted to the SWRCB as part of the annual report required by the CGP.

Definitions:

Numeric action levels refer to a specific concentration or level of a pollutant in runoff. When an NAL is exceeded, it is an indication that the current configuration of BMPs may not be effective at reducing pollutants in runoff.

Construction would likely proceed concurrently along the entire project extent under several design-build contracts, with approximately 1.5 years of continuous construction activity at any one location and earthwork occurring over a period of approximately 3 years. Therefore, careful scheduling, phasing, and coordination among contractors would be critical to minimizing potential surface water quality impacts during construction. Work proposed in wetlands or waters of the United States or waters of the State would be scheduled according to the appropriate regulatory agency requirements to minimize impacts on water quality. Additionally, scheduling would be incorporated into the grading plan. Impacts would also be addressed by minimizing areas of disturbed soil, especially in waterbodies and erosive soils, only disturbing areas that may be stabilized before the onset of winter rains, not performing grading or earthwork during the wet months or storm events, and protecting disturbed soil areas with temporary erosion and sediment control BMPs (GEO-IAMF#1 and GEO-IAMF#10).

Temporary erosion and sediment control measures would be applied to all inactive disturbed soil areas during construction. These BMPs would be critical for minimizing temporary impacts from large cut-and-fill slopes in erodible soils in the Morgan Hill and Gilroy and Pacheco Pass Subsections. Potential measures include the detention of sediment in the construction area by installing linear sediment barriers, such as silt fences, stabilization of disturbed soils with hydromulching, or the construction of temporary sediment detention basins. Other methods of minimizing erosion include preserving existing vegetation and avoiding sensitive wetland and riparian habitats to the extent feasible, which will be documented in a biological resources management plan (BIO-IAMF#5). Additionally, the SWPPP would specify the installation of replacement plantings or application of a seed mix to assist in permanently stabilizing exposed soils. Wind erosion resulting in fugitive dust emissions would be avoided or minimized through standard construction site BMPs, such as construction roadway speed limits, halting activities during windy conditions, and dust suppression by wetting disturbed soil areas (AQ-IAMF#1).

In accordance with the CGP, non-stormwater and waste management BMPs would also be implemented during the construction phase. These BMPs would provide for the management of liquids not related to rainfall or stormwater (i.e., nonstormwater) and wastes, all of which may include equipment and vehicle washwater, accidental spills of petroleum hydrocarbons (such as fuels and lubricating oils), concrete wastewater, sanitary wastes from construction work site wash facilities, and hazardous materials and waste. The Authority would minimize hazardous substances required for construction by using an environmental management system to replace hazardous materials with nonhazardous alternatives to the extent possible (HMW-IAMF#9). Alternative materials will be evaluated on an annual basis. Any hazardous materials used during construction will be stored according to state and federal regulations (HMW-IAMF#10). BMPs to minimize the potential for accidental spills and procedures to mitigate spills will be documented in the spill prevention, control, and countermeasure plans (HMW-IAMF#6) that will be implemented at all project facilities. The construction contractor will prepare a hazardous materials and waste plan that describes responsible parties and procedures for managing hazardous waste and transporting hazardous materials on public roadways (HMW-IAMF#7).

Non-stormwater and waste management BMPs would be critical in construction staging areas, concrete batch plants and pre-casting sites under all four alternatives, as well as in spoil stockpile sites near tunnel portals. In construction staging areas, the contractor would temporarily store construction materials, equipment, and wastes, which are potential sources of stormwater pollution that would need to be controlled with BMPs. Proposed concrete batch plants at Tunnel 1 (western portal) and Tunnel 2 (western and eastern portals) and pre-casting sites in southern San Jose and Gilroy would use concrete to manufacture viaduct sections; these activities would need to be controlled to prevent substantial changes in the alkalinity (i.e., increase in pH) of stormwater runoff and the receiving waters, Guadalupe River, Coyote Creek, and Llagas Creek. Non-stormwater and waste management BMPs, good housekeeping practices, and adhering to CGP conditions for the storage of hazardous materials will avoid or minimize the potential for discharging construction materials and wastes into receiving waters (HMW-IAMF#8).

Spoils generated during tunneling activities in the Morgan Hill and Gilroy and Pacheco Pass Subsections may be contaminated with naturally occurring metals, high alkalinity levels (i.e., high pH) caused by cementitious grout and concrete used during tunnel construction and additives and soil conditioners used during tunneling activities. As described in Impact HYD#10, groundwater is expected to be encountered during construction of the tunnels. Project features will reduce the amount of groundwater seepage into the advancing tunnel excavation through the use of grouting, installation of watertight tunnel lining systems, and other methods (HYD-IAMF#5). Where larger quantities of groundwater are expected, increased quantities of cementitious grout will be used to minimize groundwater inflows into the interior of the tunnel

(HYD-IAMF#5). The goal of tunnel construction would be to intercept groundwater inflows prior to contaminating them with construction materials and wastes, such as tunnel spoils and cementitious grouts and concretes. However, it is expected that groundwater and construction materials and wastes would inevitably become commingled in the interior of the tunnel structures, and this commingled water is expected to contain high concentrations of metals, elevated pH, and other chemicals such as lubricants. This contaminated tunnel construction water as well as any decant water (i.e., water that seeps out of stockpiled tunnel spoils) would likely require nonstormwater and waste management BMPs, such as an active treatment system, to avoid substantial impacts on water quality within receiving waters (Ortega Creek, Pacheco Creek, Romero Creek, and their tributaries). Refer to Impact HYD#10 for more information on the proposed construction methods associated with building tunnels and the project features that will minimize the quantities of groundwater seepage.

Active treatment systems use conventional water treatment technologies to improve the quality of stormwater and non-stormwater runoff to comply with CWA Section 402 NPDES permits. The active treatment system would potentially include the use of coagulants and a sedimentation basin to reduce turbidity and the addition of acids and bases to control pH, granular- activated carbon to reduce hydrocarbons and petroleum products, ion exchange resins to remove metals, and any other treatment systems as applicable to comply with water quality standards prior to discharge from the tunnel portals into receiving waters. Because substantial quantities of groundwater may be encountered during tunneling, substantial quantities of cement grout may be necessary to control and minimize groundwater inflows. Therefore, it is expected that water generated during tunneling activities would have high pH resulting from exposure to cement, potentially rendering adequate treatment prior to discharge technically challenging.

Additionally, the Authority would use a portion of the tunnel spoils to build the proposed railbed embankments. If this material were to meet the requirements for reuse within a public right-of-way, it would be used to build embankments throughout the entire project extent. Prior to reuse, tunnel spoils would be stockpiled in staging areas. Stockpiles will be managed in accordance with the SWPPP and CGP (HYD-IAMF#3) to minimize the potential for contaminated spoils to erode by wind or water or otherwise be discharged into a receiving waterbody. To determine the suitability of stockpiled tunnel spoils for use in the railbed, the Authority would first test the spoils for geotechnical suitability. If the spoils were suitable for reuse in the embankment from a geotechnical perspective, the Authority would test the spoils for environmental contamination to further determine their suitability. If environmental testing determines that reuse has the potential to create water quality impacts, the spoils would not be used to build the embankment and would be disposed of according to applicable state and federal regulations. Tunnel spoils determined to be suitable for reuse in embankments would be placed in a location and manner to avoid impacts on water quality. The Authority's contractor will document the protocols for stockpiling, screening, sampling, testing, storing, labelling, and disposing in a Construction Management Plan (HMW-IAMF#4). Refer to Section 3.10 for more information on soil and groundwater testing requirements.

In addition to non-stormwater BMPs, other project features will reduce the potential for encountering materials that would negatively affect water quality. Hazardous material studies and remediation will occur prior to construction (HMW-IAMF#1), minimizing the potential for dewatering subsurface contamination to a surface waterbody. If undocumented contamination were discovered during construction, dewatering activities will cease and remedial activities would be developed in consultation with the RWQCBs or California Department of Toxic Substances Control and the property owner (HMW-IAMF#4). Refer to Section 3.10 and the *San Jose to Merced Project Section Hazardous Materials and Wastes Technical Report* (Authority 2019d) for more information on hazardous materials and wastes encountered during or generated by construction activities.

Project construction would require work in waterbodies to build new bridges, culverts, and viaduct piers and to realign and relocate waterbodies (Table 3.8-16 and Table 3.8-18). Work in waterbodies would result in temporary disturbance of the beds and banks of waterbodies, leading to increased erosion and sedimentation and the exposure of construction materials, equipment, and wastes to receiving waterbodies. Work in perennial waterbodies would require temporary stream diversion and channel dewatering to allow work on a dry ground surface. Intermittent or ephemeral waterbodies would not likely contain flowing or standing water during summer when construction in waterbodies is anticipated to occur, and would not require temporary stream diversion and dewatering. Erosion and sedimentation would occur in all waterbodies directly disturbed by construction activities when flows occur during winter. Construction activities within waterbodies could elevate sediment concentrations and turbidity beyond water quality standards at each location where such work is required. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, and Section 3.7, Biological and Aquatic Resources, for more information regarding impacts on jurisdictional waterbodies in the project extent.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would entail construction activities within waterbodies that would disturb the beds and banks of waterbodies and create sources of pollutants from hazardous materials and construction equipment. Such disturbances are expected to degrade existing water quality by means of elevated sediment concentrations, turbidity, and other visible and nonvisible pollutants, including petroleum products like fuels and lubricants. In accordance with the CGP, contaminated water generated by tunneling activities would be treated prior to discharge or disposed of at a publicly owned treatment works to avoid violating water quality standards. However, while actions would be implemented before and during construction to avoid substantial water quality impacts, including the development and implementation of a SWPPP under the CGP, the project would result in the temporary degradation of water quality as a result of conducting work within waterbodies. Mitigation measures to address this impact are identified in Section 3.8.9, CEQA Significance Conclusions. Section 3.8.7, Mitigation Measures, describes these measures in detail.

Impact HYD#5: Permanent Impacts on Surface Water Quality during Construction

Project construction would convert land uses, add impervious surfaces, and relocate or fill waterbodies, which may require removal of riparian vegetation in the RSA. Prior to construction, the contractor would prepare a stormwater management and treatment plan, which would include permanent stormwater treatment BMPs to reduce the quantity and improve the quality of runoff. However, permanent impacts on water quality would result from the removal of riparian vegetation and the loss of aquatic resources from conversion to transportation land use, as described in the following narrative.

Conversion of land to certain uses may affect surface water quality by introducing new or greater amounts of pollutants into an area. Substantial changes to surface water quality conditions have the potential to occur where rural or undeveloped land uses, like parks, open spaces, agriculture, and riparian areas, are converted to transit-oriented commercial and industrial land uses associated with HSR. For example, runoff from parks and open spaces generally contain few pollutants, while agricultural land uses may contain pesticides and fertilizers applied to croplands as well as bacterial pathogens from livestock waste. Where open space and agricultural land uses are converted into transit-oriented land uses, the character of runoff would change and include pollutants like petroleum-based fuels, solvents, grease, and lubricants as well as heavy metals instead of or in addition to pesticides, fertilizers, and bacterial pathogens. Therefore, the conversion of land uses in the RSA would alter surface water quality.

Each of the project alternatives would require acquisition of different amounts and types of land for conversion to transportation use. Alternative 2 would require the most land use conversion, followed by Alternatives 3, 4, and 1. However, all four alternatives would require similar acquisitions along approximately 90 miles of the proposed alignment between San Jose and the Central Valley—ranging from approximately 2,990 acres under Alternative 4 to approximately 3,300 acres under Alternative 2. For all project alternatives, agricultural and parks/recreation/open space land uses would constitute the greatest proportion of land use conversions. Alternatives 2 and 3 would affect more agricultural land in the Morgan Hill area than Alternatives 1 and 4 by converting them into transportation uses. Additionally, Alternative 3 would convert agricultural lands in east Gilroy to transportation uses, while the other alternatives would have a smaller impact on water quality by converting urban and commercial areas in downtown Gilroy to transportation land uses, because these uses are characterized by similar pollutant loads. Even though permanent land use conversions would be smaller under Alternative 1, impacts of land use change on water quality are anticipated to be the least under Alternative 4, because it would operate in blended service with Caltrain between San Jose and Gilroy predominantly within an existing transportation corridor, minimizing land use conversion. Refer to Section 3.13, Station Planning, Land Use, and Development, for more information on project impacts on land uses.

Additionally, project construction would add impervious surfaces to the landscape. Impervious surfaces collect pollutants, such as sediment, oil and grease, hydrocarbons (e.g., fuels, solvents), heavy metals, organic fertilizers and pesticides, pathogens, nutrients, and debris, from nearby land uses. These pollutants would be mobilized by runoff during storm events and conveyed into surface water either directly or through drainage systems. Therefore, new impervious surfaces constructed under the project would result in increased pollutant loads in surface waterbodies and permanent impacts on surface water quality. Impervious surfaces would be built under all four alternatives; however, the area of impervious surface built would vary among the alternatives. Refer to Impact HYD#2 for a discussion of the hydrology impacts from hydromodification and Table 3.8-19 for the types and quantities of impervious surfaces built in each planning watershed, subsection, and alternative.

The contractor will prepare a stormwater management and treatment plan for Authority review and approval prior to construction (HYD-IAMF#1). The plan will include permanent stormwater BMPs to minimize the exposure of contaminants to stormwater runoff (site design and source control measures), reduce the quantity and improve the quality of stormwater runoff (treatment and low-impact development [LID] measures), and retain flows to prevent increases in flow rates and durations above pre-project conditions (hydromodification management). BMPs would be sized to manage the expected runoff from impervious surfaces. The stormwater management and treatment plan would specify site design, source control, LID design standards, stormwater treatment, and hydromodification management BMPs to be implemented in the HSR right-of-way according to the Phase II MS4 permit. Potential LID measures would include constructed wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated biofilters. The Caltrans Project Planning and Design Guide provides additional guidance for permanent stormwater treatment BMPs. Outside of the HSR right-of-way, permanent stormwater treatment BMPs would be selected, evaluated, and designed in accordance to the respective local jurisdictions listed in Table 3.8-1. The Authority would coordinate with local agencies regarding the design, construction, and long-term maintenance of permanent stormwater treatment BMPs that would be constructed within their jurisdiction.

In addition, the Authority would be required to inspect and maintain these permanent stormwater treatment BMPs as a condition of the Phase II MS4 permit. Inspections would include field observations of the BMPs to determine the effectiveness of those measures in removing pollutants from stormwater runoff and/or reducing hydromodification impacts. Additionally, the Authority would develop a long-term plan for conducting regular maintenance of permanent stormwater treatment BMPs within HSR right-of-way; this plan would be required to specify the frequency of maintenance to ensure continued effectiveness.

With implementation of a stormwater management and treatment plan (HYD-IAMF#1) and long-term maintenance plan for permanent stormwater treatment BMPs, stormwater runoff from new and replaced impervious surfaces, including those in areas with converted land uses, will be collected and discharged in a manner that would not produce excessive erosion. Potential sources of pollutants would be managed to minimize exposure to stormwater. On-site stormwater treatment BMPs, such as infiltration, bioretention, and biofiltration, would capture and improve the quality of runoff prior to discharge into surface waterbodies. Permeable pavers could also be implemented for the parking lots at stations and maintenance facilities. The implementation of these permanent BMPs would minimize sediment and pollutant loading in surface waters and reduce the exposure of aquatic life to toxic materials (e.g., metals, petroleum hydrocarbons). Additionally, a stormwater management and treatment plan that complies with the Phase II MS4 permit would maintain pre-project hydrology with respect to the volume, flow rate, duration, and temperature of runoff from impervious surfaces.

The MOWFs proposed under each of the alternatives would be built in a large floodplain area known as the Soap Lake floodplain. Flood control systems proposed for the MOWFs would comprise ditches, equalizer culverts, and flood control basins to minimize flood risk and impacts on the Soap Lake floodplain. These flood control systems would avoid the potential for pollutants to be discharged into receiving waters during floods and the risk of equipment and materials being carried away by floodwaters. With the flood control systems in place, the MOWFs would not be considered a substantial source of additional polluted runoff, nor would they release pollutants during floods. In accordance with HYD-IAMF#2, materials storage areas at MOWFs, MOWS, traction power facilities, and stations will be located above the 100-year water surface elevation if they are situated within a floodplain, including those at the South and East Gilroy MOWFs. Refer to Section 3.8.5.5, FEMA Floodplains, for more information on Soap Lake and Impact HYD#13 for proposed flood protection measures.

The project would require the permanent modification of waterbodies (refer to Impact HYD#2 and Table 3.8-18 for more information on where and why modifications would occur within the project footprint). Modifying waterbodies would include adjusting the existing banks and bed of the waterbody, relocating the waterbody nearby, or converting the waterbody to a transportation land use by placing fill material, such as rock and soil, in the waterbody to construct project improvements. Realigning, modifying, and partially or completely filling a waterbody would result in the degradation or loss of beneficial uses. Although some waterbodies would be realigned, the realigned waterbody may not support the same quantity or quality of beneficial uses. Realigning waterbodies would modify existing recreational opportunities, like swimming and fishing. Section 3.7 assesses impacts on the biological resources related to waterbodies including potential effects on steelhead use of instream and floodplain habitat.

With regard to riparian habitats, vegetation would be lacking from realigned channels and in locations where construction of bridges, culverts, viaduct crossings, and other elements of the project alternatives near waterbodies would require the removal of riparian vegetation, if present. Decreases in riparian cover over waterbodies would result in incremental increases in water temperatures caused by reductions of shading by the riparian canopy. These higher water temperatures could result in depressed dissolved oxygen concentrations, because the amount of oxygen water can contain decreases as temperature increases. However, it is not expected that the water quality standards for temperature and dissolved oxygen would be violated due to the removal of riparian vegetation at any one location. Instead, there is potential for the effect from incremental changes in water temperature and dissolved oxygen to accumulate in downstream waterbodies that receive the most water flowing through the project footprint, primarily Pajaro River and its tributaries, Llagas Creek and Pacheco Creek. These changes in temperature and dissolved oxygen would reduce habitat quality for aquatic species, including salmonids such as steelhead. A reduction in aquatic habitat would result in further impacts on recreation (e.g., noncontact water recreation, fishing, shellfish harvesting) in the affected waterbodies by potentially reducing populations of fish, mollusks, and other aquatic wildlife. The impact is expected to be broadly similar among the alternatives. However, it is anticipated that the impact would be the greatest under Alternative 2, which would require the most work within waterbodies that may require the removal of riparian vegetation, followed by Alternatives 1, 3, and 4.

Each of the project alternatives would require the permanent modification of waterbodies, both through realigning waterbodies and through permanent losses from fill placement and conversion to transportation land uses. The impact would be relatively similar among the alternatives, with the primary difference being the number of waterbodies affected. It is expected that Alternative 2 would have the greatest permanent impact on water quality due to its larger footprint associated with the proposed embankment in the Morgan Hill and Gilroy Subsection, followed by Alternatives 1, 3, and 4. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, and Section 3.7, Biological and Aquatic Resources, for more information regarding permanent impacts on jurisdictional waterbodies in the project extent.

Some waterbodies that would be permanently affected by the project alternatives are listed on the CWA Section 303(d) list for a water quality impairment. However, new and reconstructed bridges and culverts would not substantially contribute to increased turbidity or sediment loads, because the design of these structures would be optimized to minimize erosion and scour, and all cut-and-fill slopes and other disturbed soil areas would be permanently stabilized with erosion control BMPs. Additionally, stormwater treatment BMPs would reduce the quantity and improve the quality of runoff from impervious surfaces associated with the project, reducing pollutant loading in impaired receiving waters following best industry practices. Permanent adverse impacts on other listed impairments are not anticipated because the physical presence of the project, including the railbed, MOWFs, and stations, is not expected to otherwise affect water quality.

CEQA Conclusion

The impact under CEQA would be significant for all four alternatives because the project would substantially degrade water quality through direct removal, filling, hydrological interruption, and other indirect impacts on aquatic resources as well as the permanent conversion or removal of riparian habitat. With the implementation of stormwater treatment BMPs, construction would not result in the violation of water quality standards. While actions would be implemented before and during construction to minimize such impacts, the project would result in the permanent loss of aquatic resources and associated degradations of water quality. Mitigation measures to address this impact are identified in Section 3.8.9, CEQA Significance Conclusions. Section 3.8.7, Mitigation Measures, describes these measures in detail.

Operations Impacts

Operations and maintenance activities would include bridge or culvert maintenance and other maintenance activities conducted in or near waterbodies, such as repairing overcrossings or bridges, drainage channels, or drainage infrastructure and managing vegetation within the HSR right-of-way. Chapter 2, Alternatives, describes project operations and maintenance activities.

Impact HYD#6: Impacts on Surface Water Quality from Intermittent Maintenance Activities during Operations

During operations, maintenance activities at stations, MOWFs, MOWS, and traction power facilities would require the use and storage of materials and chemicals. Additionally, bridges and culverts would require intermittent maintenance and vegetation would need to be managed to maintain adequate track clearance. The Authority would prepare a SWPPP under the IGP for applicable station and maintenance facilities, an operations and maintenance plan identifying BMPs, and an environmental management system to identify nonhazardous alternative materials. The Authority would conduct WEAP training sessions for all maintenance employees.

Activities at the MOWFs and MOWS proposed under all four alternatives would include repairing infrastructure and equipment in the shop facilities, storing bulk and non-bulk materials in stockpile areas (such as ballast), and storing trains and rail-borne equipment on yard and siding tracks. Materials and chemicals used and stored at the MOWFs and the MOWS, as well as stations and traction power facilities, would be managed and controlled to prevent discharges of pollutants into storm drain systems and receiving waterbodies. These materials and chemicals include thousands of gallons of heavy and light oils, fuels, and hydraulic fluids as well as metal filings, cleaning products, refuse, landscaping supplies, and other potentially toxic materials.

An SWPPP will be prepared for all station and maintenance facilities regulated by the IGP prior to operations, including the MOWFs and MOWS as applicable (HYD-IAMF#4). The IGP SWPPP would describe BMPs implemented at the MOWF, the MOWS, and other applicable facilities that would prevent the exposure of materials and chemicals to stormwater and manage the quality of stormwater runoff. Performing maintenance activities on infrastructure and equipment within the shop facilities at the MOWF would be considered a source control BMP that avoids the exposure of contaminants, like oils, fuels, and lubricants, to stormwater. Stockpiles of ballast, concrete ties, and other erodible materials such as soil at the MOWF and MOWS would need to be controlled with BMPs like fiber rolls and silt fence to retain sediment on-site and prevent it from washing into the storm drain system. As applicable, drip pans would be used to contain leaks and spills of oil, grease, and other hydrocarbons from trains and rail-borne equipment stored on the yard and siding tracks at the MOWF and MOWS. Complying with the SWPPP and IGP would require periodically inspecting materials and equipment storage areas to confirm that there are no leaks or spills of materials. Additionally, a water quality monitoring program would be implemented to verify that runoff from the MOWF and MOWS does not exceed water quality standards. Thus, operational stormwater BMPs and other good housekeeping practices would be implemented at the MOWF and MOWS such that runoff would consistently meet the water quality performance standards for runoff in the IGP.

Furthermore, the Authority will minimize hazardous substances used and stored at stations, MOWF, and MOWS by using an environmental management system to replace hazardous materials with nonhazardous alternatives (HMW-IAMF#9). Alternative materials would be evaluated on an annual basis to continually avoid or minimize the use of hazardous materials during operation. If hazardous materials are required for operation and maintenance activities, state and federal laws regulate the storage of hazardous materials; regulated materials will be stored in maintenance areas with secondary containment to prevent potential spills in compliance with good housekeeping practices (HMW-IAMF#10). The Authority would limit the amount of hazardous substances used for HSR operations and would have specific cleanup protocols and trained personnel to prevent regular use or accidental spills of hazardous materials from reaching surface waterbodies; therefore, the alternatives would not contribute to a violation of regulatory standards.

In addition to the SWPPP prepared under the IGP, the Authority would be required to develop and implement an operations and maintenance plan to assign BMPs to pollutant-generating activities for the project in accordance with the Phase II MS4 Permit. The operations and maintenance plan would identify all materials that may be discharged into a waterbody or storm drain system during the following pollutant-generating activities and implement measures to reduce pollutants in stormwater and non-stormwater runoff: road and parking lot maintenance; bridge and culvert maintenance; right-of-way maintenance, including vegetation management; green waste deposited in the street; and graffiti removal.

Intermittent maintenance would be performed on bridges and culverts during operations. This maintenance would include some or all of the following activities: rechipping, grinding, saw cutting, and painting bridges and culverts, as well as other activities to maintain the capacity of the channel, such as trimming or removing vegetation. Additionally, vegetation management would be performed intermittently in the HSR right-of-way to maintain adequate horizontal track clearance. Vegetation management activities associated with maintaining bridges, culverts, and track clearance would include mowing and/or the use of pesticides, which would negatively affect receiving water quality if accidentally discharged to receiving waters or applied to vegetation adjacent to or above surface waterbodies. Furthermore, both bridge and culvert maintenance and vegetation management have the potential to contribute sediment to receiving waters. As described previously, the BMPs applicable to both of these intermittent maintenance activities would be described in the operations and maintenance plan prepared to comply with the Phase II MS4 permit.

Attachment G of the Phase II MS4 permit would also require the Authority to develop and implement integrated pest management policies to prevent the impairment of streams in the San Francisco Bay RWQCB's jurisdiction by pesticide-related toxicity. Therefore, in the watersheds of Los Gatos Creek, Guadalupe River, Coyote Creek, and Fisher Creek, integrated pest management policies would minimize the usage of the pesticides during maintenance in the Authority's right-of-way. The Authority would consider applying these policies through the project extent to further minimize the use of pesticides of concern.

Definitions:

Integrated Pest Management is an ecosystem-based strategy of pest control that focuses on long-term prevention of pests through a combination of techniques. Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the aquatic environment.

The Authority will present WEAP training to all maintenance personnel (BIO-IAMF#4). The WEAP training sessions will be given prior to initiation of maintenance activities and repeated for all maintenance employees on an annual basis. WEAP training will include a discussion of the CWA, description of jurisdictional habitat areas near maintenance activities (i.e., waterbodies and wetlands), hazardous substance spill prevention and containment measures, and the consequences of noncompliance with applicable permits and regulations. WEAP training will minimize the potential for intermittent impacts on surface water quality from bridge and culvert maintenance and vegetation management by informing maintenance personnel of regulatory requirements.

Considering these project features, Table 3.8-20 shows the number of waterbodies in which intermittent impacts from bridge and culvert maintenance and vegetation management during operations would occur. It is assumed that all waterbodies crossed by the tracks and in the proposed HSR right-of-way may require intermittent activities related to bridge or culvert maintenance and vegetation management. Alternative 2 would have the greatest intermittent operations impacts on surface water hydrology, because it requires the construction of more bridges and culverts in the Morgan Hill and Gilroy Subsection and these bridges and culverts would require intermittent maintenance. Likewise, Alternative 4 would intermittently affect fewer waterbodies during operations, because it would use more existing infrastructure with a blended alignment between San Jose and Gilroy. Alternatives 1 and 3 would intermittently affect a similar number of waterbodies during operations, but Alternative 1 would require intermittent maintenance activities in or near a few more waterbodies when compared to Alternative 3.

All four alternatives would require intermittent bridge and culvert maintenance and vegetation management in waterbodies with CWA Section 303(d) listed impairments, including Los Gatos Creek, Guadalupe River, Llagas Creek, Pajaro River, Millers Canal, Tequisquita Slough, Pacheco Creek, and Los Banos Creek. However, Alternative 3 would also require these activities in Jones (Furlong) Creek, which is also on the CWA Section 303(d) List. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, for detailed descriptions of impacts on individual waterbodies and CWA Section 303(d) List impairments.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because the project would develop a SWPPP under the IGP and an operations and maintenance plan under the Phase II MS4 permit prior to operations, which would comply with applicable CWA Section 402 NPDES permits by specifying BMPs needed to avoid or minimize impacts on water quality. The proposed South or East Gilroy MOWF would be regulated under a SWPPP prepared under the IGP, and would therefore not provide a substantial additional source of polluted runoff from intermittent maintenance activities during operations. These project features will prevent violations of water quality standards or the creation of a substantial new source of contaminated runoff during intermittent bridge, culvert, and vegetation management activities. Therefore, CEQA does not require mitigation.

Impact HYD#7: Impacts on Surface Water Quality during Continuous Operations

Operations activities at stations, MOWFs, and the MOWS would require the use and storage of materials and chemicals. The Authority would prepare a SWPPP under the IGP for applicable station and maintenance facilities, an operations and maintenance plan identifying BMPs, and an environmental management system to identify nonhazardous alternatives. The Authority would conduct WEAP training sessions for all maintenance employees.

Operations would result in the potential for pollutants to be discharged into receiving waters when trains cross over a waterbody on a bridge or culvert or are located close to a waterbody. Alternatively, pollutants emitted by trains would also be deposited on nearby impervious surfaces where runoff would eventually mobilize them to a storm drain inlet and into a receiving waterbody. The DDV would slightly change the extent of impervious surfaces compared to Alternative 4 without the DDV, but this would not materially change the amount of surficial runoff. The TDV would not change the extent of impervious surfaces. However, the technology proposed for the electric HSR system would not require large amounts of lubricants or hazardous materials that could incidentally be leaked or spilled into a waterbody during operations. The HSR system would be electrically powered and would not emit petroleum hydrocarbons or byproducts of internal combustion engines. In addition, the electric trains would use a regenerative braking technology, resulting in reduced physical braking and associated wear on mechanical components of the trains. When using regenerative braking, the train converts some kinetic energy into electrical energy and feeds this energy back into the overhead catenary system.

Nevertheless, it is expected that the trains would generate pollutants that would be discharged into waterbodies, which could impact water quality. These pollutants may include both inorganic compounds, such as metals, and organic compounds, including PAHs. The dust generated by physical braking processes may contain metals like iron, copper, silicon, calcium, manganese, chromium, and barium (Burkhardt et al. 2008; Moreno et al. 2015) as well as PAHs (Markiewicz et al. 2016). Although brake dust would consist primarily of particulate metals, some of these metals could become dissolved in rainwater. Additionally, brake dust would not be generated in equal amounts throughout the project extent. The primary locations where brake dust would be generated are areas where the trains must reduce their travel speed, such as approaches to stations, MOWFs, and the MOWS, turns, tunnel approaches, and elevation changes, primarily descents. Long stretches of flat terrain with a straight rail alignment, such as in the San Joaquin Valley, would generate less brake dust than other areas.

Additionally, the use of lubricating oils in trains may also contribute to the release of particulate PAHs into receiving waterbodies (Markiewicz et al. 2016). However, studies have shown that only a small fraction of PAHs released along transportation corridors is actually found in stormwater runoff (about 2 to 6%), and the primary sources of these PAHs are physical wear of tires, lubricant oil leakage, exhaust from internal combustion engines, road surface wear, and brakes (Markiewicz et al. 2016). Because the electric trains do not require the use of tires, internal combustion engines, or road surfaces, the primary sources of PAHs from HSR trains would be leaks and emissions of lubricants as well as brake dust. As stated previously, the electric train technology that would be utilized by the HSR system would not require large amounts of lubricants, and it would use regenerative braking technology that results in reduced physical abrasion of the braking system.

During operations, the permanent stormwater treatment BMPs specified in the stormwater management and treatment plan (HYD-IAMF#1) will reduce the quantity and improve the quality of stormwater runoff before runoff is discharged into a surface waterbody. The plan will include design criteria and locations of stormwater treatment BMPs. Potential treatment BMPs installed in the project extent would include infiltration areas, infiltration devices, biofiltration systems, detention devices, media filters, and wet basins. Of these potential treatment BMPs, all are capable of reducing concentrations of particulate materials in runoff, such as metals and PAHs, while only infiltration areas, infiltration devices, biofiltration systems, and media filters can reduce dissolved metals concentrations in runoff (Caltrans 2017b).

Because stormwater treatment BMPs, including those discussed previously, would be provided for all new and replaced impervious surfaces, the project would minimize potential water quality impacts from brake dust and PAHs deposited on impervious surfaces, including viaducts, bridges, new or reconstructed roadways, stations, and maintenance facilities, by capturing runoff and improving the quality of runoff prior to discharge into waterbodies. Runoff from at-grade and embankment profiles, which do not contain impervious surfaces, is not anticipated to flow through stormwater treatment measures; however, brake dust and PAHs are generally anticipated to be retained in track ballast material in these areas (Markiewicz et al. 2016).

