3.8 Hydrology and Water Resources

3.8.1 Introduction

This section describes the regulatory setting associated with hydrology and water resources, the affected environment for hydrology and water resources, the impacts on hydrology and water resources that may result from the project, and the project design features that would reduce these impacts. This section includes a range of topics related to water resources, including surface water hydrology, water quality, groundwater, and floodplains. Surface water resources are important for fish and wildlife habitat, urban and agricultural water supply, and conveying floodwaters. Groundwater also is an important source of urban and agricultural water supply. Additional information about issues related to hydrology and water resources, such as stream crossings, irrigation, drainage canals, stormwater systems for the Fresno and Bakersfield station areas, erosion, and wetlands, is included in Sections 3.6, Public Utilities and Energy; 3.7, Biological Resources and Wetlands; 3.9, Geology, Soils, and Seismicity; 3.10, Hazardous Materials and Wastes; and 3.14, Agricultural Lands. Information on water availability is presented in Section 3.6, Public Utilities and Energy. Historical ditches and other water conveyances are described in Section 3.17, Cultural and Paleontological Resources.

The *Final Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Proposed California High-Speed Train System* (Statewide Program EIR/EIS) (Authority and FRA 2005) concluded that the HST project would have low potential to result in impacts on water resources. The alternative would use existing transportation corridors and rail lines to reduce new crossings, changes to drainage, and encroachments on water resources. To reduce project impacts on water resources, the HST alternatives incorporate, to the extent practical, design solutions such as elevated track that avoid construction and project effects on streams.

3.8.2 Laws, Regulations, and Orders

A number of federal, state, and local laws, regulations, and agency jurisdiction and management guidance exist regarding this resource. Brief descriptions of these follow. Also, see further discussion in the *Fresno to Bakersfield Section: Hydrology and Water Resources Technical Report* (Authority and FRA 2012).

3.8.2.1 Federal

Clean Water Act (33 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 primary principle is that any pollutant discharge into the nation's waters is prohibited unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool. The applicable sections of the CWA are discussed further below.

Permit for Fill Material in Waters and Wetlands (Section 404)

Section 404 establishes a permit program administered by the U.S. Army Corps of Engineers (USACE). Section 404 regulates the discharge of dredged or fill material into waters of the United States (including wetlands).

National Pollutant Discharge Elimination System Program (Section 402)

Section 402 establishes a permitting system for the discharge of any pollutant (except dredge or fill material) into waters of the United States. It requires a National Pollutant Discharge

Elimination System (NPDES) permit from the Regional Water Quality Control Board (RWQCB) for discharges.

Clean Water Quality Certification (Section 401)

Section 401 requires that an applicant for a federal license or permit to allow activities that would result in a discharge to waters of the United States obtain a state certification that the discharge complies with other provisions of the CWA. The RWQCBs administer the certification program in California.

Water Quality Impairments (Section 303[d])

Section 303(d) requires each state to provide a list of impaired waters that do not meet or are expected not to meet state water quality standards as defined by that section. It also requires the state to develop total maximum daily loads (TMDLs) from the pollution sources for such impaired water bodies.

Section 10 of Rivers and Harbors Act (33 U.S.C. 401 et seq.)

Section 10 of the Rivers and Harbors Act requires a permit for creating obstructions (including excavation and fill activities) to the navigable waters of the United States. Navigable waters are defined as those water bodies subject to the ebb and flow of the tide and/or that are utilized, in their natural condition or by reasonable improvements, as means to transport interstate or foreign commerce.

Section 14 of Rivers and Harbors Act (33 U.S.C. Section 408)

Section 14 of the Rivers and Harbors Act requires permission for the use, including modifications or alterations, of any flood control facility work built by the United States to ensure that the usefulness of the federal facility is not impaired. The permission for occupation or use is to be granted by “appropriate real estate instrument in accordance with existing real estate regulations.” A Section 408 permit is required for modification or alteration of USACE facilities.

Floodplain Management (Executive Order 11988)

Executive Order 11988 requires that federal agency construction, permitting, or funding of a project avoid incompatible floodplain development, be consistent with the standards and criteria of the National Flood Insurance Program (NFIP), and restore and preserve natural and beneficial floodplain values.

National Flood Insurance Act (42 U.S.C. 4001 et seq.)

The purpose of the National Flood Insurance 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 projects in an area identified as having special flood hazards. Projects should avoid construction in, or develop a design to be consistent with, Federal Emergency Management Agency (FEMA)-identified flood-hazard areas.

Floodplain Management and Protection (U.S. Department of Transportation Order 5650.2) and Flood Disaster Protection Act (42 U.S.C. Sections 4001–4128)

The purpose of these acts is to identify flood-prone areas and to provide insurance. The act requires purchase of insurance for buildings in special flood-hazard areas.

3.8.2.2 State

Porter-Cologne Water Quality Act (Water Code Section 13000 et seq.)

The Porter-Cologne Water Quality Act requires projects that are discharging, or proposing to discharge, wastes that could affect the quality of the state's water to file a Report of Waste Discharge with the appropriate RWQCB. The RWQCBs are responsible for implementing CWA Sections 401, 402, and 303(d). The act also provides for the development and periodic review of basin plans that designate beneficial uses of California's major rivers and groundwater basins and establish water quality objectives for those waters. Projects primarily implement basin plans using the NPDES permitting system to regulate waste discharges so that water quality objectives are met.

Construction Activities, National Pollutant Discharge Elimination System General Construction Permit

Under the federal CWA, discharge of stormwater from construction sites must comply with the conditions of an NPDES permit. The SWRCB is the permitting authority in California and has adopted the statewide General Permit for Stormwater Discharges Associated with Construction Activity that applies to projects resulting in 1, or more, acres of soil disturbance. For projects disturbing more than 1 acre of soil, a construction stormwater pollution prevention plan (SWPPP) is required that specifies site management activities to be implemented during site development. These management activities include construction stormwater best management practices (BMPs), erosion and sedimentation controls, dewatering (nuisance-water removal), runoff controls, and construction equipment maintenance, as described below in Section 3.8.6, Project Design Features.

The Central Valley RWQCB requires a Notice of Intent to be filed before any stormwater discharge from construction activities and requires that the SWPPP be implemented and maintained onsite. On July 1, 2010, the statewide General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (SWRCB Water Quality Order No. 2009-0009-DWQ, NPDES No. CAS000002) superseded the previous statewide General Permit. The new statewide permit implements a risk-based permitting approach, specifies minimum BMP requirements, and requires stormwater monitoring and reporting.

National Pollutant Discharge Elimination System General Industrial Permit

Another required permit is the statewide General Permit for Discharges of Stormwater Associated with Industrial Activities (SWRCB Water Quality Order No. 97-03-DWQ, NPDES No. CAS000001). Qualifying industrial sites are required to prepare SWPPPs describing BMPs that will be employed to protect water quality. Industrial facilities are required to use best conventional pollutant control technology (BCT) for control of conventional pollutants and best available technology economically achievable (BAT) for toxic and non-conventional pollutants. Monitoring runoff leaving the site is also required. For transportation facilities, this permit applies only to vehicle maintenance shops and equipment-cleaning operations. The state is currently updating this general permit and received public input on the draft permit in 2011. Changes to the permit are expected to include the establishment of numeric action levels (NALs) that reflect the U.S. Environmental Protection Agency (EPA) benchmark values for selected parameters, a compliance storm event (the 10-year, 24-hour event), minimum BMP requirements, a revised monitoring protocol, and three levels of corrective actions if an NAL is exceeded.

Caltrans National Pollutant Discharge Elimination System Statewide Stormwater Permit

The California Department of Transportation (Caltrans) operates under a permit (Order No. 99-06-DWQ, NPDES No. CAS000003) that regulates stormwater discharge from Caltrans properties, facilities, and activities and requires that the Caltrans construction program comply with the adopted statewide General Permit for Stormwater Discharges Associated with Construction Activity (described above). The permit requires Caltrans to implement a year-round program in all parts of the state to effectively control stormwater and non-stormwater discharges (SWRCB 1999). The Caltrans permit is applicable to portions of the project that involve modifications to state highways.

Streambed Alteration Agreement (Sections 1601 through 1603)

The California Fish and Game Code requires agencies to notify the California Department of Fish and Game (CDFG) prior to implementing any project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake.

Cobey-Alquist Flood Plain Management Act (Water Code Section 8400 et seq.)

This act documents the state's intent to support local governments in their use of land use regulations to accomplish floodplain management and to provide assistance and guidance as appropriate.

Central Valley Flood Protection Board (California Code of Regulations Title 23, Division 1)

The Central Valley Flood Protection Board (CVFPB) exercises regulatory authority 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 Title 23 of the California Code of Regulations (CCR) contains several hundred stream reaches and waterways that are regulated streams. Projects that encroach within 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.

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 (Title 23 CCR Section 2). The CVFPB has all the responsibilities and authorities necessary to oversee future modifications as approved by the USACE, pursuant to assurance agreements with the USACE and the USACE Operation and Maintenance Manuals under Title 33 Code of Federal Regulations (CFR) Section 208.10 and Title 33 United States Code Section 408.

Central Valley Flood Protection Act

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 areas protected by flood control project levees must receive protection from the 200-year flood event level by 2025. The California Department of Water Resources (DWR) and the CVFPB are collaborating with local governments and planning agencies to prepare and adopt the Central Valley Flood Protection Plan (CVFPP) by mid-2012. The objective of the

CVFPP is to create a system-wide approach to flood management and protection improvements for the Central Valley (Sacramento Valley and San Joaquin Valley).

3.8.2.3 Regional and Local

This section discusses local and regional regulations and permitting requirements. Cities and counties within the study area, as well as regional agencies, have developed ordinances, policies, and other regulatory mechanisms to minimize negative effects during a project's construction and operation. The following local plans and policies were identified and considered in the preparation of this analysis.

Regional Water Quality Control Boards

The RWQCB was established in the Porter-Cologne Act. The HST project lies within the boundary of the Central Valley RWQCB, which makes water quality decisions for the region. Its responsibilities include setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions.

Basin Plans and Water Quality Objectives

The RWQCB adopts water quality control plans, or basin plans, that establish water quality objectives to provide reasonable protection of beneficial uses and a program of implementation for achieving water quality objectives within the basin plans. The *Water Quality Control Plan for the Tulare Lake Basin* ("Basin Plan") (CVRWQCB 2004) is the applicable basin plan for the study area.

Section 303(d) of the CWA requires that the states list waters that are not attaining water quality standards. For these, the RWQCB establishes TMDLs and a program of implementation to meet the TMDL. A TMDL must account for the pollution sources causing the water to be listed.

Dewatering Activities

Care is required for the removal of nuisance water from a construction site (known as dewatering), because of the high turbidity and other pollutants potentially associated with this activity. Central Valley RWQCB's Order No. R5-2008-0081 (NPDES No. CAG95001), Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Water, covers discharges to surface water from dewatering activities. Discharges to land from dewatering activities are covered under Resolution No. R5-2008-0182, Approving Waiver of Reports of Waste Discharge and Waste Discharge Requirements for Specific Types of Discharge within the Central Valley Region.

Stormwater Management Programs

Section 402(p) of the CWA requires that stormwater management programs be developed and implemented to meet the requirements for stormwater discharges from municipal separate storm sewer systems (MS4s). MS4 permits have been issued by the SWRCB and RWQCBs in two phases. Phase I MS4 permits are issued to a group of co-permittees encompassing an entire metropolitan area. The Phase II MS4 General Permit (Order No. 2003-0005-DWQ, NPDES No. CAS000004) was adopted by the SWRCB to provide NPDES permit coverage to municipalities not covered under the NPDES Phase I Rule (i.e., small MS4s generally for fewer than 100,000 people).

Stormwater management programs limit to the maximum extent practicable (MEP) the discharge of pollutants from storm sewer systems. A single state agency or a coalition, often consisting of more than one municipality (such as cities and counties) may implement these programs. Each program includes BMPs intended to reduce the quantity and improve the quality of stormwater discharged to the stormwater system. Discharges to storm sewer systems must comply with the stormwater management program requirements.

Stormwater management programs applicable to the project include the following:

- Fresno Metropolitan Flood Control District, City of Fresno, City of Clovis, County of Fresno, and California State University Fresno *Storm Water Management Plan* (CVRWQCB 2001).
- City of Hanford *Storm Water Management Plan* (City of Hanford 2005).
- County of Tulare *Stormwater Management Plan* (Tulare County 2008).
- Kern County and the City of Bakersfield *Stormwater Management Plan* (Kern County and City of Bakersfield 2005).

City and County Policies and Regulations

Table 3.8-1 identifies water resources policies and regulations from cities and counties in the study area that were identified and considered in the preparation of this analysis. The policies pertain to water quality, floodplain and groundwater protection, and grading. These local plans and policies and regulations were identified and considered in the preparation of this analysis.

Table 3.8-1
Local Policies and Plans

Water Quality/ Stormwater Management	Floodplain Protection	Groundwater Protection	Grading Code[a]
Fresno County			
Fresno County General Plan (Fresno County 2000) Open Space and Conservation Element, Goal OS-A, Policies OS-A.24 and OS-A.26 Public Facilities and Services Element, Policy PF-A.2, Goal PF-E, Policies PF-E.19 to PF-E.21 Fresno County Ordinance Code, Title 17, Chapter 17.64, Drainage of Land Fresno Metropolitan Area Stormwater Management Plan	Fresno County General Plan (Fresno County 2000) Open Space and Conservation Element, Policy OS-A.19 Public Facilities and Services Element, Policies PF-E.4 to PF-E.13 Fresno County Ordinance Code, Title 15, Chapter 15.48, Flood Hazard Areas	Fresno County General Plan (Fresno County 2000) Open Space and Conservation Element, Goal OS-A, Policies OS-A.23 and OS-A.29 Public Facilities and Services Element, Policies PF-C.12, PF-E.14, PF-E.17 Fresno County Ordinance Code, Title 14, Chapter 14.03 Groundwater Management; Chapter 14.04 Well Regulations; and Chapter 14.08 Well Construction, Pump Installation and Well Destruction Standards	Fresno County General Plan (Fresno County 2000) Open Space and Conservation Element, Policy OS-A.25 Public Facilities and Services Element, Policy PF-E.16 Fresno County Ordinance Code, Title 15, Chapter 15.28, Grading and Excavation

Table 3.8-1
Local Policies and Plans

Water Quality/ Stormwater Management	Floodplain Protection	Groundwater Protection	Grading Code[a]
City of Fresno			
2025 Fresno General Plan (City of Fresno Planning and Development Department 2002) Public Facilities Element, Objective E-23, Policy E-23-f Resource Conservation Element, Policy G-2-b, Objective G-3, Policies G-3-g and G-3-h Safety Element, Policies I-5-d and I-5-e Fresno Municipal Code, Article 7, Urban Stormwater Quality Management and Discharge Control Fresno Metropolitan Area Stormwater Management Plan	2025 Fresno General Plan (City of Fresno Planning and Development Department 2002) Safety Element, Objective I-5, Policy I-5-a Fresno Municipal Code, Chapter 11, Article 6, Fresno Floodplain Ordinance	2025 Fresno General Plan (City of Fresno Planning and Development Department 2002) Resource Conservation Element, Policy G-2-b and G-3-i Fresno Municipal Code, Chapter 6, Article 4, Wells	None
Kings County			
2035 Kings County General Plan (Kings County Community Development Agency 2010) Resource Conservation Element, RC Objective A1.4, RC Policy A1.4.3	2035 Kings County General Plan (Kings County Community Development Agency 2010) Land Use Element, LU Policies A1.2.5 and B6.2.1 Resource Conservation Element, RC Policies A2.1.1 and A2.1.4 Health and Safety Element, HS Goal A.4, HS Policies A4.1.1, A4.1.3 to A4.1.8 Kings County Code of Ordinances, Chapter 5A, Flood Damage Prevention	2035 Kings County General Plan (Kings County Community Development Agency 2010) Resource Conservation Element, RC Policy A1.1.1, RC Objective A1.4, RC Policies A1.4.3, A.1.6 Kings County Code of Ordinances, Chapter 14A, Water Wells	None
City of Hanford			
Hanford General Plan Update 2002 (City of Hanford 2002) Public Facilities and Service Element, Objective PF 8, Policies PF 8.1, 8.2, and 8.3 Storm Water Management Plan (City of Hanford 2005)	Hanford Municipal Code, Title 15, Chapter 15.52, Flood Damage Prevention Regulation	Hanford General Plan Update 2002 (City of Hanford 2002) Open Space, Conservation, and Recreation Element Objectives OCR 9 and 10, Program OCR 9.2-A, 10.1-A, and 10.1-B	None

Table 3.8-1
Local Policies and Plans

Water Quality/ Stormwater Management	Floodplain Protection	Groundwater Protection	Grading Code[a]
City of Corcoran			
Corcoran General Plan 2025 Policies Statement (City of Corcoran 2007) Public Services and Facilities Element, Policy 8.5 Corcoran City Code, Title 12, Chapter 1, Section 12-1-31, Drainage Area	Corcoran General Plan 2025 Policies Statement (City of Corcoran 2007) Open Space, Conservation and Recreation Element, Natural Resources Objective B Corcoran City Code, Title 9, Chapter 9, Floodplain Management Regulations	Corcoran General Plan 2025 Policies Statement (City of Corcoran 2007) Open Space, Conservation and Recreation Element, Policy 5.1	None
Tulare County			
Tulare County General Plan 2030 Update (Tulare County 2010) Water Resources, Policies WR-1.2, 2.1, 2.3, 2.4, 2.7 Tulare County Stormwater Management Plan (Tulare County 2008)	Tulare County General Plan 2030 Update Health and Safety, Policies HS-5.1, 5.2, 5.4, and 5.9 Tulare County Code, Part IV, Chapter 15, Watercourses	Tulare County General Plan 2030 Update (Tulare County 2010) Water Resources, Policies WR-1.2, 1.6 Tulare County Code, Part IV, Chapter 13, Wells	Tulare County Code, Part VII, Chapter 15, Article 7, Excavation and Grading
Kern County			
Kern County General Plan (County of Kern Planning Dept. 2007a) Metropolitan Bakersfield General Plan (Unincorporated Planning Area) (County of Kern Planning Dept. 2007b) Land Use, Open Space, and Conservation Element, General Provisions, Policies 34 and 43 Kern County Municipal Code, Title 14, Chapter 14.26, Stormwater Ordinance Kern County Stormwater Management Plan (Kern County and City of Bakersfield 2005)	Kern County Municipal Code, Title 17, Chapter 17.48, Floodplain Management; Title 19, Chapter 19.50, Floodplain Primary District Metropolitan Bakersfield General Plan (Unincorporated Planning Area) (County of Kern Planning Dept. 2007b)	Kern County General Plan (County of Kern Planning Dept. 2007a) Land Use, Open Space, and Conservation Element, General Provisions, Policy 39 Kern County Municipal Code, Title 14, Chapter 14.08, Water Supply Systems Metropolitan Bakersfield General Plan (Unincorporated Planning Area) (County of Kern Planning Dept. 2007b)	Kern County Municipal Code, Title 17, Chapter 17.28, Grading Code
City of Wasco			
Wasco General Plan (City of Wasco 2010) Conservation and Open Space Element, Policy 1 Safety Element, Flooding Policies 1 and 2 Wasco Municipal Code, Title 15, Chapter 15.28, Drainage Area	Wasco General Plan (City of Wasco 2010) Safety Element, Flooding Objective A Wasco Municipal Code, Title 15, Chapter 15.32, Flood Damage Prevention	Wasco General Plan (City of Wasco 2010) Conservation and Open Space Element, Natural Resources Objective A, Policies 1 and 2	None

Table 3.8-1
Local Policies and Plans

Water Quality/ Stormwater Management	Floodplain Protection	Groundwater Protection	Grading Code[a]
City of Shafter			
City of Shafter General Plan (City of Shafter 2005) Public Services and Facilities Program, Drainage and Flooding Policies 1, 2, 3, 4	City of Shafter General Plan (City of Shafter 2005) Environmental Hazards Program, Flooding and Drainage Policies 1, 2, 4 Shafter Code of Ordinance, Title 15, Chapter 15.44, Floodplain Management	City of Shafter General Plan (City of Shafter 2005) Environmental Management Program, Water Resources Policy 2, 3	Shafter Code of Ordinance, Title 15, Chapter 15.28, Grading Code
City of Bakersfield			
Conservation Element, Water Resources Goal 4, Policy 6 Bakersfield Municipal Code, Title 8, Chapter 8.34, Industrial Stormwater; Chapter 8.35, Stormwater System Kern County Stormwater Management Plan (Kern County and City of Bakersfield 2005)	Safety Element, Flooding Goal 3, Policy 1 Bakersfield Municipal Code, Title 15, Part II, Chapter 15.74, Flood Damage Prevention; Title 17, Chapter 17.42, FP-P Floodplain Primary Zone; Chapter 17.44, FP-S Floodplain Secondary Zone	Conservation Element, Water Resources Goal 2, Policies 1, 2, 6, 8 Bakersfield Municipal Code, Title 8, Chapter 8.70, Regulation of Wells and Water Systems	City of Bakersfield Grading Code, Section 15.05.170

[a] A grading code is a local ordinance that typically specifies requirements related to earth moving, excavation, and fill. They often contain the requirements for erosion control and any seasonal restrictions on earth moving.