Though not quantifiable at this time, the amount of brake dust and PAHs that would be discharged into surface waterbodies is not anticipated to be sufficient to alter water quality substantially. Even though certain heavy metals have the potential to bioaccumulate in the aquatic environment or stimulate the growth of microbes, resulting in adverse impacts on aquatic life, the discharge of metals into surface waterbodies is not likely to cause a violation of the water quality objectives for bioaccumulation and biostimulatory substances. Unlike metals, PAHs do not bioaccumulate or stimulate microbial growth. However, PAHs can have detrimental developmental and toxic effects on aquatic plants, fish, amphibians, and invertebrates, and they can accumulate in sediment within waterbodies (Perrin no date). Regardless, it is not expected that discharges of PAHs from trains would be of sufficient quantity to exceed water quality objectives for toxicity or population and community ecology. Considering that the project would use treatment BMPs to reduce the quantity of and improve the quality of runoff generated on all new and replaced impervious surfaces and the electric HSR system would minimize the quantity of brake dust that would be generated compared to conventional rail technology, the project would minimize potential water quality impacts from brake dust to the maximum extent practicable using the best available technology.

Activities at the MOWFs and MOWS proposed under all four alternatives would include operating equipment in the shop facilities; storing bulk and nonbulk materials, such as ballast, in stockpile areas; and storing trains and rail-borne equipment on yard and siding tracks. Materials and chemicals may also be stored at traction power facilities and stations. All materials, chemicals, and equipment stored at MOWFs, MOWS, traction power facilities, and stations would be managed and controlled to prevent discharges of pollutants into storm drain systems and receiving waterbodies. These materials and chemicals include thousands of gallons of heavy and light oils, fuels, and hydraulic fluids as well as metal filings, cleaning products, refuse, landscaping supplies, and other potentially toxic materials.

However, a SWPPP will be prepared for all station and maintenance facilities regulated by the IGP prior to operations, including the MOWFs and MOWS as applicable (HYD-IAMF#4). The IGP SWPPP will describe the BMPs implemented at the MOWF, the MOWS, and other applicable facilities that will prevent the exposure of materials and chemicals to stormwater and manage the quality of stormwater runoff. Performing operations activities on equipment inside the shop facilities at the MOWF would be considered a source control BMP that avoids the exposure of contaminants, like oils, fuels, and lubricants, to stormwater. Stockpiles of ballast, concrete ties, and other erodible materials such as soil at the MOWF and MOWS would need to be controlled with BMPs like fiber rolls and silt fence to retain sediment on site and prevent it from washing into the storm drain system. As applicable, drip pans would be used to contain leaks and spills of oil, grease, and other hydrocarbons from trains and rail-borne equipment stored on the yard and siding tracks at the MOWF and MOWS. Complying with the SWPPP and IGP would also require periodically inspecting materials and equipment storage areas to confirm that there are no leaks or spills of materials. Additionally, a water quality monitoring program would be implemented to verify that runoff from the MOWF and MOWS does not exceed water quality standards. Thus, post-construction stormwater BMPs and other good housekeeping practices would be implemented at the MOWF and MOWS such that runoff would consistently meet the water quality performance standards for runoff in the IGP.

Furthermore, the Authority will minimize hazardous substances used and stored at stations, the MOWF, and MOWS by using an environmental management system to replace hazardous materials with nonhazardous alternatives (HMW-IAMF#9). Alternative materials would be evaluated on an annual basis to continually avoid or minimize the use of hazardous materials during operation. If hazardous materials are required for operations activities, state and federal laws regulate the storage of hazardous materials; regulated materials will be stored in areas with secondary containment to prevent potential spills in compliance with good housekeeping practices (HMW-IAMF#10). The Authority would limit the amount of hazardous substances used for HSR operations and would have specific cleanup protocols and trained personnel to prevent regular use or accidental spills of hazardous materials from reaching surface waterbodies; therefore, the alternatives would not contribute to a violation of regulatory standards.

In addition to the SWPPP prepared under the IGP, the Authority would develop and implement an operations and maintenance plan to assign BMPs to pollutant-generating activities for the project in accordance with the Phase II MS4 Permit. The operations and maintenance plan would identify all materials that may be discharged into a waterbody or storm drain system during the pollutant-generating activities for operations and implement measures to reduce pollutants in stormwater and non-stormwater runoff.

Additional pollutants that may be generated and emitted during continuous operations, such as trash, would be minimal and would be managed with good housekeeping practices, such as trash pick-up and sweeping along the tracks and at stations. The pollution prevention and good housekeeping practices for operations include identifying all materials that contain pollutants, such as metals that could be discharged from operations and maintenance activities, and developing and implementing BMPs that, when applied during operation and maintenance activities, would reduce pollutants in stormwater and non-stormwater discharges.

Considering the project features described previously, including electrical train technology with regenerative braking and a stormwater management and treatment plan, Table 3.8-22 shows the number of waterbodies anticipated to have impacts during continuous operations by alternative and subsection. Alternative 4 would have impacts on the fewest waterbodies, while Alternative 2 would have impacts on the most waterbodies. Using a blended corridor would avoid impacts on Constructed Basin 1 in the Monterey Corridor Subsection under Alternative 4, but the differences in Table 3.8-22 are primarily because of the divergence of the alternative alignments in the Morgan Hill and Gilroy Subsection. In this subsection, the blended system proposed under Alternative 4 would affect the fewest waterbodies while the alignment to east Gilroy in Alternative 3 would avoid waterbodies that would be affected by the alignments to downtown Gilroy in Alternatives 1 and 2, including West Branch Llagas Creek and Upper Miller Slough. Refer to Volume 2, Appendix 3.8-C, Basin Plan Water Quality Impact Summary, for detailed descriptions of potential impacts on individual waterbodies and CWA Section 303(d) list impairments.

Table 3.8-22 Waterbodies with Impacts from the Release of Contaminants from Operating Trains

Subsection	Design Option	Number of Waterbodies Affected
San Jose Diridon Station Approach	Viaduct to I-880 (Alternative 1)	2
	Viaduct to Scott Blvd (Alternatives 2 and 3)	2
	Blended (Alternative 4)	2
Monterey Corridor	Viaduct (Alternatives 1 and 3)	3
	At-grade (Alternative 2)	3
	Blended (Alternative 4)	1
Morgan Hill and Gilroy	Viaduct to downtown Gilroy (Alternative 1)	37
	Embankment to downtown Gilroy (Alternative 2)	40
	Viaduct to east Gilroy (Alternative 3)	34
	Blended (Alternative 4)	30
Pacheco Pass	Tunnel (Alternatives 1, 2, 3, and 4)	29
San Joaquin Valley	Henry Miller Road (Alternatives 1, 2, 3, and 4)	90
Totals	Alternative 1	161
	Alternative 2	164
	Alternative 3	158
	Alternative 4	152

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because the project extent would use electric train technology and regenerative braking, which would minimize the types and quantities of pollutants generated during operations. Additionally, stormwater treatment BMPs incorporated into the design of the project extent would reduce the concentrations of particulate and dissolved metals as well as PAHs in runoff prior to discharge into surface waterbodies to the maximum extent practicable using the best available technology. Additional project features include the development of an operations and maintenance plan that includes BMPs to reduce pollutants in stormwater and non-stormwater discharges in accordance with the Authority's Phase II MS4 permit. The proposed South or East Gilroy MOWF would be regulated under a SWPPP prepared under the IGP. BMPs would be implemented and runoff would be tested to verify that the MOWF would not constitute a substantial source of additional polluted runoff during storm events. The project would minimize potential impacts on surface water quality during continuous operations and would not violate water quality standards, create a substantial new source of polluted runoff, or otherwise substantially degrade surface water quality. Therefore, CEQA does not require mitigation.

3.8.6.4 Groundwater

Project construction and operations would result in temporary and permanent changes to groundwater quality and volume, including increases in pollutant concentrations in aquifers and changes in the groundwater table elevation. Construction impacts on groundwater would result from tunnel boring and dewatering; the potential presence of undocumented contamination; leaks and spills from construction materials and equipment; the use of water; new impervious surfaces and soil compaction; obstruction of shallow groundwater flow; and the abandonment and relocation of existing groundwater wells. Operations impacts on groundwater would result from the release of brake dust from trains, the use of potentially toxic materials, the consumption of water, and dewatering. Impacts on surface water hydrology and groundwater resulting from the construction and operation of tunnels are discussed in Impact HYD#10, Impact HYD#11, Impact HYD#14, and Impact HYD#15.

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.8.6.2, Surface Water Hydrology. The same planned development and transportation projects would generally result in construction of new impervious surfaces, which would affect groundwater.

Population growth and land use change are anticipated to occur in the RSA by 2040 under the No Project Alternative (ABAG 2016). Population growth would likely affect groundwater quantity, because the demand for drinking water would increase as the population grows. Except for Merced County, drinking water in the RSA is supplied by aquifers in the RSA. As the population increases, groundwater pumping in the Santa Clara, Llagas Area, Bolsa Area, Hollister Area, and Delta-Mendota subbasins would increase to supply local demand. Land use change under the No Project Alternative would result in impacts on groundwater quality. Projections indicate a shift in economic and land use activity toward professional services and health and education under the No Project Alternative, and less in the direct production of goods (ABAG 2016). This shift in land use and economic activity would likely result in the reduced potential for groundwater contamination in the RSA associated with industry and manufacturing.

Furthermore, planned residential and highway development would result in the expansion of impervious surfaces, including residential roads, roofs on structures, widened roads, and extended roads, which would reduce groundwater recharge capacity. A full list of anticipated future development is provided in Volume 2, Appendices 3.19-A, Nontransportation Plans and Projects, and 3.19-B, Transportation Plans and Projects. Roadway widening and extension projects include Coleman Avenue and Autumn Street in San Jose; US 101 and Hale Avenue in Morgan Hill; US 101, SR 152, and Luchessa Avenue in Gilroy; and SR 152, SR 165, Pioneer Road, and Ingomar Grade in Merced County. Interchange modification projects include SR 86, US 101, SR 237, I-280, I-680, and I-880 in San Jose; US 101 in Morgan Hill; US 101 and Las

Animas Avenue in Gilroy; and Volta Road in Merced County. Terminal improvements at Mineta San Jose International Airport, roofs on structures, and parking lots would also result in the creation of impervious surfaces. Some of these impervious surfaces associated with developments in the Monterey Corridor and Morgan Hill and Gilroy Subsections could be placed in groundwater recharge areas in the Santa Clara and Llagas Area subbasins.

These trends of increased population growth and land use change under the No Project Alternative, as well as impervious surfaces from planned development, would affect groundwater in the RSA. Planned development is expected to comply with existing laws, regulations, and agencies that protect groundwater resources, including the Sustainable Groundwater Management Act. Groundwater sustainability plans prepared under or consistent with the Sustainable Groundwater Management Act for the Santa Clara, Llagas, Bolsa, Hollister, and Delta-Mendota subbasins would provide a pathway for sustainable groundwater management by 2040. However, it is expected that overdraft conditions in the Delta-Mendota subbasin would persist after implementation of a groundwater sustainability plan due to intensive agricultural production.

Project Impacts

Construction Impacts

Construction of the project alternatives would include dewatering, the use of water during construction, new impervious surfaces and soil compaction, subsurface structures, and the relocation of public drinking water supply wells. Chapter 2, Alternatives, further describes construction activities. Temporary and permanent impacts on surface water hydrology and groundwater resulting from the construction of tunnels are discussed in Impact HYD#10 and Impact HYD#11.

Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction

Dewatering would be performed for excavations that extend into the groundwater table, including piles, footings, and mass grading, as well as construction activities that are performed within the banks of waterbodies that contain standing or flowing water. The contractor would prepare a SWPPP to comply with the CGP; a construction management plan to control and minimize groundwater inflows; and a spill prevention, control, and countermeasure plan that would require the contractor to control and minimize dewatering, incorporate standard construction site BMPs, coordinate with local utility providers, and comply with regulatory agency dewatering requirements to reduce impacts on groundwater during construction.

Although specific excavation and foundation depths for viaducts, overcrossings, radio communication antennae, and other structures would not be determined until the design phase, the relatively shallow depths of groundwater in the RSA (Table 3.8-10) suggest that dewatering would likely be required in each subsection under all four alternatives and in each groundwater subbasin within the RSA. However, most excavations that may require dewatering would be widely spaced throughout the project corridor and relatively shallow such that dewatering large volumes of groundwater is generally not anticipated. Additionally, the impacts of dewatering would be temporary, because the aquifer would begin to recharge once the specific task requiring dewatering has been completed and the excavation has been backfilled.

Many of the excavations that are anticipated to require dewatering are associated with the piles and pile caps that comprise viaduct structure foundations as well as for grade separations for roadways and pedestrian facilities. Excavations in the San Jose Diridon Station Approach Subsection that may require dewatering include those for the West Hedding Street overpass (Alternative 1) or underpass (Alternatives 2 and 3); the aerial HSR in the San Jose Diridon Station in Alternatives 1, 2, and 3; the Stockton Avenue overpass and Caltrain College Park Station pedestrian underpass in Alternative 1; and a new HSR bridge over I-280 and reconstructed underpasses at Bird and Delmas Avenues in Alternative 4. In the Monterey Corridor and Morgan Hill and Gilroy Subsections, the grade separations required for Alternative 2 may require dewatering to construct four trenches, foundations for two pedestrian bridges, a pedestrian underpass, foundations for five roadway overpasses, and the lowering of approximately 18 local roadways by up to 20 feet. The aerial Downtown Gilroy Station in Alternative 1, two roadway overpasses in Alternative 3, foundations for the South and East Gilroy MOWFs, foundations for radio communication antennae, and new steel lattice towers associated with PG&E network upgrades, and the wildlife undercrossings may also require dewatering in the Morgan Hill and Gilroy Subsection. In the San Joaquin Valley Subsection, foundations for five roadway overpasses may require dewatering.

The Authority will minimize impacts on groundwater quality during all excavations, including tunnels, in accordance with the CGP (HYD-IAMF#3) and the Caltrans *Field Guide to Construction Dewatering* (Caltrans 2014) (GEO-IAMF#10). It is expected that groundwater would become commingled with construction materials or wastes, such as concrete or grout, in Tunnel 1 and Tunnel 2, causing high pH, petroleum hydrocarbons, volatile organic compounds, and sulfides. If this commingled water contains any contaminant in levels that would substantially affect surface water quality if discharged into a waterbody, it would be treated prior to discharge in accordance with the SWPPP, CGP, Caltrans guidance, and other applicable regulatory permits or hauled off site for disposal at a treatment facility. Clean groundwater that meets surface water quality standards may be discharged into a surface waterbody in accordance with the CGP, SWPPP, Caltrans guidance, and any dewatering requirements issued by the SWRCB or RWQCBs. If drilling methods are used during construction, the drilling contractor would remove and dispose of any groundwater encountered along with the drilling slurry.

Project features have been incorporated to minimize impacts on groundwater volume. The contractor will prepare a construction management plan that will address how groundwater inflows will be minimized during tunneling and during all other excavations that may encounter groundwater (GEO-IAMF#1). The Authority would also coordinate with public utility providers, including water retailers and the owners of public water supply wells to avoid or minimize service interruptions. Coordination with utility providers would determine how public drinking water supply wells in the project footprint would be temporarily protected during the construction phase or permanently relocated as described in Impact HYD#9, or alternative means employed to avoid affecting the public water supply through either a degradation in groundwater quality or a lowering of the groundwater table. The excavations and dewatering required to construct the project alternatives may disturb known or undocumented soil or groundwater contamination. In addition, pumping groundwater from the excavations for dewatering would alter hydrogeologic gradients in the immediate vicinity of the excavation, which would cause both known and undocumented sources of subsurface pollution to migrate toward the excavation. Disturbing known or undocumented contamination would result in the movement of contaminated groundwater further into the groundwater table and a potential for inadvertent groundwater contamination. These potential impacts would persist until remedial activities are performed.

The contractor will undertake hazardous materials studies to document the locations of known soil and groundwater contamination prior to any dewatering (HMW-IAMF#1). During construction, the contractor would manage any identified subsurface contamination in the project footprint through the implementation of BMPs. If undocumented subsurface contamination were discovered in the project footprint during construction, construction and dewatering would cease, and remedial actions will be coordinated with the jurisdictional groundwater management agency, the RWQCBs, and other agencies as needed (HMW-IAMF#4). Resolutions may involve conducting a site investigation, implementing remediation activities, and properly disposing of contaminated soil and groundwater. Refer to Section 3.10, Hazardous Materials and Waste, for more information on potential impacts from hazardous materials and subsurface contamination.

The implementation of standard construction site BMPs that manage and control materials and waste, as required by the CGP (HYD-IAMF#3) will avoid or minimize the potential for degrading groundwater quality with accidental leaks and spills of construction-related materials and wastes. These BMPs include water control and conservation; illegal connection and discharge detection and reporting; vehicle and equipment cleaning; vehicle and equipment fueling and maintenance; paving, sealing, saw cutting and grinding operations; thermoplastic striping and pavement markers; concrete curing and concrete finishing; spill prevention and control; materials management; stockpile management; waste management; hazardous waste management; contaminated soil; concrete waste; sanitary and septic waste; and liquid waste.

The construction contractor will also implement measures specified in the spill prevention, control, and countermeasure plan to control and minimize potential groundwater contamination from spills of hazardous materials during construction (HMW-IAMF#6). The construction contractor will minimize the number and volume of hazardous substances at the construction site by using an environmental management system to replace hazardous materials with nonhazardous alternatives (HMW-IAMF#9). If hazardous materials are required for construction, the construction contractor will prepare a hazardous materials and waste plan for Authority review and approval that describes responsible parties and procedures for hazardous waste and the transport of hazardous materials on public roadways (HMW-IAMF#7).

The discussion above and in Impact HYD#4 addresses potential impacts of tunnel construction on surface water quality and any potential impacts on groundwater quality due to discharge of tunnel inflows to surface water bodies; in addition HYD-IAMF#5 requires collection and pre-treatment of any discharge of tunnel inflow water to surface water bodies as necessary to maintain baseline water quality. As described in HYD-IAMF#5, one potential method of managing tunnel construction effects on groundwater volume and levels may include reinjection of collected tunnel inflows back into local groundwater aquifers. As noted above, tunnel inflows may become mixed with construction materials such as concrete and grout and thus will require collection and pre-treatment prior to any discharge into groundwater per the requirements of HYD-IAMF#5.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives related to activities other than tunneling because construction of the project alternatives would not substantially degrade ground water quality, substantially decrease groundwater supplies, substantially interfere with groundwater recharge, or conflict with implementation of a Basin Plan or Groundwater Sustainability Plan. Actions would be taken prior to and during construction to investigate geologic conditions, coordinate with utility providers, perform hazardous waste studies, control discharges of groundwater, and minimize leaks and spills that could affect groundwater quality. These actions would avoid substantial impacts on groundwater quality and volume.

The impact under CEQA would be less than significant for all four alternatives related to groundwater quality and tunneling because tunnel inflow water will be treated prior to any potential injection back into groundwater aquifers per the requirements of HYD-IAMF#5. Potential impacts of tunnel construction relative to groundwater volume is addressed separately in Impact HYD#10.

Therefore, CEQA does not require mitigation.

Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume during Construction

Construction of new impervious surfaces would be necessary under all four alternatives. The project would include the development and implementation of a stormwater management and treatment plan and the Authority would conduct a WEAP training session for on-site maintenance employees. BMPs and the use of techniques such as longitudinal earthen drainage ditches would facilitate the infiltration of runoff. Permanent construction impacts on surface water hydrology and groundwater resulting from the construction of tunnels are discussed in Impact HYD#11.

Project construction would result in permanent construction impacts on groundwater quality and quantity. Construction of new impervious surfaces, including access easements and roads, systems sites such as automatic train control sites, communication radio antennae, and traction power facilities, stations, maintenance facilities, local roadways, utility relocations, and aerial viaduct structures, is a component of each of the project alternatives. Some of these impervious surfaces would be placed on existing pervious surfaces that allow stormwater to infiltrate into the groundwater table. Thus, when new impervious surfaces are placed on soil the capacity for groundwater recharge is reduced. However, some impervious surface improvements would consist of reconstructing existing impervious surfaces in the same footprint; these replaced impervious surfaces would not affect groundwater recharge because there would be no change from the existing condition. Impacts on groundwater recharge from new impervious surfaces would occur under each of the project alternatives, but the impacts of each alternative would vary according to the area of new impervious surface constructed.

Portions of the project alternatives would be in areas designated for groundwater recharge by the SCVWD in the Santa Clara and Llagas Area subbasins. These designated recharge zones contain coarse alluvial soils that facilitate rapid infiltration of surface water and runoff into the subsurface. In addition, these areas have unconfined aquifers that do not contain aquitards; an aquitard restricts the vertical movement of water into the deeper aquifers that supply drinking water. Therefore, the project's impacts on groundwater recharge from impervious surfaces and soil compaction would be the greatest in these areas. Impervious surfaces would be constructed in designated groundwater recharge zones under each of the four alternatives, but the acreage of impervious surface in recharge zones would vary by alternative. Table 3.8-23 shows estimates of the area of new and replaced impervious surfaces that would be constructed in each groundwater subbasin and the designated recharge zones in the Santa Clara and Llagas Area subbasins by alternative and subsection. As shown in Table 3.8-23, Alternative 2 would result in the largest area of impervious surface improvements in groundwater subbasins and designated recharge zones, followed by Alternatives 1, 3, and 4. The proposed impervious surfaces under each of the project alternatives would occupy less than 1 percent of the designated recharge zones in the Santa Clara and Llagas Area subbasins.

Each alternative would have impacts on managed groundwater recharge facilities. SCVWD uses the coarse substrate of the Coyote Creek channel to recharge groundwater levels within the Santa Clara subbasin, and uses Madrone Channel, the Church Avenue percolation ponds, and Llagas Creek (upstream of the Church Avenue percolation ponds) to recharge groundwater levels within the Llagas Area subbasin. Alternatives 1 and 3 would require filling a portion of Coyote Creek Palustrine Forested Wetlands in order to modify the Metcalf Road bridge and realign Monterey Road; Alternatives 2 and 4 would have no permanent impacts on Coyote Creek and adjacent wetlands at this location. Bridge modifications and associated expansion of impervious surfaces would slightly reduce precipitation quantities that fall into Coyote Creek under Alternatives 1, 2, and 3, and wetland impacts under Alternatives 1 and 3 could potentially result in net reductions in groundwater recharge capacity along Coyote Creek; however, the impact of these alternatives on groundwater recharge along Coyote Creek would be negligible. Alternatives 1 and 3 would build utility crossings over Madrone Channel, but these improvements would not affect groundwater recharge within the channel; Alternatives 2 and 4 would have no impact on Madrone Channel. The Church Avenue percolation ponds would not be affected by any of the project alternatives. However, all four alternatives would affect Llagas Creek through either construction of new bridges or modification of existing bridges, which could increase impervious surface cover over the creek and reduce precipitation totals that fall into the channel. These impacts are expected to be minor and negligible, because the project would not impede sustainable management of groundwater or change percolation capacity within, upstream, or downstream from the project footprint.

Alternatives 1, 2, and 4 would pass by the SCWRA Wastewater Treatment Plant south of Gilroy. Large ponds at this facility, referred to as the Gilroy Wastewater Treatment Ponds (Figure 3.8-9), provide permitted discharge locations for the SCWRA Wastewater Treatment Plant. These ponds allow secondary treated effluent to percolate into the groundwater table, but they overlie a confining layer and do not recharge deeper aquifers that provide drinking water supplies. These ponds are shallow earthen diked ponds, about 5 to 8 feet deep (berm height) with sloped sides and unpaved service roads extending between them. Construction of the MOWF under Alternatives 1 and 2 would require acquiring and closing three of these percolation ponds, totaling 51 acres, reducing treatment capacity at the SCWRA Wastewater Treatment Plant. The SCWRA Wastewater Treatment Plant generates recycled water suitable for agricultural, irrigation, and industrial uses in an area where groundwater is the primary source of water. Thus, a reduction in the treatment capacity of the plant could potentially reduce the availability of recycled water, resulting in increased groundwater pumping in the Llagas Area groundwater subbasin. Alternative

3 would have no impact on these ponds. Refer to Section 3.6, Public Utilities and Energy, for more information regarding impacts on the SCRWA Wastewater Treatment Plant.

Table 3.8-23 Estimates of Impervious Surfaces Constructed in Groundwater Subbasins

Groundwater Subbasin	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
San Jose Diridon Station Approach				
Santa Clara	103.1 acres (<1% of subbasin)	123.7 acres (<1% of subbasin)	123.7 acres (<1% of subbasin)	34.2 acres (<1% of subbasin)
Monterey Corridor				
Santa Clara	195.8 acres (<1% of subbasin) 183.9 acres in recharge zone (<1% of recharge zone)	182.7 acres (<1% of subbasin) 175.8 acres in recharge zone (<1% of recharge zone)	195.7 acres (<1% of subbasin) 183.9 acres in recharge zone (<1% of recharge zone)	18.5 acres (<1% of subbasin) 17.6 acres in recharge zone (<1% of recharge zone)
Morgan Hill and Gilroy				
Santa Clara	130.3 acres (<1% of subbasin) 130.1 acres in recharge zone (<1% of recharge zone)	206.1 acres (<1% of subbasin) 205.5 acres in recharge zone (<1% of recharge zone)	Same as Alternative 1	18.7 acres (<1% of subbasin) 18.7 acres in recharge zone (<1% of recharge zone)
Llagas Area	365.8 acres (<1% of subbasin) 158.8 acres in recharge zone (<1% of recharge zone)	513.2 acres (1% of subbasin) 283.4 acres in recharge zone (<1% of recharge zone)	287.3 acres (<1% of subbasin) 83.1 acres in recharge zone (<1% of recharge zone)	232.7 acres (<1% of subbasin) 111.6 acres in recharge zone (<1% of recharge zone)
North San Benito	144.7 acres (<1% of subbasin)	Same as Alternative 1	141.1 acres (<1% of subbasin)	135.5 acres (<1% of subbasin)
Pacheco Pass				
North San Benito	43.2 acres (<1% of subbasin)	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Delta-Mendota	51.1 acres (<1% of subbasin)	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
San Joaquin Valley				
Delta-Mendota	269.0 acres (<1% of subbasin)	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1

Sources: DWR 2020; Authority 2019a

New impervious surfaces would also affect groundwater quality. Impervious surfaces collect pollutants, such as sediment, oil and grease, hydrocarbons (e.g., fuels, solvents), heavy metals, organic fertilizers and pesticides, pathogens, nutrients, and debris. These pollutants would flow from impervious surfaces and percolate into the groundwater table. Impacts on groundwater quality would be more severe in designated groundwater recharge zones than other portions of the subbasin; however, as stated above, the total area of impervious surfaces that would be built in recharge zones is minimal compared to the overall groundwater recharge zones. Impacts on groundwater quality from new impervious surfaces would occur under all four project alternatives.

The stormwater management and treatment plan will include permanent stormwater BMPs that manage runoff from new and reconstructed impervious surfaces in the project extent (HYD-IAMF#1). BMPs would include LID measures that promote the use of pervious surfaces and treatment facilities that use infiltration and retention to improve runoff quality, providing opportunities for groundwater recharge in the proposed drainage design. In the Llagas Area, Bolsa Area, and Hollister Area subbasins, the BMPs would be sized for the 95th percentile 24-hour storm to allow stormwater runoff from the Authority right-of-way to infiltrate into the groundwater table, according to the Central Coast RWQCB Phase II MS4 post-construction stormwater requirements (Central Coast RWQCB 2013). In the right-of-way in the San Francisco and Central Valley RWQCBs' jurisdiction, BMPs would be designed to retain or infiltrate runoff from the 85th percentile 24-hour storm. An alternative permanent BMP would be built according to the local MS4 permit requirements. A stormwater management and treatment plan that complies with the Phase II MS4 permit would maintain pre-project hydrology, including groundwater recharge processes.

Although impervious surfaces and soil compaction would reduce the capacity for groundwater recharge, stormwater BMPs include measures that would minimize impacts on groundwater recharge. BMPs would be implemented in areas below viaduct sections as well as landscape areas along access roads, parking lots, maintenance facilities, and grade-separated roadways. Additionally, longitudinal earthen drainage ditches along at-grade and embankment profiles would provide additional opportunities for groundwater recharge. Although the location of groundwater recharge may change because of the project, impacts on groundwater recharge under any of the alternatives would be minimal and would not create a substantial change in the groundwater table elevation.

The project would require the construction of subsurface structures that would permanently obstruct or impede groundwater flow or would be susceptible to groundwater inflows under all four alternatives. Impeded groundwater flow could create localized areas with higher groundwater levels on the upgradient side of the structure. Subsurface structures that would be constructed as part of the project alternatives would include railbed trench sections near tunnel portals as well as railbed trenches in Alternative 2 that would cross below Capitol Expressway, Senter Road, Luchessa Avenue, and US 101; grade separations that include roadway undercrossings, such as the lowering of approximately 18 local roadways by up to 20 feet in the Morgan Hill and Gilroy Subsection under Alternative 2; foundations for viaducts, structures at stations, utilities, and MOWFs; retaining walls; and utility vaults.

The proposed subsurface installations mentioned above (i.e., not tunnels) are relatively conventional structures that would generally not require very deep or large subsurface installations. Of these structures, viaduct foundations are expected to be among the deepest, and these aerial structures would consist of piles and pile caps. The piles supporting the viaducts would be columnar and relatively narrow in cross section, and they would not provide a large horizontal impediment to groundwater flows. Foundations for structures, including the MOWF and buildings at stations, are expected to be among the largest in area. However, these foundations would be relatively shallow, and they are not expected to extend very far, if at all, into the groundwater table. Additionally, the railbed trenches under Alternative 2 required to cross below existing roadways would be oriented roughly parallel to the overall direction of groundwater flow within the Santa Clara and Llagas Area subbasins, and they would therefore not act as a large barrier to shallow groundwater flows. In general, trenches would be designed to be resistant to groundwater inflows based on the results of the geotechnical investigation. The quantity and rate of groundwater inflows into these trenches and other subsurface structures would be based on the waterproofing product manufacturer's specifications. However, for trenches, depressed roadways, retaining walls, and other structures that are located within the groundwater table, high groundwater levels may cause high horizontal pressures on these structures, and drainage systems may be used to lower groundwater levels and reduce pressures. These drainage systems would minimize localized increases in groundwater levels associated with impeded groundwater flow. Additionally, these drainage systems would affect the uppermost portion of the groundwater table, and therefore the drainage systems would not affect the productivity of nearby wells.

Additionally, subsurface structures constructed for the project near existing groundwater cleanups conducted by others that involve in situ or pump-and-treat operations have the potential to affect the cleanup operation. These impacts would occur by altering hydrogeologic gradients and flow rates near the subsurface structure, potentially affecting groundwater levels, subsurface flow dynamics, and the duration or effectiveness of existing remedial activities. Impacts from shallow subsurface structures are anticipated to be minimal because groundwater would continue to flow around the structures. The proposed tunnels would be designed to be as watertight as possible to minimize inflows of groundwater. However, small changes in groundwater elevation would likely occur near shallow subsurface structures. Prior to construction, the Authority would consult with local groundwater management agencies to obtain a well permit for excavations that would affect groundwater and with the RWQCBs to obtain a dewatering permit. Local groundwater management agencies and the RWQCBs would review the project design plans to determine whether the project would affect the groundwater basin, existing remedial operations, and downstream water resources. Refer to Section 3.9, CEQA Significance Conclusions, for project impacts on groundwater remediation sites.