3.8.3 Methods for Evaluating Impacts

The following information sources (and associated geographic information system [GIS] data) describe the project's affected environment:

- **Climate, Precipitation, and Topography** – Sources of information for these elements included the Statewide Program EIR/EIS, California Data Exchange Center (2010), Western Regional Climate Center (2009), California Irrigation Management Information System (CIMIS) (2010), U.S. Geological Survey (USGS) topographic maps, National Elevation Dataset (NED), project description and conceptual design, and project plans and profiles.

- **Regional and Local Hydrology and Water Quality** – The following hydrology and water quality features exist in the regional and local project vicinity: major surface water features, including lakes, reservoirs, rivers, streams, canals, and floodplains; major water quality impairments; and major groundwater aquifers. Information regarding these features and their conditions originates in the following sources: the Statewide Program EIR/EIS, USGS topographic maps, FEMA Flood Insurance Rate Maps (FIRMs) (FEMA 2008a, 2008b, 2009a, 2009b, 2009c, 2009d, 2009e, 2009f), CVFPB floodway maps (CVFPB 1971a, 1971b, 1971c, 1976, 1985), CWA Section 303(d) lists of water quality–impaired reaches (SWRCB 2011), USGS Ground Water Atlas of the United States (Planert and Williams 1995), and the National Resource Conservation Service (NRCS) Web Soil Survey (WSS) (USDA-NRCS 2010).

3.8.3.1 Methods for Analyzing Study Area Impacts

To evaluate potential impacts on hydrology and water resources, both quantitative and qualitative analyses were performed.

- Conceptual-level plans (15% design) for each of the project alternatives were reviewed and compared with information on existing floodplains, surface water features, and groundwater basins.

- Federal and state statutes regulating water resources were reviewed 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, protect drinking water systems, protect aquifers, and protect floodplain and floodway values. County and city general plans and ordinances were also reviewed for applicable policies and regulations to determine if implementation of the proposed project would result in potential impacts.

- A review of available documents from various agencies including the USGS, FEMA, CVFPB, RWQCB, and USACE was conducted to determine whether water quality and/or water resources would be affected by the proposed project and alternatives. Local agencies were consulted regarding canal crossings.

- Floodplain and floodway maps from FEMA and CVFPB were reviewed. Floodplain boundaries were determined using digital FIRMs (DFIRMs) obtained from FEMA (FEMA 2008b, 2009d, 2009e, 2009f). The FEMA-designated 100-year floodplain areas and base flood elevations (BFEs) were identified and mapped using GIS and are based on FEMA's FIRMs for Fresno, Kings, Tulare, and Kern counties. The FIRMs have effective dates of February 18, 2009, for Fresno County, June 16, 2009, for Kings and Tulare counties, and September 26, 2008, for Kern County (FEMA 2008a; 2009a, 2009b, 2009c).

- Detailed topographic data were only available for a narrow swath for part of the alignment. Detailed data were not available for wider areas of the project vicinity; therefore, information was based on available USGS NED, aerial imagery, and information from FEMA and CVFPB regarding the floodplains and floodways. The detailed data included:

  - DTM DATA: These are the most-detailed data. They cover a swath about 3,000 feet wide and were centered on the alignment as it existed in October 2010. They are based on photogrammetry from photographs taken on October 20 and October 26, 2010, at a scale of 1:7200. These data represent bare ground.

  - SAR (Synthetic Aperture Radar) data: These data varied in location availability but was generally a swath about 12,000 feet wide covering the same path as the DTM data. The results were based on published data from June 2004. The data are not bare earth but include vegetation and buildings.

  - National Elevation Dataset Data: These data were used when DTM or SAR data were not available. The National Elevation Dataset is the primary elevation data product produced and distributed by the USGS. The NED is derived from diverse source data and processed to a common coordinate system and unit of vertical measure. NED data were at a 1/3 arc-second (approximately 10 meters) resolution.

The following sections summarize the methods used to analyze project impacts on surface water hydrology, surface water quality, groundwater, and floodplains using the data gathered (and the GIS databases) from the sources listed above. Water availability is discussed in Section 3.6, Public Utilities and Energy.

Surface Water Hydrology

- Analysts overlaid GIS layers for the proposed HST alternatives on the GIS layers for surface waters and flood-prone areas, USGS topographic maps, and aerial photography from web mapping services to identify the potential impacts on surface waters. Analysts then used these GIS layers to identify project crossings of streams and irrigation canals.

Surface Water Quality

- Analysts evaluated construction activities for the potential to affect surface water quality due to uncontrolled runoff and discharges. These included accidental releases of construction-related hazardous materials, ground disturbance and associated erosion and sedimentation, stormwater discharges, and dewatering discharges, particularly in locations within or close to a surface water body. An approved SWPPP when properly implemented would reduce the potential adverse water quality effects from construction.
- Analysts reviewed project operation and maintenance activities for the potential to introduce pollutants into the environment, with a particular focus on stormwater runoff from major facilities such as the heavy maintenance facility (HMF) and stations.

Groundwater

- The proposed HST alternatives and groundwater information was used to evaluate the potential for groundwater impacts during construction where there is a potential for site runoff to percolate to the groundwater aquifer. Analysts reviewed major project facilities, particularly the HMF alternative sites, for the potential to reduce groundwater recharge.
- Analysts evaluated whether water use by facilities had the potential to cause groundwater depletion of the local aquifer. To evaluate potential groundwater-use effects associated with the station and HMF alternatives, analysts calculated drawdown using the Theis Equation for unsteady flow to a well (Kruseman and de Ridder 1991).

In general, the HST stations are located within existing or planned municipal water distribution areas, while the HMF sites do not currently have connections to municipal water supply. Exceptions include the Kings Tulare Regional Station–East Alternative, which is located just outside of the Hanford urban growth area. If it is not possible or practicable to connect to a municipal supply, a groundwater well (or wells) would be installed and groundwater would be used for water supply. If pumping rates are high enough, they could influence the water level in neighboring wells.

The HMF would require approximately 50 acre-feet per year, on average, for domestic use and the Kings Tulare Regional Station–East Alternative would require 18 acre-feet per year of water for domestic use. Water use by the HMF corresponds to a pumping rate of about 31 gallons per minute (gpm), on average (assuming pumping 24 hours per day continuously), or about 62 gpm if pumping occurs 12 hours per day, while water use at the station would be less. Groundwater pumped at a well causes a local drawdown effect. The radius of influence for a well is the distance at which the effect of pumping on water levels is minor. For the analysis presented in this report, it was assumed that the radius of influence extended to where the water level was 6 inches below the original water surface level.

Floodplains

- Analysts overlaid GIS layers for the proposed HST alternatives on the GIS floodplain layers to identify how much of the project lies within the 100-year floodplain.

- Analysts evaluated the potential for the proposed HST alternatives to increase flood height and/or to divert flood flows using flood information from the FEMA county flood insurance studies and the available topographic data.

Flow data were primarily obtained from FEMA flood insurance studies from the study area. Table 3.8-2 shows the flow data available from these studies.

Table 3.8-2
Flow Data from FEMA Flood Insurance Studies Used in Flood Analyses

Location[a]	Flow (1% annual chance) (cfs)	FEMA Flood Insurance Study	Notes
Central Canal at SR 99	350	Fresno County	
Kings River upstream of Peoples Weir	19,900	Tulare County	
East Branch Cross Creek above Tule River	19,200	Kings County	Detailed study between Orange and Kansas, includes BNSF
Tule River above Cross Creek	20,500	Kings County	Detailed study at county line
Poso Creek	19,000	Kern County	Detailed study between SR 99 and Zerker Road
Kern River at Stockdale Hwy	10,200	Kern County	

Source: FEMA 2008c, 2009g, 2009h, 2009i.
[a] No information for Deer Creek
Acronyms and Abbreviations:
cfs = cubic feet per second
FEMA = Federal Emergency Management Agency
Hwy = highway
SR = state route

3.8.3.2 Methods for Evaluating Effects under NEPA

Pursuant to NEPA regulations (40 CFR 1500-1508), project effects are evaluated based on the criteria of context and intensity. Context means the affected environment in which a proposed project occurs. Intensity refers to the severity of the effect, which is examined in terms of the type, quality, and sensitivity of the resource involved, the location and extent of the effect, the duration of the effect (short- or long-term), and other considerations. Beneficial effects are identified and described. When there is no measurable effect, an impact is found not to occur. The intensity of an adverse effect is the degree or magnitude of a potential adverse effect; the intensity is described as negligible, moderate, or substantial. Context and intensity are considered together when determining whether an impact is significant under NEPA. Thus, it is possible that an impact could be less than significant even when the intensity of the effect is determined to be substantial and adverse or even beneficial, because of context.

For hydrology and water quality, the terms negligible, moderate, and substantial are defined as follows:

- Effects with *negligible* intensity are those that would have a measurable change in surface water and groundwater hydrology, water quality, and drainage and floodplains but are very close to the existing conditions.

- Effects with *moderate* intensity are those with a measurable change in these resources, but do not contribute to a violation of regulatory standards or exceed the capacity of existing facilities (e.g., drainage or flood control channels).
- Effects with *substantial* intensity are those that contribute to a measurable change and a violation of regulatory standards or exceed the capacity of existing facilities.

3.8.3.3 CEQA Significance Criteria

For this project, the following criteria are used in determining whether the project would result in a significant impact on hydrology and water quality:

- Violate any water quality standards or waste discharge requirements.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).
- Substantially alter the existing drainage pattern of an area, including through the alteration of the stream or river, in a manner which would result in substantial erosion or siltation onsite or offsite.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite.
- 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.
- Otherwise substantially degrade water quality.
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or FIRM or other flood hazard delineation map.
- Place structures within a 100-year flood hazard area which would impede or redirect flood flows.
- Expose people or structures to loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

Because the project will not construct any housing and relocation of residents as a result of the project would not cause construction of new housing (see analysis in Chapter 3.12, Socioeconomics, Communities, and Environmental Justice), placing housing within a 100-year flood hazard area is not addressed. Exposing people or structures to loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam, is addressed in Section 3.9, Geology, Soils, and Seismicity.

3.8.3.4 STUDY AREA FOR ANALYSIS

The project area lies within the South Valley Floor in the Tulare Lake Basin (Figure 3.8-1). The study area covers the area generally defined by Fresno to the north, Bakersfield to the south, the California Aqueduct to the west, and the Sierra Nevada foothills to the east. The study area for hydrology and water resources includes both sides of the right-of-way for each alternative alignment and the project's proposed physical ground disturbance footprint (e.g., stations, track, equipment storage areas, substations, temporary construction areas), as described in Section 3.1, Introduction, and the following elements:

- Surface Water: receiving waters of project runoff, including from the Sierra Nevada foothills that drain to the Tulare Lake Basin.
- Groundwater: aquifer(s) underlying the construction footprint.
- Flooding: FEMA-designated flood-hazard areas (FEMA 2008b, 2009d, 2009e, 2009f) within the proposed project's physical ground disturbance footprint, as well as any areas where flood frequency, extent, and duration could be affected by the project.

Also, see further discussion in the *Fresno to Bakersfield Section: Hydrology and Water Resources Technical Report (Authority and FRA 2012)*.

3.8.4 Affected Environment

3.8.4.1 Climate, Precipitation, and Topography

The climate within the study region is semi-arid, with long, hot, dry summers and relatively mild winters. Heavy rainfall and snow in the western Sierra Nevada are the major sources of water in the Tulare Lake Basin (Gronberg et al. 1998). As determined from the long-term records of precipitation, the average annual precipitation in the study region ranges from approximately 6.23 to 10.94 inches. More than 80% of precipitation in the study area occurs from November through April. In the Sierra Nevada, the majority of the mean annual precipitation falls as snow and ranges from 20 inches in the foothills to over 80 inches at higher elevations. The Coast Ranges west of the valley floor have annual precipitation ranging from 10 to more than 20 inches (Gronberg et al. 1998). Additional information regarding precipitation within the study region can be found in the *Fresno to Bakersfield Section: Hydrology and Water Resources Technical Report* (Authority and FRA 2012). For additional information on climate, see Section 3.3, Air Quality and Global Climate Change.

The soils underlying the project alternatives and HMFs consist primarily of alluvial deposits of clay, silt, sand, and gravel with varying grain sizes and content. The soil types and consistencies of these deposits vary by location, depending on how they were deposited. The surface soils in the project vicinity generally have high permeability and infiltrate runoff relatively quickly. Section 3.9, Geology, Soils, and Seismicity, provides more information.

Figure 3.8-1
Regional hydrologic setting

3.8.4.2 Regional Hydrology and Water Quality

Surface Waters

Stream flow consists of natural flows, irrigation runoff, and other point- and nonpoint-source discharges (EPA 2005, 2009). Natural flows depend on precipitation, snowmelt runoff, and the slow discharge of groundwater through surface seeps and springs. Natural or man-made impoundments, water diversions, levees, and channel straightening or realignment regulate stream flows. Much of the region is in a floodplain, which has a relatively flat gradient that generally slopes slowly to the west or southwest. When the stream channels overflow, shallow, 1- to 3-foot-deep overland flooding occurs that tends to pond against linear obstacles such as canal levees and road and railroad embankments lying perpendicular to the land gradient. If these facilities lack sufficient culverts or other means of cross drainage, the overland flows can be diverted for long distances before finally overflowing the linear obstacles and continuing west.

What is Nonpoint- and Point-Source Pollution?

Nonpoint-source pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (EPA 2005). A *point-source* discharge usually refers to a waste emanating from a single, identifiable place (RWQCB 1998).

Natural flow from the headwaters in the Sierra Nevada starts out generally free of pollutants. As natural flows decrease seasonally, concentrations of pollutants increase. Stormwater and irrigation runoff enters streams directly as overland flow and, therefore, surrounding land uses affect surface water quality. Urban and agricultural runoff can carry the dissolved or suspended residue of both natural and human land uses within the watershed. Pollutant sources in urban areas include parking lots and streets, industrial uses, rooftops, exposed earth at construction sites, and landscaped areas. Pollutant sources in rural and agricultural areas primarily include agricultural fields and operations. Pollutants in runoff can include sediment, oil and grease, hydrocarbons (e.g., fuels, solvents), heavy metals, organic fertilizers and pesticides, pathogens, nutrients, and debris. Construction activities, such as grading that removes vegetation and exposes soil to erosion, can contribute to accelerated erosion rates, which can result in runoff containing sediment that ultimately flows into surface waters. In addition, potentially erosive conditions occur in areas that have a combination of erosive soil types and steep slopes. Section 3.9, Geology, Soils, and Seismicity, provides more details regarding soil erosion.

The project is within the Tulare Lake Basin, which has a drainage area of 17,400 square miles (CVRWQCB 2004; see also Figure 3.8-1). The Tulare Lake Basin is drained by Kings, Kaweah, Tule, and Kern rivers, which flow to the dry beds of Tulare, Buena Vista, and Kern lakes. Before agricultural development, the Tulare Lake Basin was dominated by four large, shallow, and mainly temporary inland lakes (Gronberg et al. 1998). The Tulare Lakebed, which was the most northerly lake of the four, has been turned into a system of approximately 103 miles of levees and irrigation canals to direct flooding away from farmed tracts of land (USACE 1996). Kern River once flowed south and west across the southern portion of the valley through a complex system of sloughs, creeks, ponds, and permanent wetlands, and fed Buena Vista and Kern lakes. Figures 3.8-2 through 3.8-5 show project vicinity water resources.

To convey water for agricultural purposes, many watercourses are highly altered from their natural state. Farmers and other agricultural producers pump groundwater and surface water to and from numerous canals and drains delivering irrigation water to and from agricultural fields. Composed of packed earth or concrete-lined, canals generally lack the meanders of natural streams.

The California Aqueduct and Friant-Kern Canal are major water conveyance systems that cross the study region. The California Aqueduct, approximately 30 miles west of the alternative alignments, was constructed in the 1970s and supplies agricultural and municipal areas in southern California. The California Aqueduct generally runs north-south.

The Friant-Kern Canal transports water south from Millerton Lake, a reservoir north of Fresno created by Friant Dam, and joins Kern River approximately 4 miles west of Bakersfield. The 152-mile-long Friant-Kern Canal is east of the alternative alignments. The canal capacity near Millerton Lake is 5,000 cubic feet per second (cfs) and decreases to 2,000 cfs in the southern portion of the valley as water is diverted for municipal, industrial, and agricultural use (ICF Jones & Stokes 2008). With the consent of the U.S. Bureau of Reclamation, Kaweah River water is occasionally pumped to the canal to relieve downstream flooding in the Tulare Lakebed. Where the canal is full or downstream demand is low, the Friant-Kern Canal may not be used for flood control purposes (USACE 1996).

Kings River

Kings River originates in the Sierra Nevada and flows southwest approximately 125 miles to the Tulare Lakebed. The north, middle, and south forks of Kings River converge in the foothills upstream of Pine Flat Dam. Pine Flat Reservoir (also referred to as Pine Flat Lake) provides 475,000 acre-feet (AF) of flood control storage (see Figure 3.8-1). Upstream of Pine Flat Dam, Kings River drains approximately 1,545 square miles (USACE 1999). Downstream of the dam, Kings River flows through canals and levee systems and splits into multiple channels as water is diverted for irrigation and flood control in the valley.

The middle and south forks of Kings River within the Kings Canyon National Park are designated as wild and scenic. These reaches of the river are about 50 miles east of the alternative project alignments.

Approximately 1 mile downstream of State Route (SR) 99 (and 8 miles upstream of the BNSF Alternative crossing of Cole Slough), Peoples Weir spans Kings River and diverts water into the Lakeland Canal and Peoples Ditch. Large floods in the 1860s carved a new channel for Kings River below Peoples Weir and Cole Slough became the main channel. The old channel, known as Old River, is usually dry. About 2 miles above where the BNSF Alternative crosses Cole Slough, the channel is divided into Dutch John Slough and Cole Slough by the Dutch John Weir. Water is diverted down each channel, Cole Slough or Dutch John Slough, depending on water demands.