All four alternatives would require the protection of public drinking water supply wells during construction, as described in Impact HYD#8, and potentially the relocation of public drinking water supply wells. Existing wells in the HSR track alignment, such as below a viaduct or embankment, and other permanent impact areas, such as below realigned Monterey Road, would likely be abandoned and relocated nearby. Table 3.8-24 shows the existing public drinking water supply wells in the footprint of each alternative and subsection and the project's requirements to protect or relocate these wells in coordination with the owner. As shown in Table 3.8-24, there are no public drinking water supply wells in the San Jose Diridon Station Approach or Pacheco Pass Subsections and only one in the San Joaquin Valley Subsection. However, there are public drinking water supply wells in the Monterey Corridor and Morgan Hill and Gilroy Subsections, where groundwater is the primary source of the municipal water supply. Therefore, coordination among the Authority, SCVWD, Morgan Hill, Gilroy, and water suppliers would be paramount to avoiding permanent impacts on public water supplies. All privately owned wells located within the permanent HSR right-of-way would be replaced before the existing well is abandoned, and the Authority would pay for the replacement of these privately owned wells.

Table 3.8-24 Public Drinking Water Supply Wells in the Project Footprint (Well Identification Numbers)

Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Jose Diridon Station Approach			
No wells in the project footprint	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Monterey Corridor			
4310016-002	4310016-002 4300791-002 4300791-007 4310022-006 4310022-015	Same as Alternative 1	4300791-002 4300791-007

Alternative 1	Alternative 2	Alternative 3	Alternative 4
Morgan Hill and Gilroy			
4310006-005 4300609-002	4310006-007 4310006-043 4300621-001 4300621-002 4300604-001 4310004-001	4310006-005 4300604-001 4300609-002	4310006-043 4310020-011 4310020-012 4310020-013 4300604-001 4300609-002 4300581-001 4300990-001 4300990-002
Pacheco Pass			
No wells in the project footprint	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
San Joaquin Valley			
2400108-001	Same as Alternative 1	Same as Alternative 1	Same as Alternative 1
Total Number of Public Drinking Supply Wells			
4	12	5	12

Source: Authority 2019a; SWRCB 2016; City of Morgan Hill 2020: Attachment F, page 2

Prior to construction, the contractor will prepare a technical memorandum describing how construction activities will be coordinated with public utility providers, such as drinking water suppliers, to avoid or minimize service interruptions (PUE-IAMF#4). The Authority would consult with affected water suppliers to relocate existing public drinking water wells. The relocation of existing wells would not further deplete groundwater supplies through additional groundwater pumping or substantially change the water level in neighboring wells, because the replacement wells would be located in the same vicinity as the original wells and would pump at approximately the same rate and depth as the existing wells. The Authority would perform hydraulic studies to determine the location of new wells such that operation of the new wells would not create secondary impacts on other wells in the vicinity. Permanent impacts on privately owned wells would affect property use and value. See Section 3.6, Public Utilities and Energy, for more information on impacts on public water utility infrastructure.

CEQA Conclusion

The impact under CEQA would be less than significant for each of the four project alternatives because construction of the project would not substantially degrade groundwater quality, substantially interfere with groundwater supplies or recharge, or impede sustainable groundwater management. Proposed impervious surfaces would not substantially interfere with groundwater recharge, and subsurface structures would not substantially impede shallow groundwater flow. Stormwater BMPs and longitudinal earthen ditches would provide opportunities for runoff from impervious surfaces to infiltrate into the groundwater table. The Authority would coordinate with public drinking water supply agencies to relocate existing wells and conduct studies to avoid or minimize impacts on adjacent wells. These project actions would minimize impacts on groundwater quality and volume. Therefore, CEQA does not require mitigation.

Impact HYD#10: Temporary Impacts on Groundwater and Surface Water Hydrology during Tunnel Construction

This analysis considers hydrologic effects from tunnel construction; refer to Section 3.7 regarding the analysis of potential effects on biological resources associated with tunnel construction.

All four project alternatives include construction of the same two tunnels: Tunnel 1 in the Morgan Hill and Gilroy Subsection and Tunnel 2 in the Pacheco Pass Subsection. Tunneling would provide a conduit for groundwater to seep into the excavation as the advancing tunnel intersects subsurface fractures and faults that contain water. Where groundwater is present in the subsurface, groundwater is expected to leak from the rock mass into the tunnels through the cutterhead of the tunnel boring machine (TBM), conventionally mined tunnel walls, or first pass tunnel lining segments. In such cases, groundwater inflows or seepage may temporarily affect the hydrology of seeps, springs, water supply wells, creeks, streams, and other waterbodies. Effects associated with changes in groundwater contribution to hydrology include both the potential for a localized reduction in well productivity and spring and seep flows, resulting in partial or complete degradation of aquatic habitat, and the potential for aggregated downstream changes to habitats. Modifications to seep and spring flow could affect downstream or downslope receiving streams and aquifers by reducing groundwater infiltration and altering flow levels as well as the extent and quality of aquatic habitats that support fish, wildlife, and plant species. A localized lowering of the groundwater table could occur as water seeps into the tunnel, and this effect is expected to persist until the aquifers naturally refill with rainfall. Hydrology effects associated with tunneling could occur simultaneously with inflows into the tunnel, or they could begin weeks to months after the advancing tunnel excavation has passed near the well, seep, spring, or waterbody, depending on subsurface rock permeability. Based on information gained from tunneling projects conducted by others, including the New Irvington Tunnel and the Arrowhead Tunnel (SFPUC 2009; Berg 2012), any such effects are expected to persist for months to several years following completion of tunneling and installation of the watertight tunnel liner.

Several sources of information have been developed to support the environmental process and guide the design of the proposed tunnels, including preliminary groundwater monitoring (ENGEO 2018), plans and profiles of the tunnels in relation to geologic units (Authority 2019e), conceptual tunnel design reports (Authority 2011, 2017a, 2017b), and technical design memoranda (Authority 2010a, 2010b). These documents summarize groundwater inflow rates and durations that were observed during construction of several nearby tunnels; describe the geologic units that the tunnels would pass through; provide professional judgments of potential groundwater inflow conditions along both tunnels; and describe specifications guiding the design of tunnels, performance criteria for long-term waterproofing and permeability, and operational requirements. In addition, the analysis has been informed by review of the experience of construction of several other lengthy tunnels in California, which are described further in subsequent sections of this narrative.

While the available information is adequate to conclude that effects of tunnel construction on groundwater and surface water flows are reasonably foreseeable, the Authority has determined that the information needed to fully and comprehensively identify the specific effects on groundwater and surface water hydrology is incomplete or unavailable. Therefore, the following analysis complies with the requirements described in 40 C.F.R. Section 1502.22 concerning NEPA analysis when information is incomplete or unavailable. In accordance with this regulation, the following narrative is organized as follows:

- Statement of incomplete or unavailable information regarding tunneling effects
- Relevance of incomplete or unavailable information to evaluating tunneling effects
- Existing information relevant to evaluating tunneling effects
- Effect evaluation following theoretical approaches

Statement of Incomplete or Unavailable Information Regarding Tunneling Effects

Despite the preliminary assessments of subsurface conditions along the proposed tunnel alignments that have been conducted to date and the information derived from construction of other tunnels in the Pacheco Pass area and California, many aspects of the groundwater conditions that would be encountered during tunnel construction have been only partially defined.

The current data gaps surrounding bedrock, groundwater, soil, and surface hydrology conditions present in the vicinity of the proposed tunnels include the following:

- Aquifer conditions, including boundaries, groundwater and hydrostatic pressures, annual and interannual variation of groundwater conditions, responses to rainfall, anisotropic conductivity, specific yield of unconfined layers, specific storage of confined layers, fault and fracture zone features, hydrologic connectivity with surface water resources and overlying alluvial aquifers, and groundwater chemistry.
- Existing hydrology information, including average productivity of existing groundwater wells, seeps, and springs, including annual and interannual variation in productivity; locations of privately-owned groundwater wells; metrics describing average, peak, and low-flow conditions of streams and creeks; and hydroperiods of wetlands.
- Geologic conditions, including spatial distribution of rock formations; rock structure types (e.g., bedding, joints, shears); rock orientation (i.e., strike and dip); extent and intensity of fractures and shear zones; and characteristics of the Ortigalita fault zone, including lengths, widths, depths, and alignment of the fault zone in the subsurface.

The following data are planned to be collected during geotechnical investigations along the proposed tunnel alignments during the design phase once the Authority gains access to privately owned property overlying the proposed tunnel alignments (Authority 2019e):

- Laboratory testing to ascertain general engineering properties of rock and soil in the subsurface would include the following: moisture content and dry density; grain size distribution; plasticity index; unconfined compressive strength; proctor/compaction; r-value; point load tests; direct shear; indirect (Brazilian) tensile strength; Schmidt hammer hardness; punch penetration tests; static elastic constants; corrosion tests (pH, resistivity, sulfate, chloride, redox potential); mineralogic and petrographic evaluations on thin sections; slake durability test; and CERCHAR abrasivity index.
- In-situ testing and instrumentation would be performed to identify the following: rock permeability and in-situ stress with packer tests; groundwater pressures with piezometers; landslide movement with inclinometers; and presence of subsurface vapors with gas wells.

Much of the land overlying the proposed tunnels is privately owned, and these areas were inaccessible for field surveys and preliminary investigations into hydrologic and groundwater conditions during preparation of this environmental document. The Authority attempted to gain access to these areas to investigate these conditions during the environmental phase of the project, but the property owners did not grant permission to enter. At this time, the only avenue through which the Authority could gain access to these properties would be to acquire them through eminent domain. The process to exercise eminent domain is lengthy and would result in a delay to complete the NEPA/CEQA process.

Even assuming the Authority received permission to enter privately owned property overlying the tunnel for the purposes of obtaining the incomplete or unavailable information without going through eminent domain, and these investigations are performed as part of the environmental phase prior to completing the NEPA/CEQA process, it would result in a delay of the entire project of approximately 3 years. Such delays would result in substantial cost increases in terms of both construction costs due to escalation as well as costs associated with delayed operation of HSR service within the project extent. The Authority considers the cost of $1.95 billion for a 3 year delay to be an exorbitant cost (Authority 2020).

Relevance of Incomplete/Unavailable Information to Evaluating Tunneling Effects

Understanding the potential groundwater conditions that may be encountered by a proposed tunnel is essential so that tunnel structures are designed and constructed to meet operational requirements, to protect worker safety, and to avoid and minimize project effects on groundwater and related surface water resources. For example, pumping requirements and groundwater control measures such as grouting and tunnel lining systems, are commonly based on predicted groundwater inflow rates, durations, and pressures. As described previously, more complete information can only be obtained once the Authority gains access to the privately-owned properties overlying the proposed tunnel alignments, allowing a detailed subsurface investigation to be conducted and obtain this information.

Evaluating the existing hydrologic conditions of surface water resources overlying the tunnel alignments is essential to understanding the connections between groundwater and surface water flows, surface water hydroperiod, and daily, seasonal, and interannual variations in hydrologic conditions due to precipitation, temperature, and other variables. Only through complete field investigations to develop the necessary understanding can the potential effect of tunneling on specific water resources be accurately evaluated. As with conducting a detailed subsurface investigation, a complete field investigation into the surface water resources overlying the proposed tunnel alignments to gain relevant hydrologic information can only be conducted once the Authority gains access to the privately-owned properties overlying the proposed tunnel alignments.

Predictive groundwater modeling methods can be used to estimate potential groundwater conditions that may be encountered by a proposed tunnel. These analytical methods can also be utilized to evaluate potential hydrological effects of tunnel construction on the local groundwater system, including defining the approximate extent, duration, and intensity of groundwater and surface water effects as well as post-construction recovery of these resources. However, predictive modeling methods can only be used to evaluate these conditions and effects if adequate input data, including site-specific geotechnical and hydrologic data collected by subsurface investigations, in situ monitoring, and field investigations, are available. In the absence of these data, these predictive modeling methods cannot be employed. Therefore, predictive groundwater modeling methods cannot be used to evaluate potential effects associated with the proposed HSR tunnels at this time.

Lacking the detailed subsurface and field investigations into existing geologic and hydrologic conditions overlying the proposed tunnels, the data needed to fully estimate the extent, intensity, and duration of tunneling effects on groundwater and surface water hydrology conditions are not available. Accordingly, the following narrative and analysis relies on existing data for the tunnel alignments, prior tunneling experience in the Pacheco Pass and elsewhere, and a relative risk assessment of areas of greater or lesser potential effects on groundwater and surface water resources.

Existing Information from Prior Tunnel Construction

As stated previously, data generated by several other tunnels in California were reviewed to identify existing information that is relevant to evaluating foreseeable adverse effects related to tunneling as well as to inform a theoretical analysis of potential tunneling effects on groundwater and surface water resources. These tunnels are referenced in the following narrative, and they include:

- Three tunnels referred to as the Central Valley Project tunnels, which were constructed by the U.S. Department of the Interior, Bureau of Reclamation as part of water conveyance system to deliver water from San Luis Reservoir to Santa Clara and San Benito Counties. These three tunnels consist of the Santa Clara Tunnel, Pacheco Tunnel Reach 1, and Pacheco Tunnel Reach 2. Data generated by the construction of these tunnels are relevant to the project alternatives, because these tunnels are in close proximity to and within the same geologic units as the proposed tunnels.
- The existing Irvington Tunnel and the New Irvington Tunnel, which were constructed by the San Francisco Public Utilities Commission (SFPUC) to convey water from the Hetch-Hetchy Reservoir between the Sunol Valley and city of Fremont in Alameda County. These tunnels pass through some of several geologic units expected to be encountered by the proposed tunnels. Monitoring was performed during construction of the New Irvington Tunnel to identify and remedy observed groundwater and surface water effects.
- The Arrowhead Tunnels were constructed by the Metropolitan Water District of Southern California as part of a regional water transmission facility in San Bernardino County known as the Inland Feeder Project. Monitoring was performed during and after construction to identify and remedy observed groundwater and surface water effects.

Table 3.8-25 shows the groundwater conditions experienced during construction of the Central Valley Project tunnels by geologic unit. Similar groundwater conditions are expected to be encountered during construction of the proposed HSR Tunnels 1 and 2 based on the specific geology of each tunnel alignment.

Table 3.8-25 Groundwater Conditions Observed during Construction of Central Valley Project Tunnels by Geologic Unit

Geologic Unit	Groundwater Conditions
Great Valley Sequence (Panoche Formation)	Mostly dry to moist conditions, with local higher heading flush flows of less than 100 gallons per minute. High groundwater inflows are expected at sheared zones or intensely fractured rocks with open joints.
Franciscan mélange	Mostly dry to moist conditions, with local high heading flush flows of up to 200 gallons per minute. Groundwater heads of up to 500 feet may be encountered during tunneling in sheared zones or intensely fractured rock with open joints, resulting in temporary inflows of more than 200 gallons per minute.
Cleaved metagraywacke	Mostly dry to moist conditions, with local high heading flows up to 100 gallons per minute. High groundwater inflows are expected at sheared zones or intensely fractured rocks with open joints.
Uncleaved metagraywacke	It is anticipated that this unit has geologic characteristics like those of cleaved metagraywacke.

Source: Authority 2011

Beyond the Central Valley Project tunnels that were constructed near the proposed HSR tunnels, the Irvington Tunnels constructed by SFPUC and Arrowhead Tunnels constructed by the Metropolitan Water District of Southern California provide additional insights into how the project alternatives may affect groundwater and surface water resources in the RSA. Although these tunnels are not expected to have geologic and hydrologic conditions that are substantially like the proposed tunnels, these insights help to partially define the extent and duration of effects related to tunneling.

The Irvington Tunnels were constructed east of the San Francisco Bay between the Sunol Valley and city of Fremont in Alameda County. The original Irvington Tunnel was constructed between 1928 and 1932 using conventional mining methods (Tsztoo no date). Groundwater inflows of up to 1,200 gallons per minute were observed (Rush 2013), which is substantially more than the inflows of up to 200 gallons per minute expected in the proposed HSR tunnels. More than 20 springs were reported to have reduced flow rates during the original Irvington Tunnel construction (SFPUC 2009). Most of these affected springs were within 3,000 feet of the tunnel, though springs as far as 5,000 feet experienced flow reductions (SFPUC 2009). Historic data indicate that water levels in wells dropped about 4 to 10 feet during original Irvington Tunnel construction (SFPUC 2009) while some reports indicate that some wells were completely depleted (Rush 2013). Data regarding post-construction groundwater recovery are limited; however, at least partial recovery is presumed to have occurred as indicated by field surveys conducted in the mid-2000s that observed flowing springs in the affected areas (SFPUC 2009).

SFPUC recently constructed a new tunnel, called the New Irvington Tunnel, parallel to the original Irvington tunnel, between 2010 and 2015. The New Irvington Tunnel is approximately 3.5-miles long with an internal diameter of 8.5 feet (Tsztoo no date). Approximately 20 percent of the overall length of the New Irvington Tunnel passed through the Great Valley Sequence, but it did not encounter Franciscan mélange (SFPUC 2009); accordingly, much of the geology of these tunnels differs from what is expected to be encountered by the proposed HSR project tunnels. However, the New Irvington Tunnel passes through faulted, fractures, and folded areas that contain springs, seeps, and wells (SFPUC 2009). Consequently, the data gained from construction and monitoring of these tunnels provides some context for the anticipated effects of the proposed HSR tunnels which also cross through faulted, fractured and folded areas containing springs, seeps, and wells.

Predictive groundwater modeling for the New Irvington Tunnel was conducted during the environmental phase of the project to identify the potential extent and intensity of changes to the groundwater level. This was possible because the SFPUC owns a portion of the land overlying the proposed tunnels, local landowners willingly provided access to most of the study area, and thus access to conduct detailed subsurface investigations was not an issue. The model predicted that groundwater levels could decrease within approximately 2,800 feet of the tunnel; groundwater levels could drop by more than 200 feet in localized areas; and up to 33 wells would be affected by a reduction in the groundwater table. The model also predicted that these groundwater effects would be naturally ameliorated within 5 years and groundwater conditions within annual variation would be restored within 20 years. Additionally, the model predicted that the greatest extent and intensity of groundwater effects would occur along fault zones, which contain extensive fractures and shear zones with higher rates of water transmission and the capacity to store relatively larger quantities of water. (SFPUC 2009)

The predictive groundwater model identified an area known as the Sheridan Valley as an area with a high potential for substantial groundwater inflow rates and resulting groundwater depletion. To address constructability issues in this area, the subsurface of the valley was intentionally dewatered to minimize inflow rates into the advancing tunnel excavation. Because the water supply of Sheridan Valley is exclusively derived from groundwater, this intentional dewatering resulted in a disruption of the local water supply via the depletion of water supply wells as well as a spring that supplied water to a nearby pond. This effect on the water supply required the development and implementation of mitigation to remedy disruptions in the local water supply (Rush 2013).

Like the original Irvington Tunnel, the New Irvington Tunnel was constructed with conventional mining methods including roadheaders and controlled detonation where hard rock could not be excavated by the roadheaders. TBMs were not used due to the high potential to become stuck as it passed through areas of intense ground squeezing at seven fault zones. During construction of the New Irvington Tunnel, a pre-excavation grouting program composed of probe drilling and grout injection was used as a groundwater cutoff measure to minimize groundwater inflow into the advancing excavation in addition to intentional dewatering of Sheridan Valley (Rush 2013). In total, approximately 7.8 million pounds of grout was injected into the tunnel to control groundwater inflows as part of the pre-excavation grouting program (Tsztoo no date). Groundwater inflows of more than 300 gallons per minute were documented in the 2-inch probe holes, fault zones, and shear zones (Rush 2013). Based on the 1,200 gallons per minute of inflow observed during construction of the original Irvington Tunnel, it is likely that the pre-excavation grouting program reduced potential inflows by approximately 900 gallons per minute. The inflow rate of 300 gallons per minute exceeds the maximum expected groundwater inflow rate of approximately 200 gallons per minute that is expected to be encountered by the proposed HSR tunnels. While the predictive groundwater model estimated that 33 wells could be affected by tunneling, only approximately half of these wells were affected by the project (Rush 2013). Construction monitoring indicated effects occurred to wells and springs up to approximately 2,800 feet of the tunnel alignment.

Mitigation was incorporated into the New Irvington Tunnel project to proactively manage groundwater effects during and after construction of the tunnel. Mitigation included predictive groundwater modeling to identify likely areas of groundwater reduction as well as the development and implementation of a groundwater management plan to address any effects on the water supply. The predictive groundwater model allowed the SFPUC to plan for the provision of supplemental water to address expected shortages of groundwater within water supply wells. The management plan in conjunction with the predictive groundwater model allowed the SFPUC to work with potentially affected property owners and water users ahead of and during construction to keep them informed and to correct expected groundwater loss due to tunnel construction throughout the duration of the project. Specific mitigation actions implemented during tunneling included modifications and upgrades to existing well pump systems, installation of new water tanks to make up for expected water supply shortages, commercial water truck deliveries to fill water tanks, and installation of 2.5-mile-long water supply system for affected residents, which resulted in substantial financial savings associated with reduced frequency of commercial water truck deliveries. (Tsztoo no date)

The Metropolitan Water District of Los Angeles constructed the Arrowhead Tunnels near the San Bernardino Mountains in southern California as part of a regional water transmission facility referred to as the Inland Feeder project. As part of the tunnel mitigation program, effects on surface hydrology were monitored during and after tunneling. Approximately 75 locations were monitored for surface water flows during and after construction, and hydrologic effects were registered at 18 locations because of tunneling. Hydrologic effects were observed out to 1.1 mile from the tunnel alignments, with many of the effects occurring within approximately 0.5 mile of the tunnels. Mitigation, as supplemental water applied to surface waterbodies, was routinely applied for several years during and after construction. The temporary water supply facilities utilized to deliver this water consisted of six storage tanks, several miles of conveyance pipes, and pumps to transmit the water over the sloping terrain. Just over 57 million gallons of supplemental water was applied to surface waterbodies to compensate reduced natural flows attributable to tunneling; this quantity of supplemental water is only approximately 4% of the total quantity of groundwater that flowed into the tunnel excavation, yet the supplemental water effectively compensated for much of the flow reductions. The observed duration of the effects varied, with the longest temporary effects persisting for up to 5 years after the tunnels were watertight. (Berg 2012)

Existing Information Relevant to Pacheco Pass Project Tunneling Effects

The proposed HSR tunnels would pass through Franciscan Assemblage and Great Valley Sequence (Panoche Formation) rocks (Authority 2017b, 2019f). The proposed tunnels would not pass through alluvial deposits along Pacheco Creek (Authority 2017b), which comprise a portion of the Hollister Area groundwater subbasin (DWR 2004d), or alluvium along any other creeks, streams, or waterbodies (Authority 2017b, 2019f). Although the tunnels are not expected to pass through any alluvial aquifers (Authority 2017b 2019f), Franciscan Assemblage and Great Valley Sequence rocks in the Pacheco Pass area are known to contain groundwater in fractures, shear zones, and faults (Authority 2011, 2017b; ENGEO 2018). Additionally, relatively thin deposits of unconsolidated sediment with perched water tables may overlie these bedrock formations, and these sediments would be encountered only at the tunnel portals.

Tunnel 1 would be approximately 1.5 miles long with a maximum depth of 700 feet (Authority 2017b). Tunnel 1 would be constructed entirely within the Great Valley Sequence, as shown in Table 3.8-25 (Authority 2017b, 2019f). Groundwater conditions for Tunnel 1 are anticipated to be like those encountered during construction of the Santa Clara Tunnel, which was constructed nearby in the same geologic unit. Approximately 95 percent of the Santa Clara Tunnel was constructed with groundwater inflows less than 15 gallons per minute at the heading with only 5 percent of groundwater inflows exceeding that inflow rate. All groundwater inflows into the Santa Clara Tunnel decreased significantly within several days (Authority 2017b).

Tunnel 2 would be approximately 13.5 miles long with a maximum depth of approximately 1,200 feet. Although Tunnel 2 would not be excavated within alluvial aquifers, Tunnel 2 would be excavated within bedrock deposits underlying alluvial aquifers, including those along Pacheco Creek (Authority 2019e). Additionally, Tunnel 2 is expected to encounter considerably more challenging groundwater and geologic conditions than Tunnel 1. The geology of Tunnel 2 includes shear zones near the Ortigalita fault, intense folding, and high groundwater pressures (Authority 2017b). Tunnel 2 is planned to be approximately 250 feet below the ground surface where it passes through the Ortigalita fault zone and up to 550 feet below the ground surface in other areas (Authority 2019a). The Ortigalita fault zone may contain substantial quantities of groundwater (Authority 2017b); however, because the character of this fault in the subsurface has not been defined through subsurface investigations, actual groundwater conditions at the tunnel fault crossing are not known.

Table 3.8-26 shows the groundwater conditions expected to be encountered during construction of Tunnel 1 and Tunnel 2. The alphabetic segment identifiers assigned to portions of Tunnel 2 in the following table (A, B, C, D, and E) are provided to facilitate the following discussions.

According to *Conceptual Tunnel Design and Constructability Considerations for Pacheco Pass* (Authority 2017b):

- Tunnel 1
  - The entire tunnel (1.5 miles) is expected to encounter mostly dry or moist conditions with inflows up to 15 gallons per minute persisting for up to several days.
- Tunnel 2
  - Approximately 8.1 miles of Tunnel 2 (segments A and B) is expected to encounter primarily moist conditions with local groundwater inflows up to or greater than 200 gallons per minute persisting for up to several days.
  - Approximately 4.3 miles of Tunnel 2 (segment C) is expected to be mostly dry to moist, with local heading inflows up to 100 gallons per minute persisting for up to several days.
  - Approximately 0.2 mile of Tunnel 2 (segment D) would pass through or near the Ortigalita fault zone, which may contain substantial quantities of groundwater.
  - Approximately 1 mile of Tunnel 2 (segment E) is expected to encounter mostly dry or moist conditions with temporary inflows up to 15 gallons per minute persisting for up to several days.

Table 3.8-26 Anticipated Groundwater Conditions along Tunnel 1 and Tunnel 2

Segment Identifier	Segment Stationing	Segment Length	Geologic Unit	Groundwater Conditions
Tunnel 1 (Morgan Hill and Gilroy Subsection)				
Entire tunnel	B2185+00 to B2270+00	1.5 miles	Great Valley Sequence	Tunnel excavation is anticipated to be moist with local inflows up to 15 gallons per minute.
Tunnel 2 (Pacheco Pass Subsection)				
A	B3323+50 to B3487+00	3.1 miles	Franciscan mélange with fractured rock and shear zones	Maximum groundwater head of 450 feet. Tunnel excavation is anticipated to be moist with local inflows up to 200 gallons per minute.
B	B3487+00 to B3750+00	5 miles	Franciscan mélange with fractured rock and shear zones	Maximum groundwater head of 550 feet. Tunnel excavation is anticipated to be moist with local inflows up to 200 gallons per minute. Due to high rock permeability and groundwater head, temporary inflows greater than 200 gallons per minute may occur.
C	B3750+00 to B3978+40	4.3 miles	Cleaved metagraywacke of the Franciscan Formation	Tunnel excavation is expected to be mostly dry to moist, with local heading inflows up to 100 gallons per minute.
D	B3978+40 to B3988+40	0.2 mile	Ortigalita fault zone	The fault may contain substantial volumes of water.
E	B3988+40 to B4043+50	1 mile	Great Valley Sequence	Tunnel excavation is anticipated to be moist with local inflows up to 15 gallons per minute

Source: Authority 2017b

As shown in Table 3.8-26, hydraulic conductivity of the subsurface strata is expected to be low along many parts of the proposed tunnel alignments. However, certain sections of the tunnel alignments such as fault zones, zones of highly fractured or sheared rock, or other pervious deposits, could exhibit higher hydraulic conductivity, higher rates of groundwater inflow into excavated opening(s), and higher water pressure(s) on tunnels' permanent structure (final watertight liner). Subsurface conditions for the HSR tunnels could include groundwater pressures up to 435 pounds per square inch (psi) (Authority 2017b).

The USGS operates a streamflow monitoring station along Pacheco Creek near the east portal of Tunnel 1 near the communities of Casa de Fruta and Dunneville (Station 11153000). This monitoring station has been documenting surface water hydrology conditions along Pacheco Creek almost continuously since 1939. These data (USGS 2019) show that the highest average monthly flows in Pacheco Creek typically occur in February, with a monthly average flow rate around 127 cubic feet per second (cfs), with the lowest flows typically occurring in October before the onset of winter rains, with a monthly average flow rate of 1.9 cfs. Additionally, these data indicate that moderate to high flow conditions in Pacheco Creek occur during the rainy season (November through April) while low flow conditions are observed during the drier months (May through October). The fact that continued flows are observed in this part of Pacheco Creek throughout summer (when rainfall is absent) suggests that this lower portion of Pacheco Creek is perennial. This is consistent with recent evaluations undertaken by San Benito County that identify this portion of Pacheco Creek as a groundwater-dependent resource (San Benito County Water District 2019). Additionally, a review of aerial imagery indicates that reaches of Pacheco Creek upstream of this location are intermittent or ephemeral, meaning they only flow seasonally or immediately after or in the days to weeks following rainfall.

Aside from Pacheco Creek, preliminary evaluations have identified the remainder of the waterbodies that cross over the proposed tunnels to be intermittent or ephemeral. Whereas flows in perennial streams are sustained by groundwater contributions through the summer months when rainfall is lacking, intermittent and ephemeral streams only contain water seasonally. Both intermittent and ephemeral streams flow in response to rainfall; however, intermittent streams receive inputs of groundwater when groundwater levels are seasonally higher, but these groundwater inputs stop when groundwater levels are lower during summer. A distinguishing characteristic of ephemeral streams is that they do not receive inputs from groundwater, because the groundwater table does not intersect the channel of ephemeral streams. Consequently, surface manifestations of hydrology effects along ephemeral streams are less likely to occur when compared to perennial and intermittent streams. However, both intermittent and ephemeral streams may recharge alluvial groundwater aquifers that support baseflow in downstream perennial stream reaches when little or no precipitation occurs. Thus, there is potential for tunneling to alter subsurface groundwater flows along intermittent and ephemeral streams that may aggregate along downstream perennial waterways, like Pacheco Creek.

To minimize these potential groundwater and surface water effects, the Authority will require the design-build contractor to design and construct the tunnels to minimize both groundwater inflows during construction and to avoid long-term seepage into the tunnels after construction (HYD-IAMF#5). While the required tunnel design features and construction methods are expected to reduce the quantity and rates of groundwater inflows into the advancing tunnel excavation, these features are not expected to eliminate such inflows. Therefore, while project features will utilize construction methods and design features to minimize the effects on the groundwater table and surface water hydrology, it is expected that effects would nevertheless occur.

The amount of groundwater reduction would depend on the geotechnical and hydrogeological conditions along the tunnel alignment, the tunnel construction methods used, and design features to minimize inflows. Temporary inflows into the tunnel and groundwater flow around the outside of the tunnel (annular flow) during construction are likely unavoidable. Thus, temporary effects on surface and groundwater conditions are foreseeable even with the incorporation of project features and other avoidance and minimization measures. Methods to control potential effects would be employed in response to expected conditions and the nature of the anticipated effects.

Tunnel Construction Methods

Tunnel excavation would likely be conducted using a combination of tunnel boring machines (TBM) and conventional tunneling methods at either end of the tunnel portals. The type of machine used would be determined by the Authority's design-build contractor, based on the tunnel length, the geology of the project, the amount of groundwater present and its condition, and other factors. A detailed discussion of tunnel construction methods is available in the *San Jose to Merced Project Section Conceptual Tunnel Design and Constructability Considerations—Pacheco Pass* (Authority 2017b) as well as Section 2.11.3.3, Tunnels, and is summarized below:

- **Tunnel boring machines**—TBMs are shielded or open-type machines consisting of a rotating cutting wheel, called a cutterhead, followed by a main bearing, a thrust system and trailing support mechanisms. Support mechanisms can include conveyors or other systems for muck removal, control rooms, electrical systems, dust removal, ventilation, and mechanisms for transport of pre-cast segments. These machines excavate rock with disc cutters mounted in the cutterhead, and then transfer the excavated rock through openings in the cutterhead to a belt conveyor for removal from the tunnel. Following TBM excavation, a tunnel lining is built with steel ribs and lagging or precast concrete segments. The shield is then pushed forward with hydraulic jacks that thrust against the installed lining and the back of the tunnel shield.
- **Conventional tunneling methods**—The primary conventional tunneling method anticipated to be used is a roadheader, consisting of a boom-mounted cutting head, a loading device usually involving a conveyor, and a crawler traveling track to move the machine forward into the rock face. Drill-and-blast techniques and the use of hydraulic excavators could also be required. Conventional tunneling methods require access to the open face of the tunnel and are limited to ground which can remain stable during excavation. In very hard rock, drill and shoot methods, are required. In medium to soft rock, a road header can be employed and in stiff clay and soil an excavator can be used. Conventional tunneling is a very flexible method and can adapt to varying ground conditions and changing geometry

Table 3.8-27 shows the potential for temporary and permanent groundwater effects for the two primary tunneling methods. The potential for groundwater effects also depends on geologic and groundwater conditions.