Cole Slough rejoins the Old River at Reynolds Cut, less than 3 miles below the BNSF Alternative crossing of Cole Slough. Reynolds Weir controls flow into Murphy Slough, Liberty Canal, and Grant Canal. The Hanford West Bypass 1 Alternative and Hanford West Bypass 2 Alternative cross Murphy Slough, Grant Canal, and Kings River approximately 2 miles downstream of Reynolds Weir.

Dutch John Cut joins Old River about 2 miles below the BNSF Alternative crossing of Kings River (also known as Old River at this location). The flow through Dutch John Cut to the Old River becomes the main flow of Kings River, which continues downstream. Flow from Kings River eventually reaches the Tulare Lakebed (KRCD and KRWA 2009).

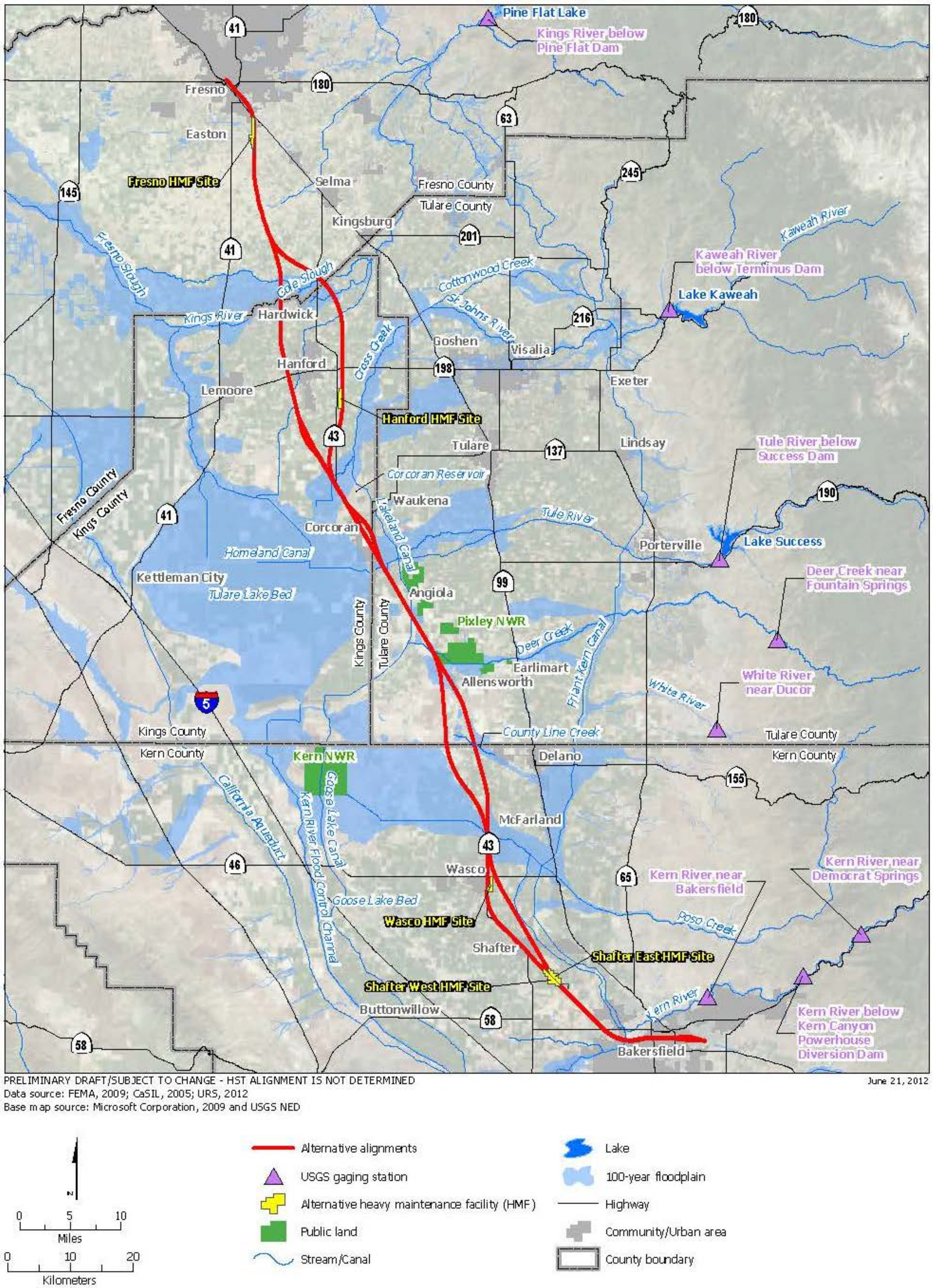


Figure 3.8-2
Floodplains within Fresno to Bakersfield study area

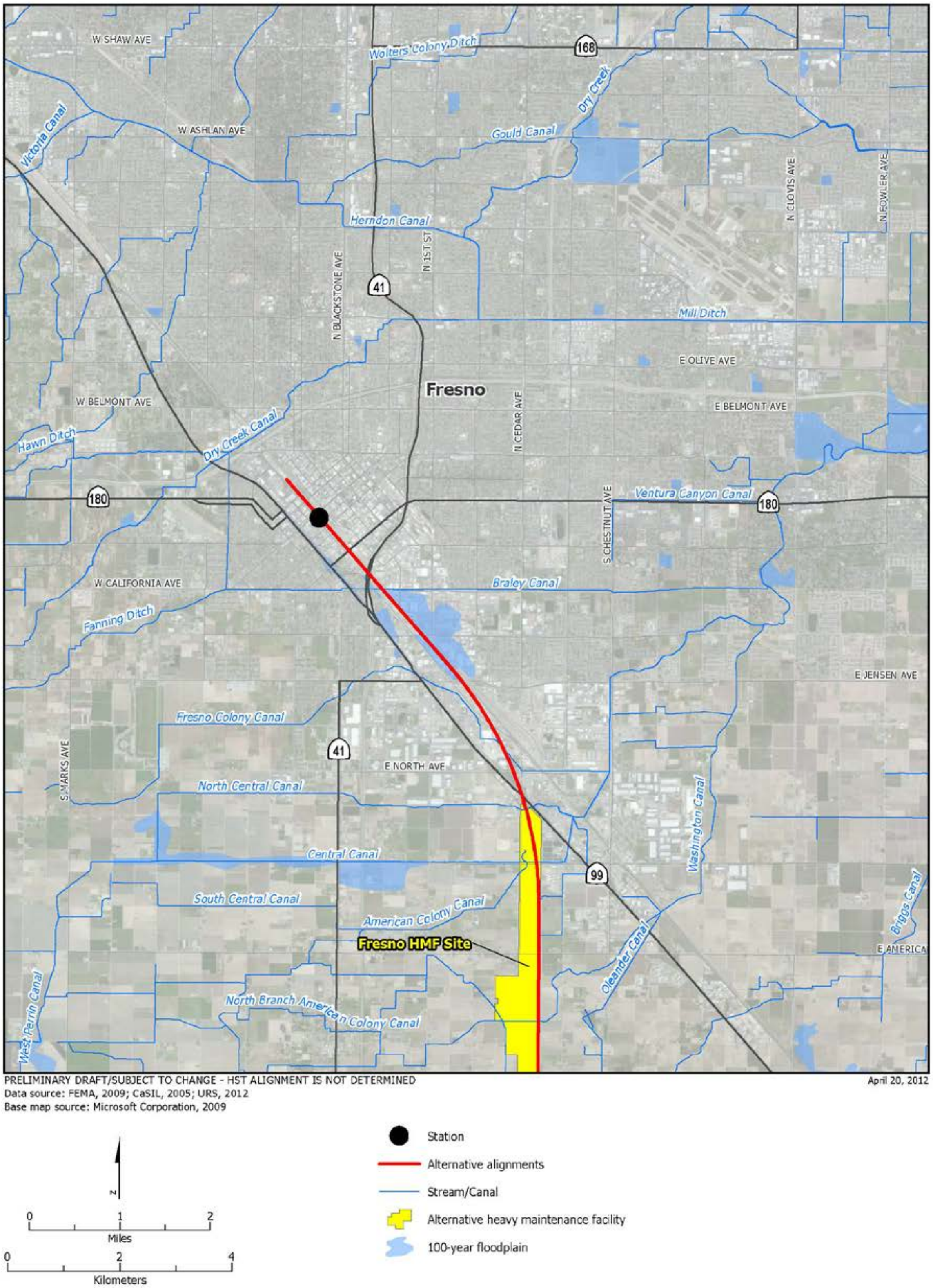


Figure 3.8-3
Floodplains in Fresno

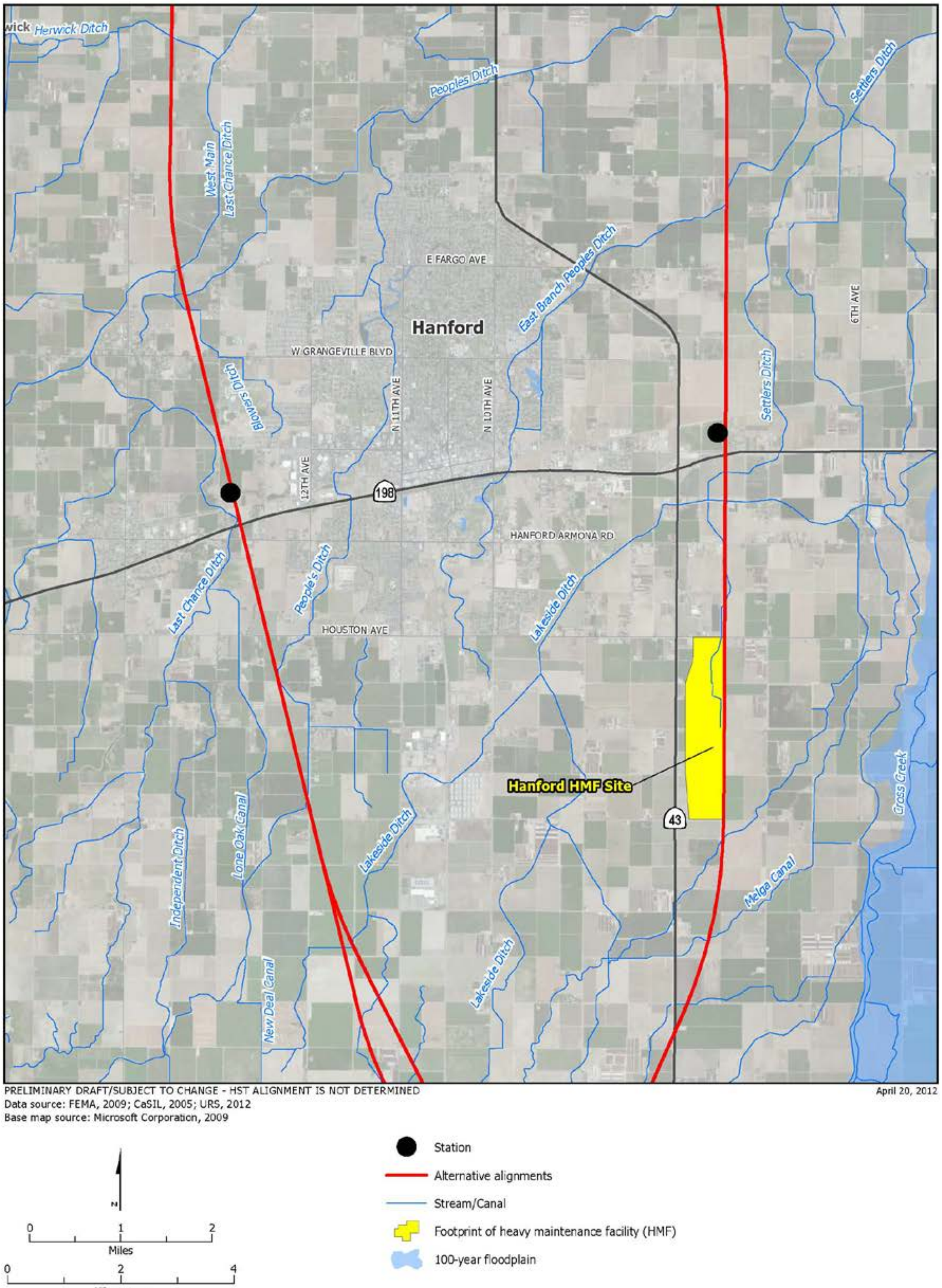
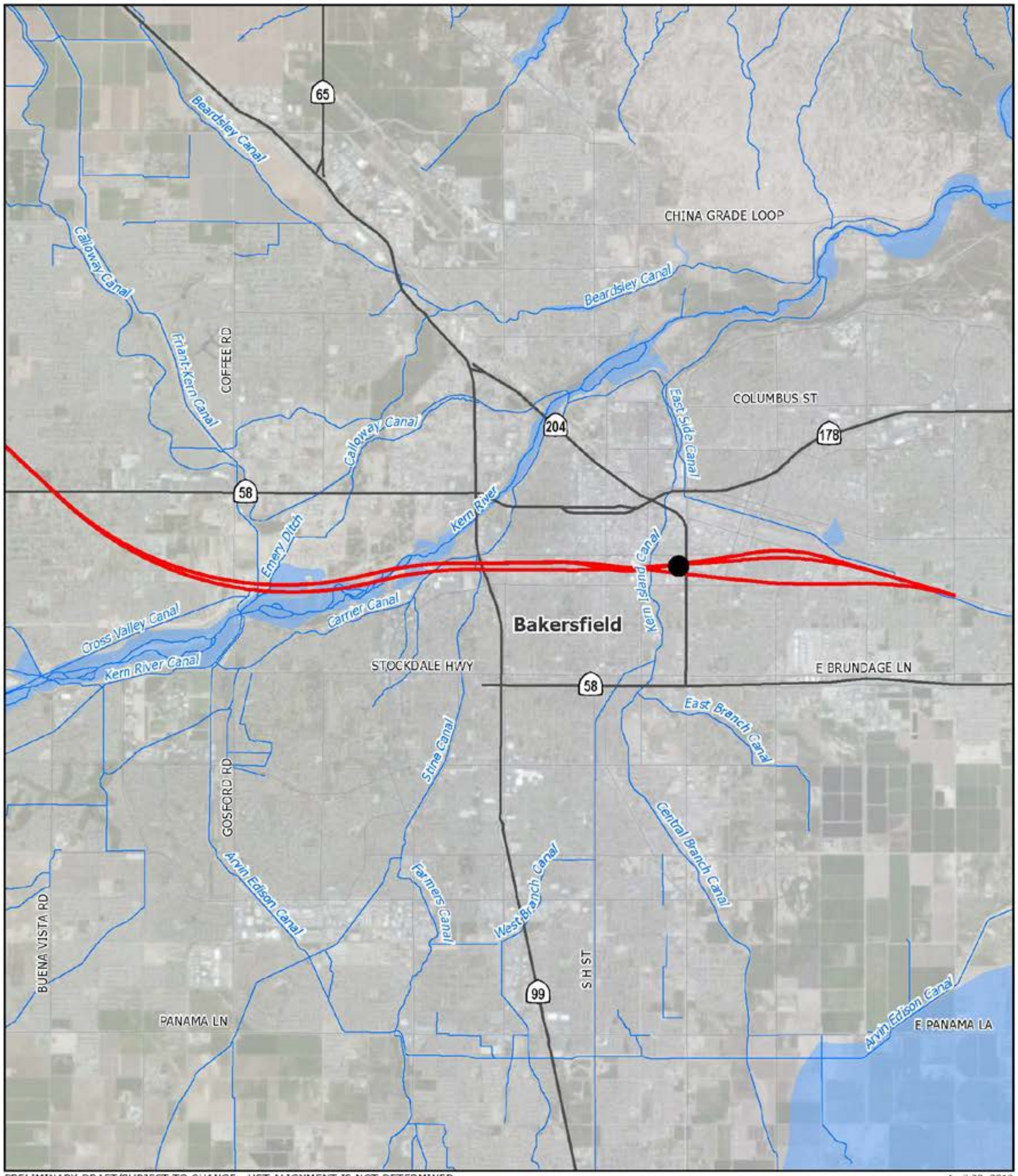


Figure 3.8-4
Floodplains in Hanford



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Data source: FEMA, 2009; CaSIL, 2005; URS, 2012
Base map source: Microsoft Corporation, 2009

April 20, 2012

Figure 3.8-5
Floodplains in Bakersfield

South of the Kings River crossing, the BNSF Alternative crosses Riverside Ditch approximately 0.2 mile south of Old River. The Hanford West Bypass 1 and the Hanford West Bypass 2 alternatives cross Riverside Ditch approximately 1 mile south of Kings River.

Originating at Peoples Weir, Peoples Ditch conveys water southwest through the city of Hanford. The BNSF Alternative crosses Peoples Ditch approximately 3 miles northeast of the city of Hanford, and the Hanford West Bypass 1 and Hanford West Bypass 2 alternatives cross Peoples Ditch about 2 miles south of Hanford.

Last Chance Ditch conveys water southwest from Last Chance Weir, located on Kings River (or Old River) between Dutch John Cut and Reynolds Cut. The Hanford West Bypass 1 and Hanford West Bypass 2 alternatives cross the West Main of Last Chance Ditch approximately 1 mile northwest of the city of Hanford. Last Chance and Peoples ditches are irrigation canals.

Cross Creek

Cross Creek, a reach of Kaweah River, is formed from the merging of Cottonwood Creek and St. Johns River in the eastern San Joaquin Valley (see Figure 3.8-2). Cottonwood Creek flows from the foothills of the Sierra Nevada, and St. Johns River branches off Kaweah River approximately 3 miles below Terminus Dam. Cross Creek flows southwest approximately 35 miles through Tulare and Kings counties to the Tulare Lakebed. The creek is a FEMA- and CVFPB-designated floodway that the BNSF Alternative, Hanford West Bypass 1 Alternative, and Hanford West Bypass 2 Alternative cross just north of Corcoran Reservoir and east of SR 43.

The Corcoran Reservoir is approximately 3 miles north of Corcoran. The BNSF Alternative, Hanford West Bypass 1 Alternative, and Hanford West Bypass 2 Alternative would pass adjacent to the northwestern portion of Corcoran Reservoir. Corcoran Elevated and Corcoran Bypass alternatives begin near Corcoran Reservoir. The reservoir is operated by Corcoran Irrigation District and is used for storage and recharge.

> **What is recharge?**
>
> *Recharge* is the natural replenishment of groundwater from rain or other surface water. *Overdraft* describes the condition when water pumped from a groundwater basin exceeds the supply flowing into the basin.

At the northeastern city limit of Corcoran, the Corcoran Bypass Alternative would cross Sweet Canal and the BNSF Alternative, and the Corcoran Elevated Alternative would cross Sweet Canal at the southern city limit of Corcoran. This canal is used for distribution of irrigation water and generally runs north to south.

The Lakeland Canal conveys water north-south to the east of the BNSF Alternative near Cross Creek and Corcoran. The Lakeland Canal would cross the BNSF Alternative in two locations, approximately 3 miles northwest of Corcoran and approximately 10 miles southeast of Corcoran.

Tule River

Tule River originates in the Sierra Nevada and flows to Lake Success before entering the valley. The north, middle, and south forks of the Tule River converge in the foothills upstream of Lake Success, the lake formed by Success Dam with a capacity of 82,300 AF. The Tule River drainage area upstream from Success Dam covers approximately 393 square miles (USACE 1999). From Lake Success, Tule River flows generally westward across the San Joaquin Valley floor to the Tulare Lakebed. Stream flow data for Tule River were collected at a USGS gauging station below Success Dam, and are summarized in the *Fresno to Bakersfield Section: Hydrology and Water Quality Technical Report*. During summer, Tule River is often characterized by alternating dry and wet periods resulting from irrigation districts taking water from and discharging water to the natural channels. Friant-Kern Canal also provides flow to Tule River during summer. Tule River water that reaches the Tulare Lakebed is either stored for irrigation or evaporates (ICF Jones &

Stokes 2008). The BNSF, Corcoran Elevated, and Corcoran Bypass alternatives would cross the Tule River south of Corcoran.

Deer Creek

Deer Creek originates in the southern Sierra watershed and flows west from the foothills of the Sierra Nevada in Tulare County. The creek is joined by Fountain Springs Gulch near Terra Bella. Stream flow data for Deer Creek were collected at a USGS gauging station in the Sierra Nevada foothills and are summarized in the *Fresno to Bakersfield Section: Hydrology and Water Quality Technical Report*. Deer Creek flows through the Pixley National Wildlife Refuge (NWR), which is on the valley floor, and is crossed by the BNSF Alternative and the Allensworth Bypass Alternative. Deer Creek is channelized where it flows through the Pixley NWR and discharges to Homeland Canal approximately 2 miles west of the BNSF Alternative.

County Line Creek

County Line Creek is a remnant alluvial fan located near the boundary of Kern and Tulare counties. It is mapped as a special flood hazard zone on the county FIRMs but has lost its connection to drainage from the hills. There is no clearly defined channel, but water draining from the area passes under the existing BNSF freight infrastructure though two underpasses.

Poso Creek

Poso Creek originates in the southern Sierra watershed and flows west from the Sierra Nevada approximately 10 miles north of Bakersfield. Poso Creek receives discharge from the Cawelo Water District's Reservoir B for the purpose of intentional recharge (CVRWQCB 2007b). Poso Creek flows toward the Kern NWR, which is approximately 15 miles downstream of the study area (CVRWQCB 2007a; see Figure 3.8-2). The BNSF Alternative and the Allensworth Bypass Alternative would cross Poso Creek north of Wasco. An access road for the BNSF Alternative would also cross Poso Creek.

Kern River

Kern River, its forks, and Lake Isabella are the major water features within the Kern River watershed (ICF Jones & Stokes 2008; see Figure 3.8-1). Kern River flows generally southwest through Bakersfield to the Buena Vista Lakebed. The BNSF, Bakersfield South, and the Bakersfield Hybrid alternatives cross Kern River in the city of Bakersfield.

The upper reaches of the north and south forks of the Kern River are designated Wild and Scenic. These reaches of the river are about 60 miles east of the project alternative alignments. In the valley, Kern River is bordered by conveyance and diversion canals for much of its length, and its water is diverted for consumption or groundwater recharge (ICF Jones & Stokes 2008).

Lake Isabella Dam was constructed in 1953, is on Kern River approximately 35 miles northeast of Bakersfield, and forms Lake Isabella. The primary purpose of the dam and reservoir is to provide flood control. The dam is operated so that the maximum flow in Kern River at the Pioneer turnout near Bakersfield does not exceed the capacity of the river channel, which is 4,600 cfs. Lake Isabella has a capacity of approximately 570,000 AF, and provides water for irrigation (Gronberg et al. 1998). Stream flow data for Kern River downstream of Lake Isabella were collected at USGS gauging stations and are summarized in the *Fresno to Bakersfield Section: Hydrology and Water Quality Technical Report*.

The Friant-Kern Canal joins Kern River in the city of Bakersfield. The BNSF, Bakersfield South, and Bakersfield Hybrid alternatives cross Kern River and Friant-Kern Canal as well as various other diversion canals, including Arvin Edison Canal, Cross Valley Canal, Carrier Canal, Stine Canal, Kern Island Canal, and East Side Canal.

Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (33 CFR 329.4). Although conclusive determinations of navigability are made by federal courts, those made by federal agencies are accorded substantial weight by the courts (33 CFR 329.14). Kern River is on the USACE Sacramento District's list of "navigable-in-fact" traditionally navigable waters. The other rivers crossed by the HST are not listed as navigable or navigable-in-fact.

Numerous large- and small-scale special districts provide local water supply, flood control, sanitation, and agricultural water supply, storage, and groundwater banking infrastructure that crosses the proposed HST alignments between Fresno and Bakersfield. Table 3.8-3 and Figure 3.8-6 show these districts. Details on the districts, including their locations, are provided in Section 3.6, Public Utilities and Energy.

Table 3.8-3
Districts Supplying Water, Sanitation, or Flood Control That Have Infrastructure Crossing the Proposed HST Alignments

Water Districts	
Alpaugh Irrigation District	Kings River Conservation District
Angiola Water District	Laguna Irrigation District
Arvin-Edison Water Storage District	Lakeside Irrigation Water District (part of Lakeside Ditch Company)
Atwell Island Irrigation District	Liberty Water District
California Water Service Company	Lower Tule River Irrigation District
City of Corcoran Public Works	North of River Sanitation District
City of Fresno Service Area	Pixley Irrigation District
City of Hanford Public Works	Pond-Poso Improvement District
City of Wasco Public Works	Rosedale Ranch Improvement District
Consolidated Irrigation District	Rosedale-Rio Bravo Water Storage District
Corcoran Irrigation District	Semitropic Water Storage District
Fresno Irrigation District	Shafter-Wasco Irrigation District
Fresno Metropolitan Flood Control District	Southern San Joaquin Municipal Utility District
Kaweah Delta Water Conservation District	Tulare Irrigation District
Kern County Water Agency Improvement District No. 4	Vaughn Water Company Service Area
Kern Delta Water District	
Kings County Water District (part of Lakeside Ditch Company)	

Sources: U.S. Bureau of Reclamation 2009 (for federal water district boundaries).
U.S. Bureau of Reclamation 2003a (for state water district boundaries).
U.S. Bureau of Reclamation 2003b (for private water district boundaries).

Acronym:
HST = high-speed train

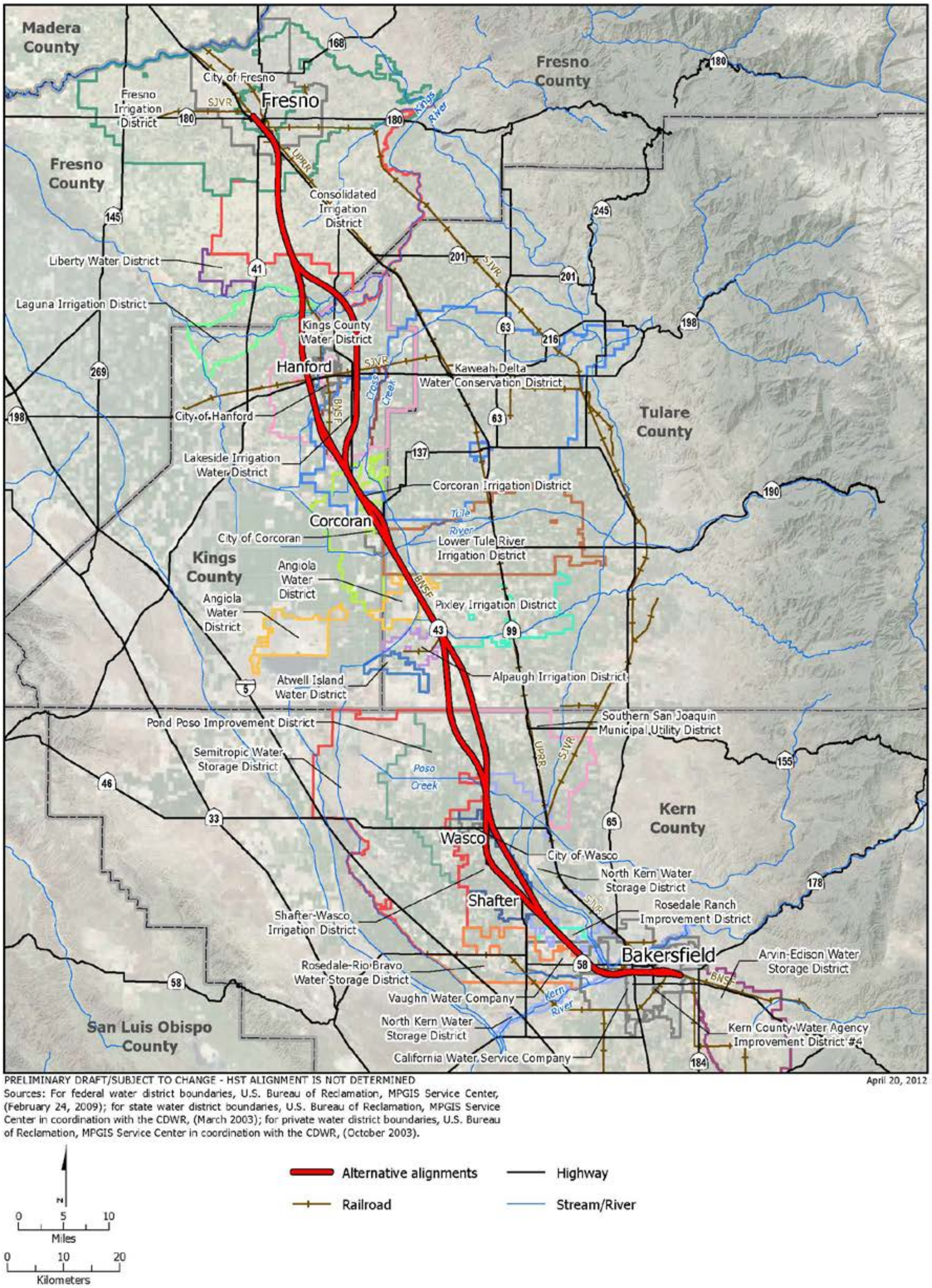


Figure 3.8-6
Boundaries of agricultural water districts and community water service areas

Surface Water Quality

The Basin Plan (CVRWQCB 2004) designates beneficial uses for specific surface water and groundwater resources, establishes water quality objectives to protect those uses, and sets forth policies to guide the implementation of programs to attain the objectives. The HST project is consistent with the Basin Plan if control measures are in compliance with permitting requirements and properly implemented. Table 3.8-4 lists the beneficial uses that have been identified for water bodies in the Tulare Lake Basin that cross the study area (CVRWQCB 2004). Beneficial uses for canals are not identified in the Basin Plan by the Central Valley RWQCB.

Table 3.8-4
Beneficial Uses of Surface Water in the Project Vicinity

Surface Water Body	Beneficial Uses
Kings River (Peoples Weir to Stinson Weir on North Fork and to Empire Weir No. 2 on South Fork)	Agricultural Supply; Water Contact Recreation; Non-Contact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat; Groundwater Recharge
Cross Creek (Kaweah River, below Lake Kaweah)	Municipal and Domestic Water Supply; Agricultural Supply; Industrial Service Supply; Industrial Process Supply; Water Contact Recreation; Non-Contact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat; Groundwater Recharge
Tule River (below Lake Success)	Municipal and Domestic Water Supply; Agricultural Supply; Industrial Service Supply; Industrial Process Supply; Water Contact Recreation; Non-Contact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat; Groundwater Recharge
Poso Creek	Agricultural Supply; Water Contact Recreation; Non-Contact Water Recreation; Warm Freshwater Habitat; Cold Freshwater Habitat; Wildlife Habitat; Groundwater Recharge; Freshwater Replenishment
Kern River (below Southern California Edison Kern River Powerhouse No. 1)	Municipal and Domestic Water Supply; Agricultural Supply; Industrial Service Supply; Industrial Process Supply; Hydropower Generation; Water Contact Recreation; Non-Contact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat; Rare, Threatened, or Endangered Species; Groundwater Recharge
Source: CVRWQCB 2004.	

The SWRCB developed a list of water bodies (known as 303[d] water quality-limited water bodies) that are impaired and do not meet water quality objectives. (CWA Section 303[d] specifies the requirements for listing impaired water bodies.) A TMDL is developed for constituents on the list to restore the quality of the water body. The SWRCB and/or RWQCB develops TMDLs over several years. Contributing pollutants that are listed on a 303(d) list or for which a TMDL has been developed could be considered as substantially degrading water quality. TMDLs have not been identified for most of the surface water bodies in the vicinity of the BNSF Alternative. Exceptions are shown in Table 3.8-5.

Table 3.8-5
Section 303(d) List of Impaired Waters in the Project Vicinity

Water Body	Impairment	Potential Source of Impairment	TMDL Completion Date
Kings River, Lower (Pine Flat Reservoir to Island Weir)	Chlorpyrifos Unknown Toxicity	Agriculture Source Unknown	2021
Kings River, Lower (Island Weir to Stinson and Empire Weirs)	Electrical Conductivity, Molybdenum, Toxaphene	Agriculture	2015
Cross Creek (Kings and Tulare counties)	Unknown Toxicity	Source Unknown	2021
Deer Creek (Tulare County)	pH (high), Unknown Toxicity	Source Unknown	2021

Source: 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report), SWRCB 2011.
TMDL total maximum daily load

Groundwater

Groundwater in the study region is present in unconfined or semi-confined aquifers as a part of the San Joaquin Valley Groundwater Basin. Groundwater levels fluctuate with seasonal rainfall, withdrawal, and recharge.

Groundwater is a major water supply source in the study region. For example, the predominant water supply source for domestic use within unincorporated communities is the individual, private well system, and most source water for municipal supply is groundwater. The large demand for groundwater has caused subsidence in some areas of the valley, primarily along its western side and southern end (DWR 2003). Depth to groundwater in the San Joaquin Valley ranges from a few inches to more than 100 feet.

Groundwater in the Tulare Lake Basin is used for urban and agricultural purposes and may have localized impairments, which include elevated total dissolved solids (TDS), nitrate, arsenic, and organic compounds (DWR 2003). Septic disposal systems and leach fields are potential sources of nitrate contamination in groundwater, and such uses must generally be approved at a local level and are based on local soil conditions and the potential for contamination.

The accumulation of salts in groundwater is a major water quality issue because of the closed nature of the Tulare Lake Basin, which has minimal surface and subsurface water outflows. This problem is exacerbated by groundwater overdraft for municipal, agricultural, and industrial supplies, and by agricultural practices such as over-applying irrigation water.

Floodplains

Floodplains provide floodwater storage (which reduces the risk of downstream flooding), provide habitat for native species, improve water quality by allowing sediments and other contaminants to filtrate, and may provide locations for groundwater recharge. Within most urban areas, levees and upstream dams control floods. Many rural areas, however, are subject to shallow flow or ponding, which is typically 1 to 3 feet deep and spreads out over extensive areas. Shallow flooding occurs primarily from overflows of stream channels when flows exceed the capacity of the channels.

Historically, flooding has been a natural occurrence in the valley because it is a natural drainage basin for thousands of watershed acres of Sierra Nevada (on the east) and Coast Range (on the west) foothills and mountains. However, the construction of dams and levees in the valley has changed the pattern of flooding, restricting it mainly to rivers and creeks and their adjacent floodplains. The two types of flooding that can occur in the valley are general rainfall floods in the late fall through winter and snowmelt floods in the late spring and early summer. Major flood events are also produced by extended periods of rain or snow during the winter months.

The eastern side of the Tulare Lake Basin is drained primarily by Kings, Kaweah, Tule, and Kern rivers. Small streams draining the foothills are usually dry except during winter and spring runoff. Historically, runoff from large storm events flowed from the foothills and terminated on the valley floor. As areas were developed, natural flow paths were altered and encroached upon by agricultural practices and urban development. These changes to the waterways have resulted in a series of streams and channels that are not capable of handling large storm event flows (FMFCD 2009).

Although an extensive flood control system has been constructed in the region, large portions of the Tulare Lake Basin are considered to be flood hazard areas. This threat is mainly from riverine flooding and ponding on the flat valley floor. The Tulare Lake Basin is relatively flat, with broad, shallow floodplains that are either uncontained, or are uncontained at higher flows due to levee overtopping. In the vicinity of the proposed alignments, a notable factor contributing to the size of the floodplains is the existing BNSF Railway embankment, which acts as an impediment to water moving from east to west toward the Tulare Lake Basin. Floodplains within the study region are shown in Figures 3.8-2 through 3.8-5.

3.8.4.3 Hydrology and Water Quality in the Study Area

Surface Waters

High-Speed Train Alignment Alternatives

Numerous natural water bodies flow through the project area (see Figures 3.8-1 and 3.8-2). Table 3.8-6 lists the major natural water bodies and the HST alternatives that cross them. The CVFPB regulates many of the stream crossings. Cole Slough, Dutch John Cut, and Kings River have CVFPB-designated floodways where the BNSF Alternative crosses these channels near the boundary of Fresno and Kings counties. The Hanford West Bypass 1 and Hanford West Bypass 2 alternatives cross a CVFPB-designated floodway at Kings River. The BNSF Alternative, Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, and Corcoran Bypass alternatives cross a CVFPB-designated floodway at Cross Creek.

Stream crossings must meet the provisions of Title 23 of the CCR. This regulation requires that new crossings maintain stream channel flow capacity through such measures as perpendicular crossings (where practicable), adequate streambank freeboard, and measures to protect against streambank and channel scour. Section 208.10 requires that construction of improvements, including crossings, does not reduce the capacity of a channel within a federal flood control project.

The CVFPB reviews applications for encroachment permits for a new channel crossing or other channel modification. For a proposed crossing that could affect a federal flood control project, the CVFPB coordinates review of the encroachment permit application with the USACE for approval under Section 408 of the Rivers and Harbors Act (33 U.S.C. 408). Under Section 408 of the Rivers and Harbors Act, the USACE must approve any proposed modification that involves a federal flood control project. A Section 408 permit would be required if construction modifies a federal levee. A

Section 208.10 permit would be required where the project encroaches on a federal facility but does not modify it. Encroachments include levee systems and waterways regulated by the USACE.

Title 23 of the CCR also includes construction provisions at CVFPB-regulated streams. According to Title 23 of the CCR, work activities, such as excavation, cut-and-fill construction, and obstruction, within the CVFPB-designated floodway and on levees adjacent to a regulated stream are restricted during the flood season unless specifically permitted by CVFPB, pending weather forecasts and river flood conditions.

Table 3.8-6
Major Water Bodies Crossed by the California High-Speed Train Alternative Alignments
Fresno to Bakersfield Section

Water Body (Name)[a]	Alternative	Type[b]	Approximate Crossing Width (feet)[c]
Cole Slough (part of Kings River complex)	BNSF Alternative	I	300
Dutch John Cut (part of Kings River complex)	BNSF Alternative	I	700
Kings River	BNSF Alternative, Hanford West Bypass 1, and Hanford West Bypass 2	I	300 to 1,625[d]
Cross Creek	BNSF Alternative, Hanford West Bypass 1, and Hanford West Bypass 2	I	150 to 200
Tule River	BNSF Alternative, Corcoran Elevated, and Corcoran Bypass	I	300
Deer Creek	BNSF Alternative and Allensworth Bypass	I	140
Poso Creek	BNSF Alternative and Allensworth Bypass	I	140
Kern River	BNSF Alternative, Bakersfield South and Bakersfield Hybrid	P	1,500

Notes:
[a] Features identified from review of USGS topographic maps, aerial photographs, and design drawings.
[b] Type: I=intermittent, P=perennial.
[c] Crossing widths subject to change once HST alternative alignments are finalized. HST alternative alignments do not cross perpendicularly to Kern River. Therefore, the approximate crossing width is greater than the perpendicular river width.
[d] Length varies due to crossing location for the alternatives. The Hanford West Bypass 1 and the Hanford West Bypass 2 cross Kings River at a location with a larger CVFPB-designated floodway.
Acronym:
HST = high-speed train

In addition, the Kings River Conservation District (KRCD) maintains several levees on the Kings River system as part of a federal flood project. These include the left and right banks of Cole Slough and the right bank of Dutch John Cut. Encroachments to these levees are subject to approval by CVFPB, KRCD, and USACE.