Table 3.8-27 Tunnel Excavation Methods and Likelihood for Groundwater Effects

Tunneling Method	Potential for Temporary Groundwater Reduction	Potential for Permanent Groundwater Reduction	Comments
TBM Methods	Typically, lower inflows than conventional mining in areas of lower hydraulic conductivity, but may be high in areas of high groundwater pressures. Inflows are controlled by TBM design that includes special measures (described in HYD-IAMF#5 and below in text) applied from the TBM or from the surface to lower potential for groundwater inflows into the tunnel	Very low, especially with the provision of a watertight lining. Also, grouting around precast segmental liner would lower potential for directional groundwater reduction caused by annular flows along the tunnel alignment	Generally, TBM tunnels will have a one-pass precast concrete segmental lining designed to be watertight

Tunneling Method	Potential for Temporary Groundwater Reduction	Potential for Permanent Groundwater Reduction	Comments
Conventional Mining or SEM Methods	typically, can be higher than with TBM methods; inflows along the entire tunnel alignment can be controlled by special measures (described in HYD-IAMF#5 and below in text) until final lining is installed	Very low, since a watertight lining will be provided	Initial lining installed using this approach is usually not a watertight lining. Special measures (grouting) can control higher inflows during sequential excavation and initial liner construction. Drainage system may be provided to reduce hydrostatic pressures on final lining; however, such systems are usually not practical in long tunnels due to requirement for continuous maintenance measures of the system components (cleanouts, piping)

In accordance with HYD-IAMF#5, tunnels will be designed to be watertight, smooth, durable, and low maintenance to maintain existing groundwater levels over the tunnel structures throughout the tunnel design service life. Tunnel lining would consist of one- or two-pass lining systems to meet HSR design criteria requirements. The specific tunnel lining type would be determined during final design, informed by Phase 2 geotechnical investigations proximate to the tunnel alignment. The contractor would use tunnel design and construction methods to avoid or minimize groundwater reduction to the maximum extent practicable.

TBM Methods

One-pass tunnel lining construction entails the installation of a precast concrete segmental lining with gaskets at each segment joint to construct an essentially watertight tunnel lining. The segmental lining is installed from within the shield at the rear of the TBM. A dual system of gaskets can be used to increase safety factors for resisting water pressures and arrest groundwater intrusion into the final tunnel structure. The feasibility for one-pass watertight linings is limited to magnitudes of water pressure less than 40 bars (580 psi) (Authority 2017a).

A two-pass tunnel lining system involves two stages of construction and would be used in tunnels where groundwater pressures exceed the capacity of one-pass linings available at the time of project construction. During the first stage of construction, an initial ground support system (e.g., precast segmental lining for a TBM tunnel) would be erected during the excavation cycle to maintain stability of the excavated opening, minimize water inflows, and protect workers. During the second stage, a watertight membrane together with a cast-in-place concrete liner would be installed as the final component and permanent support of the lining system. This two-pass lining approach has been used in long HSR tunnel projects with high ground water pressures, such as for tunnels in the Lyon-Turin line, the Gotthard Base Tunnel (Switzerland), and the Vienna-St. Pölten Railway Line (Austria).

In accordance with HYD-IAMF#5, TBM requirements will include the following:

- Capability to control potential water inflows by using a closed-face, shielded TBM including special shield provisions (multiple brush system with inflatable seals) to maintain waterproofed excavation on a temporary basis prior to segmental liner installation.
- Capability of systematic probe drilling, monitoring of water inflows, and pre-excavation grouting and backfilling with two-component grout. Grouting requirements include providing adequate backfill grouting, monitoring grout volumes, and using appropriate grout mixes to prevent grout washout; these measures would improve watertight performance of tunnel linings.
- Check-grouting through dedicated sockets in precast segmental liner to completely fill the annular opening created by TBM over-excavation, between the segments and the ground.

Pre-excavation grouting can be undertaken through grout ports in the TBM cutter-head and the shield when the TBM is set up for concurrent drilling and grouting of multiple holes. For predominantly noncohesive or cohesive soils, Slurry TBMs or Earth Pressure Balance (EPB) TBMs, respectively, as well as variable density TBMs, use pressurized tunnel face and pressurized tunnel perimeter around the tunnel shield to counterbalance external earth and groundwater pressures to minimize groundwater inflow during tunnel construction and work in concert with special layered shield brush-system with inflatable seals, to achieve shield water-tightness during the tunnel excavation. State-of-the-art of slurry and EPB technology limits maximum pressure to approximately 17 bars/247 psi (570 feet of hydrostatic pressure).

Conventional Tunneling Methods

Conventional tunneling methods using drill and blast or mechanical excavation would also be designed to be undrained and watertight to arrest or minimize potential groundwater reduction effects. The initial concrete linings used for temporary excavation support would likely consist of sprayed shotcrete, reinforced or unreinforced, and may be preceded by implementation of grouting measures to control groundwater inflows during excavation. Following application of initial shotcrete support and prior to installation of permanent (final) lining, a waterproofing membrane would be installed. Compartmentalization of the waterproofing membrane can be implemented, including grouting hoses, to allow local repairs to be made later in case groundwater leakage is identified during the liner service life. The shape and size of the tunnel cross section of a conventionally mined tunnel would be designed and adjusted to accommodate ground conditions, including potentially high groundwater pressures.

Support type and excavation methods can be adapted to meet the ground conditions, including the ability to vary the support types, size of opening, ring closure time, and excavation technique, as well as other factors. Tunneling can be done full face or in several drifts and benches. Typically, the cyclic steps of excavation included loosening and removing material in short sets of 3 feet to 10 feet before placing support measures. The freshly exposed ground must remain stable long enough to allow workers time to put initial support measures such as dowels, mesh, shotcrete, and lattice girders in place. The face and sides of the tunnel are exposed during the time between excavation and placement of support. For this reason, conventional tunneling methods are limited to stiff soil or rock. Construction below the water table in fractured rock or highly permeable ground, such as sand, requires ground modification measures such as grouting or ground freezing in advance of excavation. Such measures are usually employed for short stretches of tunnel or adits but generally are cost prohibitive for long tunnels, where use of a TBM is much more economical.

In conventional mined tunnel segments and cross passages, the contractor would use pre-excavating grouting techniques as the preliminary primary method of groundwater control to lower ground permeability and minimize or arrest groundwater inflow into the excavated openings, prior to excavation of cross passages and other underground structures. Pre-excavation grouting would be adjusted as necessary to control groundwater inflows. Pre-excavation grouting for conventionally mined tunnels would be carried out within the tunnel by face grouting or radial grouting. Ground improvement measures such as jet grouting and ground freezing, as applicable to specific ground conditions, are other methods that may be used to stabilize the excavation and seal off water during construction.

If unanticipated groundwater inflows are so extensive (such as the 1,200 cfs experienced during construction of the original Irvington Tunnel) that excavation by conventional tunneling methods is only possible with dewatering, design of dewatering measures would specify horizontal and vertical limits on lowering of the groundwater table. Controlled dewatering, if necessary, could be accomplished by vertical or horizontal wells or vacuum drains from the ground surface or from within the tunnel. If monitoring and modeling indicate that water levels outside of the immediate vicinity of the tunnel could be affected, a simultaneous pumping and injection system could be used to maintain existing water levels away from the immediate vicinity of the tunnel.

Monitoring and Adjustment in Tunnel Design and Construction Methods

Per the requirements of HYD-IAMF#5, hydrogeologic information from pre-construction subsurface investigations will be used to model existing hydrogeologic features and evaluate potential effects of tunneling on the local groundwater regime. Based on this assessment, the contractor will identify the preferred methods (described in HYD-IAMF#5) to minimize construction effects on the existing groundwater regime and tunnel excavation methods and design to minimize or eliminate the risk and likelihood of effects on groundwater.

Following initial tunnel construction, if groundwater inflow or annular flow around the completed tunnel indicates substantial ongoing groundwater reduction, then additional actions, primarily consisting of additional grouting into void spaces around the tunnel exterior or other appropriate actions, would be implemented.

Effect Evaluation Using Theoretical Approaches

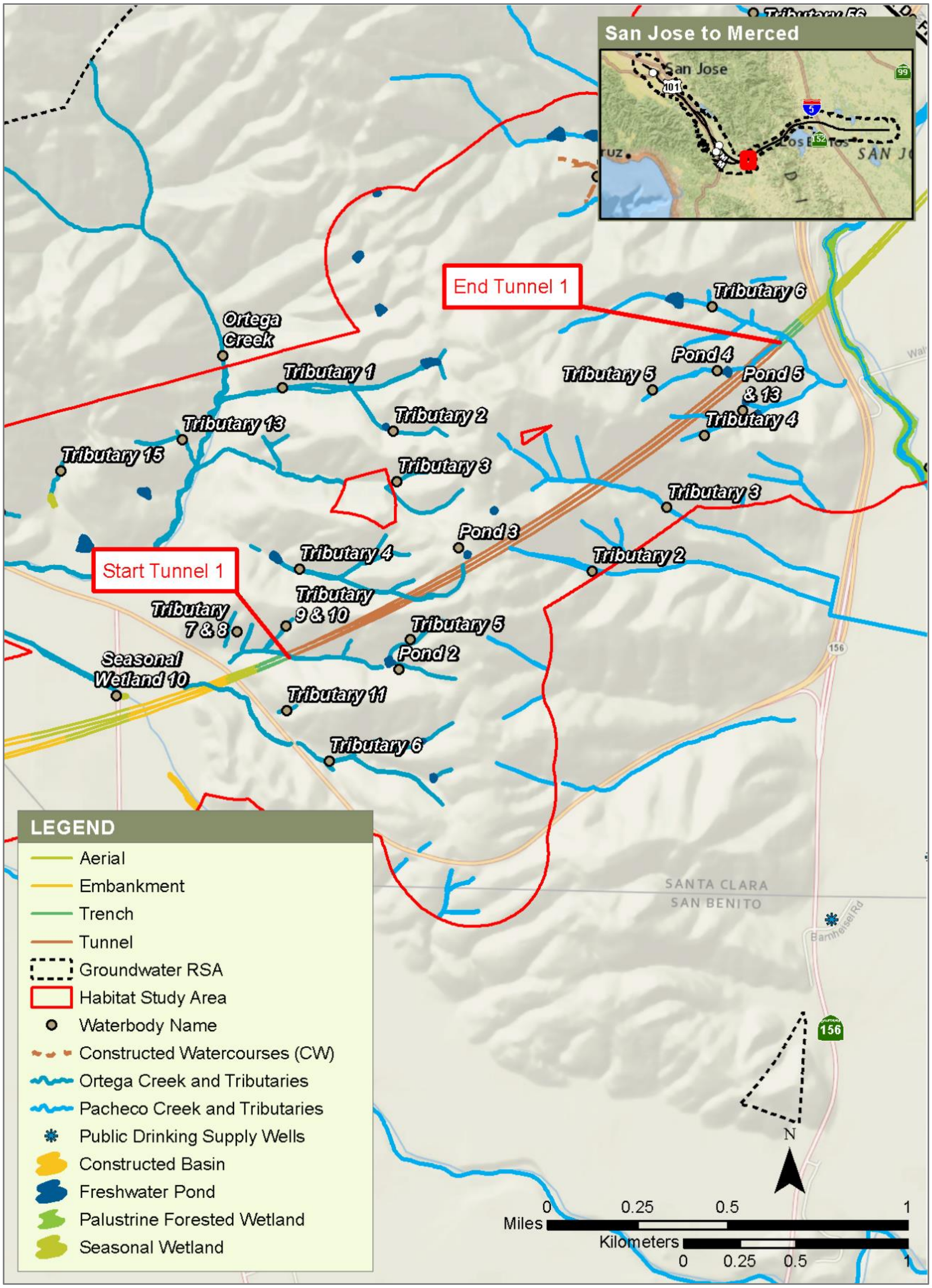
Based on the information gained from construction of the Irvington Tunnels and the Arrowhead Tunnels, it is expected that the proposed HSR tunnel construction is likely to affect groundwater and surface water resources within a maximum distance of approximately 1 mile from the tunnel alignments. However, it is expected that only a subset of the resources within 1 mile would be affected, with most effects occurring within 0.25 to 0.5 mile of the tunnel alignments and many resources within 1 mile of the tunnel alignments having no effects or limited effects. The groundwater and surface water resources that directly overlie or are in proximity to the proposed tunnel alignments are anticipated to have the highest potential to be affected by tunneling. These effects are expected to be temporary, lasting months to years after the tunnels become watertight. The slight shift in vertical tunnel alignment for the TDV (less than 10 feet) would not change the potential indirect effects, including surface water effects, related to groundwater inflow into the tunnel during construction.

Assuming that the proposed design and construction methods (HYD-IAMF#5) will not completely avoid the potential for groundwater inflows during tunneling, and that the quantity of groundwater inflows into the proposed tunnels will indicate a corresponding effect on surface hydrology conditions, a relative risk for groundwater and hydrology effects can be assigned to specific segments of the proposed tunnels. To generate this relative risk assessment, locations where more groundwater inflows are anticipated were assumed to have a higher potential for groundwater and surface hydrology effects; conversely, locations where less groundwater would be encountered were assumed to have a lower potential for groundwater and surface hydrology effects. While this theoretical approach to evaluating the potential effect provides a useful tool for identifying segments of the tunnels that are more or less vulnerable to surface water effects in comparison to other portions of the tunnels, it does not allow for a full evaluation of foreseeable effects, including extent, intensity, or duration. Given the current uncertainties and data gaps, there is potential for surface water effects to occur even in locations with a low risk of effect, and there could be instances where little groundwater inflow would occur in areas with a high risk for effect.

Table 3.8-28 shows the relative risk for effects to result from tunneling as well as the groundwater and surface water resources that have the highest potential to be affected (i.e., features that cross directly over or in very close proximity to the tunnel alignments). Figure 3.8-12 to Figure 3.8-15 illustrate the alignments of the proposed tunnels in relation to the locations of public water supply wells, seeps/springs, and surface water resources.

Table 3.8-28 Potential Temporary Groundwater and Hydrology Effects of Tunneling

Segment Identifier	Segment Stationing	Relative Risk of Effect	Resources Potentially Affected	
			Groundwater	Surface Waterbodies
Tunnel 1 (Morgan Hill and Gilroy Subsection)				
Entire tunnel	B2185+00 to B2270+00	Low	Privately owned water supply wells	Ortega Creek and tributaries 4–5 Pacheco Creek and tributaries 2–6
Tunnel 2 (Pacheco Pass Subsection)				
A	B3323+50 to B3487+00	High	Public water supply well (No. 4300606-001) Privately owned water supply wells	Pacheco Creek and tributaries 21–24, 46–53, and 57
B	B3487+00 to B3750+00	High	Privately owned water supply wells	Pacheco Creek and tributaries 25–27, 28-30, and 54-55 South Fork Pacheco Creek Tributaries 1–3 to San Luis Reservoir
C	B3750+00 to B3978+40	Moderate	Seep/spring (National Hydrography Dataset No. 135775706)	Tributaries 4–9 to San Luis Reservoir Cottonwood Creek and tributaries 1–8, 12–16
D	B3978+40 to B3988+40	High	None identified	Cottonwood Creek and tributary 9
E	B3988+40 to B4043+50	Low	None identified	Cottonwood Creek and tributaries 9–11 Romero Creek and tributary 1



Sources: CAL FIRE 2013; DWR 2020; SWRCB 2016; USGS 2007–2014

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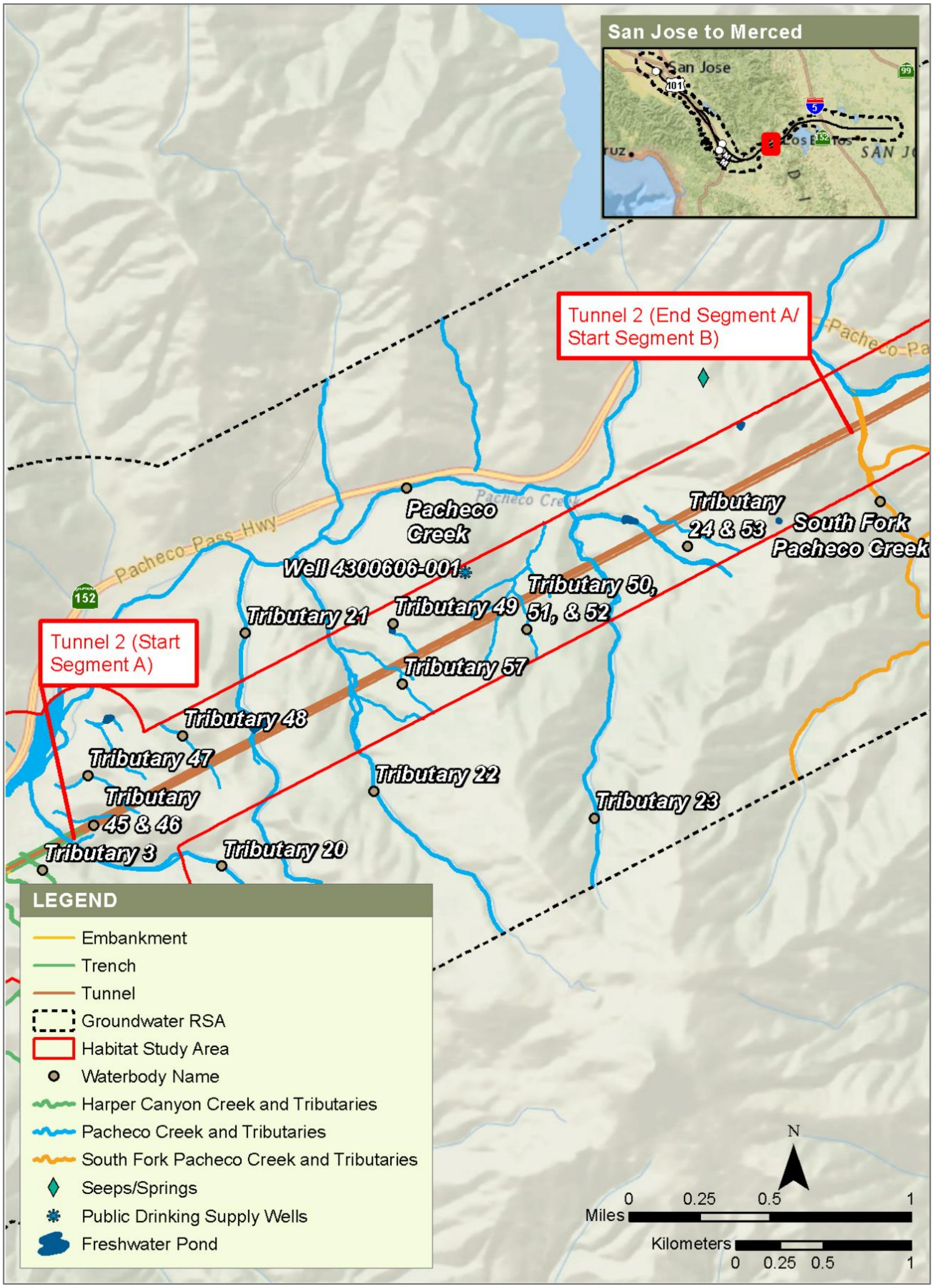
Figure 3.8-12 Groundwater and Surface Water Resources That May Be Affected during Tunnel 1 Construction, Morgan Hill and Gilroy Subsection



Sources: CAL FIRE 2013; DWR 2020; SWRCB 2016; USGS 2007–2014

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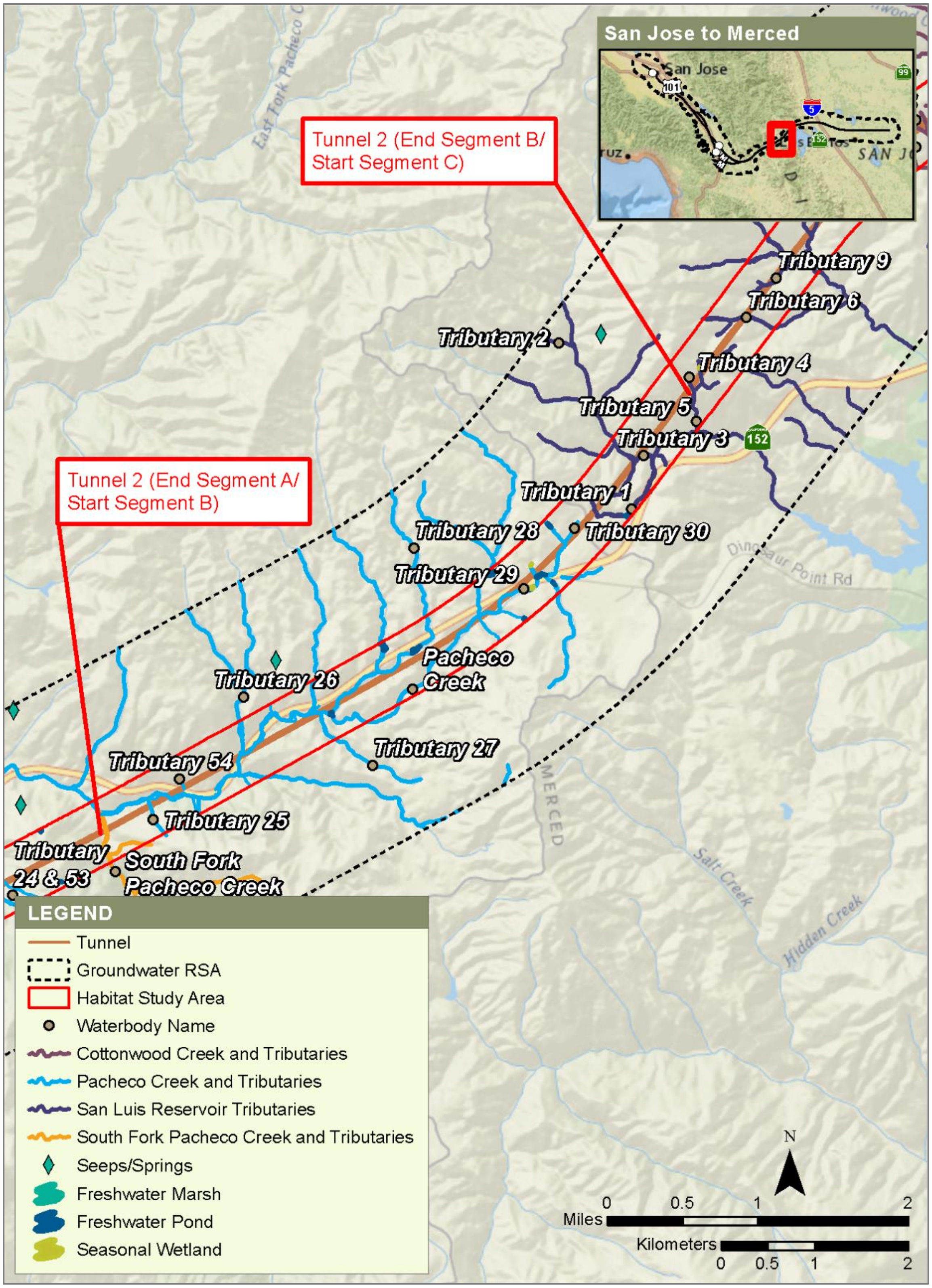
Figure 3.8-13 Groundwater and Surface Water Resources That May Be Affected during Tunnel 2 Construction (western portion)



Sources: CAL FIRE 2013; DWR 2020; SWRCB 2016; USGS 2007–2014

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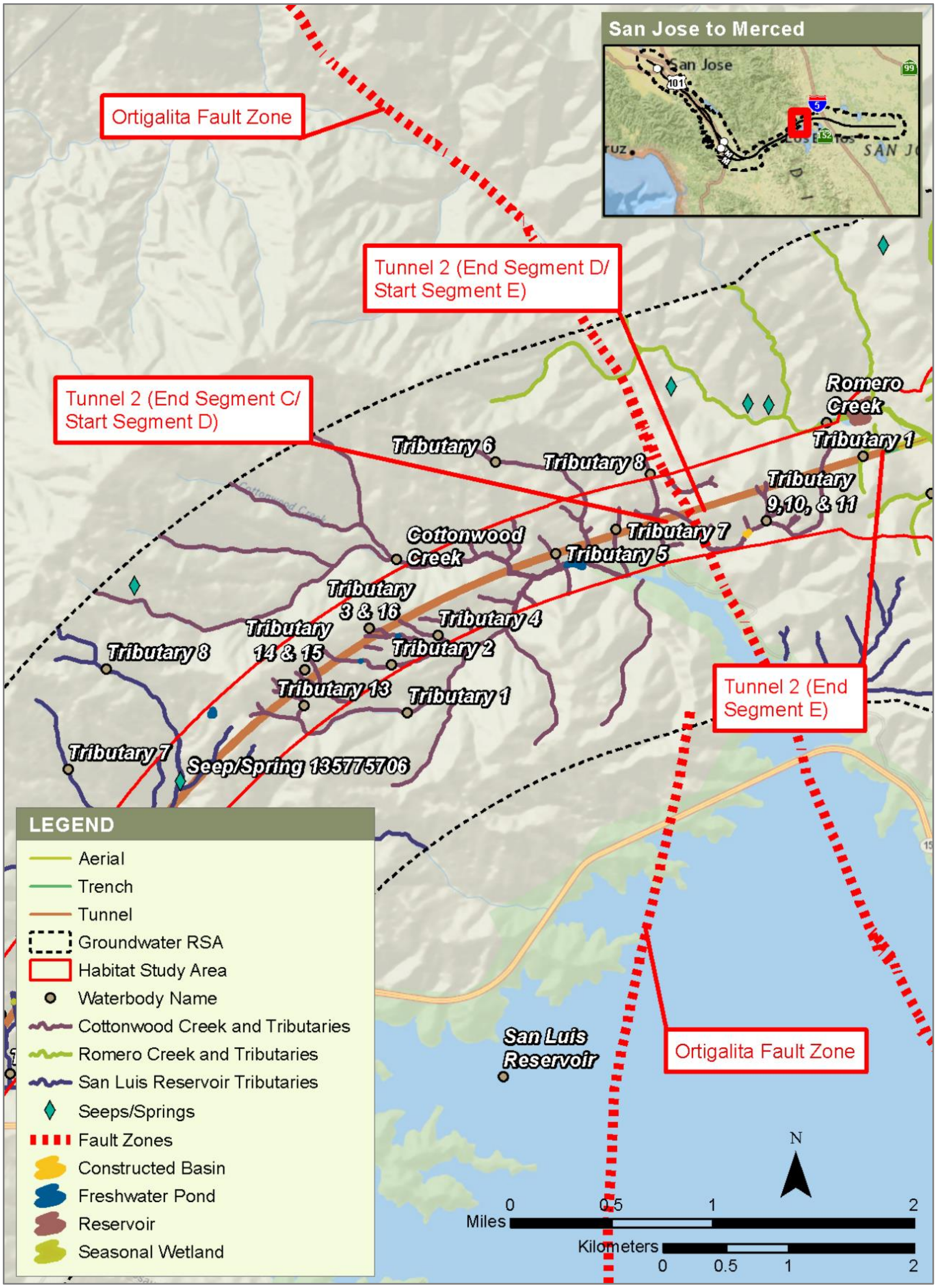
Figure 3.8-14 Groundwater and Surface Water Resources That May Be Affected during Tunnel 2 Construction (central portion)



Sources: CAL FIRE 2013; DWR 2020; SWRCB 2016; USGS 2007–2014

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Figure 3.8-15. Groundwater and Surface Water Resources That May Be Affected during Tunnel 2 Construction (eastern portion)

Groundwater and surface water resources within 1 mile of the proposed tunnel alignments include the following (approximately): 132 streams and creeks; 42 wetlands, ponds, and reservoirs; 1 public water supply well; 98 private water supply wells, including 63 domestic wells and 35 production wells; and 11 seeps and springs. However, not all of these resources are expected to be affected by tunnel construction because of the following: (1) many of the streams and creeks are likely not supported by groundwater flow based on observed hydrology; (2) most of the tunnel alignment is in areas of low groundwater conductivity where groundwater flows are expected to be limited and the implementation of HYD-IAMF#5 will lower the potential for large-scale effects to reach every feature within the RSA; and (3) prior tunneling experience has indicated that the bulk of the effects on water resources would occur on resources located over the tunnel alignment or much closer to the alignment than 1 mile.

As shown in Table 3.8-28 and illustrated on Figure 3.8-12 to Figure 3.8-15, tunneling would occur near a public water supply well (No. 4300606-001) and may also affect private wells. Given the limited access to the alignment overlying the tunnel alignment to date and based on the information currently available, the precise locations of existing privately-owned wells in the vicinity of the proposed tunnels have not yet been determined. However, according to the DWR (2019), there are approximately 5 privately owned water supply wells near Tunnel 1 and 18 privately owned water supply wells near segments A and B of Tunnel 2 that have the potential to be affected by tunneling. According to the expected groundwater inflow rates for Tunnel 1, there is a relatively low potential for affecting the water supply associated with the five privately owned water supply wells. However, groundwater inflows rates into segments A and B of Tunnel 2 indicate a higher potential that groundwater levels in the public water supply well and 18 private water supply wells would be affected by tunneling. On this basis, there is potential for tunneling to cause some level of disruption to the water supply provided by 24 wells.

Additionally, Table 3.8-28 and Figure 3.8-12 to Figure 3.8-15 show that tunneling may directly affect water levels in 56 creeks and a seep/spring (NHD No. 135775706). The tunneling may affect three other waterbodies (Ortega Creek, Romero Creek, and San Luis Reservoir[3]) due to effects on some of the tributaries to these other waterbodies. The potential for all surface water resources overlying the tunnels to be affected is expected to vary along the tunnel alignment: the waterbodies near Tunnel 1 and segment E of Tunnel 2 have a relatively low risk for hydrology effects, while the remainder of Tunnel 2 has a moderate to high potential to affect surface water hydrology. Data collected by the USGS (2019) and San Benito County Water District (2019) indicate that the lower reach of Pacheco Creek near Tunnel 1 is perennial and strongly influenced by groundwater contributions. Because this portion of Pacheco Creek is likely dependent on groundwater, this portion of Pacheco Creek is vulnerable to effects associated with tunneling. However, as indicated by the Central Valley Project tunnels (Authority 2017b), groundwater inflows into Tunnel 1 are not expected to be substantial (in the range of 15 gallons per minutes that subside after several days). Therefore, while this portion of Pacheco Creek is vulnerable to tunneling effects, the relative risk of these effects to result from Tunnel 1 is expected to be low. Regardless of the effects on Pacheco Creek resulting from Tunnel 1, there is potential for Tunnel 2 to create changes in the hydrology of any overlying intermittent streams as well as subsurface groundwater flows along intermittent and ephemeral streams that could accumulate and create changes in groundwater contributions to this perennial reach of Pacheco Creek (Goodrich et al. 2018).

In contrast to Pacheco Creek, the remainder of the streams that cross over Tunnels 1 and 2 are not perennial based on observed hydrology. These streams include Ortega Creek, Cottonwood Creek, and Romero Creek and their tributaries, South Fork Pacheco Creek, and tributaries to Pacheco Creek. Flows in these streams are driven primarily by rainfall, but some may receive some flow contributions from groundwater when the groundwater table is seasonally higher. Therefore, these streams are less likely to experience tunneling-induced hydrology effects because they are minimally influenced by groundwater and tunneling would have no effect on precipitation patterns. However, the highly variable stream flow conditions of these streams over the course of a year make assessing potential tunneling effects difficult, because the absence of

[3] San Luis Reservoir is an artificial lake that derives its source water from the California Aqueduct via the O'Neill Forebay.

surface flows at these sites during summer does not indicate an effect is occurring. Moreover, potential effects caused by tunneling may be disguised by rainfall and runoff processes during winter. Therefore, while the vulnerability of these streams to surface hydrology effects is relatively low, these effects are much more difficult to predict and monitor than other hydrologic effects (Berg 2012). Although Ortega Creek and Romero Creek are not directly crossed by a tunnel, there is potential for drawdown of their tributaries to cause groundwater levels to drop along those creeks.