Within Bakersfield, the BNSF Alternative, Bakersfield South, and Bakersfield Hybrid alternatives would cross Kern River, which has regulated uses according to the Bakersfield Zoning Code. The City of Bakersfield Planning Division has zoned Kern River and adjacent land as Floodplain

Primary and Floodplain Secondary zones, respectively. As discussed in Section 3.8.2, Laws, Regulations, and Orders, the city restricts uses that would obstruct flood flow or cause peripheral flooding of other properties. The City also regulates uses of the land adjacent to Kern River in the Floodplain Secondary Zone, and requires conditional-use permits for most development projects.

> **What are intermittent and perennial streams?**
>
> *Intermittent* streams normally stop flowing for periods of time each year. *Perennial* streams flow year-round, although they may also cease flowing during dry years, and become intermittent during a drought.

Smaller intermittent streams, creeks, and canals are also present on the valley floor, some of which cross the alternative alignments. Surface water and groundwater are pumped to and from these rivers and numerous canals that deliver irrigation water to and from agricultural fields throughout the region. With the exception of the Corcoran Reservoir, no lakes or reservoirs are adjacent to or within the study area along the alternative alignments.

Canals typically provide irrigation water from riverine diversions and convey agricultural drainage. Such channels often have little to no slope so that water can be moved in either direction. Table 3.8-7 shows the major irrigation channels crossed by the alternative alignments. Irrigation canals and ditches are crossed by the alternative alignments by aerial structures, bridges, and culverts. Appendix 3.8-A indicates the alternative alignments that cross each of these canals listed in Table 3.8-7, the approximate crossing width, and the proposed crossing type.

Table 3.8-7
Major Irrigation Canals and Ditches Crossing the Proposed HST Alignments

Irrigation Canals		
Fresno Colony Canal	Settler's Ditch	Lone Oak Canal
North Central Canal	Lakeside Ditch	New Deal Canal
Central Canal	Melga Canal	West Branch Lakeland Canal
Washington Colony Canal	Lakeside Ditch	Sweet Canal
North Branch Oleander Canal	Liberty Ditch	Taylor Canal
Wristen Canal	Murphy Slough	Lakeland Canal
Harlan Stevens Ditch	"A" Canal	Arvin Edison Canal
Davis Ditch	Grant Canal	Friant-Kern Canal
Elkhorn Ditch	Hardwick Ditch	Cross Valley Canal
Crosscut Waste	Bakker Ditch	Carrier Canal
Riverside Ditch	West Main Last Chance Ditch	Stine Canal
Peoples Ditch	Blowers Ditch	Kern Island Canal
East Branch of Peoples Ditch	Last Chance Ditch	East Side Canal

Acronym:
HST = high-speed train

Heavy Maintenance Facility Alternatives

No natural water bodies cross any of the proposed HMFs. However, the proposed footprint of the Fresno Works–Fresno HMF site is crossed by five canals, and the footprint for the Kings County–Hanford HMF site is crossed by one canal.

Downtown Fresno and Bakersfield Stations and Kings/Tulare Regional Stations

No natural water bodies or canals cross any of the proposed station locations.

Surface Water Quality

Agriculture influences the surface water quality within the South Valley Floor (SVF) watershed. Between November and January, fields are sprayed with pesticides that can be conveyed to water bodies through stormwater runoff and agricultural return flows. Pesticides, known to be associated with agricultural operations, have been detected at concentrations that exceed water quality objectives in at least one of the SVF water bodies that have been monitored. Elevated levels of arsenic, boron, cadmium, copper, iron, lead, manganese, molybdenum, selenium, and zinc have been detected at multiple locations within the SVF watershed. The above metals are all naturally occurring and are partially mobilized and concentrated by irrigated agriculture. Copper and molybdenum are also used in pesticides (ICF Jones & Stokes 2008).

Groundwater

The study area is within the San Joaquin Valley Groundwater Basin and crosses through five of its seven subbasins: Kings, Tulare Lake, Kaweah, Tule, and Kern. Figure 3.8-7 shows where the alternative alignments pass through those subbasins, and Table 3.8-8 summarizes the groundwater subbasins crossed by the alternative alignments. The freshwater-bearing deposits of the aquifers in the subbasins are generally thick, reaching their maximum thickness of 4,400 feet at the southern end of the San Joaquin Valley. Although the average depth to groundwater is shallow at some locations in the groundwater subbasins, water supply wells frequently extend 1,000 feet below ground surface (bgs) (DWR 2003).

Groundwater levels fluctuate with seasonal rainfall, withdrawal, and recharge. The large demand for groundwater has caused overdraft and subsidence in some areas of the valley, primarily along its western side and southern end (DWR 2003). Water levels in the Kings subbasin have declined up to 50 feet since 1976 in response to droughts, and are currently recovering to mid-1980s levels (DWR 2006b). Groundwater levels in the Kaweah subbasin declined 12 feet from 1970 to 2000 and groundwater levels were observed to fluctuate as much as 60 feet over the 30-year period. Groundwater levels in the Tule subbasin fluctuated up to 36 feet from 1970 to 2000, but water levels in 2000 were approximately 4 feet above 1970 levels (DWR 2004b). Although water levels in different parts of the Kern County subbasin have varied over the last several decades, the average groundwater level in the subbasin has been relatively stable since 1970 (DWR 2006a).

The source water used as local municipal supply is primarily groundwater. Groundwater pumped by the city of Fresno for municipal supply ranged from 136,000 to 165,500 acre-feet per year from 2002 to 2007 (City of Fresno 2008). In the city of Hanford, groundwater pumping rates for municipal supply have ranged from 11,600 to 12,900 acre-feet per year from 2006 to 2010 (City of Hanford 2011). Groundwater pumping by the city of Wasco for municipal supply has varied between 4,400 to 4,900 acre-feet per year from 2005 to 2009 (City of Wasco 2011). The amount of groundwater pumped for California Water Service Company's Bakersfield District was between 44,000 and 53,900 acre-feet per year between 2006 and 2010 (California Water Service Company 2011).

Table 3.8-8
Groundwater Subbasins Crossed by the California High-Speed Train Alignment Alternatives—Fresno to Bakersfield Section

Groundwater Basin (Name)	Total Groundwater Basin Area (acres)[a]	Typical Well Depths (feet)	Approximate Length of Groundwater Basin Crossed (length of BNSF alternative) (miles)	Approximate Area of Groundwater Basin Crossed (acres)[b]	Designated Sole-Source Aquifer[c]
Kings Subbasin	976,000	100 to 500	23.1 to 25.1 (BNSF Alt: 25.1)	810 to 960 (BNSF Alt: 960)	Yes
Tulare Lake Subbasin	524,000	150 to 2,000	18.1 to 19.9 (BNSF Alt: 19.2)	560 to 730 (BNSF Alt: 580)	No
Kaweah Subbasin	446,000	100 to 500	6.7 to 8.0 (BNSF Alt: 7.4)	170 to 350 (BNSF Alt: 320)	No
Tule Subbasin	467,000	200 to 1,400	21.2 to 22.5 (BNSF Alt: 21.9)	540 to 730 (BNSF Alt: 730)	No
Kern County Subbasin	1,945,000	150 to 1,200	42.3 to 44.1 (BNSF Alt: 43.2)	1,100 to 1,360 (BNSF Alt: 1,360)	No

Notes:

[a] Total basin areas are from the following sources: DWR 2004a, 2004b, 2006b, 2006a, 2006c.

[b] Area based on GIS intersection of the groundwater basin and the HST permanent footprint.

[c] The EPA defines a sole- or principal-source aquifer as an aquifer that supplies at least 50% of the drinking water consumed in the area overlying the aquifer. These areas may have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend on the aquifer for drinking water. For convenience, all designated sole- or principal-source aquifers are referred to as "sole-source aquifers" (SSAs).

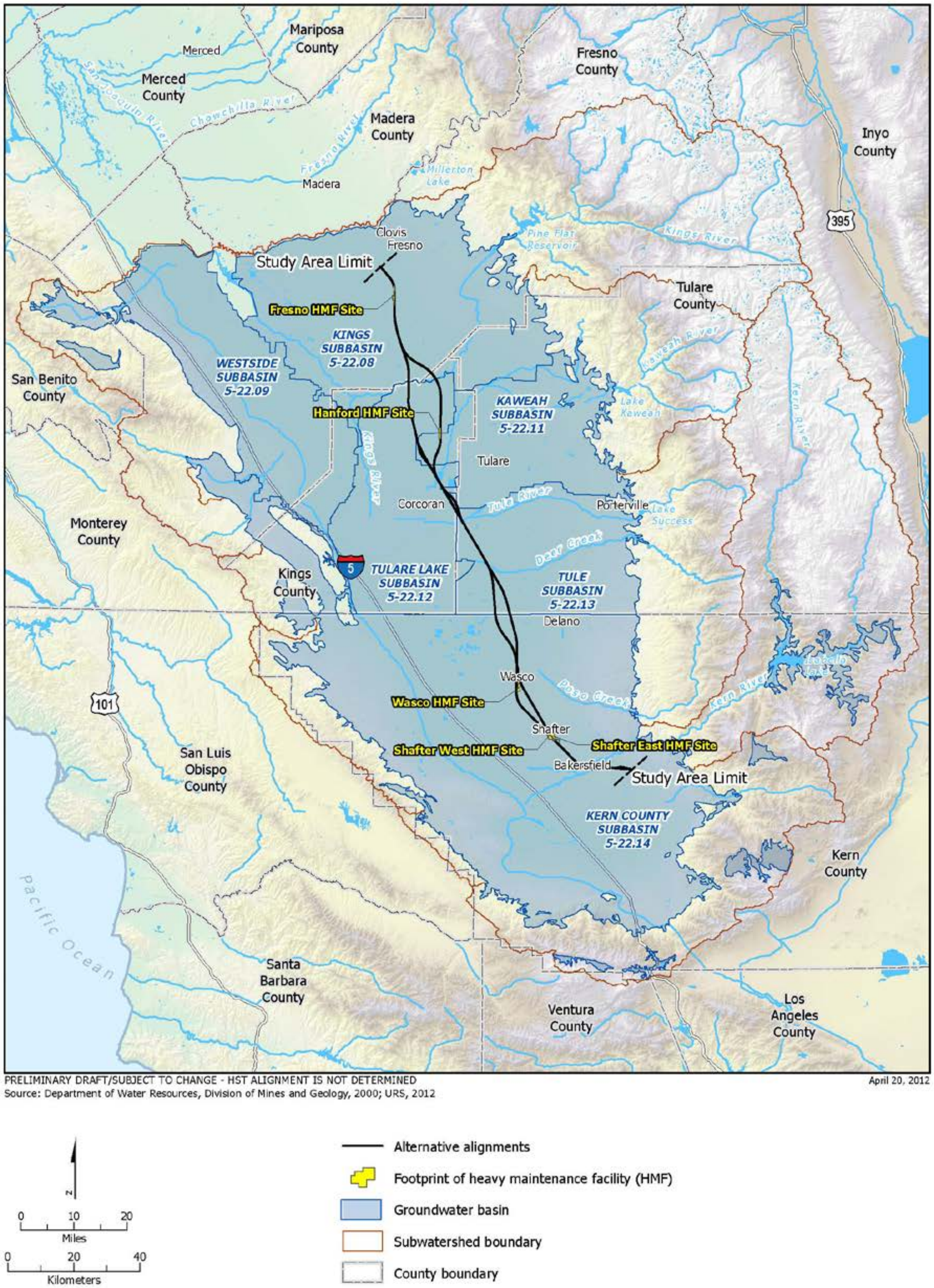


Figure 3.8-7
Groundwater basins

Floodplains

High-Speed Train Alternatives

FEMA has identified special flood-hazard areas (SFHAs) on FIRMs for all communities that participate in the National Flood Insurance Program, including the counties of Fresno, Kings, Tulare, and Kern. State and local governments use these FIRMs for administering floodplain management programs, enforcing building codes, and mitigating flooding losses. Special flood hazard areas in the study area include flood zones A, AE, AH, and AO, which are defined in Table 3.8-9. The FEMA-delineated 100-year floodplains exist along most of the minor creeks and streams in the study area. In urban areas and along most of the reaches of the major rivers, the 100-year floodplains are generally contained within the riverbanks. The 100-year floodplain corresponds to FEMA's SFHA. The SFHA is the land area covered by the base flood to which the FEMA floodplain management regulations apply (FEMA 2009a).

Detailed floodplain studies have been conducted for Cross Creek, Deer Creek, Kern River, and areas within the city of Fresno. Other delineated floodplain areas for this corridor include Kings River, Dutch John Cut and Cole Slough, Tule River, an unnamed watercourse at the Tulare-Kern County border (County Line Creek) and Poso Creek. These flood-prone areas are generally designated as "Zone A" by FEMA, indicating a floodplain for which FEMA has determined approximate inundation area(s), but without detailed flow or water surface elevation information.

Floodplains within the study region are shown in Figures 3.8-2 through 3.8-5. Floodplains and floodways crossed by the high-speed train alternative alignments are shown in Table 3.8-10.

Table 3.8-9
FEMA Special Flood Hazard Zone Designations in the Study Area

Zone	Zone Description
A	Areas with a 1% annual chance of flooding. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
AE	Areas with a 1% annual chance of flooding. FEMA flood maps provide base flood elevations.
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. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
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 within these zones.

Source: FEMA 2009a, b, c.

Acronym:
FEMA = Federal Emergency Management Agency

Downtown Fresno and Bakersfield Stations and Kings/Tulare Regional Stations

None of the proposed stations lie within an SFHA.

Table 3.8-10

Floodplains and Floodways Crossed by the California High-Speed Train Alternative Alignments—Fresno to Bakersfield Section

Floodplain Name or Flooding Source	County	Alternative	FEMA Special Flood-Hazard Area[a]	Approximate Length of Floodplain Crossed (miles)	Floodplain Crossing Type and Length (miles)	FEMA Base Flood Elevation or Depth near Crossing (feet)[b]	Approximate Length of FEMA Floodway Crossed (feet)	CVFPB Designated Floodway Width (feet)	FEMA FIRM Panel
Downtown Fresno	Fresno	BNSF Alternative	Zone AH	0.62	open cut, 0.62	El = 287 to 288	N/A	N/A	06019C2110H
North Central Canal	Fresno	BNSF Alternative	Zone A	0.02	elevated, 0.02	N/A	N/A	N/A	06019C2125H
Central Canal	Fresno	BNSF Alternative	Zone AE	0.03	at-grade, 0.03	El = 288	N/A	N/A	06019C2125H
Kings River Complex (Cole Slough/Dutch John Cut)	Fresno & Kings	BNSF Alternative	Zone A	2.60	at-grade, 2.60	N/A	N/A	180 530 400	06019C2925H, 06031C0100C
Kings River	Fresno & Kings	Hanford West Bypass 1 and Hanford West Bypass 2	Zone A	3.12	elevated, 0.55	N/A	N/A	1,540	06019C2925H, 06031C0100C
Cross Creek	Kings	BNSF Alternative	Zone A	1.43	elevated, 0.82	N/A	1,950	11,800	06031C0375C
			Zone AE	1.41	elevated, 1.41	El = 212 to 214			
		Hanford West Bypass 1	Zone A	1.10	elevated, 0.67	N/A	880	13,200	
			Zone AE	1.79	elevated, 1.71	El = 207 to 210			
		Hanford West Bypass 2	Zone A	1.48	elevated, 0.48	N/A	1,800	9,400	
			Zone AE	1.28	elevated, 1.19	El = 212			
		BNSF Alternative	Zone A	1.03	elevated, 0.37	N/A	N/A	1,900	
		Corcoran Elevated	Zone A	0.87	at-grade, 0.87	N/A		N/A	
			Zone AE	0.15	at-grade, 0.15	El = 212			
		Corcoran Bypass	Zone A	1.47	at-grade,1.47	N/A		N/A	
			Zone AE	0.15	at-grade, 0.15	El = 212			

Table 3.8-10

Floodplains and Floodways Crossed by the California High-Speed Train Alternative Alignments—Fresno to Bakersfield Section

Floodplain Name or Flooding Source	County	Alternative	FEMA Special Flood-Hazard Area[a]	Approximate Length of Floodplain Crossed (miles)	Floodplain Crossing Type and Length (miles)	FEMA Base Flood Elevation or Depth near Crossing (feet)[b]	Approximate Length of FEMA Floodway Crossed (feet)	CVFPB Designated Floodway Width (feet)	FEMA FIRM Panel
Tule River	Kings & Tulare	BNSF Alternative	Zone A	2.38	at-grade, 2.38	N/A	N/A	N/A	06031C0525C, 06017C1550E
		Corcoran Elevated	Zone A	2.38	elevated, 0.71	N/A			
		Corcoran Bypass	Zone A	2.87	elevated, 1.44	N/A			
Local Flooding (near Angiola)	Tulare	BNSF Alternative	Zone AH	1.52	at-grade, 1.52	El = 207	N/A	N/A	06107C1900E
Deer Creek[c]	Tulare	BNSF Alternative	Zone A	0.42	at-grade, 0.42	N/A	N/A	N/A	06107C1900E, 06107C2250E
			Zone AO	4.56	elevated, 1.01	Depth = 1 to 2			
		Allensworth Bypass	Zone A	0.74	at-grade, 0.74	Depth = 1			
			Zone AO	3.18	elevated, 0.86				
County Line Creeks	Tulare & Kern	BNSF Alternative	Zone A	0.75	at-grade, 0.75	N/A	N/A	N/A	06107C2275E, 06029C0200E
Poso Creek	Kern	BNSF Alternative	Zone A	1.74	at-grade, 1.74	N/A	N/A	N/A	06029C0725E, 06029C1275E
		Allensworth Bypass	Zone A	2.03	elevated, 0.83				
		Wasco-Shafter Bypass	Zone A	2.21	elevated, 0.11	N/A			
Local Flooding (City of Shafter)	Kern	BNSF Alternative	Zone AH	0.36	elevated, 0.36	El = 349	N/A	N/A	06029C1275E, 06029C1775E
			Zone AO	0.65	elevated, 0.65	Depth = 1			
Local Flooding (South of Shafter)	Kern	BNSF Alternative	Zone A	1.83	at-grade, 1.83	N/A	N/A	N/A	06029C1800E
		Wasco-Shafter Bypass	Zone A	0.81	elevated, 0.62				
Kern River	Kern	BNSF Alternative	Zone AE	1.63	elevated, 1.63	El = 387 to 396	N/A	1,100–1,500	06029C2277E, 06029C2281E
		Bakersfield South	Zone AE	1.11	elevated, 1.11	El = 387 to 396			
		Bakersfield Hybrid	Zone AE	1.11	elevated, 1.11	El = 387 to 396			

Table 3.8-10
Floodplains and Floodways Crossed by the California High-Speed Train Alternative Alignments—Fresno to Bakersfield Section

Floodplain Name or Flooding Source	County	Alternative	FEMA Special Flood-Hazard Area[a]	Approximate Length of Floodplain Crossed (miles)	Floodplain Crossing Type and Length (miles)	FEMA Base Flood Elevation or Depth near Crossing (feet)[b]	Approximate Length of FEMA Floodway Crossed (feet)	CVFPB Designated Floodway Width (feet)	FEMA FIRM Panel

Sources: CVFBP 1971a, 1971b, 1971c, 1976, 1985; FEMA 2008a; 2009a, 2009b, 2009c.

Acronyms and Abbreviations:
BFE base flood elevation
CVFPB Central Valley Flood Protection Board
El elevation
FEMA Federal Emergency Management Agency
FIRM Flood Insurance Rate Map
N/A not applicable

Notes:
[a] Special Flood-Hazard Areas or the 100-year flood designated by FEMA. In the study area, these include:
Zone A–no BFE determined
Zone AE–BFE determined
Zone AH–flood depth of 1 to 3 feet and BFE determined
Zone AO–flood depth of 1 to 3 feet and average depth determined

[b] FEMA floodplains with Zone A designation do not have BFEs determined and are indicated with N/A. For Zone AO, average depth is shown. For Zones AE and AH, the FEMA-determined BFEs within the project footprint are shown on the table.

[c] The 100-year floodplain associated with Deer Creek extends from approximately Avenue 120 to 1 mile south of Avenue 40. Most of the project footprint on the eastern side of the existing tracks is designated as Zone A. On the western side, zones of AH and AO are designated. A localized area of Zone AH lies between Avenue 96 and Avenue 88, with a BFE of 207 feet. Two areas of Zone AO have depths equal to 2 feet; the remainder of Zone AO has a depth equal to 1 foot.

Heavy Maintenance Facility Alternatives

The proposed footprint of the Fresno HMF site is crossed by the Central Canal, which has a FEMA floodplain associated with it. The floodplain is mostly contained within the canal banks, with possibly some minor flooding to the immediate sides of the channel. The Kern Council of Governments–Shafter East and the Kern Council of Governments–Shafter West HMF sites are partially located in a FEMA-designated Zone A floodplain. However, the floodplain is defined by a small depression in the topography and has no water body associated with it.

3.8.5 Environmental Consequences

3.8.5.1 Overview

Construction and/or operation of the HST alternatives, the stations, and the HMF could result in impacts on existing drainage, irrigation distribution systems, and water quality; however, the project design would incorporate avoidance and minimization measures to reduce impacts on water resources. These measures include, but are not limited to, project design features for stormwater management and flood protection, and erosion and sedimentation controls, tracking controls, and waste management and materials pollution controls. All construction and operation effects related to hydrology and water quality would be considered to be of moderate or negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Stream channels would temporarily be disturbed at several crossings. The alternative alignments would cross eight natural water bodies and two unnamed drainages. Some of these crossings, such as the Kern River crossing, would require in-water work for the construction of supporting piers. To the extent construction in the stream channel occurs during wet weather, there could be an increase in sediment in the river during the event. Construction BMPs, such as cofferdams, could be used to minimize or avoid discharge of sediment from the construction site and would comply with standards described in Section 3.8.6, Project Design Features, and listed in Appendix 2-D. In those streams with wet-weather construction in the stream channel, the effects to water quality during construction would have moderate intensity under NEPA, and impacts would be less than significant under CEQA.

Project facilities would result in changes to existing drainage, as well as increased runoff from project impervious surfaces. The HST alternatives could redirect shallow flooding, and thereby affect SFHAs. Placing at-grade track sections on embankments with culverts adequately sized and placed would minimize flood and drainage problems. The project would incorporate avoidance and minimization measure to maintain pre-project drainage conditions to the extent practicable (e.g., emphasizing onsite retention of stormwater runoff using measures such as flow dispersion, infiltration, and evaporation, supplemented by detention, where required) and would comply with standards described in Section 3.8.6, Project Design Features, and listed in Appendix 2-D, Applicable Design Standards. Effects to flood risk at the at-grade sections of the track would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Any alignment alternative could result in changes to the hydrology, hydraulics, and connectivity of natural watercourses, including floodways. As described in Section 3.8.6, Project Design Features, designing water crossings to maintain existing hydraulic capacity and connectivity would ensure that no operational impacts on hydrology and floodplains would occur. As part of the project design, the soffit of the bridges would be set above the estimated 100-year flood level, and the total width of openings in the embankment would pass the 100-year flood flows without increasing the water surface elevation in the floodway and without increasing the water surface elevation in the floodplain by more than 1 foot, or as required by state or local agencies. Piers would be placed and designed to minimize backwater effects and local scouring. The shape and alignment of the piers would be designed to minimize adverse hydraulic effects. Effects to hydraulic capacity at water crossings would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

The trains and tracks would not be expected to be significant pollutant sources; however, the stations, the new road overpasses, and the HMF facility could create new sources of potentially contaminated runoff. Project stormwater system design would accommodate project runoff and would provide stormwater quality treatment for the new and replaced roads and highways (see Chapter 2, Alternatives), train stations, and HMF facility. Runoff from these facilities would be directed to treatment BMPs and should not result in water quality changes to local water bodies. Effects to water quality during project operation would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

Groundwater use at an HMF site or station has the potential to change local groundwater elevations if local groundwater is used for water supply. The change depends on the amount of existing groundwater pumping at the prospective HMF site or station as compared to the amount of groundwater pumping needed to supply the HMF or station. Based on the analysis in this section, the worst-case conditions of pumping would cause changes in local groundwater levels with negligible intensity under NEPA, and impacts would be less than significant under CEQA.

3.8.5.2 No Project Alternative

As discussed in Chapter 1, Purpose, Need, and Objectives, and in Section 3.18, Regional Growth, the San Joaquin Valley population has been growing and is projected to continue to grow. Planned and programmed transportation improvements that are constructed and become operational by 2035 under the No Project Alternative would add to the effects under existing conditions. Section 3.19, Cumulative Impacts, provides foreseeable future projects. Impacts on hydrologic and hydraulic resources, such as increased runoff from additional lanes of paved surface, could result from non-project transportation improvements under the No Project Alternative.

Under the No Project Alternative, the effects of the current built environment on hydrology and water resources would continue, including effects from continued operation of existing highways, airports, and railways. Higher vehicle miles traveled also are expected under the No Project Alternative, which could degrade water quality because of increased pollutants in stormwater from roadways. The population in the project area is projected to grow, as discussed in Section 3.18, Regional Growth. The land development needed to serve the population would increase, as would traffic, as reflected in the numerous reasonably foreseeable projects listed in Section 3.19, Cumulative Impacts. As documented in Section 3.13, Station Planning, Land Use, and Development, a consequence of the No Project Alternative would be that the project vicinity would not include the higher-density, transit-oriented development planned around proposed HST stations, and the continuation of low-density development would be likely. This development is likely to occur on the urban fringe rather than in the urban centers. This development in undeveloped areas would result in an increase in impervious area and an associated increase in stormwater runoff in the urban fringe; however, stormwater facilities associated with urban fringe development would reduce potential water quality impacts on local streams. In addition, the demand for domestic water supply would increase and agricultural demand would decrease, as a result of increased population and a reduction in irrigated acreage. Net water demand is generally predicted to decrease (DWR 2009); however, aquifers could continue to experience drawdown effects if groundwater withdrawals exceed recharge rates.

3.8.5.3 High-Speed Train Alternatives

Construction Period Impacts

Chapter 2.0, Alternatives, discusses project construction. The majority of project construction is anticipated to be completed within 8 years, with completion of the stations and the HMF following thereafter. Heavy construction (such as grading, excavating, constructing the HST railbed, and laying the trackway) of the entire Fresno to Bakersfield Section would be accomplished within a 4-year period, but heavy construction at any one site would not occur continuously for this period. Potential effects include changes in hydrology, stormwater runoff patterns, and water quality. Section 3.10, Hazardous Materials and Wastes, addresses impacts from release of hazardous materials.

Common Surface Water Impacts

Construction activities associated with the proposed project would involve handling, storing, hauling, excavating, and placing fill; possible pile driving; stations, parking lots, maintenance facility, aerial structure, bridge construction, and concrete track bed construction. Likely pollutants that may be contributed by the project during construction include floating material, oil and greases, sediment, settable material, suspended material, chemical constituents (e.g., fuels, solvents), and turbidity. Construction of at-grade and below-grade sections of the railroad would require excavating or leveling the ground surface, which would potentially result in the need to pump and discharge groundwater, or would expose a groundwater resource to pollutants.

All HST alternatives could result in hydrology and hydraulic effects resulting from changes in local drainage and stormwater runoff occurring at crossings of natural and artificial water bodies due to channel disturbance associated with construction of piers, bridge abutments, and culverts. As indicated in Table 3.8-11, the alternative alignments would have similar numbers of natural water body and canal crossings. As described in Chapter 2, Alternatives, the HST alternatives would install bridges or box culverts at natural water body crossings. Also see further discussion in the *Fresno to Bakersfield Section: Hydrology and Water Resources Technical Report* (Authority and FRA 2012). Potential impacts on biological resources related to HST water body crossings and in-stream supports are evaluated in Section 3.7, Biological Resources and Wetlands.

Table 3.8-11
HST Alternatives Water Body Crossings[a]

Alternative	Natural Water Bodies	Major Canals and Ditches	Total
Alternative Alignments[b]			
BNSF Alternative	10	32	42
Hanford West Bypass 1	2 (5)	19 (11)	21 (15)
Hanford West Bypass 2	2 (5)	19 (11)	21 (15)
Corcoran Elevated	1 (1)	3 (2)	4 (3)
Corcoran Bypass	1 (1)	3 (2)	4 (3)
Allensworth Bypass	2 (4)[c]	0 (0)	2 (4)
Wasco-Shafter Bypass	0 (0)	0 (0)	0 (0)
Bakersfield South	1 (1)	7 (8)	8 (9)
Bakersfield Hybrid	1 (1)	7 (8)	8 (9)

Table 3.8-11
HST Alternatives Water Body Crossings[a]

Alternative	Natural Water Bodies	Major Canals and Ditches	Total
Heavy Maintenance Facility Alternatives			
Fresno Works–Fresno HMF Site	0	5	5
Kings County–Hanford HMF Site	0	1	1
Kern Council of Governments–Wasco HMF Site	0	0	0
Kern Council of Governments–Shafter East HMF Site	0	0	0
Kern Council of Governments–Shafter West HMF Site	0	0	0

Notes:

[a] Features identified from review of USGS topographic maps and aerial photographs.

[b] The number of natural water bodies or major canals and ditches for the corresponding segment of the BNSF Alternative is presented in parenthesis. Minor crossings of irrigation canals and distribution pipelines are not included.

[c] Includes two unnamed drainages that are identified as "County Line Creek" in the Common Floodplain Impacts, Permanent Floodplain Impacts, High-Speed Train Alternatives section below.

HST = high-speed train
USGS = U.S. Geological Survey

Impact HWQ#1 - Temporary Changes to Drainage Patterns and Stormwater Runoff

Construction activities such as grading and establishing construction staging areas could alter existing drainage patterns and redirect stormwater runoff. In addition, the amount of stormwater runoff would increase if construction activities include removal of natural vegetation or other barriers to runoff, or if the activities result in an increase in impervious surface. However, the amount of ground disturbance required for each of the HST alternatives is relatively small compared to the overall study area. An SWPPP would be prepared and implemented for construction activities described further in Section 3.8.6, Project Design Features, and stormwater would be infiltrated onsite and/or existing discharge locations would be maintained, to the extent practicable. The SWPPP, to be prepared prior to construction, would describe temporary drainage patterns within the construction site and indicate stormwater discharge locations from the construction site.

High-Speed Train Alignment Alternatives

Temporary diversion of stream flow may be necessary during the installation of support piers and bridge abutments in stream channels. In some cases, flowing streams may be temporarily re-routed around construction areas located within the channel. This could temporarily reduce channel capacity, potentially cause erosion or sedimentation, degrading water quality, and could temporarily increase flood risk. Conventional construction techniques, such as cofferdams, would be used for in-stream work. Cofferdams would be designed to minimize increases in water surface elevations during the design flood event and as required by state or local agencies. Cofferdams would also be designed per the SWPPP, which would specify measures to reduce erosion and sedimentation. Project design standards are described in Section 3.8.6, Project Design Features, and are listed in Appendix 2-D, Applicable Design Standards.

All alternatives would disturb ground during construction and result in the potential for changes in stormwater runoff patterns. Each alternative requires grading, construction laydown and staging areas, construction of piers in floodways and water channels, and/or at-grade stream crossings that could temporarily alter existing drainage patterns. Temporary changes to stormwater drainage patterns and runoff would be minimal and have an effect with negligible intensity under NEPA and a less-than-significant impact under CEQA because stormwater would be infiltrated onsite and/or existing discharge locations would be maintained.

Fresno Station, Bakersfield Station and Kings/Tulare Regional Station Alternatives

The Fresno and Bakersfield station areas would not be adjacent to water bodies and would have little effect on stormwater runoff patterns given the urban nature of the areas. In addition, the Fresno and Bakersfield sites are currently developed and construction would require limited vegetation clearing. For these reasons, station construction would result in an effect with negligible intensity under NEPA and a less-than-significant impact under CEQA.

The potential Kings/Tulare Regional Station–East Alternative and the potential Kings/Tulare Regional Station–West Alternative are in flat agricultural areas with permeable soils and would not be adjacent to water bodies. Runoff would be contained onsite and directed to an infiltration basin (pumping would be required for the Kings/Tulare Regional Station–West Alternative below-grade option); this would result in an effect with negligible intensity under NEPA and a less-than-significant impact under CEQA.

Heavy Maintenance Facility Alternatives

As described in Section 3.8.4, above, none of the HMF sites have any natural stream crossings and therefore work at the HMF would not disturb any streams. The Fresno HMF site would have five canal crossings, the largest number of any of the facilities, and several of these canals have berms. The Hanford HMF site has one canal crossing. Runoff would be contained onsite in an infiltration/detention basin that would comply with the design standards listed in Appendix 2-D, Applicable Design Standards, and therefore would result in an effect with negligible intensity under NEPA and a less-than-significant impact under CEQA.

Impact HWQ#2 - Temporary Water Quality Impacts

Soil-disturbing activity during construction (i.e., excavation and grading) can lead to erosion and sedimentation resulting from the exposure of bare soils to stormwater, which are more likely to erode than vegetated areas that provide infiltration, retention, and dispersion. Table 3.8-12 lists the construction area disturbance for each alternative, station, and HMF site. These areas could be cleared of vegetation or otherwise physically disturbed during construction.

Table 3.8-12
Acres Disturbed During Construction of HST Alternatives

Alternative	Disturbed Acres	Permanent Acres
Alternative Alignments[a,b]		
BNSF Alternative	6,020	3,960
Hanford West Bypass 1, at-grade option	1,000 (1,540)	890 (1,020)
Hanford West Bypass 1, below-grade option	950 (1,540)	840 (1,020)
Hanford West Bypass 2, at-grade option	1,060 (1,540)	860 (1,020)
Hanford West Bypass 2, below-grade option	1,000 (1,540)	810 (1,020)
Corcoran Elevated	630 (750)	270 (410)

Table 3.8-12
Acres Disturbed During Construction of HST Alternatives

Alternative	Disturbed Acres	Permanent Acres
Corcoran Bypass	660 (750)	290 (410)
Allensworth Bypass	620 (710)	470 (570)
Wasco-Shafter Bypass	990 (1,430)	630 (790)
Bakersfield South	520 (580)	240 (300)
Bakersfield Hybrid	530 (580)	240 (300)
Station Options[c]		
Fresno Station–Mariposa Alternative	18	21
Fresno Station–Kern Alternative	18	19
Kings/Tulare Regional Station–East Alternative	22	25
Kings/Tulare Regional Station–West Alternative, at-grade option	48	48
Kings/Tulare Regional Station–West Alternative, below-grade option	48	48
Bakersfield Station–North Alternative	21	19
Bakersfield Station–South Alternative	24	20
Bakersfield Station–Hybrid Alternative	30	24
Heavy-Maintenance Facility Alternatives[d]		
Fresno Works–Fresno HMF Site	590	150
Kings County–Hanford HMF Site	510	150
Kern Council of Governments–Wasco HMF Site	420	150
Kern Council of Governments–Shafter East HMF Site	500	150
Kern Council of Governments–Shafter West HMF Site	480	150

Notes:
[a] Permanent areas include the track right-of-way, traction power substations, freight rail relocation areas, road improvement areas, utility relocation areas, and relocated train yards. Temporary areas include the permanent footprint, construction staging areas, and precast concrete yards. Permanent and construction footprints will be refined further during design.

[b] Equivalent numbers for the corresponding segment of the BNSF Alternative are presented in parenthesis.

[c] Existing parking structures are included in the permanent station area but not the disturbed area.

[d] Approximately 150 acres would be used for any of the HMF alternatives; however, additional acreage is available.

HMF = heavy maintenance facility
HST = high-speed train

High-Speed Train Alignment Alternatives

Construction in areas of high groundwater or in surface water (e.g., bridges and culverts) could require excavation and dewatering. Stream crossings would be particularly vulnerable to degraded water quality because construction could occur in the stream channel, and contaminants would have a direct path to surface water. Bridge supports in areas of high groundwater or in surface water would require excavation in the stream channel and dewatering of the work area. Construction of the below-grade sections could encounter groundwater; however, available data indicate that the depth to groundwater in these areas is typically greater than 50 feet, which would be deeper than the expected excavation (DWR 2005). The proximity of flowing water to active construction could provide a direct path for construction-related contaminants to reach surface water.

The risk of polluted runoff and the potential for sedimentation effects on water quality would be minimized through implementation of various control measures detailed in the SWPPP, the Waste Discharge Requirements for Dewatering and Other Low Threat Discharges to Surface Waters, the Construction General Permit and Spill Prevention Plan. Implementing these procedures would identify pollutant sources that could affect water quality, and would identify, implement, and maintain BMPs to reduce pollutants and non-stormwater discharges in construction site runoff. These control measures are also discussed in Section 3.8.6, Project Design Features. With the implementation of these standard minimization and avoidance measures for all construction activities, contaminated or sediment-laden water is not likely to be released into surface waters.

All alternatives would involve ground disturbance for project construction. Because the risk of polluted runoff and the potential for sedimentation effects on water quality would be minimized through implementation of various control measures (e.g., BMPs detailed in the SWPPP, Spill Prevention Plan, or NPDES permits), effects from construction on surface water quality would have moderate intensity under NEPA and impacts would be less than significant under CEQA. These measures are also discussed in Section 3.8.6, Project Design Features.

Fresno Station, Bakersfield Station and Kings/Tulare Regional Station Alternatives

Although the Fresno and Bakersfield stations are within developed urban areas, construction of the stations without implementation of appropriate water quality BMPs could provide additional sources of polluted runoff to the local stormwater system, or could otherwise degrade water quality. The potential Kings/Tulare Regional Station–East Alternative and the potential Kings/Tulare Regional Station–West Alternative are in rural agricultural areas, but are not next to any water bodies, and station construction in these areas could provide additional sources of polluted runoff locally. Because water quality BMPs (e.g., erosion and sedimentation controls, tracking controls, waste management and materials pollution controls) would be implemented during construction at the proposed stations, the project could have a temporary effect with moderate intensity on water quality under NEPA and a less-than-significant impact under CEQA.

Heavy Maintenance Facility Alternatives

No streams lie beside or pass through any of the alternative HMF sites. Several canals cross the Fresno Works–Fresno HMF site, and one canal is located along the border of the Kings County–Hanford HMF site. Because the HMF sites are not located next to any natural water bodies, and water quality BMPs (e.g., erosion and sedimentation controls, tracking controls, waste management and materials pollution controls) would be implemented during construction that would meet the Construction SWPPP standards, particularly near canals, the project would have an effect with moderate intensity on water quality under NEPA and a less-than-significant impact under CEQA.

Common Groundwater Impacts

Impact HWQ#3 – Temporary Impacts on Groundwater

Groundwater levels in the project area are generally deep; most of the water depths in the project area are greater than 50 feet (see Table 3.8-13), so it is not expected that much dewatering would be required during construction of the at-grade or below-grade sections of the railroad. Construction activities would not affect groundwater quality because there would not be a direct path for construction-related contaminants to reach groundwater due to the depth of groundwater at the alternative alignments.