The highest potential for groundwater and hydrology effects is near the Ortigalita fault zone. While groundwater conditions in the Ortigalita fault zone (segment D of Tunnel 2) have not been defined through subsurface investigations, the fault has the potential to contain large quantities of groundwater (Authority 2017b). The potential to encounter large quantities of groundwater at this fault is supported by observations made during construction of the New Irvington Tunnel, where the greatest intensity of groundwater effects was predicted to occur along fault zones due to high rates of water transmission through fractures and shear zones in the subsurface (SFPUC 2009). Although Cottonwood Creek tributary 9 crosses almost directly over where Tunnel 2 intersects the Ortigalita fault zone, surface flows within this creek are not expected to be substantially affected by tunneling because its stream flows are driven by rainfall. Additionally, no public or privately owned water supply wells or seeps and springs have been identified in this area (USGS 2007–2014; SWRCB 2016; DWR 2019). Therefore, while tunneling through the fault zone has a high potential to affect groundwater resources and surface hydrology, no groundwater resources or groundwater-dependent streams have been identified in close proximity to the fault zone at this time.

CEQA Conclusion

The impact under CEQA for all four alternatives would be significant because groundwater inflows into the advancing tunnel excavation has the potential to decrease groundwater supplies as well as alter the surface water hydrology of waterbodies. The impact would be the same under all four alternatives because all four would share the same tunnel alignments. Per HYD-IAMF#5, contractors will be required to design and construct tunnels to avoid or minimize impacts on groundwater resources and surface water hydrology by using pre-grouting excavation techniques to lower geologic permeability and installing watertight tunnel liner systems designed to withstand full hydrostatic groundwater pressures. Although the project would minimize potential for groundwater leakage into tunnel construction areas and flows around the exterior of the tunnel, based on prior tunneling experience, localized groundwater reduction likely cannot be fully avoided, and thus tunnel construction could result in a temporary substantial decrease in groundwater supplies and cause effects on interconnected surface waters. The duration of this temporary impact could vary from several days to months or even up to several years after construction, based on the experience of prior tunnels. Decreases in groundwater supplies could substantially decrease water produced at wells, seeps, and springs. Mitigation measures to address this impact are identified in Section 3.8.9, CEQA Significance Conclusions. Section 3.8.7, Mitigation Measures, describes these measures in detail.

Impact HYD#11: Permanent Impacts on Groundwater and Surface Water Hydrology after Tunnel Construction

As described in detail in Impact HYD#10, the proposed tunnels will be designed to be as watertight as feasible to avoid permanent effects on groundwater and surface water hydrology (HYD-IAMF#5). The proposed tunnels will include either a single-pass or double-pass liner that will be designed to withstand full hydrostatic groundwater pressures and resist groundwater inflows after construction of the tunnels has been completed (HYD-IAMF#5). Additionally, project features include monitoring and implementing remedial actions during the construction phase to minimize permanent alterations in groundwater flow pathways (HYD-IAMF#5). Therefore, permanent effects on groundwater and surface water hydrology would be avoided or minimized, because the tunnels would be designed to be watertight and prevent substantial annular flow, avoiding permanent drawdown of groundwater resources, ongoing discharge of water from the tunnel during operations, and permanent alterations in groundwater flow characteristics. Moreover, the Authority’s commitment to designing and constructing tunnels that are watertight, to the extent feasible, would avoid or minimize the need for continuous pumping or dewatering of groundwater during operations to either remove seepage from the interior tunnel structures or artificially lower the groundwater table in response to limitations of the tunnel liner system.

CEQA Conclusion

The impact under CEQA would be less than significant for all alternatives because leakage of groundwater into tunnels would either not occur or would occur at *de minimis* levels. Consequently, groundwater quality would not be degraded and groundwater supplies and recharge would not be substantially decreased. The proposed tunnels would be designed to be resistant to groundwater inflows by using either a single-pass or double-pass liner to resist groundwater inflows and withstand existing hydrostatic groundwater pressures. Project features (HYD-IAMF#5) will avoid permanent impacts on groundwater levels and surface water hydrology. Therefore, CEQA does not require mitigation.

Operations Impacts

Operations of the project would involve activities at stations and maintenance facilities, train travel, the consumption of water, and dewatering. Chapter 2 describes operations and maintenance activities in additional detail.

Impact HYD#12: Impacts on Groundwater Quality and Volume from Intermittent Maintenance Activities during Operations

During operations, maintenance activities at stations, MOWFs, and the MOWS would require the use and storage of materials and chemicals. The Authority would design stations and maintenance facilities to minimize stormwater pollution in accordance with the Phase II MS4 permit, prepare a SWPPP under the IGP for applicable stations and maintenance facilities, and use an environmental management system to replace hazardous materials with nonhazardous alternatives. Maintenance activities would not require dewatering, pumping, or other activities that would affect the elevation of the groundwater table or groundwater volume.

Activities at the MOWFs and MOWS under all four alternatives would include repairing infrastructure and equipment inside the shop facilities, storing bulk and non-bulk materials in stockpile areas, and storing trains and rail-borne equipment on yard and siding tracks. Repairing infrastructure and equipment at the MOWF as well as other maintenance activities at the MOWS and stations would require the on-site use and storage of materials and wastes, such as thousands of gallons of oils, fuels, and lubricants, as well as metal filings, hydraulic fluids, cleaning products, refuse, landscaping supplies, and other potentially toxic materials. These materials and wastes would be stored and controlled to prevent the project from creating elevated levels of petroleum hydrocarbons, dissolved and particulate metals, ammonia, nutrients in fertilizers such as nitrate and phosphorus, and pesticides in aquifers in the RSA.

Intermittent operations impacts on groundwater quality from leaks and spills at stations, MOWFs, and the MOWS would be similar under all four alternatives. They would be similar because the MOWS and all stations would be shared among the alternatives except the Downtown Gilroy Station under Alternatives 1, 2, and 4 and East Gilroy Station under Alternative 3; however, both the Downtown and East Gilroy Stations would be in the Llagas Area subbasin. Additionally, the impacts would be similar because the South and East Gilroy MOWFs under all four alternatives would also be in the Llagas Area subbasin. Moreover, the types and volumes of materials and wastes that would be stored at the MOWFs and MOWS would be the same for all four project alternatives. Therefore, leaks and spills at the stations, Downtown Gilroy Station, and South Gilroy MOWFs under Alternatives 1, 2, and 4 would have a similar impact on groundwater quality as a leak or spill at the East Gilroy Station and East Gilroy MOWF under Alternative 3.

Intermittent activities that would occur in Tunnels 1 and 2 during HSR operations under any of the alternatives include resealing the concrete tunnel structures, including recaulking joints and chemical grouting of cracks with polyurethanes, acrylate esters, or cement. Additional intermittent tunnel operations may include cleaning of drains through the portal structures; maintaining instrumentation, ducts, and cabling associated with ground movement and groundwater management; and implementing preventive measures such as rail lubrication, rail grinding, joint maintenance, and re-gauging (Authority 2010b). These activities would require the on-site use of materials and generation of wastes, such as oils, fuels, and lubricants, as well as hydraulic fluids, cleaning products, and other potentially toxic materials. However, the tunnels would be designed to be as watertight as possible; therefore, any spills of materials inside the tunnels would not have a pathway to enter directly into the groundwater table.

The project features described in Impact HYD#6 will also minimize potential groundwater pollution during operations. The project features that will also minimize groundwater quality impacts include managing the MOWF, MOWS, and other applicable facilities with a SWPPP prepared under the IGP (HYD-IAMF#4), incorporating source control and treatment BMPs into the design of the MOWF and MOWS in accordance with the Phase II MS4 permit (HYD-IAMF#1), implementing an operations and maintenance plan under the Phase II MS4 permit, using an environmental management system to reduce the toxicity resulting from a potential leak or spill, and storing all hazardous materials according to state and federal regulations. Specific measures that would be considered during operations are limiting maintenance activities on infrastructure and equipment to inside the shop facilities; controlling stockpiles at the MOWF and MOWS with BMPs like fiber rolls and silt fence; and placing drip pans below trains and rail-borne equipment to contain any leaks and spills of oil, grease, and other hydrocarbons.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because intermittent maintenance activities during operations would not violate groundwater quality standards or impede sustainable groundwater management. These activities would also not require dewatering, pumping, or other activities that would affect groundwater volume. The project would minimize pollutants generated at stations and maintenance facilities and reduce the number of hazardous materials required for operations that could leak or spill and affect groundwater quality. Intermittent tunnel operations would avoid substantial changes in groundwater quality. In addition, an industrial SWPPP, source-control BMPs, and an operations and maintenance plan that complies with the Phase II MS4 permit would prevent violations of groundwater quality standards by controlling sources of pollutants. These project features will minimize potential impacts on groundwater quality and volume from intermittent maintenance activities during operations. Therefore, CEQA does not require mitigation.

Impact HYD#13: Impacts on Groundwater Quality and Volume during Continuous Operations

As described under Impact HYD#7, project operations would generate few pollutants. However, dust consisting of metals, primarily iron, but also copper, silicon, calcium, manganese, chromium, and barium, and PAHs would be generated by the physical wear of brake pads while braking and the use of lubricants that may leak or spill (Burkhardt et al. 2008; Moreno et al. 2015; Markiewicz et al. 2017). Drainage ditches that parallel tracks on an embankment profile and stormwater treatment BMPs that treat runoff from impervious surfaces would minimize the impact of brake dust on groundwater quality.

Once released by a train, the pathway that brake dust and PAHs follow in the environment and resulting impacts on groundwater quality would be determined, in part, by the profile of the rail. Brake dust and PAHs emitted from trains traveling on an at-grade or embankment profile are anticipated to be retained in the ballast material beneath the tracks. However, rain would mobilize brake dust and PAHs in track ballast into the ground or earthen drainage ditches that parallel the track alignment. Brake dust and PAHs deposited on impervious surfaces, such as viaducts, bridges, or roadways, would eventually be mobilized to a drain inlet, where it would enter a storm drain system and eventually be discharged into a surface waterbody. Brake dust may be discharged into waterbodies. Particulate metals and PAHs would remain in the sediment along the bed of the waterbody, whereas dissolved metals may percolate through the sediment and enter the groundwater table.

The contractor will prepare a stormwater management and treatment plan for the project extent prior to construction (HYD-IAMF#1). The plan will include stormwater treatment BMPs that reduce the quantity and improve the quality of stormwater runoff before runoff is discharged into a surface waterbody, where it would percolate into the groundwater table. Potential treatment BMPs include infiltration areas, infiltration devices, biofiltration systems, and media filters, all of which can reduce particulate and dissolved metals concentrations in runoff (Caltrans 2017b). Furthermore, because pervious areas (i.e., soil) can filter both particulate and dissolved metals as well as PAHs from runoff (Caltrans 2017b), earthen drainage ditches along at-grade and embankment profiles would provide filtration of runoff that infiltrates into the subsurface in these ditches.

Though not quantifiable at this time, the amount of brake dust and PAHs that would enter the groundwater table is not anticipated to be sufficient to substantially alter groundwater quality or violate the groundwater quality objectives for organic or inorganic chemicals. Considering earthen drainage ditches would provide filtration of runoff along at-grade and embankment profiles and because the project would incorporate stormwater treatment BMPs to filter runoff from new and replaced impervious surfaces before it percolates into the groundwater table, the project extent would minimize potential groundwater quality impacts from brake dust and PAHs to the maximum extent practicable using the best available technology.

Project operations are not expected to require substantial continuous dewatering of infrastructure below the naturally occurring groundwater table, because trenches and pedestrian and roadway underpasses would be designed to minimize groundwater inflows as described in Impact HYD#8 and Impact HYD#9.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because project operations would not violate groundwater quality standards, including those for inorganic chemicals; substantially decrease groundwater recharge or supplies; or impede sustainable groundwater management. The project would provide opportunities to filter particulate and dissolved metals in runoff prior to percolations into the ground and avoid or minimize the need for the continuous dewatering of infrastructure in the groundwater table. These project features will minimize potential impacts on groundwater quality and volume during continuous operations. Therefore, CEQA does not require mitigation.

3.8.6.5 Floodplains

Project construction and operations would result in temporary and permanent changes to floodplains, such as changes to the vertical profile or horizontal extent of flooding, peak flows, and flood patterns. Construction activities that would result in impacts on floodplains include the placement of fill in floodplains and the realignment or modification of waterbodies in floodplains. Maintenance activities would not require fill, realignment, or modification of waterbodies in floodplains. Therefore, no operations impacts are anticipated to the existing floodplains.

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.8.6.2, Surface Water Hydrology. The same planned development and transportation projects would generally result in additional development in floodplains and construction of new impervious surfaces, both of which would affect floodplains.

The No Project Alternative includes numerous residential, industrial, commercial, and transportation projects. Some of these projects, such as improvements at Mineta San Jose International Airport, roadway widening along US 101, and interchange improvements at SR 152 and Frazier Lake Road, would be located in or adjacent to existing 100-year floodplains delineated by FEMA. These projects would include the construction or modification of existing culverts, bridges, roadways, structures, and/or other improvements in existing 100-year floodplains. Such improvements could require the placement of temporary and permanent fill inside of floodplains and floodways, which can alter existing water surface elevations, footprints, and peak flows of 100-year floodplains. Most of the Soap Lake floodplain has been zoned for agricultural land uses, which restrict residential, commercial, industrial, and other nonagricultural development in the floodplain, allowing it to remain free of substantial floodplain development under the No Project Alternative (County of Santa Clara 2019; County of San Benito 2019). Other projects in the RSA along streams or other low-lying valley areas near San Jose, Gilroy, and the San Joaquin Valley would also require placing temporary or permanent fill in a floodplain.

Without construction of the project and the HSR system, improvements to the transportation networks in the RSA would require a larger footprint for additional traveled lanes for roadway and highway projects, as well as new terminals and runways at airports to accommodate current growth projections along the alignment. The project, however, would provide an alternative mode of transportation in the RSA, potentially reducing the rate at which the number of vehicles on roadways and highways and the number of travelers using airplanes and airports to travel in California would otherwise increase. Thus, the additional land acquisition and development that would be required for transportation projects under the No Project Alternative would result in incrementally more floodplain development than the project alternatives. A full list of anticipated future development is provided in Volume 2, Appendix 3.19-A, Nontransportation Plans and Projects, and Appendix 3.18-B, Transportation Plans and Projects.

Planned residential, industrial, commercial, and transportation projects would build new impervious surfaces in the RSA. Transportation developments that would result in new impervious surfaces include projects along SR 86, US 101, SR 237, I-280, I-680, I-880, Coleman Avenue, and Autumn Street in San Jose; US 101 and Hale Avenue in Morgan Hill; US 101, SR 152, Las Animas Avenue, and Luchessa Avenue in Gilroy; and SR 152, SR 165, Pioneer Road, Volta Road, and Ingomar Grade in Merced County. In addition, aviation improvements at Mineta San Jose International Airport may also result in new impervious surfaces. These impervious surfaces would cumulatively increase the total volume of runoff generated during storm events and increase the risk of flooding in receiving waterbodies.

Under the No Project Alternative, planned development would be constructed, which would likely result in impacts on floodplains. Development under the No Project Alternative is anticipated to comply with floodplain management regulations that minimize impacts on floodplains, and the Soap Lake floodplain is anticipated to remain free of substantial floodplain development. In addition, these projects would also include various forms of mitigation to address impacts on floodplains. Compliance with existing laws and regulations would avoid, minimize, or mitigate impacts on floodplains.

Project Impacts

Construction Impacts

Project construction would require the placement of fill in floodplains and the modification and filling of waterbodies in floodplains. Temporary fill would include forms, falseworks, trestles, cofferdams, and construction equipment and materials. Permanent fill in floodplains would be necessary to build the South and East Gilroy MOWFs, East Gilroy Station, new or modified bridges and culverts, new tracks, and the modification and filling of waterbodies. Chapter 2, Alternatives, describes project construction activities in greater detail.

Impact HYD#14: Temporary Impacts on Floodplain Hydraulics during Construction

Project construction would require temporary fill within 100-year floodplains regulated by FEMA. Temporary fill in floodplains would be associated with activities in temporary construction easements required to build new bridges and culverts for at-grade, embankment, and viaduct sections of the railbed to cross floodplains, as well as construction staging areas and concrete pre-casting sites in floodplains. Depending on the specific construction methods selected by the contractor, temporary fill in floodplains during the construction phase would include temporary structures such as formworks (temporary molds for new concrete structures), falseworks (temporary supports for new structures), trestles (temporary elevated working surfaces), cofferdams (temporary structures to isolate work from receiving waters), and equipment, including excavators and pumps. When floodwaters are present, temporary fill would reduce the storage capacity of the floodplain, resulting in localized changes in water surface elevation, flow velocity, flood flow patterns, or extents of the floodplain to areas that may not have previously experienced flooding.

Project construction would also require the storage of materials at staging areas and concrete pre-casting sites located within 100-year floodplains regulated by FEMA. Alternatives 1, 2, and 3 would include construction staging areas in 100-year floodplains in the San Jose Diridon Station Approach, Morgan Hill and Gilroy, and Pacheco Pass Subsections, including an isolated floodplain near Cinnabar Street and Guadalupe River north of the San Jose Diridon Station; floodplains on the west side of Coyote Creek where the alignments of the alternatives diverge in southern San Jose; floodplains between Little Llagas and Llagas Creeks south of Morgan Hill; several staging areas in the Soap Lake floodplains required for the railbed, grade separations, and MOWFs; and floodplains along Harper Canyon Creek for construction of the Tunnel 2 portal. However, Alternative 4 would only have staging areas in floodplains in the Morgan Hill and Gilroy and Pacheco Pass Subsections, such as those near Little Llagas and Llagas Creeks, Soap Lake, and Harper Canyon Creek. Additionally, a concrete pre-casting site for Alternatives 1, 2, and 3 would be located in floodplains on the west side of Coyote Creek in southern San Jose. Materials stored at staging areas and concrete pre-casting sites would have the potential to be released if exposed to floodwaters.

Floodplain impacts from temporary fill in the floodplain and release of pollutants would be avoided by monitoring weather forecasts for intense storm events that have the potential to create flood conditions. When there is a possibility for flooding in the project footprint, the contractor would remove mobile structures, equipment, and materials from waterbodies, wetlands, and floodplains. If formworks, falseworks, trestles, and cofferdams must stay in place over the winter during the rainy season, they would be designed to withstand the hydraulic forces of flood flows without substantial impacts on floodplain hydraulics. In addition to floodplains along or near waterbodies, there are floodplains in the project footprint on local roadways or in isolated areas that are not adjacent to waterbodies. In these areas, the contractor may elect to remove temporary structures, equipment, and materials from the floodplain area, or use temporary drainage systems to reroute flood flows safely away from active construction areas without exposing nearby structures and residences to new flood hazards. In accordance with the SWPPP (HYD-IAMF#3), the contractor will secure temporary construction easements, staging areas, and concrete pre-casting sites to prevent the release of pollutants, including the removal of mobile equipment and materials from the floodplain. Further, the contractor will coordinate with water districts regarding scheduled releases from upstream dams.

Although the project would have minimal temporary impacts on the hydraulics of floodplains, it would have temporary impacts on ecological values of floodplains. Temporary floodplain impacts during the construction of new bridges and culverts, modification of existing bridges and culverts, and any other construction activity performed in a floodplain would include the loss of vegetation that provides habitat for wildlife during the construction activity. Project features, such as preserving existing vegetation to the extent feasible in compliance with the CGP and Phase II MS4 permit, will minimize these impacts on the ecological values of floodplains. Refer to Section 3.7, Biological and Aquatic Resources, for more information on the ecological impacts of the project on aquatic resources.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because construction of the project would not result in flooding on or off site, impede or redirect flood flows, or risk release of pollutants during floods. The project would avoid construction activities in waterbodies when the risk of flooding is greatest. Additionally, the contractor would monitor weather forecasts for potential flood conditions, coordinate with water and irrigation districts regarding scheduled releases from dams, and relocate equipment and materials temporarily stored in floodplains when floods are forecasted or releases from dams are scheduled. The project would therefore minimize potential temporary impacts on floodplains. Therefore, CEQA does not require mitigation.

Impact HYD#15: Permanent Impacts on Floodplain Hydraulics during Construction

The project would include installation of new bridges and culvert structures or the widening of existing bridges and culvert structures. Where bridge approaches, abutments, and the structures themselves would be located within 100-year floodplains regulated by FEMA, the engineered features would be considered fill inside of floodplains. Permanent fill inside of floodplains would result in changes to channel geometry and flood flow characteristics. A flood protection plan (HYD-IAMF#2) will be prepared to minimize development within floodplains, associated changes in water surface elevations, and other impacts on floodplains. Nevertheless, modifications to existing bridges, culverts, and other structures have the potential to result in permanent impacts on floodplain hydraulics. Table 3.8-29 shows an inventory of the proposed bridges, culverts, viaduct piers, and other structures that would be constructed within 100-year floodplains.

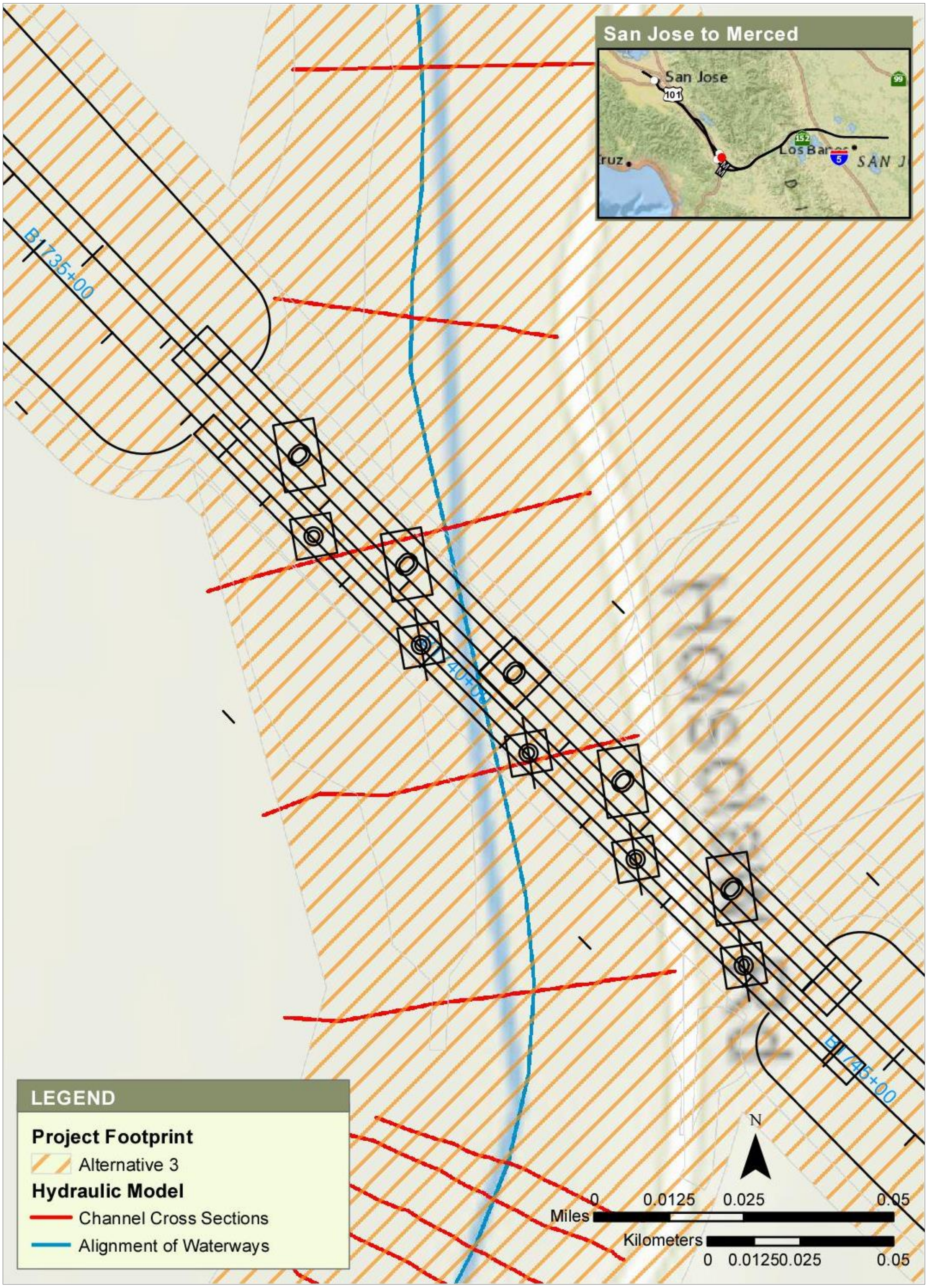
Table 3.8-29 Proposed Hydraulic Structures in 100-Year Floodplains

Waterbody	Type of Proposed Structure
Los Gatos Creek	New viaduct over creek (Alternatives 1–3). Use existing railroad bridge (Alternative 4).
Guadalupe River	New viaduct over river with pier columns on western channel bank (Alternatives 1–3). New railroad bridge adjacent to the south side of the existing bridges (Alternative 4).
Canoas Creek (Guadalupe River tributary)[1]	Floodwalls and equalizer culverts along embankment railbed (Alternatives 1–4).
Coyote Creek	New viaduct along western bank of the creek (Alternatives 1 and 3). New embankment along western bank of the creek (Alternative 2). Use of existing railroad track along western bank of the creek (Alternative 4). Wildlife crossings below new and existing railroad structure and under Monterey Road (Alternatives 1–4).
Fisher Creek	New viaduct over creek and new wildlife crossing below Monterey Road replacing the existing cross culvert (Alternatives 1 and 3). New embankment with new wildlife crossing to replace the existing railroad bridge and Monterey Road cross culvert (Alternative 2). New wildlife crossing in existing embankment to replace the existing railroad bridge and Monterey Road cross culvert (Alternative 4).
West Little Llagas Creek	New viaduct over creek (Alternatives 1 and 3). New embankment with new cross culvert for creek (Alternative 2). Existing embankment with new cross culvert for creek (Alternative 4).
Llagas Creek (at San Martin)	New viaduct over creek (Alternatives 1 and 3). New embankment with new bridge over creek and relocated existing roadway and railroad bridges (Alternative 2). Existing embankment with new railroad bridge on same alignment as existing railroad bridge (Alternative 4).
Llagas Creek (at East San Martin Avenue)	New roadway bridge along new roadway alignment (Alternative 2).
Llagas Creek (at east Gilroy)	New embankment with new bridge over creek (Alternative 3).
Uvas-Carnadero Creek (Soap Lake)	New embankment and South Gilroy MOWF in overbank floodplain (Alternatives 1, 2, and 4). New viaduct in overbank floodplain (Alternative 1). New trench within overbank floodplain. New roadway bridge (Alternatives 1 and 2).
Llagas Creek, West Branch Llagas Creek, and Llagas Creek Overflow (Soap Lake)	New embankment or viaduct within the existing floodplain (Alternatives 1–4). Fitzgerald/Masten Avenue would be depressed into a trench to cross below Monterey Road (Alternative 2).
Jones, Dexter, and San Ysidro Creeks (Soap Lake)	New embankment or viaduct within the floodplain (Alternatives 1, 2, and 4). East Gilroy MOWF (Alternative 3).
Unnamed creeks (Soap Lake)	New embankment or viaduct within the floodplain (Alternatives 1–4).
Tequisquita Slough (Soap Lake)	New embankment with multiple new box culverts and new bridge over the existing floodplain within the existing floodplain limits (Alternatives 1–4).
Pacheco Creek (Soap Lake)	New embankment with multiple new box culverts and new bridge over creek within the existing floodplain limits (Alternatives 1–4).

Source: Authority 2019a
[1] Although Canoas Creek does not cross the project extent, spill flow from the creek will encroach into the project extent. More information about Canoas Creek is discussed in Appendix 3.8-B.

The Authority performed preliminary hydraulic analyses to quantify impacts from new or modified hydraulic structures for floodplains with existing hydraulic models. Existing hydraulic models were available for seven waterbodies and their associated floodplains in the RSA that have the potential to be permanently affected by the project: Los Gatos Creek, Guadalupe River, Coyote Creek, Fisher Creek, Llagas Creek, West Branch Llagas Creek, and Uvas-Carnadero Creek. The Authority modified the inputs in the hydraulic models to represent the proposed hydraulic structures to assess the potential impact. Based on extensive coordination with the SCVWD, the project design and hydraulic analysis for Llagas Creek and its tributaries assume completion of the Upper Llagas Creek Flood Protection Project (PL-556). According to the SCVWD webpage about the PL-556 (2020), Phase 1 began construction in September 2019. Phase 2 of the PL-556 is planned to be advertised in mid-2020.

The preliminary hydraulic analysis for Los Gatos Creek, Guadalupe River, Coyote Creek, Fisher Creek, and Uvas-Carnadero Creek revealed that there would be no increases in the water surface elevations of 100-year floodplains of more than 1 ft. No increase in the floodplain and floodway elevation of West Branch Llagas Creek would occur as a result of the realignment of Fitzgerald/Masten Avenue under Alternative 2. Flows from West Branch Llagas Creek would enter the depressed roadway profile; however, the overall existing flood patterns would not be affected. For Alternatives 1, 2, and 4, there would be no impacts on the floodplain hydraulics of Llagas Creek. However, Alternative 3 would affect the hydraulics of the Llagas Creek floodplain near east Gilroy from the construction of a bridge that would include three piers within the regulatory floodway, one pier on the western levee, and limited channel widening to offset fill from piers (Figure 3.8-16). Nevertheless, preliminary hydraulic analysis revealed that the water surface elevations of the 100-year floodway of Llagas Creek would increase by approximately 0.4 ft even with limited channel widening. Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Modeling, for detailed descriptions of the methods and results of the preliminary hydraulic analysis performed for the project.



Sources: SCVWD 2015; Authority 2019a

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Figure 3.8-16 Hydraulic Model Overview and Proposed Bridge over Llagas Creek near East Gilroy under Alternative 3

Prior to construction, the contractor will prepare a flood protection plan for review and approval by the Authority (HYD-IAMF#2). Using detailed hydraulic analysis that incorporates topographic surveys of the project footprint and updated project design, the flood protection plan will describe how the project would remain operational, where feasible, during a 100-year flood event where the railbed, stations, and MOWFs are in or above 100-year floodplains. General approaches to minimizing permanent effects include balancing cut and fill in floodplains; elevating platforms and structures above the 100-year floodplain water surface elevation where feasible; and implementing design standards that minimize backwater, erosion, scour, and other adverse effects from hydraulic structures. Additionally, prior to the construction of any element of the project, including earthwork and hydraulic structures, in a floodplain regulated by FEMA, the Authority would obtain approval of local floodplain managers such that project construction would not result in a substantial permanent construction effect on floodplains.

The flood protection plan will describe the specific methods that will be employed, where feasible, to minimize increases in the 100-year water surface elevations of floodplains and avoid the risk of releasing pollutants during floods (HYD-IAMF#2). The underside of bridges, or soffits, would be set above the estimated 100-year flood level, and the total width of openings in the embankment would pass 100-year flood flows without increasing the water surface elevation in the floodplain by more than 1 foot. The Authority would design and place piers to minimize backwater impacts and local scouring. The shape and alignment of the piers would be designed to minimize hydraulic impacts. Additionally, the ground-floor elevation of materials storage areas at traction power facilities, MOWF, and MOWS would be raised with fill above the 100-year water surface elevation or otherwise protected from flooding to prevent the release of pollutants during floods. Table 3.8-30 shows the specific design elements that could be incorporated into the flood protection plan (HYD-IAMF#2) to minimize permanent floodplain impacts.

Railbeds along at-grade or embankment profiles would be designed to minimize impacts on floodplain storage capacity and flood flow patterns. While the presence of ballast or the embankment would reduce the storage capacity of the floodplain, equalizer culverts would provide cross drainage to minimize impediments to shallow overland flows as needed. Where applicable, equalizer culverts would be placed in embankments every 100 feet to allow flood flows to pass through the rail alignment and minimize impacts on flood flow patterns. Where wildlife crossings would be installed within at-grade or embankment profiles, they would be designed to ensure that they would not induce flooding in new areas or cause floodplains to expand substantially. The goal for designing new at-grade and embankment railbed is to situate the alignment above the 100-year floodplain elevation where feasible and avoid impacts on existing overland flow patterns.