Table 3.8-13
Depth to Groundwater in the Vicinity of the HST Alternatives

Groundwater Subbasin	Location	Approximate Depth to Groundwater (feet bgs)
Kings Subbasin	Fresno	50 to 100
	Laton	60
Tulare Lake Subbasin	Hanford	100 to 120
	Corcoran	110
Kaweah Subbasin	South of Hanford	100
Tule Subbasin	Pixley National Wildlife Refuge	200
Kern County Subbasin	Wasco	260
	Shafter	250 to 260
	Bakersfield	150

Source: DWR 2005

Notes:
bgs = below ground surface
HST = high-speed train

The aerial structure sections of the railroad would be supported by piers. The piers could be either drilled or driven. Although pier construction methods have not been determined and would be based on local conditions, it is possible that slurry would be used as part of the drilling method. In these cases, if groundwater is encountered, it would be removed and disposed of with the drilling slurry. If a drilled hole needs to be dewatered, groundwater would be disposed of according to the requirements for the NPDES Permit for the discharge from dewatering and other low threat discharges. In either case, the volume of groundwater removed would be minor as it would consist only of water that seeps into the drilled hole below the water table during drilling. As stated above most of the groundwater is deeper than 50 feet so little groundwater is expected to enter the holes. Driven piers would not require dewatering.

At major river crossings, such as at Kern River, shallow groundwater may be encountered during construction of the piers for the aerial structures. The amount of water that would need to be removed if drilled piers are used would be minor, and would be disposed of according to the requirements for the NPDES Permit for the discharge of dewatering and other low-threat discharges.

Groundwater pumped for construction use could locally increase groundwater withdrawals. Section 3.6, Public Utilities and Energy, describes the changes in water use at the construction site during project construction, due to the conversion of irrigated agricultural lands. Water demand could be met by either surface water or groundwater supplies. The potential impacts and/or benefits of the change in water use due to construction is also provided in Section 3.6, Public Utilities and Energy. The amount of water used for construction of the Fresno, Kings/Tulare Regional, and Bakersfield stations would be similar (see Water Usage Analysis Technical Memorandum, Appendix 3.6-A). This water could be from either surface water or groundwater supplies. The amount of water used for construction of the HMF would not depend on the HMF location.

The HMFs may require installing new water supply wells, or abandoning existing wells prior to project operations. In either case, the installation or abandonment of the wells will be done in accordance with local regulations.

All sites will implement BMPs appropriate to the site to limit the effects of construction on water quality (e.g., erosion and sedimentation controls, tracking controls, and waste management and materials pollution controls). Therefore, effects from construction relating to groundwater quality would be the same for all alternative alignments; the same for all station alternatives; and the same for all HMF sites. The alternative alignments are the BNSF, Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter Bypass, Bakersfield South, and Bakersfield Hybrid alternatives. The station alternatives are Fresno Station–Mariposa, Fresno Station–Kern, Kings/Tulare Regional Station–East, Kings/Tulare Regional Station–West at-grade and below-grade options, Bakersfield Station–North, Bakersfield Station–South, and Bakersfield Station–Hybrid. The HMF sites are Fresno Works–Fresno, Kings County–Hanford, Kern Council of Governments–Wasco, Kern Council of Governments–Shafter East, and Kern Council of Governments–Shafter West.

The alignments, stations, and HMF are not located in areas of shallow groundwater so percolation of stormwater into groundwater would not affect groundwater quality. Groundwater is not expected to be encountered during construction because depth to groundwater is greater than 50 feet and a direct path for construction-related contaminants to reach groundwater would not be available. Therefore, construction would result in effects with negligible intensity under NEPA and less-than-significant impacts under CEQA on groundwater.

Common Floodplain Impacts

Impact HWQ#4 - Temporary Impacts on Floodplains

Construction in a floodplain temporarily could impede or redirect flood flows because of the presence of construction equipment and materials in the floodplain, depending on the activity occurring within a specific area. The length of the construction footprint within special flood hazard zones is shown in Table 3.8-10. The majority of this area lies within shallow (1 to 3 feet of inundation) flood zones.

Construction staging areas are proposed in several floodplains, including the Kings River complex, Cross Creek, Tule River, city of Shafter, and Kern River floodplains. Construction staging areas are also proposed in CVFPB-designated floodways for Kings River and Cross Creek. Although construction activities would be temporary, a construction staging area may be active for 1 to 3 years.

The CVFPB requires an encroachment permit for construction areas in a CVFPB-designated floodway. Work activities such as excavation, cut-and-fill construction, and obstruction in the floodway are not allowed during the flood season. The CVFPB grants exemptions to this time restriction if they determine that forecasts for weather or river flood conditions are favorable.

Uses that do not impede the free flow in the floodway or jeopardize public safety are permitted in a designated floodway. These permitted uses include structures that do not impede flows, and are anchored to prevent the structure from floating; roads, pipelines, fences, and walls that do not obstruct flood flows; and storage yards for equipment and materials that are securely anchored or can be removed upon notice.

Construction activities in FEMA-designated floodplains would include construction of at-grade and elevated track, HST bridge overpasses with bridge abutments, road overpasses with bridge abutments, traction power substations, freight rail relocation areas, and a canal realignment area. HST bridge overpasses would be constructed in the Tule River, Deer Creek, County Line Creek, and Poso Creek floodplains. Traction power substations would be constructed in the Deer Creek, Poso Creek, and Kern River floodplains. An access road for the traction power substation would cross Poso Creek. Freight rail relocation areas are proposed in the city of Wasco and city of Shafter floodplains. A canal realignment is proposed at Cross Creek, in the FEMA-designated floodway.

The Shafter East HMF, Shafter West HMF, and Shafter maintenance-of-way facility sites lie in a FEMA-designated floodplain. However, the floodplain is defined by a depression in the topography and is not associated with any water body; therefore, construction in the floodplain would not affect surrounding flood levels.

Because construction workers and local districts would monitor weather conditions for heavy storms (and potential flood flows), construction equipment would be able to relocate to minimize the potential flood risk. Therefore, during construction, the HST alternatives would have an effect with negligible intensity under NEPA and a less-than-significant impact under CEQA.

Project Impacts

Common Surface Water Impacts

Any of the HST alternatives would result in permanent impacts on hydraulic capacity and floodplains. Water quality impacts could result from runoff associated with roadways and HMFs. However, water quality control measures (e.g., BMPs detailed in the SWPPP, Spill Prevention Plan, or NPDES permits) would be implemented to reduce the potential for adverse water quality impacts.

Impact HWQ#5 - Permanent Impacts on Hydraulic Capacity and Connectivity of Natural Water Bodies

High-Speed Train Alignment Alternatives

Direct impacts on surface water from operation of the project would include changes to the hydrology and connectivity of natural water bodies in the study area. Table 3.8-11 lists the number of natural and artificial water-body crossings, each of which could require bridge abutments on banks, support piers in the water channel, or box culverts at the channel. Bridge components could obstruct the ability of the water body to convey peak flows by reducing its channel capacity and possibly by raising flood elevations locally.

As described in Section 3.8.6, Project Design Features, the design for each crossing would maintain the existing hydraulic capacity resulting in a minimal rise in existing flood or high water elevations. Elevated crossings could require support piers in the water channel. At-grade crossings of stream channels would require bridge abutments on banks and support piers in the water channel or, in some cases, the alignment would cross natural water bodies using box culverts. Final design would minimize the number of piers on banks and in channels to the extent possible.

Culverts would be installed at canals and ditches and in areas adjacent to culverts currently in place on the BNSF Railway where the alignments are parallel. Culverts would be designed to maintain or provide greater hydraulic conveyance capacity of the existing canal, ditch, or adjacent culvert. In locations where the proposed HST alignment and the BNSF Railway are not in close proximity, periodic surface flow relief culverts are proposed at a maximum interval of 5,000 feet along the alignment—these culverts may be necessary to convey sheet flow across (beneath) the alignment. If the HST alignment is not located adjacent to the existing BNSF Railway or existing road, the HST alignment may divide local drainage, and local drainage would need to be redirected.

In the context of irrigation canals, culverts include pipes, box structures, or inverted siphons used to pass water from an open canal headwork under the HST embankment and adjacent embankments. Where possible, a straight culvert would be used rather than a U-shaped siphon. A straight culvert can flush out sediment and debris more easily.

Areas beneath the track would have reduced infiltration. Stormwater would drain toward swales running parallel to at-grade track. In areas where the right-of-way is constrained, swales would be replaced with drainage pipes or lined channels leading to established discharge locations. Tracks placed on embankments with retaining walls would feature weep holes near the base of the wall to prevent the buildup of stormwater in the embankment. Tracks set below grade would have drainage systems to collect stormwater, and stormwater would be pumped out of the trench and discharged into a drainage facility. Drainage systems within the portions of elevated track would collect and drain stormwater to the ground below through downspouts at the columns. Depending upon location, drainage from the downspouts would be retained onsite, discharged to a detention basin, conveyed to a nearby stormwater collection system, or dispersed in a non-erosive fashion. Where the alignment travels through urban areas, impermeable surfaces are common because of past land development, so in most cases, existing stormwater systems would convey track runoff. In areas with infiltrative soils, runoff would likely infiltrate within the right-of-way.

The construction of roadway overpasses will slightly increase impervious area because of the lengthening of paved surfaces, compared to the existing at-grade roadway. Stormwater would be collected at the toe of embankments, and directed to detention basins. Road underpasses would require pump stations that would pump runoff from the low point of the road to either a municipal drainage system or a detention basin. Several rail crossing improvements would require new paved access or frontage roads. In most cases, proposed new roads are in rural areas, and stormwater would run off into unlined roadside ditches and typically infiltrate. In more urban cases, runoff would flow to an existing storm drain system.

> **Definitions**
>
> *Retention Pond* – A pond designed to hold and infiltrate most or all of the runoff that it receives.
>
> *Detention Pond* – A pond designed to temporarily store and slowly release the runoff that it receives.
>
> *Swale* – A shallow ditch used to temporarily convey, store, or filter runoff.

Effects to hydraulic capacity and connectivity of natural water bodies would be the same for all alternative alignments. These effects to hydraulic capacity and connectivity of natural water bodies for all track alignments would have negligible intensity under NEPA, and impacts would be less than significant under CEQA because culverts would be installed to maintain or provide greater hydraulic conveyance capacity of the existing canal, ditch, or adjacent culvert. These design features are discussed in more detail in Section 3.8.6, Project Design Features.

Fresno Station, Bakersfield Station and Kings/Tulare Regional Station Alternatives

Increases in paved surfaces at HST stations in urbanized areas have the potential to contribute additional volumes of runoff to stormwater drainage systems in Fresno and Bakersfield. However, the increase in runoff should be minor because the station sites are in existing urbanized, developed areas. As discussed in Section 3.8.6, Project Design Features, the capacity of the receiving stormwater drainage system would be evaluated, and if necessary, onsite stormwater management measures, such as detention or selected upgrades to the receiving system, would be designed to provide adequate capacity. The Kings/Tulare Regional Station alternatives are located in rural areas without a municipal drainage system. Runoff would be detained onsite and infiltrate locally.

Effects to hydraulic capacity and connectivity of natural water bodies would be the same for all station alternatives. These effects to hydraulic capacity and connectivity of natural water bodies for HST stations would have negligible intensity under NEPA, and impacts would be less than significant under CEQA because drainage systems would collect and discharge stormwater to the local stormwater system in urban areas or to swales in rural areas.

Heavy Maintenance Facility Alternatives

All HMF sites would create approximately 65 acres of impervious surface. There would be an additional 90 acres for storage tracks, which are relatively impervious because of compaction of the ground surface below. This increase in impervious surface at a single location could result in increased stormwater runoff. Without adequate stormwater facilities to collect, retain, and treat the stormwater, these facilities could alter existing drainage, thus resulting in local flooding or channel erosion. The design for the HMF site would include infiltration ponds or detention basins which, based on engineering evaluations, would be adequate to reduce the potential for impacts of stormwater runoff on nearby streams and comply with regional and local standards. The design standards for these basins are described in Section 3.8.6, Project Design Features, and listed in Appendix 2-D. Therefore, this would be an effect with negligible intensity under NEPA, and a less-than-significant impact under CEQA.

Impact HWQ#6 - Permanent Impacts on Surface Water Quality

Water quality objectives are set forth in the Basin Plan developed by the Central Valley RWQCB (CVRWQCB 2004). Table 3.8-14 lists the water quality constituents described in the Basin Plan and their objectives. Violation of a water quality standard or discharge requirement would be considered an effect with substantial intensity under NEPA and a significant impact under CEQA.

Table 3.8-14
Water Quality Objectives Provided in the Water Quality Control Plan for the Tulare Lake Basin

Water Quality Constituent	Water Quality Objective
Ammonia	In no case shall the discharge of wastes cause concentrations of NH3 to exceed 0.025 mg/L (as N) in receiving waters.
Bacteria	In waters designated REC-1,[a] the fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed a geometric mean of 200/100 ml, nor shall more than 10% of the total number of samples taken during any 30-day period exceed 400/100 ml.
Biostimulatory Substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses.

Table 3.8-14
Water Quality Objectives Provided in the Water Quality Control Plan for the Tulare Lake Basin

Water Quality Constituent	Water Quality Objective
Chemical Constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, water designated MUN[b] shall not contain concentrations of chemical constituents in excess of the MCLs specified in the following provisions of Title 22 of the CCR.
Color	Waters shall be free of discoloration that causes nuisance or adversely affects beneficial uses.
Dissolved Oxygen	Waste discharges shall not cause the monthly median DO concentrations in the main water mass (at centroid of flow) of streams and above the thermocline in lakes to fall below 85% of saturation concentration, and the 95 percentile concentration to fall below 75% of saturation concentration. In addition in Kings River at the location of the railroad crossing the DO concentration has to remain above 7 mg/L.
Floating Material	Waters shall not contain floating material, including but not limited to solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
pH	The pH of water shall not be depressed below 6.5, raised above 8.3, or changed at any time more than 0.3 unit from normal ambient pH.
Pesticides	Waters shall not contain pesticides in concentrations that adversely affect beneficial uses.
Radioactivity	Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or which result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life.
Salinity	Waters shall be maintained as close to natural concentrations of dissolved matter as is reasonable considering careful use of the water resources.
Sediment	The suspended sediment load and suspended sediment discharge rate of waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Settable Material	Waters shall not contain substances in concentrations that result in the deposition of material that causes nuisance or adversely affects beneficial uses.
Suspended Material	Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Taste and Odors	Waters shall not contain taste- or odor-producing substances in concentrations that cause nuisance, adversely affect beneficial uses, or impart undesirable tastes or odors to fish flesh or other edible products of aquatic origin or to domestic or municipal water supplies.
Temperature	Natural temperatures of waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses.

Table 3.8-14
Water Quality Objectives Provided in the Water Quality Control Plan for the Tulare Lake Basin

Water Quality Constituent	Water Quality Objective
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed limits provided in the Basin Plan.

Notes:
[a] All stream segments crossed by the project have a REC-1 designated use.
[b] MUN beneficial use designation applies to Tule River and Kern River. Valley Floor waters are not designated.

Acronyms:
CCR = California Code of Regulations.
DO dissolved oxygen
MCL maximum contaminant level
mg/L milligram(s) per liter
ml milliliter
MUN municipal and domestic water supply
N nitrogen
NH3 un-ionized ammonia
REC-1 water contact recreation

Because the HST would run parallel to the existing BNSF Railway for a considerable portion of the Fresno to Bakersfield Section and potential pollutant types for the HST are similar to those in existing and active railroads, the HST would not introduce new types of pollutants to the Tulare Lake Basin. However, the presence of the new HST could increase the amount of the pollutants associated with rail operations that may already exist in the watershed because of increased rail service.

Contributing pollutants that are listed on a 303(d) list or for which a TMDL has been developed could be considered as substantially degrading water quality. TMDLs have not been identified for most of the surface water bodies in the vicinity of the Fresno to Bakersfield segment of the HST; however, the following have been included on the 303(d) list:

- Kings River, lower (Pine Flat Reservoir to Island Weir) – unknown toxicity and the pesticide chlorpyrifos.
- Kings River, lower (Island Weir to Stinson and Empire weirs) – electrical conductivity (EC), molybdenum (an essential trace element), and the pesticide toxaphene.
- Cross Creek (Kings and Tulare counties) – unknown toxicity.

In addition, approximately 55 miles downstream, Mendota Pool and San Joaquin River are identified as impaired for selenium (a naturally occurring trace element) and exotic species (non-native invasives), respectively. Kings River only discharges to Mendota Pool and San Joaquin River during extreme storm events, so these TMDLs are not relevant to the HST project.

With respect to the pollutants listed on the 303(d) list, the project would not contribute toxaphene, a pesticide that is currently banned in the United States, and whose use has been severely restricted since the 1980s; nor would it contribute chlorpyrifos, a more recently developed pesticide. The existing molybdenum problem is likely from natural sources or fertilizers. Molybdenum is used as an alloy with steel to increase strength and heat resistance, and sometimes used in lubricants in the form of molybdenum disulfide, so it may exist in the materials used to construct and operate the HST. Molybdenum forms insoluble complexes with copper and sulfate, and therefore molybdenum would not be in a form or in a quantity that would contribute to water quality degradation. EC is a surrogate for dissolved solids. Operation of the HST would not contribute any dissolved solids to receiving waters and therefore not contribute to conductivity in Kings River.

During project operations stormwater runoff from station parking lots, the heavy maintenance facility, and railroad rights-of-way could potentially result in degradation of water quality. Runoff from station parking lots and the heavy maintenance facility would be treated, where required, prior to being directed to infiltration basins or stormwater drainage systems. Runoff from the track rights-of-way would be dispersed in a non-erosive fashion, infiltrated onsite, conveyed to a nearby stormwater collection system, or directed through swales to infiltration basins located within the project right-of-way and maintained by the project. The basins would be designed as a water quality control measure. No runoff from the project would be discharged directly to any surface water bodies, irrigation canals, private property, or county roads. Runoff from bridges, overpasses, underpasses, and aerial structures at major river and creek crossings would be collected and discharged to infiltration basins or adjacent stormwater drainage systems. Any discharges to stormwater drainage systems would be pursuant to requirements of the entity controlling the stormwater drainage system (such as that managed by FMFCD for the portion of the project in Fresno County).

Table 3.8-15 shows the estimated amount of impervious area, the water quality design volume, and infiltration basin size based on water quality requirements for BMP design for the Kings/Tulare Regional Stations, HMF sites, and bridges or aerial structures at major river and creek crossings. Site conditions and local rain gauge stations were used to estimate the amount of runoff from these features for the 85th percentile, 24-hour storm event as required by the Central Valley RWQCB for water quality basin design. The basin sizes were determined using the State of California Basin Sizer program (Caltrans 2010). Analysis will be required at each location to confirm that infiltration is feasible and to determine infiltration basin size. Additional design requirements for peak flow, conveyance, and possibly detention may be designated by flood control agencies. Basins required for flood control would be designed based on local flood control agency requirements. The siting of specific stormwater facilities would be accomplished during detailed design.

The technology proposed for the HST System does not require large amounts of lubricants or hazardous materials for operation. The electric trains would use a regenerative braking technology, resulting in reduced physical braking and associated wear. Runoff from the at-grade tracks and the elevated guideways would have minimal pollutants.

The project would relocate several interchanges and construct new grade-separated roads at a number of project rail crossings. These new sources of road runoff from the new crossings, relocated highways, or frontage roads could affect water quality. However, stormwater would be collected at the toe of embankments and directed to detention basins or existing drainage systems. Road underpasses would require pump stations that would pump runoff from the low point of the road to either a municipal drainage system or a detention basin. These water quality design measures would be implemented to reduce the potential for adverse water quality impacts, and no runoff from the project would be directed to private property. Water quality design measures are described in Section 3.8.6, Project Design Features.