Where tracks would be above existing grade, such as viaducts and passenger platforms, they would be raised at least 2 feet above the water level of 100-year water surface elevations to minimize flood risk where feasible. Otherwise, alternative solutions to protecting the railbed would be described in the flood protection plan. The potential for diverting flood flows with elevated viaduct structures is less than that associated with at-grade or embankment profiles, because only the viaduct piers would serve as barriers to the passage of flood flows. However, viaduct piers would be considered fill in the floodplain because they would increase 100-year water surface elevations. The goal for designing new viaduct and platforms is to situate these structures above the 100-year floodplain elevation and avoid impacts on existing overland flow patterns to the extent feasible.

The goal for designing new trench sections in floodplains is to prevent inundation of the trench and tracks and minimize impacts on flood flow patterns. Where trench sections would be located in floodplains, they would be covered with a lid to prevent inundation and allow flows to pass over the trench. This project feature will minimize impacts on flood flow patterns from trench sections.

Table 3.8-30 Specific Design Elements that would Minimize Permanent Floodplain Impacts

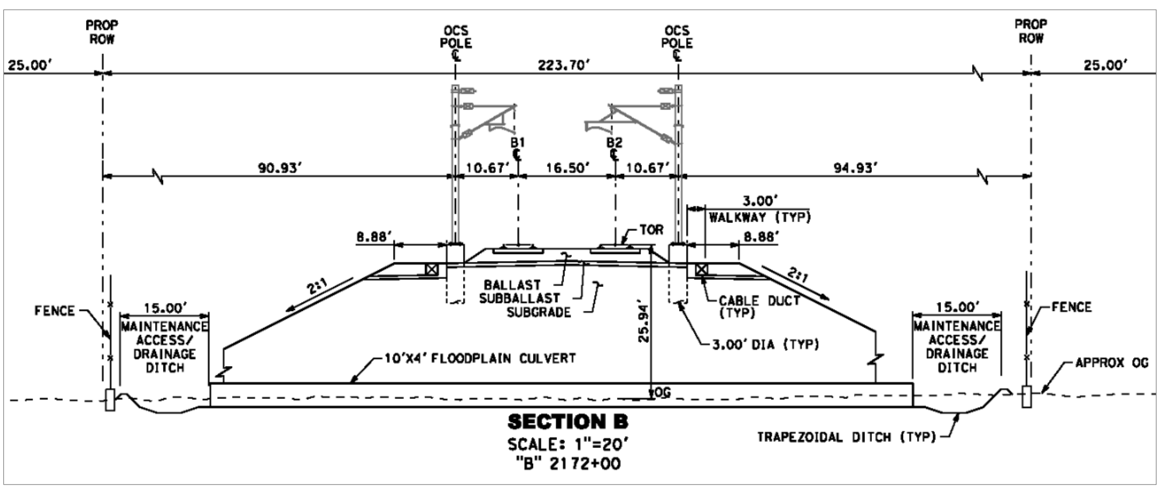
Floodplain	Alternative 1	Alternative 2	Alternative 3	Alternative 4
San Tomas Aquino Creek[1]	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains.
Guadalupe River	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains.
Isolated Floodplains	Balance cut and fill.	Balance cut and fill.	Balance cut and fill.	Balance cut and fill.
Coyote Creek	Balance cut and fill in overbank floodplains and inside Coyote Creek mainline. Optimize design of the proposed Metcalf Road bridge.	Balance cut and fill in overbank floodplains.	Balance cut and fill in overbank floodplains and inside Coyote Creek mainline. Optimize design of the proposed Metcalf Road bridge.	Balance cut and fill in overbank floodplains.
Fisher Creek	Balance cut and fill.	Balance cut and fill.	Balance cut and fill.	Balance cut and fill.
West Little Llagas Creek	Balance cut and fill.	Balance cut and fill.	Balance cut and fill.	Balance cut and fill.
Llagas Creek (near San Martin)	Balance cut and fill; additional cut would maintain existing floodway conditions.	Optimize design of the relocated UPRR and Monterey Highway bridges and proposed HSR bridge and balance cut and fill; additional cut would maintain existing floodway conditions.	Balance cut and fill; additional cut would maintain existing floodway conditions.	Balance cut and fill; optimize design of the proposed railroad bridge.
Llagas Creek (at East San Martin Avenue)	Not in Alternative 1.	Balance cut and fill.	Not in Alternative 3.	Not in Alternative 4.
Llagas Creek (near east Gilroy) and Llagas Overbank	Balance cut and fill.	Balance cut and fill.	Balance cut and fill, including areas around the East Gilroy Station; additional cut would maintain existing floodway conditions. Install equalizer culverts in embankment section at Llagas Overbank.	Balance cut and fill.

Floodplain	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Uvas-Carnadero Creek	Balance cut and fill; optimize design of Bloomfield Avenue bridge over Uvas-Carnadero Creek and the bridge overbank areas.	Balance cut and fill; install lids on trench section below US 101 to maintain flood flow patterns and prevent inundation of tracks, optimize design of Bloomfield Avenue bridge over Uvas-Carnadero Creek and the bridge overbank areas.	Not in Alternative 3.	Balance cut and fill.
Soap Lake floodplain	Reduce length of embankment sections by using viaducts, install retention ditches and equalizer culverts along embankment sections and the maintenance facility, balance fill in Tequisquita Slough with cut, and install flood control basin.	Reduce length of embankment sections by using viaducts, install retention ditches and equalizer culverts along embankment sections and the maintenance facility, balance fill in Tequisquita Slough with cut, and install flood control basin.	Reduce length of embankment sections by using viaducts, install retention ditches and equalizer culverts along embankment sections, balance fill in Tequisquita Slough with cut, reconfigure Jones-Dexter-San Ysidro Creek confluence with new channel to contain 100-year flood, install flood control basin.	Reduce length of embankment sections by using viaducts, install retention ditches and equalizer culverts along embankment sections and the maintenance facility, balance fill in Tequisquita Slough with cut, and install flood control basin.
Pacheco Creek and tributaries	Balance cut and fill, provide bridge crossing with appropriate design of pier columns, and provide bridge opening or cross culverts in embankment sections and realigned roadways.	Balance cut and fill, provide bridge crossing with appropriate design of pier columns, and provide bridge openings or cross culverts in embankment sections and realigned roadways.	Balance cut and fill, provide bridge crossing with appropriate design of pier columns, and provide bridge openings or cross culverts in embankment sections and realigned roadways.	Balance cut and fill, provide bridge crossing with appropriate design of pier columns, and provide bridge openings or cross culverts in embankment sections and realigned roadways.
San Joaquin River	Balance cut and fill, provide bridge crossing over floodplain with appropriate design of pier columns, and provide equalizer culverts in embankment sections and realigned roadways.	Balance cut and fill, provide bridge crossing over floodplain with appropriate design of pier columns, and provide equalizer culverts in embankment sections and realigned roadways.	Balance cut and fill, provide bridge crossing over floodplain with appropriate design of pier columns, and provide equalizer culverts in embankment sections and realigned roadways.	Balance cut and fill, provide bridge crossing over floodplain with appropriate design of pier columns, and provide equalizer culverts in embankment sections and realigned roadways.

HSR = high-speed rail
UPRR = Union Pacific Railroad
US = U.S. Highway
[1] San Tomas Aquino Creek does not cross the project extent. However, the floodplain encroaches into the project extent. More information on San Tomas Aquino Creek is discussed in Appendix 3.8-B.

All four alternatives would cross the Soap Lake floodplain with the track on a combination of embankment and viaduct profiles; Alternative 2 would also include a trench in this area. Both embankment and viaduct track profiles would require the placement of fill in the floodplain for either ballast or viaduct piers. In addition, both the South and East Gilroy MOWFs, as well as roadways and electrical utility improvements, would be in the Soap Lake floodplain. Under Alternatives 1, 2, and 4, the South Gilroy MOWF would be located between Uvas-Carnadero Creek and Llagas Creek, and the East Gilroy MOWF under Alternative 3 would be located at the confluence of Jones, Dexter, and San Ysidro Creeks. The proposed maintenance facilities would permanently occupy approximately 50 to 75 acres of the Soap Lake floodplain with maximum widths of 800 to 850 feet.

To minimize impacts on the Soap Lake floodplain, the project would cross most of the floodplain with aerial viaduct structures. Using aerial structures to cross the floodplain would minimize obstructions to flood flows and fill in the floodplain that would otherwise be associated with embankments or at-grade profiles. Nevertheless, fill would be required in the Soap Lake floodplain to construct piers to support the aerial viaduct structures, MOWFs, and short sections of embankment where the railbed ascends in elevation along the approach to Tunnel 1. Embankments would be required for the MOWFs along the western boundary of the Soap Lake floodplain and near Tequisquita Slough and lower Pacheco Creek along the eastern boundary of Soap Lake. Both the MOWFs and railbed embankments near Tunnel 1 would be designed to minimize impacts on the floodplain. Stabilized trapezoidal ditches would be built longitudinally along the upstream and downstream side of the MOWFs and track embankments in the Soap Lake floodplain under all four alternatives (Figure 3.8-17). Ditches on the upstream side of the embankment would retain flood flows until the water surface elevation in the ditch reaches the flow line elevation of the equalizer culverts, at which point flood flows would pass through the culvert and discharge into the ditches on the downstream side. The ditches on the downstream side would further retain discharges from the equalizer culverts until the water surface elevation reaches the top of the ditch elevation. When this occurs, flood flows would overtop the retention ditch and continue sheet-flowing downstream.



Source: Authority 2019a

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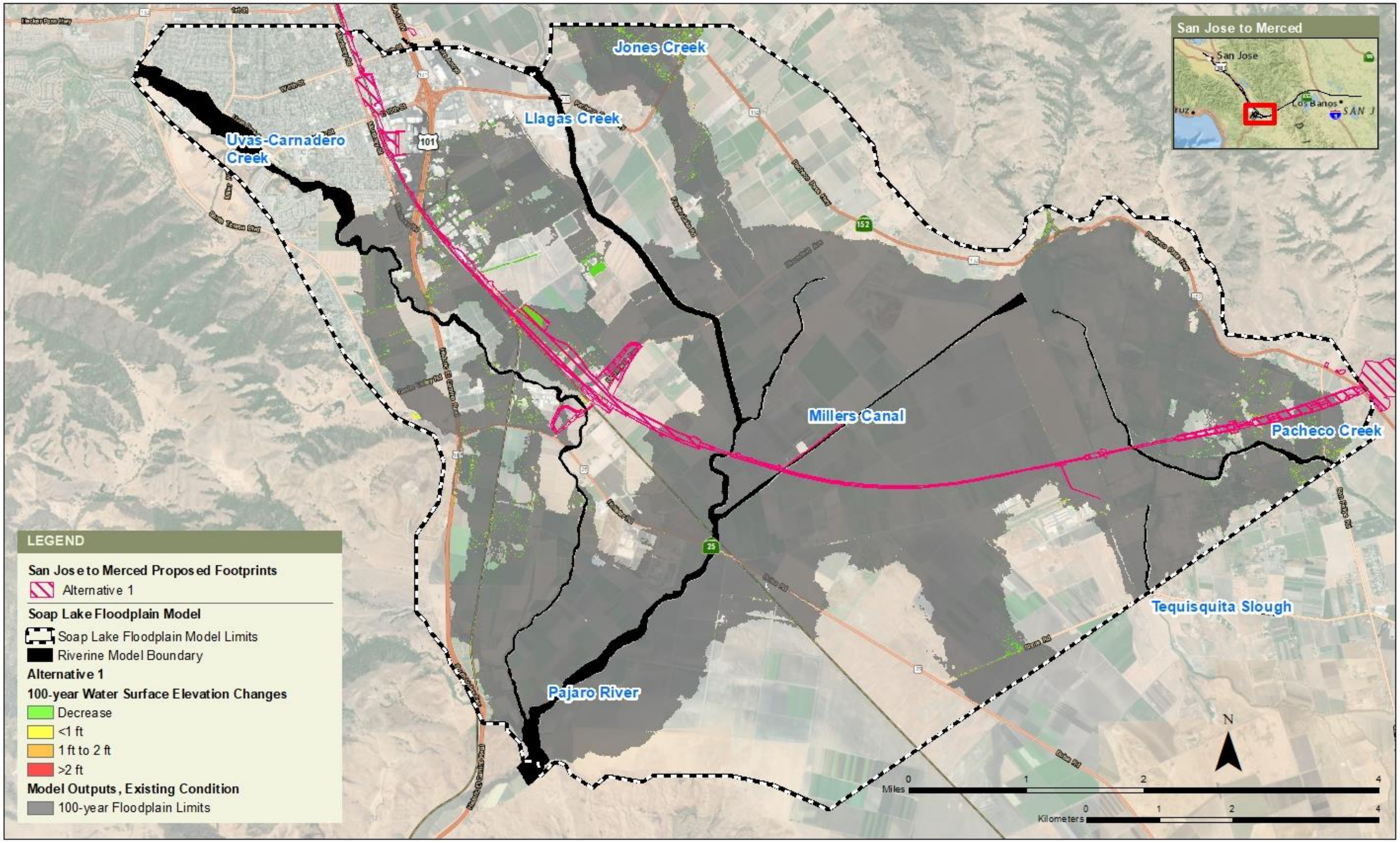
Figure 3.8-17 Embankment Cross Section in Soap Lake Floodplain

Under Alternative 3, the East Gilroy MOWF would be located at the existing confluence of Jones Creek, Dexter Creek, and San Ysidro Creek, where overland flows may occur during floods. To minimize the flood risk at the maintenance facility, the channel of Jones Creek would be realigned to flow along the northern boundary of the East Gilroy MOWF. The realigned Jones Creek channel would intercept flood flows from Dexter and San Ysidro Creeks to the north of the existing confluence and convey them to the east along the northern boundary of the facility. At the eastern end of the East Gilroy MOWF, the realigned Jones Creek channel would turn to the south and cross the rail below a viaduct section. The realigned Jones Creek would have the capacity to convey the peak 100-year flow inside the channel.

In addition, flood control basins would be installed at the South and East Gilroy MOWFs to minimize impacts on flooding patterns and water surface elevations. The basins would function by detaining flood flows in the basin area and releasing the flows at a controlled rate. To release the temporarily detained flood flows in a controlled manner, an outlet structure would be incorporated into the flood control basins. The diameter and elevation of the outlet pipe or the width and elevation of an overflow weir would determine the rate at which water in the basin is released. The basins would be designed to detain flood flows and prevent increases of the 100-year water surface elevations of the Soap Lake floodplain by 1 foot or more.

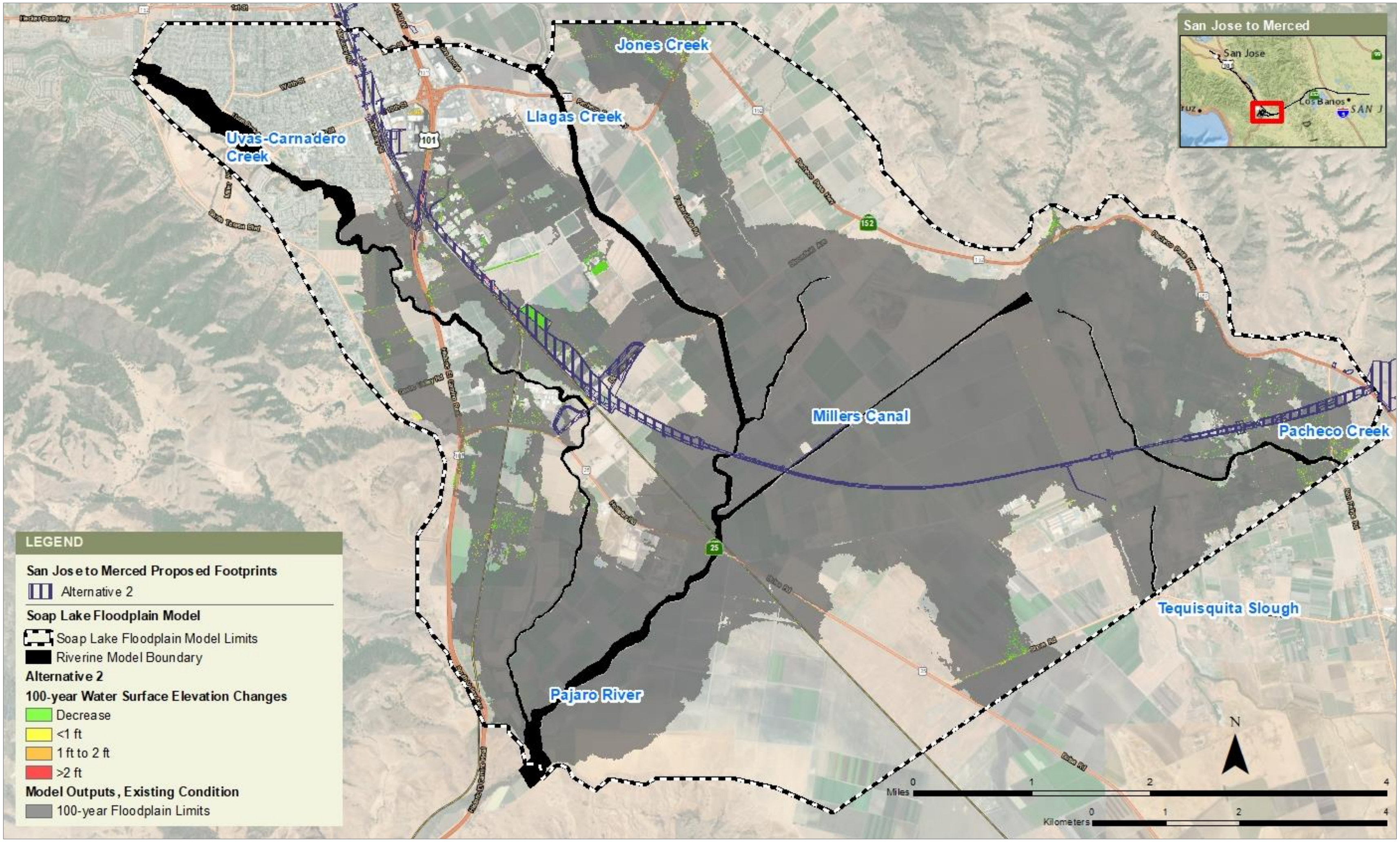
These design features will minimize potential impacts on the hydraulics of the Soap Lake floodplain, because the system of ditches, equalizer culverts, basins, and viaduct sections, as presented in the record set Preliminary Engineering for Project Definition, would offset permanent fill with cut and minimize effects on flood flow patterns, water surface elevations, and the footprint of the floodplain. These design features will also reduce the risk of releasing pollutants during floods associated with materials stored at the MOWF. Figure 3.8-18 through Figure 3.8-21 illustrate the impacts on Soap Lake under Alternatives 1, 2, 3, and 4. In these figures, areas shaded in grey indicate no impact on the existing Soap Lake floodplain. Areas shaded in green indicate where the 100-year water surface elevation would decrease. While these areas shaded in green would permanently experience less severe flooding from the project, downstream areas may experience worse flooding because a smaller volume of floodwater is stored in the areas shaded green. The 100-year water surface elevation in areas shaded in yellow would increase but not by more than 1 foot and would not trigger the FEMA regulatory 1-foot criteria for the existing 100-year floodplain (44 C.F.R. 9.11 (d)(4)). No areas are shaded in orange and red in the figures that follow, which indicates that 100-year water surface elevations of the Soap Lake floodplain would not increase by more than 1 foot. Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Monitoring, for technical descriptions of the methods and results of hydraulic modeling performed for the Soap Lake floodplain.



Note: Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Monitoring, for technical descriptions of the methods and results of hydraulic modeling performed for the Soap Lake floodplain

JANUARY 2020

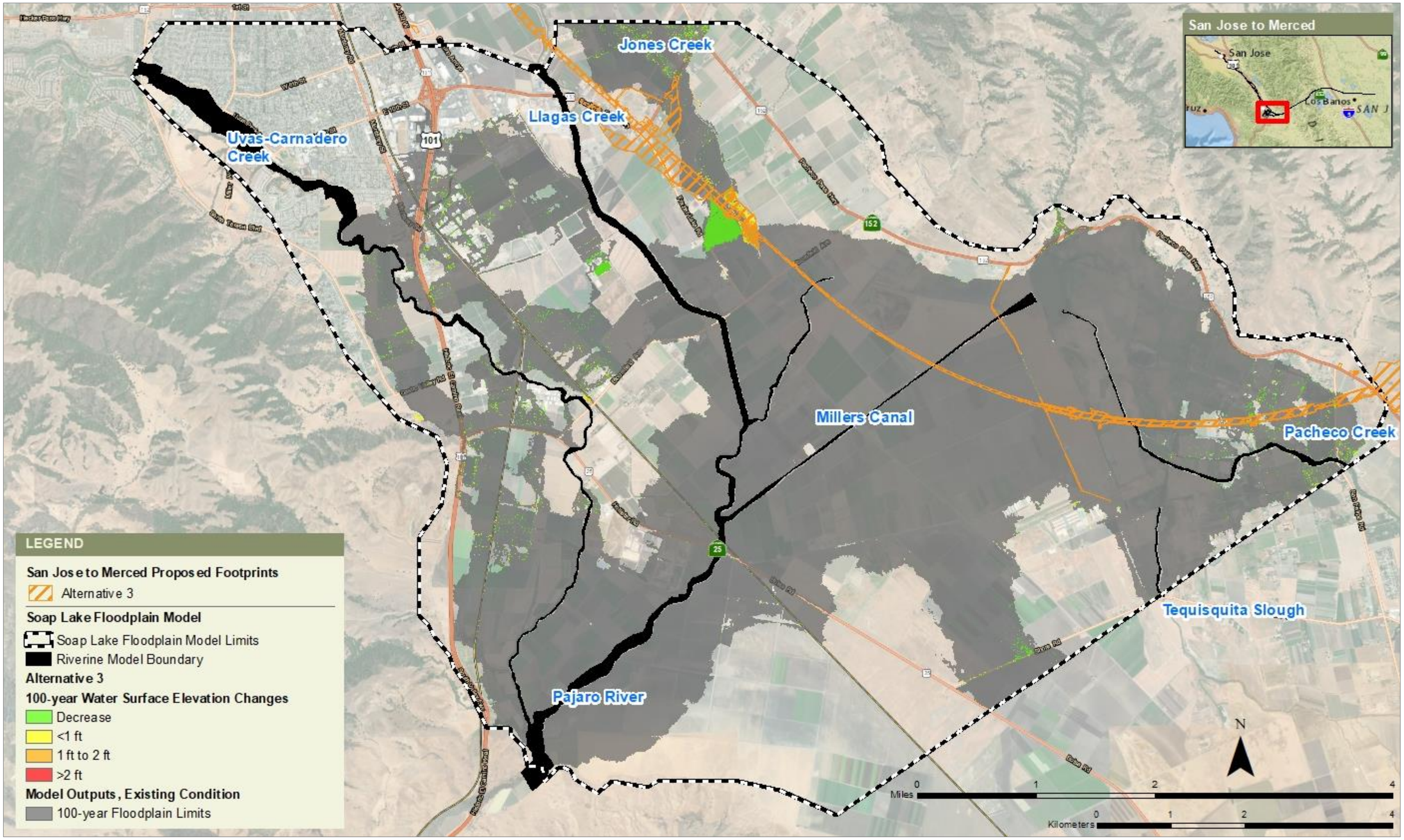
Figure 3.8-18 Impacts on the Soap Lake Floodplain under Alternative 1, Morgan Hill and Gilroy Subsection



Note: Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Monitoring, for technical descriptions of the methods and results of hydraulic modeling performed for the Soap Lake floodplain
WSE = water surface elevation

JANUARY 2020

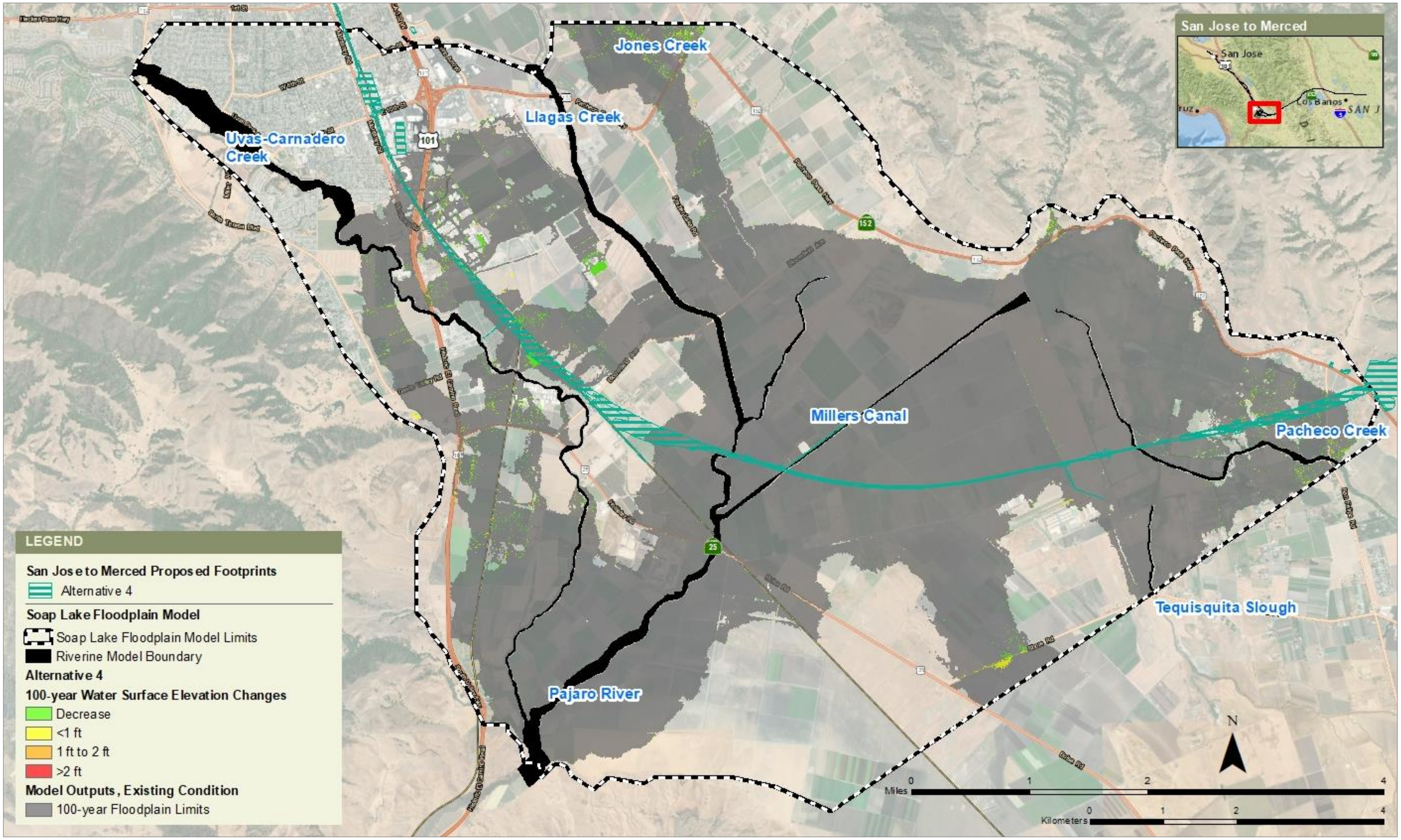
Figure 3.8-19 Impacts on the Soap Lake Floodplain under Alternative 2, Morgan Hill and Gilroy Subsection



Note: Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Monitoring, for technical descriptions of the methods and results of hydraulic modeling performed for the Soap Lake floodplain
WSE = water surface elevation

JANUARY 2020

Figure 3.8-20 Impacts on the Soap Lake Floodplain under Alternative 3, Morgan Hill and Gilroy Subsection



Note: Refer to Volume 2, Appendix 3.8-B, Summary of Hydraulic Monitoring, for technical descriptions of the methods and results of hydraulic modeling performed for the Soap Lake floodplain

JANUARY 2020

Figure 3.8-21 Impacts on the Soap Lake Floodplain under Alternative 4, Morgan Hill and Gilroy Subsection

In addition to having minimal impacts on the hydraulics of the Soap Lake floodplain, the project would have minimal impacts on the hydrology of the Soap Lake floodplain. The peak 100-year flow, as measured at Chittenden Gap, which is the downstream end of Soap Lake and the floodplain RSA, would decrease by approximately 10 to 50 cfs under Alternatives 1, 2, and 3 and increase by approximately 110 cfs under Alternative 4 (Table 3.8-31). The increase in peak flow rate under Alternative 4 would be minimal because it represents a 0.25 percent increase in flow rate from the existing condition. Furthermore, preliminary hydraulic analysis indicates there would be negligible impacts on downstream floodplains and floodways as a result of the minimal increase in peak flow rates under Alternative 4. At Sargent Pass, which is designated as a floodway by FEMA, the 100-year water surface elevation would increase by less than 0.05 foot under Alternative 4. On this basis, the construction of project elements in the Soap Lake floodplain would not have substantial downstream impacts.

Table 3.8-31 Existing and Proposed Peak 100-Year Flows of the Soap Lake Floodplain in the ICM Hydraulic Model

Peak 100-Year Flow	Alternative 1 (cfs)	Alternative 2 (cfs)	Alternative 3 (cfs)	Alternative 4 (cfs)
Existing	41,450	41,450	41,450	41,450
Proposed [1]	41,400 (-50)	41,440 (-10)	41,400 (-50)	41,560 (+110)

[1] Change from existing flow shown in parentheses.
cfs = cubic feet per second

The project would also require the permanent realignment of creeks and channels in existing 100-year floodplains. Creeks and channels that are oriented longitudinally and in conflict with the proposed improvements would be realigned to flow around the project improvements or to cross below proposed roadways or tracks. Channels in 100-year floodplains that would be realigned include Tequisquita Slough in the Morgan Hill and Gilroy Subsection under all four alternatives, Butterfield Channel in the Morgan Hill and Gilroy Subsection under Alternative 2, and Dexter Creek, San Ysidro Creek, and Jones Creek in the Morgan Hill and Gilroy Subsection under Alternative 3. Impacts from channel realignment would include modified flooding patterns. Table 3.8-18 shows the number of all waterbodies that would be permanently realigned or modified by alternative and subsection. Refer to Section 3.7, Biological and Aquatic Resources, for more information on the impacts of the project on aquatic resources and associated species. Table 3.8-30 shows the specific design elements that could be incorporated into the flood protection plan (HYD-IAMF#2) to minimize permanent floodplain impacts.

The project would pass through federal flood control projects along Guadalupe River and Llagas Creek near San Martin and east Gilroy (Table 3.8-32) and would thus require permission from USACE under Section 14 of the Rivers and Harbors Act (33 U.S.C. § 408) for work proposed at Guadalupe River as well as Llagas Creek near San Martin under all four alternatives. Alternative 3 would also require coordination with and approval by the SCVWD and NRCS for a new bridge over Llagas Creek near Holsclaw Road in east Gilroy through a permitting process under the Watershed Protection and Flood Prevention Act that is similar to that of the Section 14 process of the Rivers and Harbors Act (Arroyo 2017).

Table 3.8-32 Floodplains Requiring Authorizations under the Rivers and Harbors Act or Watershed Protection and Flood Prevention Act

Waterbody	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Guadalupe River	Viaduct over Guadalupe River	Same as Alternative 1	Same as Alternative 1	New bridge located upstream from existing railroad bridges
Llagas Creek near San Martin	Viaduct over Llagas Creek	New bridge over Llagas Creek, relocated to west of the existing bridge	Same as Alternative 1	New bridge over Llagas Creek, same alignment as the existing bridge
West Branch Llagas Creek near Gilroy	Utility improvements in floodplain	Fitzgerald/Masten Avenue would be depressed to cross under Monterey Road	Not in Alternative 3	Utility improvements in floodplain
Llagas Creek near east Gilroy	Not in Alternative 1	Not in Alternative 2	New bridge over Llagas Creek	Not in Alternative 4

Source: Arroyo 2017

Under Section 14 of the Rivers and Harbors Act (33 U.S.C. § 408), permission must be obtained from USACE for any proposed modification that involves a federal flood control project. In 2010, the Authority entered into an MOU with the FRA, USEPA, and USACE. Part of the MOU describes the steps the Authority would take to engage USACE in the design process to facilitate timely and informed decision-making with respect to compliance with Section 14 of the Rivers and Harbors Act (33 U.S.C. § 408). The Authority and USACE (San Francisco District) would continue to consult on the design for the crossings at Guadalupe River and Llagas Creek to address any substantial impacts on the floodplain hydraulics of these waterbodies under all four alternatives. Although the project has been designed to avoid substantial impacts on the 100-year water surface elevations of Guadalupe River at the existing railroad bridge crossing and Llagas Creek near San Martin, the Authority would confer with USACE pursuant to the Section 408 process. In addition, the Llagas Creek crossing near east Gilroy under Alternative 3 and the West Branch Llagas Creek crossings under Alternatives 1, 2, and 4 would require coordination with and approval by the SCVWD and NRCS regarding potential impacts on the floodplain.

The East Gilroy Station proposed under Alternative 3 would be built in existing 100-year floodplains associated with Llagas Creek. However, as mentioned previously, the SCVWD and USACE are in the process of implementing the Upper Llagas Creek Flood Control Project. This project would extend from Morgan Hill in the upper reaches of the Llagas Creek watershed through San Martin and into Gilroy and includes improvements along Llagas Creek, West Little Llagas Creek, and West Branch Llagas Creek. The project would be implemented in two phases. Phase 1 includes improvements along West Little Llagas Creek in Morgan Hill and San Martin, as well as improvements along Llagas Creek south of San Martin. Phase 2 includes channel widening, channel deepening, improvements for wildlife habitat, and construction of a tunnel to carry high water flows and local runoff. Implementation of Phase 2 of this project would contain flows in Llagas Creek such that the Llagas Overbank floodplain would no longer be inundated during the 100-year flood, protecting the East Gilroy Station from flooding and avoiding incompatible floodplain development surrounding the station (SCVWD 2016d).

Additionally, the East Gilroy Station under Alternative 3 would not encourage transit-oriented development in overbank floodplains along Llagas Creek. Currently, land surrounding the proposed East Gilroy Station is regulated under Gilroy's Measure H, which prohibits development outside the 20-year urban growth boundary without voter approval (Faber 2016). Therefore, the parcels of land surrounding the East Gilroy Station site, which are a part of the Llagas Overbank floodplain, are currently protected from development and land use change by Measure H and they would be protected from flooding by implementation of Phase 2 of the Upper Llagas Creek Flood Protection Project.

The project would increase impervious surfaces, which would increase the total volume of runoff discharging to receiving waterbodies that contribute flows to existing 100-year floodplains (Table 3.8-19). However, impacts on floodplain hydrology and hydraulics from new impervious surfaces would be avoided because the Authority will manage stormwater runoff from impervious surfaces to maintain pre-project hydrology through on-site stormwater management measures, such as infiltration and retention of stormwater runoff, where appropriate (HYD-IAMF#1).

CEQA Conclusion

The impact under CEQA would be less than significant for Alternatives 1, 2 and 4 because the design of the project would include flood protection measures to minimize impacts on the vertical profile, horizontal extent, flow patterns, and peak flows of 100-year floodplains. The project would develop and implement a flood protection plan that would include specific measures to minimize development in floodplains and prevent increases in 100-year water surface elevations by more than 1 foot in floodplains and no increases in floodways, including balancing cut and fill in floodplains, modifying the existing channels that are currently delineated as floodways, and optimizing bridge designs to minimize backwater, as well as raising the ground-floor elevations of the traction power facilities, MOWFs, and MOWS to avoid the risk of discharging pollutants during floods. Therefore, construction of the project alternatives would not substantially impede or redirect flood flows, substantially alter flooding patterns on or off site, or risk release of pollutants during floods for Alternatives 1, 2 and 4. Therefore, CEQA does not require mitigation.

The impact under CEQA would be significant for Alternative 3 because construction of the proposed bridge over Llagas Creek near Holsclaw Road in east Gilroy would impede flood flows, causing the 100-year water surface elevation of the regulatory floodway to increase by approximately 0.4 foot. The project would develop and implement a flood protection plan that would include specific measures to minimize development in floodplains. However, project features will not entirely avoid the impact on Llagas Creek under Alternative 3. Mitigation measures to address this impact are identified in Section 3.8.9, CEQA Significance Conclusions. Section 3.8.7, Mitigation Measures, describes these measures in detail.

Operations Impacts

The placement of fill inside the floodplains and floodways is not anticipated during operations to maintain bridges, culverts, and the proposed flood control measures around the proposed maintenance facilities in the Soap Lake floodplain. Chapter 2, Alternatives, describes operations and maintenance activities in further detail.

Impact HYD#16: Impacts on Floodplain Hydraulics from Intermittent Maintenance Activities during Operations

Project operations would require intermittent maintenance on bridges, culverts, and other portions of the right-of-way in floodplains regulated by FEMA, such as the flood control systems proposed for the MOWFs in Soap Lake. The DDV is not located within a floodplain or regulated floodway and thus there would be no change in flooding effects. The TDV would not change the infrastructure encroachment into the Soap Lake floodplain or any other floodplains and thus there would be no change in flooding effects. However, these maintenance activities would not require the placement of fill in floodplains or risk release of pollutants during floods.

The flood control systems proposed for the MOWFs and embankment sections in the Soap Lake floodplain would require intermittent maintenance. Debris deposited in the flood control facilities would need to be removed as specified in the flood protection plan to maintain floodwater storage and conveyance capacity. Debris carried by flood flows is anticipated to include woody debris such as fallen trees and logs, sediment and rocks, and other natural and constructed materials like organic matter, refuse, and plastics. These materials would need to be removed and disposed if they accumulate in substantial quantities that would compromise the effectiveness of the ditches surrounding the MOWFs and embankments, the equalizer culverts that allow floodwaters to pass below the MOWFs and embankments, and the flood control basins at the MOWFs and Tequisquita Slough. These intermittent maintenance activities in floodplains are necessary to minimize the flood risk during operations to provide safe HSR services between Gilroy and the San Joaquin Valley.

Intermittent maintenance activities in floodplains would not occur when there is a risk of flooding. Maintenance workers would monitor weather forecasts for heavy storms and potential flood flows. When flood conditions or heavy rains are predicted, maintenance activities in floodplains would be rescheduled and all equipment and materials temporarily stored within floodplains would be removed to minimize potential flood and safety risks. Furthermore, when maintenance activities are planned in a waterbody or floodplain, the Authority would coordinate with water districts to avoid or plan for scheduled releases from upstream dams.

CEQA Conclusion

The impact under CEQA would be less than significant for all four alternatives because intermittent operations would not result in flooding on or off site, impede or redirect flood flows, or risk release of pollutants during floods. The project would avoid intermittent operations activities in waterbodies when the risk of flooding is greatest. Additionally, maintenance personnel would monitor weather forecasts for potential flood conditions, coordinate with water and irrigation districts regarding scheduled releases from dams, and relocate equipment and materials stored in floodplains when floods are forecasted or releases from dams are scheduled. The project would thus minimize potential impacts on floodplains from intermittent maintenance activities during operations. Therefore, CEQA does not require mitigation.

3.8.7 Mitigation Measures

To mitigate potential impacts on groundwater and floodplains, the mitigation measures shown in Table 3.8-33 would be implemented as appropriate based on alternative. Descriptions of the mitigation measures follow the table.

Table 3.8-33 Hydrology and Water Resources-Specific Mitigation Measures

Mitigation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4
HYD-MM#1: Prepare and Implement a Groundwater Adaptive Management and Monitoring Program	X	X	X	X
HYD-MM#2: Maintain Existing 100-year Water Surface Elevations of the Llagas Creek Floodway near Holsclaw Road in East Gilroy			X	

Impacts on surface water hydrology and groundwater associated with construction and operation of proposed tunnels would likely result in secondary impacts on biological and aquatic resources. Refer to Section 3.7 for descriptions of impacts on biological and aquatic resources and associated mitigation measures related to tunnels.

Mitigation measures developed to address impacts on biological and aquatic resources will also reduce significant temporary and permanent impacts on water quality, including impacts associated with groundwater inflow into tunnels during construction. Mitigation measures for biological and aquatic resources are presented and described in Section 3.7, Biological and Aquatic Resources. The following mitigation measures will contribute to the mitigation of significant impacts on water quality and groundwater:

- BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan
- BIO-MM#3: Establish Environmentally Sensitive Areas and Nondisturbance Zones
- BIO-MM#4: Conduct Monitoring of Construction Activities
- BIO-MM#9: Prepare and Implement a Groundwater Adaptive Management and Monitoring Plan
- BIO-MM#25: Prepare Plan for Dewatering and Water Diversions
- BIO-MM#71: Restore Temporary Riparian Habitat Impacts
- BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat
- BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts
- BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts on Aquatic Resources

HYD-MM#1: Prepare and Implement a Groundwater Adaptive Management and Monitoring Program

To minimize potential impacts on public and private water supplies derived from groundwater resources, including water supply wells, springs, and seeps, as well as from surface water resources supported by groundwater, the Authority proposes to implement a long-term Groundwater Adaptive Management and Monitoring Program (GAMMP), which will include ongoing monitoring, management, and reporting activities to detect, address, and remedy groundwater and hydrology impacts that may arise during and after tunneling in a timely manner.

GAMMP requirements for stream flows, wetland inundation, and the biological resources that are supported by groundwater-dependent water resources, including plants, wildlife, wetlands, and habitats, are discussed in Mitigation Measure BIO-MM#9 in Section 3.7. Although mitigation for stream flows and wetland inundation is relevant to the hydrology and water resources impacts described in Section 3.8, mitigation requirements for stream flows and wetland inundation have been developed to sustain existing biological functions and values. The GAMMP requirements described here also apply to Mitigation Measure BIO-MM#9.

The GAMMP will advance a flexible strategy to respond to monitoring information that indicates changes to existing conditions resulting from project activities. In addition, if monitoring demonstrates that adaptive management actions taken to address such changes are not achieving the intended outcomes, management actions will be modified, or other strategies implemented to meet the objectives. In summary, the intent of the GAMMP is to:

- Define a study area and identify locations where impacts are likely to occur using detailed geological information generated by the geotechnical investigation and existing data sources.
- Establish baseline groundwater and surface water hydrology conditions with data collection and in situ monitoring devices.
- Develop a groundwater model that can be used to predict where groundwater and surface water impacts are likely to occur. The model will be updated during construction with additional geological information generated during tunnel construction, and the updated model will be used to predict potential changes in groundwater conditions and anticipate adaptive management needs.

- Develop a monitoring program to detect real-time changes in groundwater and surface water conditions during and after construction through comparison to baseline conditions and use of paired reference sites.
- Establish numeric triggers that require implementation of adaptive management measures to avoid or reduce impacts on groundwater and surface water resources during construction. Adaptive management measures may include modifying construction methods, providing supplemental water to affected resources, and other feasible measures that will reduce or avoid a predicted impact.
- To the extent feasible, provide water quality treatment for groundwater inflows and beneficially reuse groundwater inflows as part of the adaptive management program or discharge treated groundwater to receiving waterbodies.
- Generate reports to keep the public and resources agencies apprised of groundwater and surface water conditions before, during, and after construction as well as contribute to the body of scientific knowledge about the complex hydrogeology of the Pacheco Pass area.

Goals, Objectives, and Review/Approval of GAMMP

The purpose of the GAMMP is to maintain the minimum baseline range of well productivity, spring and seep flow, and measured groundwater levels within documented seasonal variation to:

- Maintain water resource conditions during construction substantially like flows documented during pre-construction/baseline monitoring.
- Detect any material changes in conditions that may forewarn of conditions that have potential to affect groundwater and surface water resources.
- Avoid or minimize disruptions in public and private water supplies with adaptive management measures.

Prior to construction, the GAMMP will be submitted to the U.S. Department of the Interior, Bureau of Reclamation, SWRCB, RWQCBs, and local groundwater management agencies such as the SCVWD, San Benito County, and Merced County for review (and approval as applicable).

Assessment, Modeling, and Monitoring Actions

Define Groundwater Study Area and Area of Potential Effects

A hydrogeologist will review existing geologic maps, groundwater monitoring data, results of the geotechnical investigation, and other data sources as necessary to define a groundwater study area around the proposed tunnels as well as downstream of the proposed tunnels along receiving waterbodies (i.e., Pacheco Creek, Ortega Creek, and Romero Creek). Within the groundwater study area, an area of direct surface water drawdown associated with groundwater inflows into the interior of the tunnels will be identified. The area of potential effect will also include, as appropriate, downstream reaches of receiving waterbodies specifically including Pacheco Creek.

Baseline Inventory and Monitoring of Groundwater and Surface Water Resources

The Authority, to the extent feasible, will establish baseline hydrologic conditions within the groundwater study area through data collection and monitoring. The baseline inventory will include surveying and mapping all surface water resources within the groundwater study area. Baseline surveys will characterize potential surface water and groundwater resources within the groundwater study area, including but not limited to:

- General characteristics (e.g., age of well, depth of pump and screen, production capacity, water level, water flow, water quality, use of water) and locations of public and private water supply wells, springs, and seeps.
- Reviewing well completion reports associated with public and private water supply wells in the vicinity of the proposed tunnels and any relevant hydrology data from gaging stations on Pacheco Creek.

- Monitoring groundwater pressures within geotechnical bore holes and wells as well as monitoring of seeps and springs to collect information on flows.
- Typical responses of wells, springs, and seeps to seasonal changes and weather fluctuations.
- Establishing baseline water quality through field and laboratory testing. Parameters measured with field instrumentation will include dissolved oxygen, electrical conductivity, pH, oxidation-reduction potential, temperature, and turbidity. Laboratory testing will include total hardness, calcium, magnesium, sodium, potassium, total alkalinity, hydroxide, carbonate, bicarbonate, chloride, sulfate, nitrate as N, fluoride, nitrite as N, and Title 22 metals (i.e., mercury, antimony, arsenic, barium, beryllium, cadmium, total chromium, cobalt, copper, lead, manganese, molybdenum, nickel, selenium, silver, thallium, vanadium and zinc).

Groundwater Modeling

A hydrogeologist will build a gridded surface water/groundwater model prior to commencing any tunneling activities. The purpose of the modeling will be to identify potential locations, durations, and extents of drawdown effects on the groundwater table and resulting surface water hydrology effects associated with tunneling; support the selection of appropriate locations to monitor groundwater drawdown during and after construction and reference sites that will not be affected by tunnel-related groundwater effects; identify properties where temporary water supply facilities may be necessary to remedy any shortages during tunneling; and estimate required storage capacity of temporary water supply facilities to offset estimated shortages. The model will be calibrated using baseline data collected through data collection and monitoring and structural geologic information generated from the geotechnical investigation, which will include faults and fractures in the area. The model will be updated during the construction period, and it will be used during tunneling to predict where groundwater conditions are expected to change substantially. In this way, the model will be used to predict the specific locations where adaptive management measures may be necessary, as well as the specific adaptive management measures that may remedy the impact such that impacts can be anticipated by the contractor and remedial measures can be implemented in a timely fashion. Model inputs will include rainfall, groundwater elevations, historical rainfall, and temperature data and model outputs will include evapotranspiration gaging, spring and stream flow rates, and surface water outflows.

Construction Monitoring

The Authority will designate locations and methodologies for monitoring wells, springs, and seeps that are most likely to be affected by tunneling as indicated by groundwater modeling. The purpose of this monitoring is to capture nearly real-time changes in groundwater conditions (e.g., flow, pressure readings) that might be related to tunnel construction. Monitoring data collected during construction will be compared to baseline ranges of data collected during pre-construction monitoring and with paired reference sites that are not expected to be affected by groundwater drawdown. The monitoring plan will include a schedule for monitoring that reflects periods when effects are most likely to occur at specific locations (e.g., when tunneling is nearing areas with high quantities of groundwater inflows). The monitoring plan will account for a potential delay between groundwater drawdown associated with tunneling and the appearance of surface water effects. In addition, the plan will require additional monitoring efforts if groundwater levels are found to be affected beyond the predicted area of effect established by pre-construction groundwater modeling in order to capture the full extent of potential effects on wells and springs. The following actions will be required to monitor groundwater and hydrology conditions during construction:

- Update and calibrate groundwater model with structural geology (e.g., faults and fracture trends), water pressures, groundwater inflows, water quality, temporal changes, and other observations and monitoring data. Use model to help predict potential groundwater effects in advance of tunnel construction heading.
- Establish remotely accessed telemetry system for measuring real-time variations in groundwater pressures and select spring/stream flows within area of potential drawdown and paired reference sites.

- Measure pressure changes in monitoring wells and existing water supply wells near tunnel construction for early indicators of potential effects on wells, springs, and streams.
- During construction, monitor flows of springs and streams weekly or bimonthly for early detection of any changes in comparison to the baseline data and reference sites.
- Compare minimum flow range of monitored resources to paired reference sites outside of construction influence to determine if factors, related or not related to construction, may be influencing trend (e.g., seasonal changes).
- Emphasize more frequent monitoring intervals as the TBM approaches critical ranges predicted by the groundwater model or as effects of water flows become more apparent as the TBM approaches established monitoring points.
- Test water quality of groundwater inflows for comparison to baseline water quality of springs and stream flows. Changes in water chemistry may indicate that streams or springs have tapped into different groundwater resources as a result of water losses into tunnel.
- Track groundwater recovery using pressure transducers or piezometers between the spring locations and increasing distance with the TBM that has passed a resource.
- Measure travel time through the system.
- Measure water quality parameters.
- Track groundwater and spring/seep flow recovery.
- Use of an on-site rainfall gaging station to correlate recovery of resources with rainfall quantities.

Post-Construction Monitoring

The extent of water drawdown is not predictable at this time, but implementation of the GAMMP is intended to monitor and detect hydrological changes that may result from tunneling activities. Upon completion of tunnel construction (i.e., lining system installation, backfill grouting), tunnels are generally sealed from the groundwater system, and leakage into the tunnels is stopped. Under such conditions, groundwater resources will recover from tunneling effects by being recharged by natural precipitation. However, this could take months to years after the final tunnel lining system is installed (Berg 2012). Additional monitoring will be developed to observe recovery of water resources after tunnel construction activities are completed. The monitoring will continue until such time that conditions are comparable to the ranges of baseline conditions established before construction.

- The post-construction monitoring program will be modified to focus on areas where the GAMMP has documented water resource effects during construction, until such time that recovery of the water resources is complete.
- The gridded surface water/groundwater model will be updated and calibrated it with the data collected during tunnel construction. The modeling program will be used to help predict rates of recovery for water resources affected during construction.

Remedial Actions

Beneficial Reuse of Groundwater Inflows

Two general scenarios are available for the contractor to manage groundwater inflows into the tunnel during construction: discharge into a waterbody or disposal at a publicly owned treatment works. To minimize temporary indirect reductions in groundwater levels along receiving waterbodies (e.g., Pacheco Creek, Ortega Creek, Romero Creek) and conserve water, the Authority will prioritize discharging groundwater into receiving waterbodies under applicable permits from resources agencies or beneficially reusing the water as part of the adaptive management program after treatment with a temporary active treatment system. Off-haul and disposal of contaminated groundwater at a publicly owned treatment facility will only be considered if the Authority demonstrates that providing adequate levels of treatment prior to discharge is technically infeasible using the best available and economically practicable technology. Discharging treated groundwater inflows into receiving waterbodies will provide opportunities for water to percolate back into the water table, recharge downstream aquifers, and offset potential downstream reductions in groundwater levels and stream flows. Additionally, the Authority will consider using the treated effluent from the active treatment system to provide supplemental nonpotable water as needed based on construction monitoring and adaptive management triggers, but only if the effluent meets appropriate water quality standards for the end use of the water. Providing adequate levels of water quality treatment to meet water quality standards for discharges into receiving waterbodies or reuse as part of the adaptive management program is expected to be challenging due to high pH levels associated with exposure to cement grouts and concrete as well as other construction materials in the interior of the tunnels. To meet water quality standards for beneficial reuse, settling ponds, storage tanks, and a series of treatment systems may be necessary. Only treated groundwater that meets appropriate water quality standards will be beneficially reused or discharged into receiving waterbodies.

Adaptive Management Measures

Adaptive management measures will be implemented to remedy observed impacts on water supplies.

Adaptive Management Triggers

The GAMMP will establish quantitative triggers that forewarn of potential effects on surface water resources and groundwater levels and begin the implementation of adaptive management measures. Quantitative adaptive management triggers will be established for each potentially affected seep, spring, well, or water resource based on comparisons to the baseline inventory or reference sites. Quantitative adaptive management triggers may include, but will not be limited to, exceeding or falling below specified flow rates of springs and seeps; water levels falling below screened intervals of existing wells; and well productivity falling below certain rates. Additionally, adaptive management measures would be considered if any landowner or public water agency reports changes in their water supply, as described below.

Notifications and Hotline

The Authority will establish a hotline for property owners and public water agencies to report changes to wells, springs, and seeps on their property during construction. The hotline number will be included in the notice to be sent to all property owners and public water agencies prior to construction and will be prominently posted at each of the work areas. The Authority will check the hotline daily and respond to all calls within 24 hours.

Pre-Tunneling Supplemental Water Infrastructure Provision

In advance of tunneling and as approved by landowners and public water agencies, the Authority will install water tanks and water lines on properties with wells, springs, and seeps not already equipped with sufficient storage capacity in the area where groundwater modeling predicts that an effect on groundwater levels could occur.

The tanks and lines will be sufficiently sized to make up the potential shortfall of capacity up to the average baseline water supply and use based on pre-construction monitoring data for the period the groundwater is affected. Tanks, lines, appurtenances, and all other associated temporary facilities required for the provision of supplemental water supplies will consist of inert materials that will not contribute to the degradation of water quality, such as chemical leaching from synthetic materials. Temporary facilities used to provide supplement water to surface water resources like streams and creeks will be shielded from solar radiation or adequately insulated to prevent substantial increases in water temperature. The Authority will be responsible for installing and maintaining all temporary facilities required to convey, store, and use supplemental water. After installation, the temporary water supply facilities will be inspected and tested to verify that it is in proper working order prior to engaging tunneling activities that may affect the existing water supply. Once monitoring demonstrates that affected resources have recovered to existing conditions are within the range of natural variation, the Authority will be responsible for removing these temporary facilities.

Additionally, the Authority will review currently planned and permitted landowner development projects within the groundwater study area. If it is determined that the water supply of planned or permitted developments could be adversely affected during or after construction of tunnels, the Authority will provide water tanks or temporary water supply facilities with sufficient storage capacity to offset any shortfalls generated by tunneling activities.

The required storage capacity of temporary water supply facilities will be calculated by a hydrogeologist. The hydrogeologist will calculate potential water supply shortages and identifying the storage capacity required to remedy estimated shortages. The predictive groundwater model will be used to estimate changes in groundwater levels and associated water supply shortages, unless more precise methods are available prior to and during project construction.

Adaptive Management Measures

If, during construction, monitoring indicates that adaptive management triggers have been met, the Authority will initiate appropriate actions to arrest or minimize further changes in the water resources. All employees engaged in implementation of the following adaptive management measures will be properly trained on appropriate mitigation procedures so that they are executed in a timely manner. The following adaptive management measures would be implemented, as necessary:

Additional Monitoring and Engineering Controls to Minimize Groundwater Inflows

As appropriate, during construction, addition engineering controls and monitoring methods will be implemented to minimize potential inflows. Additional monitoring actions will be required to determine effective engineering controls that can more effectively arrest or mitigate water losses. Additional monitoring actions will include geotechnical investigations to identify appropriate modification of construction methods; these additional investigations could include probe drilling ahead of the TBM, surface exploratory drilling, and installing additional monitoring instrumentation. These monitoring methods will inform whether increasing quantities of pre-excavation and backfill grout can further reduce or prevent high inflow rates.

Upgrade Existing Water Supply Wells and/or Provide Supplemental Water

If, during tunneling, a landowner, planned/permitted project proponent, or public water agency notifies the Authority that their water supply and use is being negatively affected, as soon as possible and no more than 8 hours later, the Authority will inspect the well, seep, or spring, verify there is a change from baseline conditions based on available pre-construction monitoring data and, if warranted, initiate the provision of supplemental water to the affected party. Where an effect is verified, the Authority will:

- Assess if the change in conditions can be addressed by modifying the well equipment, such as by lowering the pump within the well, cleaning the pump, or providing a larger pump; if so, the Authority will implement such changes. The Authority will provide supplemental water as necessary during the time period required to modify the well equipment.
- If supplemental water is the selected approach, the Authority will initiate provision of supplemental water from the previously placed water tank or water line or fill the landowner’s existing tank with supplemental water. Supplemental potable water will be purchased from a water retailer or a commercial water delivery service. For nonpotable water, the Authority will consider using effluent from active treatment systems used to treat groundwater inflows, but only if the effluent meets water quality standards appropriate for end uses of the water supply. Alternatively, the Authority will consider using recycled water available from water retailers or publicly owned treatment works, such as the South County Regional Wastewater Authority in Gilroy, provided that recycled water is of adequate quality to meet end water uses. By 2025, the SCVWD is planning to make an additional 8 billion gallons of recycled water per year available (SCVWD and City of San Jose 2012), so it is believed that an adequate supply of recycled water will be available for use during tunnel construction, because similar tunnel mitigation programs only used 60 million gallons total over the course of several years (Berg 2012). Lastly, the Authority will coordinate with the appropriate water agencies to determine whether water impounded by the existing Pacheco Reservoir along North Fork Pacheco Creek may be used for nonpotable supplemental water.

- In coordination with the landowner or public water agency, water provided could be a combination of potable water meeting regulatory requirements for human consumption and, where applicable, water of equal or better quality than water supply used for landscaping and livestock watering. If preconstruction data are not available to determine the quality of water used for landscape and livestock, supplemental water will meet state and federal drinking water standards.
- The Authority will continue to refill the tank or tanks or operate supplemental water lines on an ongoing basis until it is determined that well or spring production capacity has been restored such that baseline average water supply and use conditions are restored, the existing well has been modified to restore baseline average water supply and use, or another long-term measure is implemented, as discussed in the next item.
- Supplemental water discharged into surface waterbodies must comply with water quality standards. As previously described, water supply infrastructure will consist of inert materials that have low to no risk of leaching into the supplemental water supply. This infrastructure will also be either shielded or otherwise insulated from solar radiation to prevent substantial increases in water temperature in receiving waterbodies. If conventionally treated potable or recycled water will be used to supplement surface water flows in waterbodies, the water will be aerated, circulated, exposed to ultraviolet light, or otherwise treated to reduce concentrations of chlorine and other byproducts of water treatment prior to discharge.

Provide Supplemental Water Outside of Area of Predicted Effects

The Authority will establish contingency procedures to provide supplemental water outside the area of predicted effects and within the groundwater study area, if warranted by monitoring. As soon as possible and no more than 24 hours after notification, the Authority will inspect affected resources, verify if there is a change from baseline conditions based on available pre-construction monitoring data and, if warranted, initiate the provision of supplemental water to the affected landowner. Where an effect is verified, the Authority will:

- Assess if the change in conditions can be addressed by modifying the well equipment, such as by lowering the pump within the well, cleaning the pump, or providing a larger pump, and if so, will implement such changes. The Authority will provide supplemental water as necessary during the time period required to modify the well equipment.
- Begin providing supplemental water to the landowner(s) to make up for the shortfall, such as by providing on-call commercial water truck delivery to the property.
- Within 1 week of verified effect, the Authority will work with the landowner(s) to increase commercial water delivery service, install a tank and water lines or fill an existing tank, as necessary, to provide any shortfall in supply relative to the baseline average water supply and use for the period of effect.
- The Authority will have staff, equipment, and supplies readily available for quick response, such as by having an on-call commercial service in place or staging materials at one of the work areas (e.g., trucks; water containers; tanks; plumbing pipe, fixtures, and hoses).
- In coordination with the landowner(s), water provided could be a combination of potable water meeting regulatory requirements for human consumption and nonpotable water for landscaping and livestock consumption.
- The Authority will continue to provide supplemental water to make up shortfalls until the Authority can document that the project is not causing an effect or, if it is causing an effect, until it is determined that well or spring production capacity has been restored such that baseline average water supply and use conditions are restored, the existing well has been modified to restore baseline average water supply and use, or another long-term measure is implemented, as discussed in the following items.

Reporting Actions

The following reports will be prepared, published, and posted on a publicly accessible internet website to keep stakeholders and the public informed of baseline conditions observed, impacts and remedial actions taken during construction, and post-construction recovery of water resources. Additionally, making this information publicly available will assist the broader scientific community with understanding the complex geology and hydrology of the area.

- Prepare and publish annual summary reports. The first annual summary report will be published by January 31 of the year following initiation of pre-construction monitoring. Annual summary reports will be prepared before, during, and after tunnel construction. Preparation and publication of these reports will persist until post-construction monitoring has ended. Annual summary reports will summarize the content of the quarterly construction and post-construction monitoring reports, including the results of all monitoring performed during the calendar year, discussion of how monitoring results relate to progression of tunnel construction, comparison of monitoring data to baseline data or paired reference sites, remedial actions taken during construction if any and descriptions of their efficacy at achieving intended results, and post-construction monitoring efforts.
- Prepare and publish quarterly pre-construction monitoring reports that summarize baseline conditions observed since preparation and publication of the previous report, including seasonal and long-term responses of monitoring sites to rainfall.
- Prepare and publish quarterly construction monitoring reports that summarize all construction monitoring of water resources as well as any adaptive management measures implemented in response to monitoring observations or notifications from landowners.
- Prepare and publish quarterly post-construction monitoring reports to document recovery of water resources once the tunnels are complete.
- Prepare and publish a comprehensive tunneling report that describes the results of this GAMMP, whether it was effective at identifying and remediating observed impacts, lessons learned, and a summary of all data collected as part of baseline data collection, construction monitoring, and post-construction recovery. This report will include descriptions of observed effects on surface water and groundwater resources, including changes in groundwater quality, during tunneling and any remedial actions taken to reduce effects, including frequency and quantity of any supplemental water provided to landowners. The report will also include summaries of the duration of impact and recovery for wells, seeps, springs, and surface water resources.

Secondary Impacts of Mitigation

Implementing the surface water hydrology monitoring requirements of the GAMMP could have secondary impacts on water quality and biological resources. These secondary impacts would result from accessing waterbodies, seeps, and springs to perform monitoring. Accessing these waterbodies may require minor vegetation trimming or removal and monitors may need to walk through waterbodies. These activities could result in small areas of disturbed soil, which could erode or wash into a waterbody and create localized areas of increased turbidity and suspended sediment concentrations. However, these increases in turbidity and suspended sediment concentrations are not expected to exceed applicable water quality standards or substantially disrupt aquatic species. Therefore, implementing monitoring requirements of the GAMMP is not expected to have a significant secondary impact on water quality and biological resources.

The beneficial reuse of treated groundwater inflows would not cause significant secondary impacts on water quality or biological resources. Only treated groundwater that meets appropriate water quality standards would be beneficially reused as nonpotable water as part of the adaptive management program or discharged into receiving waterbodies. Additionally, regulatory permits governing these discharges, including the CGP (HYD-IAMF#3) and potentially Waste Discharge Requirements, will require that all discharges into receiving waters to be done in a manner that will avoid erosion and deposition of sediment. Compliance with these water quality standards and permits would avoid significant impacts on water quality.

Providing supplemental water supply infrastructure on properties with the potential to have their water supply impacted by tunnel construction could have secondary impacts on water quality and biological resources. These secondary impacts may result from soil disturbances associated with installing temporary water tanks, temporary water lines, and associated appurtenances. These areas of disturbed soil have the potential to erode and contribute to elevated turbidity and suspended sediment concentrations in receiving waterbodies and may disrupt existing habitat for biological species. However, the secondary impacts on water quality would not be significant, because compliance with the CGP and requirements of the SWPPP (HYD-IAMF#3) will require the application of soil stabilization and sediment control BMPs, as applicable, to prevent substantial adverse effects on water quality. All applicable mitigation relative to biological resources in Section 3.7, Biological and Aquatic Resources, will apply to disturbances due to installation of water supply infrastructure such that potential impacts will be mitigated to a less than significant level.

The installation of additional groundwater monitoring wells specific to implementing the monitoring requirements of the GAMMP could have secondary impacts on groundwater quality and volume. Installing these wells may require dewatering the excavations, resulting in temporary and localized reductions in the groundwater table. Additionally, installing the wells will require the use of material that, if accidentally discharged into the well, could impact groundwater quality. However, these are routine activities and are not expected to have significant impacts on groundwater. After installation of the casing, screens, permeable material (i.e., sand) in the annular space, and bentonite cap, groundwater levels will be allowed to return to existing conditions. Well installation will have limited effects on biological resources; all applicable mitigation relative to biological resources in Section 3.7, Biological and Aquatic Resources, will apply to well installation such that potential impacts will be mitigated to a less-than-significant level.

HYD-MM#2: Maintain Existing 100-Year Water Surface Elevations of the Llagas Creek Floodway near Holsclaw Road in East Gilroy

Preliminary hydraulic analysis for Alternative 3 indicates that the proposed Llagas Creek bridge near east Gilroy, which includes limited channel widening as shown in the record set Preliminary Engineering for Project Definition, will increase the 100-year water surface elevation of the regulatory floodway by approximately 0.4 foot. This mitigation measure will include the design and modification of the bridge and/or the floodway that will maintain existing 100-year water surface elevations within the Llagas Creek floodway, as demonstrated through detailed hydraulic analysis using topographic survey of the project footprint and updated project designs. Mitigation could potentially include, but is not necessarily limited to, optimizing the design of or relocating the piers supporting the proposed bridge, relocating the existing levee to establish a wider channel and floodplain, and dredging the channel. The proposed mitigation requires approval from the SCVWD and the U.S. Department of Agriculture–NRCS through a permitting process similar to Section 408 (Section 14 of the Rivers and Harbors Act [33 U.S.C. § 408]).

Bridge, levee or floodway modifications will require additional excavation and construction activity which could disrupt water quality, biological resources, and/or agricultural farmland. Secondary impacts on water quality would consist of increases in turbidity and suspended sediment concentrations within Llagas Creek. All applicable mitigation relative to biological resources in Section 3.7, Biological and Aquatic Resources, and relative to agricultural farmland in Section 3.14, Agricultural Farmland, will apply to temporary or permanent disturbances due to bridge, levee, or floodway modifications such that potential impacts on water quality, biological resources, or agricultural farmlands will be mitigated to a less-than-significant level. The modifications are not expected to adversely affect visual resources at this location because the bridge, levee and floodway modifications will be in the same locations as the designed location and the changes to the visual appearance of the bridge, levee and floodway will not be readily observable to viewers from public viewpoints, so that aesthetic impacts are expected to be less than significant.

3.8.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.6.4, Methods for Evaluating Impacts, the impacts of project actions under NEPA are compared to the No Project Alternative when evaluating the impact of the project on the resource. The determination of impact is based on the context and intensity of the change that would be generated by project construction and operations. Table 3.8-34 shows the hydrology and water resource impacts by alternative.

Table 3.8-34 Comparison of Project Alternative Impacts for Hydrology and Water Resources

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Surface Water Hydrology				
Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction	Changes to surface water hydrology that result in erosion and sedimentation would occur in 94 waterbodies with minor disturbances, and construction activities would occur in 232 waterbodies. Maintaining drainage patterns to the extent feasible, a SWPPP under the CGP, and adhering to regulatory permits would minimize potential impacts on surface water hydrology.	Impacts under Alternative 2 would be similar to Alternative 1; however, two fewer waterbodies would have minor disturbances (92) and 14 more waterbodies would be disturbed by construction activities (246).	Impacts under Alternative 3 would be similar to Alternative 1; however, the same quantity of waterbodies would have minor disturbances (94) and two fewer waterbodies would be disturbed by construction activities (230).	Impacts under Alternative 4 would be similar to Alternative 1; however, two fewer waterbodies would have minor disturbances (92) and seven fewer waterbodies would be disturbed by construction activities (225).
Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff during Construction	Grading, cut-and-fill slopes, impervious surfaces, new bridges and culverts, and realigned or modified waterbodies would result in minimal changes to drainage patterns and stormwater runoff. New rail and roadway crossings would maintain drainage patterns of 152 waterbodies; 132 waterbodies would be realigned or filled; there would be 52,944,372 cubic yards of cut and fill; and 1,419.2 acres of impervious surface would be constructed or reconstructed. Maintaining drainage patterns and pre-construction flow rates, a stormwater management and treatment plan, and the design of realigned or modified waterbodies would minimize permanent impacts on surface water hydrology.	Impacts under Alternative 2 would be similar to Alternative 1; however, the same quantity waterbodies would have new railroad and roadway crossings (152), 11 more waterbodies would be realigned or filled (143), there would be more cut and fill (53,181,504 cubic yards), and the largest amount of impervious surface would be constructed (1,642.1 acres).	Impacts under Alternative 3 would be similar to Alternative 1; however, fewer waterbodies would have seven fewer new railroad and roadway crossings (145), four fewer waterbodies would be filled or realigned (128), and a smaller area of impervious surface would be constructed (1,358.9 acres), but it would require the most cut and fill (55,524,808 cubic yards).	Impacts under Alternative 4 would be similar to Alternative 1; however, 11 fewer waterbodies would have new railroad and roadway crossings (141), 11 fewer waterbodies would be filled or realigned (121), a smaller area of impervious surface would be constructed 919.3 acres), and it would require the least cut and fill (52,674,633 cubic yards).

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#3: Impacts on Drainage Patterns and Stormwater Runoff from Intermittent Maintenance Activities during Operations	Operations and maintenance activities would result in minimal intermittent changes to drainage patterns and stormwater runoff. Approximately 172 waterbodies would be affected by bridge and culvert maintenance, vegetation management, and other operations conducted near waterbodies during intermittent maintenance activities. The application of BMPs, a SWPPP under the IGP, and an operations and maintenance plan under the Phase II MS4 permit would minimize potential impacts.	Impacts under Alternative 2 would be similar to Alternative 1; however, operations and maintenance would affect two more waterbodies (174).	Impacts under Alternative 3 would be similar to Alternative 1; however, operations and maintenance would affect three fewer waterbodies (169).	Impacts under Alternative 4 would be similar to Alternative 1; however, operations and maintenance would affect seven fewer waterbodies (165).

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Surface Water Quality				
Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction	Grading, excavation, work in waterbodies, temporary stream diversion, and other activities that would disturb, destabilize, and stockpile soil would result in temporary impacts on surface water quality. Runoff from 4,936 acres of disturbed soil would be controlled to prevent elevated turbidity and sedimentation in receiving waterbodies. Construction activities would occur in 232 waterbodies, 139 of which would be temporarily diverted and dewatered, which would physically disturb waterbodies and may require removal of riparian vegetation. Applying construction site BMPs in accordance with a SWPPP and the CGP and adhering to regulatory permit conditions would reduce temporary water quality impacts.	Impacts under Alternative 2 would be similar to Alternative 1; however, construction would disturb a larger area of soil (5,642 acres); disturb the bed, banks, and vegetation in 14 more waterbodies (246); and require temporarily diverting and dewatering 10 more waterbodies (149).	Impacts under Alternative 3 would be similar to Alternative 1; however, construction would disturb a larger area of soil (5,031 acres); disturb the bed, banks, and vegetation in two fewer waterbodies (230); and require temporarily diverting and dewatering two fewer waterbodies (137).	Impacts under Alternative 4 would be similar to Alternative 1; however, however, construction would disturb the smallest area of soil (4,336 acres); disturb the bed, banks, and vegetation in the seven fewer waterbodies (225); and require temporarily diverting and dewatering the six fewer waterbodies (133).

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#5: Permanent Impacts on Surface Water Quality during Construction	Land use change, impervious surfaces, and realigned or filled waterbodies would permanently affect surface water quality. Alternative 1 would construct or reconstruct 1,419.2 acres of impervious surfaces, much of which would be new impervious surface associated with a viaduct between San Jose and Gilroy. Implementing a stormwater management and treatment plan would manage the quality and quantity of runoff generated by impervious surfaces. However, 132 waterbodies would be realigned or filled, resulting in permanent conversion or loss of aquatic resources and riparian vegetation.	Impacts under Alternative 2 would be similar to Alternative 1; however, Alternative 2 would construct the largest area of impervious surface (1,642.1 acres) from the construction of grade separations in the Morgan Hill and Gilroy Subsection and would fill, realign, or modify the 11 more waterbodies (143).	Impacts under Alternative 3 would be similar to Alternative 1; however, Alternative 3 would add or replace a smaller area of impervious surfaces (1,358.9 acres) and fill, realign, or modify four fewer waterbodies (128).	Impacts under Alternative 4 would be similar to Alternative 1; however, Alternative 4 would create the smallest area of new or reconstructed impervious surfaces (919.3 acres) and fill, realign, or modify the 11 fewer waterbodies (121) by using existing Caltrain infrastructure between San Jose and Gilroy.
Impact HYD#6: Impacts on Surface Water Quality from Intermittent Maintenance Activities during Operations	Station and maintenance facility activities, including train and materials storage, would result in minimal changes to surface water quality. Bridge and culvert maintenance and vegetation management would result in minimal impacts on surface water quality during intermittent maintenance activities. These activities would occur in or near 172 waterbodies. The design of stations and maintenance facilities, a SWPPP under the IGP, and an operations and maintenance plan under the Phase II MS4 permit would minimize potential impacts under Alternative 1.	Impacts under Alternative 2 would be similar to Alternative 1; however, operations and maintenance activities would occur in two more waterbodies (174).	Impacts under Alternative 3 would be similar to Alternative 1; however, operations and maintenance activities would occur in three fewer waterbodies (169).	Impacts under Alternative 4 would be similar to Alternative 1; however, operations and maintenance activities would occur in seven fewer waterbodies (165).

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#7: Impacts on Surface Water Quality during Continuous Operations	Brake dust, PAHs, and other contaminants released by trains during ongoing operation of the rail would be deposited in 161 waterbodies. However, the electrical train technology with regenerative braking proposed for the HSR system and a stormwater management and treatment plan would minimize potential water quality impacts from brake dust and other contaminants to the maximum extent practicable using the best available technology.	Impacts under Alternative 2 would be similar to Alternative 1; however, brake dust and other contaminants would be deposited in three more waterbodies (164).	Impacts under Alternative 3 would be similar to Alternative 1; however, brake dust and other contaminants would be deposited in three fewer waterbodies (158).	Impacts under Alternative 4 would be similar to Alternative 1; however, brake dust and other contaminants would be deposited in nine fewer waterbodies (152).
Groundwater				
Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction	Dewatering, excavations, and accidental leaks and spills of materials and waste would minimally affect groundwater quality and volume. Impacts would be reduced by adhering to the RWQCBs' dewatering requirements; a construction management plan; coordination with utility providers and the RWQCBs; and implementing BMPs and project features regarding the management, transport, and disposal of construction waste and materials.	Impacts under Alternative 2 would be greater than Alternative 1, because more excavations due to the trenches, road improvements, and additional structures could potentially result in more dewatering.	Impacts under Alternative 3 would be similar to Alternative 1, as a comparable number of structures would require excavation and potential dewatering.	Impacts under Alternative 4 would be slightly less than under Alternative 1, because there would be fewer structures requiring excavation and therefore potentially less dewatering would be required.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume during Construction	New impervious surfaces in groundwater subbasins (1,303.0 acres) and recharge zones in the Santa Clara and Llagas Area subbasins (314.0 and 158.8 acres, respectively), shallow subsurface structures, and relocating or protecting 4 public drinking water supply wells would minimally affect groundwater quality and volume. Alternative 1 would reduce groundwater percolation capacity at the Gilroy Wastewater Treatment Ponds. Permanent stormwater BMPs and coordination with the RWQCBs and water utility providers would minimize impacts, but not avoid impacts entirely.	Impacts under Alternative 2 would be similar to Alternative 1; however, the largest area of impervious surface would be constructed in groundwater subbasins (1,533.7 acres) and recharge zones, eight more public drinking water supply wells (12) would be protected or relocated, and percolation capacity at the Gilroy Wastewater Treatment Ponds would be reduced.	Impacts under Alternative 3 would be less than Alternative 1; as a smaller area of impervious surface would be constructed in groundwater subbasins (1,241.4 acres), a smaller area of impervious surface would be constructed in groundwater recharge zones, one public drinking water supply well would be protected or relocated (5), and percolation capacity at the Gilroy Wastewater Treatment Ponds would not be reduced.	Impacts under Alternative 4 would be similar to Alternative 1; as the smallest area of impervious surface would be constructed in groundwater subbasins (802.9 acres), the smallest area of impervious surface would be constructed in groundwater recharge zones, eight more public drinking water supply wells would be protected or relocated (12), and percolation capacity at the Gilroy Wastewater Treatment Ponds would not be reduced.
Impact HYD#10: Temporary Impacts on Groundwater and Surface Water Hydrology during Tunnel Construction	Tunnel construction activities have the potential to substantially decrease groundwater supplies and reduce groundwater contributions to surface water flows. The highest potential for these impacts to occur are along Tunnel 2 in the highest elevations of the Pacheco Pass corridor near the Santa Clara/Merced County boundary as well as at the Ortigalita fault zone. In these areas, there is potential for substantial drawdown of groundwater resources and effects on interconnected surface water resources, even with project features that govern tunnel construction methods and tunnel waterproofing specifications.	Impacts under Alternative 2 would be the same as Alternative 1, because they share the same proposed tunnels.	Impacts under Alternative 3 would be the same as Alternative 1, because they share the same proposed tunnels.	Impacts under Alternative 4 would be the same as Alternative 1, because they share the same proposed tunnels.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#11: Permanent Impacts on Groundwater and Surface Water Hydrology from Tunnel Construction	The proposed tunnels would be designed to be as watertight as possible by installing a single-pass or double-pass liner to withstand full hydrostatic groundwater pressures and resist groundwater inflows after construction of the tunnels has been completed. Substantial permanent impacts on groundwater and surface water hydrology would be avoided, because the tunnels would be designed to be watertight and avoid permanent drawdown of groundwater resources.	Impacts under Alternative 2 would be the same as Alternative 1, because they share the same specifications for waterproofing the proposed tunnels.	Impacts under Alternative 3 would be the same as Alternative 1, because they share the same specifications for waterproofing the proposed tunnels.	Impacts under Alternative 4 would be the same as Alternative 1, because they share the same specifications for waterproofing the proposed tunnels.
Impact HYD#12: Impacts on Groundwater Quality and Volume from Intermittent Maintenance Activities during Operations	There are new impervious surfaces, such as the Downtown Gilroy Station, that would be within groundwater recharge zones; however, operations and maintenance activities would minimally affect groundwater quality during intermittent maintenance activities. These activities would also not require dewatering, pumping, or other activities that would affect groundwater volume. The design of stations, maintenance facilities, a SWPPP under the IGP, and project features regarding the management, transport, and disposal of waste and materials would minimize impacts on groundwater quality.	Impacts under Alternative 2 would be the same as Alternative 1, because these alternatives would use the same stations, South Gilroy MOWF, and MOWS.	Impacts under Alternative 3 would be similar to Alternative 1 because the East Gilroy MOWF is in the same groundwater subbasin (Llagas Area) as the South Gilroy MOWF.	Impacts under Alternative 4 would be similar to Alternative 1 because the South Gilroy MOWF under Alternative 4 is in a different location in the Llagas Area subbasin than the MOWF in Alternative 1.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#13: Impacts on Groundwater Quality and Volume during Continuous Operations	Brake dust, PAHs, and other contaminants emitted by trains would minimally affect groundwater quality during operations and continuous dewatering of tunnels is not anticipated. The electrical train technology with regenerative braking proposed for the HSR system would not generate many pollutants and a stormwater management and treatment plan would reduce the potential for brake dust to percolate into groundwater aquifers using the best available technology.	Impacts under Alternative 2 would be similar to Alternative 1; brake dust would be deposited in different locations because of different track alignments between San Jose and Gilroy.	Impacts under Alternative 3 would be similar to Alternative 1; brake dust would be deposited in different locations because of different track alignments between San Jose and Gilroy.	Impacts under Alternative 4 would be similar to Alternative 1; brake dust would be deposited in different locations because of different track alignments between San Jose and Gilroy.
Floodplains				
Impact HYD#14: Temporary Impacts on Floodplain Hydraulics during Construction	Construction would require temporary fill in existing 100-year floodplains. Potential temporary floodplain impacts would be minimized by monitoring weather forecasts, coordinating with water and irrigation districts regarding planned releases from dams, and removing temporary fill from waterbodies and floodplains when flooding may occur.	Impacts under Alternative 2 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection and a larger footprint.	Impacts under Alternative 3 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection.	Impacts under Alternative 4 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection and a smaller footprint.

Impact	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Impact HYD#15: Permanent Impacts on Floodplain Hydraulics during Construction	Construction would require cut and fill in floodplains, including bridges, culverts, roadways, embankments, viaducts, trenches, stations, maintenance facilities, realignment and modification of waterbodies, and utility upgrades. The development and implementation of a flood protection plan and coordination with the U.S. Army Corps of Engineers would minimize permanent impacts on floodplains, including the Soap Lake floodplain south of Gilroy.[1]	Impacts under Alternative 2 would be similar to Alternative 1; however, Alternative 2 would cross different floodplains.	Impacts under Alternative 3 would be similar to Alternative 1; however, Alternative 3 would increase the 100-year water surface elevation of the Llagas Creek floodway near east Gilroy by approximately 0.4 foot.	Impacts under Alternative 4 would be similar to Alternative 1; however, Alternative 4 would cross different floodplains.
Impact HYD#16: Impacts on Floodplain Hydraulics from Intermittent Maintenance Activities during Operations	Operations and maintenance activities would require intermittent activities in floodplains delineated by FEMA, including maintaining the flood control basin at the South Gilroy MOWF. Potential impacts would be minimized by monitoring weather forecasts for intense storms and flood conditions.	Impacts under Alternative 2 would be similar to Alternative 1; however, different floodplains would be affected by a larger footprint and by different alignments in the Morgan Hill and Gilroy Subsection.	Impacts under Alternative 3 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection, including a flood control system for Dexter, San Ysidro, and Jones (Furlong) Creeks at the East Gilroy MOWF.	Impacts under Alternative 4 would be similar to Alternative 1; however, different floodplains would be affected by different alignments in the Morgan Hill and Gilroy Subsection and a smaller footprint.

[1] Refer to Section 3.7 for more information on the ecological impacts of the project on aquatic resources and associated species.
BMP = best management practice
CGP = construction general permit
FEMA = Federal Emergency Management Agency
HSR = high-speed rail
IGP = industrial general permit
MS4 = municipal separate storm sewer system
PAH = polycyclic aromatic hydrocarbons
RWQCB = regional water quality control board
SWPP = stormwater pollution prevention plan

Project features have been incorporated into the design of the project that reduce impacts on hydrology and water resources. Prior to construction, the contractor will develop a stormwater management and treatment plan to reduce the quantity and improve the quality of runoff discharged into waterbodies (HYD-IAMF#1), minimizing permanent construction impacts on surface water hydrology, water quality, and groundwater as well as impacts on surface water quality and groundwater during intermittent and continuous operations. The contractor will prepare a flood protection plan to ensure that the project extent remains operational during the 100-year flood, provide for a safe method of transportation, and minimize potential permanent construction impacts on floodplains (HYD-IAMF#2). SWPPPs under the CGP and IGP will minimize potential temporary construction impacts on surface water hydrology and surface water quality, as well as impacts on surface water quality and groundwater during intermittent operations (HYD-IAMF#3 and HYD-IAMF#4). Proposed tunnels will be constructed using methods that avoid or minimize potential groundwater inflows and designed to be as watertight as possible (HYD-IAMF#5). These construction and design requirements of tunnels also avoid the need for continuous pumping of groundwater during operations (HYD-IAMF#5). Additional features of the project's design will serve to further reduce impacts, including but not limited to maintaining existing drainage and flooding patterns to the extent feasible, and relocating permanently affected public drinking water supply wells. The project features described above will avoid substantial changes to drainage patterns and stormwater runoff. However, project features are not sufficient to avoid adverse impacts on surface water quality, groundwater, and floodplains.

Temporary and permanent impacts on water quality from work in waterbodies would have the potential to exceed water quality standards for sediment and turbidity, as well as from the temporary and permanent loss of riparian vegetation and permanent conversion of aquatic resources to transportation land uses. Mitigation measures would be implemented to minimize the disturbance of waterbodies and riparian habitat, dewater creeks and waterbodies in a manner that minimizes erosion and siltation, restore disturbed waterbodies, revegetate disturbed riparian habitat, and compensate for permanent losses of water resources and habitat.

Groundwater inflows during tunnel construction have a greater potential to lower the groundwater table, potentially directly altering the hydrology of 56 creeks, 1 public water supply well, 1 spring/seep, and approximately 23 private groundwater wells. Groundwater inflows could also affect three other waterbodies (Ortega Creek, Romero Creek, and San Luis Reservoir) due to impacts to some of the tributaries to these other waterbodies. It is possible that additional resources within approximately 1 mile of the tunnel alignments could also be affected. Measures would be implemented to define the area of potential impact; model the severity of potential impacts; create an inventory of potentially affected resources; monitor potentially affected resources prior to, during, and after construction; and provide supplemental water as determined by monitoring.

Construction of a bridge to carry the proposed HSR tracks over Llagas Creek near east Gilroy under Alternative 3 would require placing piers within a regulatory floodway. Limited channel widening has been incorporated into the project to minimize the impact of the piers on the hydraulics of Llagas Creek, but this constraint would not avoid the impact entirely. Measures would be implemented to optimize the bridge design, widen the channel further, and dredge the channel so there would be no change in the 100-year water surface elevations of Llagas Creek near east Gilroy under Alternative 3 compared to existing conditions.

3.8.9 CEQA Significance Conclusions

As described in Section 3.1.6.4, Methods for Evaluating Impacts, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less than significant impact, or a significant impact. Table 3.8-35 shows the CEQA significance determinations for each impact discussed in Section 3.8.6, Environmental Consequences. A summary of the significant impacts, mitigation measures, and factors supporting the significance conclusion after mitigation follows the table.

Table 3.8-35 CEQA Significance Conclusions and Mitigation Measures for Hydrology and Water Resources

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Surface Water Hydrology			
Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction	Less than significant for all four alternatives. Through effective management and control measures and compliance with the CGP, project features will minimize potential temporary impacts on drainage patterns and stormwater runoff.	No mitigation measures are required	N/A
Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff during Construction	Less than significant for all four alternatives. Project features, such as the development and implementation of a stormwater management and treatment plan and providing drainage facilities for sources of concentrated flows, minimize potential permanent impacts on drainage patterns and stormwater runoff.	No mitigation measures are required	N/A
Impact HYD#3: Impacts on Drainage Patterns and Stormwater Runoff from Intermittent Maintenance Activities during Operations	Less than significant for all four alternatives. The project includes implementing a SWPPP under the IGP and an operations and maintenance plan in compliance with the Phase II MS4 permit that would minimize potential impacts.	No mitigation measures are required	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Surface Water Quality			
Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction	Significant for all four alternatives. Project features include developing and implementing a SWPPP that incorporates BMPs to minimize potential temporary degradation of stormwater runoff quality and avoid discharges of non-stormwater to surface waters. However, there would be significant temporary impacts on receiving water quality and riparian habitat resulting from construction activities performed within waterbodies and the removal or disturbance of riparian vegetation.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Non-Disturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#25: Prepare Plan for Dewatering and Water Diversions BIO-MM#71: Restore Temporary Riparian Habitat Impacts BIO-MM#73: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts to Aquatic Resources	Less than Significant
Impact HYD#5: Permanent Impacts on Surface Water Quality during Construction	Significant for all four alternatives. Project features minimize the potential for permanent degradation of stormwater runoff quality; construction would not result in the violation of water quality standards or creation of a substantial new source of polluted runoff. However, there would be permanent water quality impacts resulting from the permanent loss or conversion of aquatic resources and riparian habitat.	BIO-MM#72: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#74: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts to Aquatic Resources	Less than Significant
Impact HYD#6: Impacts on Surface Water Quality from Intermittent Maintenance Activities during Operations	Less than significant for all four alternatives. Project features will minimize potential discharges of sediment, pesticides, and other pollutants into receiving waterbodies.	No mitigation measures are required	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Impact HYD#7: Impacts on Surface Water Quality during Continuous Operations	Less than significant for all four alternatives. Project features include the use of stormwater BMPs to minimize surface water quality impacts during pollutant-generating activities, in accordance with state, regional, and local permits.	No mitigation measures are required	N/A
Groundwater			
Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction	Less than significant for all four alternatives: Actions would be taken prior to and during construction to investigate geologic conditions, coordinate with utility providers, perform hazardous waste studies, minimize groundwater withdrawal, control discharges of groundwater, and minimize leaks and spills that could affect groundwater quality.	No mitigation measures are required	Less than Significant
Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume during Construction	Less than significant for all four alternatives. Construction would not violate groundwater quality standards, substantially interfere with groundwater recharge, or impede sustainable groundwater management. The Authority would coordinate with public drinking water supply agencies to relocate existing wells and perform studies to avoid or minimize impacts on adjacent wells.	No mitigation measures are required	N/A
Impact HYD#10: Temporary Impacts on Groundwater and Surface Water Hydrology during Tunnel Construction	Significant for all four alternatives: Construction of tunnels has the potential to substantially temporarily decrease groundwater supplies and affect productivity of water supply wells as well as flows from springs and seeps. Additionally, construction of tunnels has the potential to result in effects on interconnected surface water resources such as creeks, wetlands, and ponds.	HYD-MM#1: Prepare and Implement a Groundwater Adaptive Management and Monitoring Program	Less than Significant
Impact HYD#11: Permanent Impacts on Groundwater and Surface Water Hydrology from Tunnel Construction	Less than significant for all four alternatives: Tunnels would be designed to be as watertight as possible by installing a single-pass or double-pass liner to withstand full hydrostatic groundwater pressures and resist groundwater inflows after construction of the tunnels is complete.	No mitigation measures are required	N/A
Impact HYD#12: Impacts on Groundwater Quality and Volume from Intermittent Maintenance Activities during Operations	Less than significant for all four alternatives. Project features include effective measures to avoid or minimize potential impacts from accidental leaks and spills at stations and maintenance facilities, including designing stations and maintenance facilities to avoid exposing contaminants to runoff and reducing the number of hazardous materials required for operations. These activities would also not require dewatering, pumping, or other activities that would affect groundwater volume.	No mitigation measures are required	N/A
Impact HYD#13: Impacts on Groundwater Quality and	Less than significant for all four alternatives. Continuous pumping of groundwater near the proposed tunnels is not expected to be required during operations. Project features include effective measures to prevent continuously	No mitigation measures are required	N/A

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Volume during Continuous Operations	degrading groundwater quality during operations, including measures that minimize the impact of brake dust generated by trains, avoid continuous dewatering, and require the use recycled water during operations if available.		
Floodplains			
Impact HYD#14: Temporary Impacts on Floodplain Hydraulics during Construction	Less than significant for all four alternatives: Construction of the project would not result in flooding on or off site, impede or redirect flood flows, or expose people to flood hazards during construction. Project features include measures to avoid construction activities in waterbodies when the risk of flooding is greatest.	No mitigation measures are required	N/A
Impact HYD#15: Permanent Impacts on Floodplain Hydraulics during Construction	Less than significant for Alternatives 1, 2, and 4. Project features include the development of a flood protection plan. The flood protection plan would include measures to prevent increases in 100-year water surface elevations by more than 1 foot in floodplains, to allow no increases in floodways to comply with FEMA regulatory standards, and to implement design requirements that avoid discharges of pollutants during floods (44 C.F.R. 9.11 (d)(4)).	No mitigation measures are required	N/A
	Significant for Alternative 3. The proposed bridge over Llagas Creek near East Gilroy would impede flood flows, causing an increase of the 100-year water surface elevation of the Llagas Creek floodway by approximately 0.4 foot.	HYD-MM#2: Maintain Existing 100-year Water Surface Elevations of the Llagas Creek Floodway near Holsclaw Road in East Gilroy	Less than Significant
Impact HYD#16: Impacts on Floodplain Hydraulics from Intermittent Maintenance Activities during Operations	Less than significant for all four alternatives. Intermittent operations would not result in flooding on or off site, impede or redirect flood flows, or expose pollutants to flood waters. Intermittent operations in floodplains would not occur when there is a risk of flooding.	No mitigation measures are required	N/A

BMP = best management practice
C.F.R. = Code of Federal Regulations
CMP = Compensatory Mitigation Plan
CGP = construction general permit
FEMA = Federal Emergency Management Agency
IGP = industrial general permit
MS4 = municipal separate storm sewer system
N/A = not applicable
SWPPP = stormwater pollution prevention plan

Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction

The Authority would implement mitigation measures to reduce temporary impacts on water quality resulting from erosion and sedimentation in waterbodies as well as potential increases in water temperature and decreases in dissolved oxygen. BIO-MM#1 will involve preparation of a restoration and revegetation plan that would identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#3 will require the project biologist to establish environmentally sensitive areas and nondisturbance zones that contain aquatic resources to reduce impacts on water quality prior to ground-disturbing activity. BIO-MM#25 will require the Authority to prepare a dewatering plan that incorporates measures to minimize turbidity and siltation of downstream waters. BIO-MM#4 will require the project biologist to monitor construction activities that occur within or adjacent to aquatic resources and document compliance with applicable avoidance and minimization measures, including measures set forth in regulatory authorizations issued under the CWA or Porter-Cologne Act. BIO-MM#71 will require contractors to begin revegetation of temporarily affected riparian areas within 90 days of completing construction. BIO-MM#73 will minimize temporary impacts on aquatic resources by requiring contractors to begin restoration of temporarily disturbed features within 90 days of completing construction. BIO-MM#74 will require preparation and implementation of a CMP for impacts on waters of the United States regulated under the federal CWA and waters of the state under the Porter-Cologne Act. These measures are expected to avoid or minimize temporary impacts and compensate for permanent impacts on receiving water quality resulting from the conversion or loss of aquatic resources and riparian habitat. Therefore, the impact would be less than significant after mitigation for all four alternatives.

Impact HYD#5: Permanent Impacts on Surface Water Quality during Construction

The Authority would implement mitigation measures to reduce permanent impacts on water quality resulting from the realignment, filling, or modification of waterbodies as well as the removal of riparian vegetation. BIO-MM#72 identifies minimum compensatory mitigation requirements for riparian habitat. BIO-MM#74 requires preparation and implementation of a CMP for both temporary and permanent impacts on aquatic resources. Together, these measures are expected to compensate for permanent impacts on receiving water quality resulting from the conversion or loss aquatic resources. Therefore, the impact would be less than significant after mitigation.

Impact HYD#10: Temporary Impacts on Groundwater and Surface Water Hydrology during Tunnel Construction

The Authority would implement mitigation to reduce potential impacts on public and private water supplies derived from groundwater resources, including water supply wells, springs, and seeps, during construction of tunnels in the Morgan Hill and Gilroy and Pacheco Pass Subsections. HYD-MM#1 will require the preparation and implementation of a GAMMP prior to, during, and after construction of tunnels. The GAMMP will specify requirements for baseline data collection, groundwater modeling, monitoring during and after construction, adaptive management triggers and required remedial actions, and communication and reporting requirements. Mitigation will reduce impacts on groundwater and surface water resources and provide supplemental water to landowners and public water agencies if tunneling disrupts water supplies. Therefore, the impact would be less than significant after mitigation.

Impact HYD#15: Permanent Impacts on Floodplain Hydraulics during Construction

The Authority would implement mitigation to reduce permanent impacts on the floodway of Llagas Creek near east Gilroy under Alternative 3. HYD-MM#2 will require the proposed Llagas Creek bridge near Holsclaw Road near East Gilroy bridge to be designed and constructed to pass the 100-year flood without increasing water surface elevations. Potential design solutions include optimizing the design of the bridge, providing additional channel/floodplain widening, and dredging the channel to maintain existing 100-year water surface elevations. The design would be coordinated with and approved by the SCVWD and NRCS through a permitting process. Therefore, the impact would be less than significant after mitigation.