Effects to surface water quality from the HST tracks and relocated roads would have moderate intensity under NEPA and impacts would be less than significant under CEQA because runoff from the rights-of-way would be dispersed in a non-erosive fashion, infiltrated onsite, conveyed to a nearby stormwater collection system, or directed through swales to infiltration basins, the technology proposed for the HST System does not require large amounts of lubricants or hazardous materials for operation, and water quality design measures would be implemented.

The Fresno and Bakersfield station alternatives would be in the existing urban areas of downtown Fresno and Bakersfield. Few, if any, new potential pollution sources would be constructed and there would be minimal impact on existing water quality. Activities associated with the stations are similar to those currently conducted in the downtown areas, such as office use, pedestrian uses, and parking. Runoff generated at the Kings/Tulare Regional Station alternatives would be allowed to infiltrate locally or be directed to onsite infiltration or detention basins. Table 3.8-15 shows the proposed size of the infiltration basin required to meet water quality regulations. The effects to stormwater quality from the HST stations would have moderate intensity under NEPA, and impacts would be less than significant under CEQA.

At the HMF, most train maintenance would occur under roofed areas. Diesel fuel, gasoline, and lubricants would be stored in large underground tanks and would not pose a risk to water quality. However, train and service vehicle washing could occur outdoors. The HMF would include a system to recycle the wash water from the train sets to reduce water consumption and improve water quality in discharge water. Runoff from this activity would be contained within the site wastewater system and, therefore, would not pose a threat to water quality.

Maintenance and other vehicles would be fueled outside. In addition, the HMF would employ approximately 1,500 workers and provide 2-lane access roads and parking for up to 2,000 vehicles. The HMFs, including their fueling facilities, would be subject to state and federal hazardous materials regulations (see Section 3.10, Hazardous Materials and Wastes). An Industrial SWPPP would be maintained for the site. Stormwater runoff from these areas would be treated either through detention basins, bioswales, or other stormwater BMPs that would meet the Industrial SWPPP standards, and therefore, would not carry contaminants to such extent that the runoff could affect the local water quality of nearby receiving water bodies. Therefore, stormwater runoff from the HMF would result in effects with moderate intensity to surface water quality under NEPA and less-than-significant impacts under CEQA.

Effects to water quality would be the same for all alternative alignments, the same for all station alternatives, and the same for all HMF sites because similar BMPs would be implemented for each of these categories. The alternative alignments are the BNSF, Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter Bypass, Bakersfield South, and Bakersfield Hybrid alternatives. The station alternatives are Fresno Station–Mariposa, Fresno Station–Kern, Kings/Tulare Regional Station–East, Kings/Tulare Regional Station–West at-grade and below-grade options, Bakersfield Station–North, Bakersfield Station–South, and Bakersfield Station–Hybrid. The HMF sites are Fresno Works–Fresno, Kings County–Hanford, Kern Council of Governments–Wasco, Kern Council of Governments–Shafter East, and Kern Council of Governments–Shafter West.

Table 3.8-15
Estimated Basin Sizes for Infiltration Basins Located at the Kings/Tulare Regional Station, Proposed HMF Sites, and at the Aerial Structure Sections of the Alignment

Project Feature	Impervious Area (assumed to be concrete or asphalt) (acres)	Saturated Hydraulic Conductivity Ksat (in/hr)[a]	Inches of Runoff from Impervious Surfaces (in)[b]	Rainfall Station (station closest to site was selected)	Runoff Volume (WQV) (acre-ft)	Width of Bottom of Basin (assumed to have square shape) (ft)	Depth (ft)	Area at the Top of the Basin (acres)
Station								
Kings/Tulare Regional Station–East Alternative	25.3	4.0	0.44	Hanford 1 S	0.9	71	5.3	0.27
Kings/Tulare Regional Station–West Alternative, at-grade option	14.2	1.3	0.44	Hanford 1 S	0.5	94	2.2	0.30
Kings/Tulare Regional Station–West Alternative, below-grade option	13.9	1.3	0.44	Hanford 1 S	0.5	93	2.2	0.29
Heavy Maintenance Facility								
Fresno Works–Fresno HMF site[c]	120	4.0	0.54	Fresno Yosemite Intl	5.4	172	6.4	1.08
Kings County–Hanford HMF site	120	4.0	0.44	Hanford 1 S	4.4	155	6.3	0.91
Kern COG–Wasco HMF site[d]	120	1.3	0.39	Wasco	3.9	258	2.4	1.78
Kern COG–Shafter East HMF site	120	4.0	0.39	Wasco	3.9	146	6.2	0.83
Kern COG–Shafter West HMF site	120	4.0	0.39	Wasco	3.9	146	6.2	0.83
Bridges/Aerial Structures								
Cole Slough (BNSF Alternative)	0.3	1.3	0.44	Hanford 1 S	0.01	9	1.8	0.02
Dutch John Cut (BNSF Alternative)	0.7	1.3	0.44	Hanford 1 S	0.01	15	1.5	0.02
Kings River (BNSF Alternative)	0.6	1.3	0.44	Hanford 1 S	0.01	13	1.4	0.02
Kings River (Hanford West Bypass 1, Hanford West Bypass 2)	2.2	1.3	0.44	Hanford 1 S	0.04	26	1.7	0.04

Table 3.8-15
Estimated Basin Sizes for Infiltration Basins Located at the Kings/Tulare Regional Station, Proposed HMF Sites, and at the Aerial Structure Sections of the Alignment

Project Feature	Impervious Area (assumed to be concrete or asphalt) (acres)	Saturated Hydraulic Conductivity Ksat (in/hr)[a]	Inches of Runoff from Impervious Surfaces (in)[b]	Rainfall Station (station closest to site was selected)	Runoff Volume (WQV) (acre-ft)	Width of Bottom of Basin (assumed to have square shape) (ft)	Depth (ft)	Area at the Top of the Basin (acres)
Cross Creek (BNSF Alternative, Hanford West Bypass 1 and 2)	0.4	0.4	0.41	Corcoran Irrigation District	0.01	20	0.6	0.02
Tule River (BNSF Alternative, Corcoran Elevated, Corcoran Bypass)	0.4	1.3	0.41	Angiola	0.01	11	1.4	0.01
Deer Creek (BNSF Alternative, Allensworth Bypass)	0.3	0.4	0.41	Angiola	0.005	16	0.6	0.02
Poso Creek (BNSF Alternative, access road crossing, Allensworth Bypass)	0.4	1.3	0.39	Wasco	0.01	10	1.3	0.01
Kern River (BNSF Alternative, Bakersfield South, Bakersfield Hybrid)	1.9	4.0	0.39	Bakersfield	0.03	13	2.8	0.03

Notes:
[a] USDA Soil Survey (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx) (USDA-NRCS 2010): sand = 13 in/hr, sandy loam = 4 in/hr, loam = 1.3 in/hr, silt loam = 0.4 in/hr.
[b] Caltrans Basin Sizer Program was used to size the stormwater basin (Caltrans 2010).
[c] Hydraulic conductivity range for the Fresno site: 4 to 13 in/hr.
[d] Hydraulic conductivity range for the Wasco site: 1.3 to 4 in/hr.

Assumptions:
Design Rainfall Event: 85th percentile, 24-hour storm event
Runoff coefficient: 0.95 for impervious surfaces
Basin shape: Square
Side slopes: 3:1 (H:V)
Freeboard: 12 inches
Two infiltration basins per aerial structure (one on each side)

Acronyms:

AP	Airport
COG	Council of Governments
ft	foot/feet
HMF	heavy maintenance facility
hr	hour
ID	Irrigation District
in	inch
Ksat	Saturated hydraulic conductivity
S	south
SR	state route
WQV	water quality volume

Common Groundwater Impacts

Impact HWQ#7 - Permanent Impacts on Groundwater Quality and Volume

High-Speed Train Alignment Alternatives

Portions of the study area serve as recharge areas for rivers and creeks in the Tulare Lake Basin, primarily along active stream channels containing sands and gravels. The project may include putting piers in the channel at some locations. Because of the narrow, linear project footprint, and the small overall footprint of the piers relative to the footprint of the river where recharge occurs, effects to groundwater basin recharge from pier footings would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

The center of the HST track embankment would have reduced infiltration. The central part of the at-grade track, approximately 40 feet wide, would consist of ballast and tie or slab track bed over a dense sub-ballast and sub-grade. This portion of the embankment would be impermeable, or nearly so. The remainder of the rail alignment (up to 60 feet) would be graded for surface drainage. This peripheral area would be more permeable than the central embankment, and would continue to provide infiltration. Stormwater would drain from the track embankment towards swales running parallel to at-grade sections of track. Although the location of infiltration would be slightly altered, runoff would drain to the pervious ground surface, unlined drainage ditches or basins. Because the HST System is electrical, the track runoff would carry few pollutants. In areas with infiltrative soils, stormwater would percolate into the natural and landscaped areas of the right-of-way without affecting groundwater quality. Effects to groundwater quality and volume would be the same for all alternative alignments. The alternatives would have an effect with negligible intensity on groundwater quality under NEPA and a less-than-significant impact under CEQA.

As described in Section 3.6, Public Utilities and Energy, the project could result in an overall reduction in water use compared to existing use at HST facilities due primarily to the conversion of currently irrigated agricultural lands.

Fresno Station, Bakersfield Station and Kings/Tulare Regional Station Alternatives

The Fresno and Bakersfield station sites are in urbanized areas with little potential for any increase in groundwater recharge. The potential Kings/Tulare Regional Station–East and potential Kings/Tulare Regional Station–West alternatives would use stormwater detention basins, and stormwater would infiltrate locally. The detention basins would be designed in accordance with the standards listed in Appendix 2-D. The stations, therefore, would have an effect with negligible intensity on groundwater volumes, infiltration, and quality under NEPA and would have a less-than-significant impact under CEQA.

The Fresno, Bakersfield, and Kings/Tulare Regional Station–West alternatives are within municipal water supply areas. The Kings/Tulare Regional Station–East Alternative is located just outside of the Hanford municipal service area; therefore there is a potential that a groundwater well would be installed and groundwater treated and used for potable water supply. The station would use approximately 18 acre-feet per year of water for domestic use, which is less than the 50 acre-feet of water demand at the HMF location. Effects and impacts of groundwater pumping at the Kings/Tulare Regional Station–East Alternative would be less than calculated for the HMF. Preliminary drawdown calculations conducted for the HMF facilities (analysis is shown below) indicate that drawdown is expected to be minimal (e.g., less than 6 inches of drawdown) at a distance of 100 feet from the pumping well. Groundwater pumping at the Kings Tulare Regional Station–East Alternative would be less than at the HMFs and would not influence water levels in neighboring wells because the nearest identified wells are outside of the radius of influence as shown below and, therefore, this effect would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

Heavy Maintenance Facility Alternatives

The HMFs would increase impervious surfaces in the study area because they would be located primarily on agricultural land. Because permeable areas surround the HMF sites and runoff from HMF impermeable surfaces would remain onsite in infiltration/detention ponds or would filtrate through the permeable areas immediately offsite, the effect on groundwater recharge would have negligible intensity under NEPA, and a less-than-significant impact under CEQA. Detention basins or infiltration ponds would be designed in accordance with design standards addressed in Section 3.8.6, Project Design Features, and listed in Appendix 2-D.

The HMF sites would have outdoor washing and fuel storage areas, as well as parking lots, which could generate polluted stormwater runoff. The HMF would include a system to recycle the wash water from the train sets to reduce water consumption and improve water quality in discharge water. None of the HMFs are located in areas of shallow groundwater so percolation of stormwater into groundwater would not affect groundwater quality, resulting in an effect with negligible intensity under NEPA and a less-than-significant impact under CEQA.

The HMF sites do not have a connection to a municipal water supply. If it is not possible or practicable to connect to a municipal supply, then a groundwater well (or wells) would be installed and groundwater would be used for water supply. The HMF demand of 50 acre-feet of water per year would not deplete groundwater supplies through pumping groundwater. The amount of groundwater pumped from underlying aquifers for water supply at the HMF would be small compared to the estimated storage capacities of the subbasins, each of which has over 12 million acre-feet of storage, and small (less than 1%) compared to groundwater pumping by local municipal suppliers (see Table 3.8-16).

Table 3.8-16
Groundwater Extraction in the Tulare Lake Hydrologic Region

Users Of Groundwater for Water Supply	Groundwater Pumping (AF/year)
Regional Groundwater Demand (Tulare Lake Hydrologic Region)	
Agricultural and Municipal groundwater use	4,340,000
Local Municipal Supply	
City of Fresno municipal supply	136,000 to 165,500
City of Hanford municipal supply	11,600 to 12,900
City of Wasco municipal supply	4,400 to 4,900
City of Bakersfield municipal supply	27,800 to 38,700
California Water Service Company’s Bakersfield District municipal supply	44,000 to 53,900
HST Facilities	
HMF Alternative	50
Kings/Tulare Regional Station–East Alternative (potential)	18

Table 3.8-16
Groundwater Extraction in the Tulare Lake Hydrologic Region

Users Of Groundwater for Water Supply	Groundwater Pumping (AF/year)
Source: DWR 2003, City of Fresno 2008, City of Hanford 2011, City of Wasco 2011, City of Bakersfield 2007, California Water Service Company 2011 Notes: AF/year = acre-feet per year HST = high-speed train HMF = heavy maintenance facility	

Depending on the rate and volume of pumping, water levels in neighboring wells could be affected by the project. To analyze this potential effect, the radius of influence of a HMF municipal supply well was calculated using the following factors.

- Domestic water use. As described in Chapter 3.6, Public Utilities and Energy, the HMF would require approximately 50 acre-feet per year of water on average for domestic use. This corresponds to a pumping rate of about 31 gpm on average (assuming pumping 24 hours per day continuously) or about 62 gpm if pumping occurs 12 hours per day.
- Hydraulic conductivity. The lower San Joaquin Valley has an upper and lower layer separated by a clay aquitard (often referred to as the Corcoran Clay). It was assumed that the well would be installed in the lower aquifer. The hydraulic conductivity of this aquifer varies. Faunt (2009) describes results from several well tests in the San Joaquin Valley that provide a range in hydraulic conductivities of coarse grain material of 31 to 104 feet/day. The calibrated groundwater model described in Faunt (2009) used hydraulic conductivities in the range from 0.24 foot/day for fine grain material and 3,300 feet/day for coarse grain material. The aquifer material below the Corcoran Clay layer in the project area tends to be on the order of 20-to 40-percent coarse grain material (Faunt 2009) resulting in hydraulic conductivities on the order of 600 feet/day. Other studies have shown hydraulic conductivities to be on the order of 60 feet/day. A value of 60 feet/day was used in this analysis.
- Aquifer depth. The depth of the aquifer was assumed to be 1,000 feet. This is consistent with the 1,500-foot depth used in the USGS Central Valley Groundwater Model (Faunt 2009) and the 1,500 to over 3,000 feet reported in the USGS Groundwater Atlas of the United States.
- Storativity. The storativity is a measure of the ability of the aquifer to release water from storage. A value of 8.6x10-8/foot was used (Faunt 2009).

The radius of influence was calculated based on pumping continuously at 31 gpm and for 62 gpm for 12 hours. The results indicated that the radius of influence of the well is less than 100 feet.

These preliminary drawdown calculations, based on typical aquifer properties, indicate that drawdown resulting from pumping continuously would be expected to be minimal (e.g., less than 6 inches of drawdown) at a distance of 100 feet from the pumping well. Drawdown would be less than 6 inches farther from the pumping well. Table 3.8-17 shows the wells that were identified within a 1,000-foot radius of the HMF locations and the King/Tulare Regional station alternatives. The well locations were obtained from the California Department of Water Resources water data library (http://www.water.ca.gov/waterdatalibrary/index.cfm). This information has not been field verified. No wells were located within 100 feet of the property boundary. For the Wasco, Shafter-

East, and Shafter-West HMF sites, several wells were located within the HMF footprint. Whether these wells will continue in operation or be abandoned after construction of the HMF has not yet been determined.

The HMF demand of 50 acre-feet of water per year would not deplete groundwater supplies through pumping of groundwater or influence the water level in neighboring wells because the nearest identified wells adjacent to the proposed HMFs are at least 100 feet from property boundaries. Permeable areas surround the HMF sites and runoff from HMF impermeable surfaces would remain onsite in infiltration/detention ponds or would infiltrate through the permeable areas immediately offsite. For these reasons, effects on groundwater would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Table 3.8-17
Approximate Distances to Groundwater Wells near the HMF Facility Locations

HST Facility	Well ID	Approximate Distance[1]
Fresno Works–Fresno HMF Site	15S20E12F001M	>1,000 ft
Kings/Tulare Regional Station–East Alternative (potential)	18S22E28A001M	>1,000 ft
Kings/Tulare Regional Station–West Alternative (potential)	18S21E34F001M	600 ft
Kings County–Hanford HMF Site	19S22E09C001M	100 ft
	19S22E09B001M	200 ft
	19S22E09M001M	350 ft
	19S22E21C001M	1,000 ft
Kern Council of Governments–Wasco HMF Site	27S25E07L001M	**within**
	27S25E18F001M	**within**
	27S25E06N002M	550 ft
	27S25E07M001M	1,000 ft
Kern Council of Governments–Shafter East HMF Site	several	**within**
	28S25E36A001M	200 ft
	29S26E05C001M	900 ft
Kern Council of Governments–Shafter West HMF Site	several	**within**
	28S26E32P001M	200 ft
	28S26E32C001M	200 ft
	28S26E30J001M	200 ft
	28S26E30F001M	200 ft

[1] Source: DWR 2011. Data have not been field verified.

Acronyms and Abbreviations:
ft = feet
HMF = heavy maintenance facility

Common Floodplain Impacts

Impact HWQ#8 - Permanent Impacts on Floodplains

Project components in FEMA-designated floodplains would include at-grade track, piers at sections of elevated track or stream crossings, bridge abutments from HST bridges and road overpasses, traction power substations, freight rail or yard relocation areas, utility relocation areas, and some of the HMF alternatives. HST bridge overpasses would be constructed in the Tule River, Deer Creek, County Line Creek, and Poso Creek floodplains. Traction power substations would be constructed in the Deer Creek, Poso Creek, and Kern River floodplains. An access road would be constructed to the traction power substation in the Poso Creek floodplain. Freight rail relocation areas are proposed within the city of Wasco and the city of Shafter floodplains.

Table 3.8-18 details the area of the permanent project footprint within special flood hazard zones (as defined in Table 3.8-9). The study area has a relatively flat gradient that slopes gently to the west or southwest. During periods of high stream flow, shallow overland flooding, which can range from 1 to 3 feet in depth, tends to pond against canal berms, levees, and road and railroad embankments that are perpendicular to the land gradient.

Stream crossings could reduce the watercourse's ability to convey peak flows by reducing the floodplain's capacity to convey flow, resulting in potential floodplain impacts. As discussed in Section 3.8.5, under Construction Period Impacts, each stream crossing would be designed to maintain existing hydrology and connectivity, but some physical changes could occur. Most canals and channels would require culverts. Most river and creek crossings would require bridges and the placement of piers in the floodway and/or floodplain. Although pier construction methods have not been determined and would be based on local conditions, it is possible that some crossings would require in-water work for pier construction. Design of these bridge crossings would include measures to minimize the effects of placing piers in the floodplains and floodways (e.g., piers would be placed and designed to minimize backwater effects and local scouring and the shape and alignment of the piers would be designed to minimize adverse hydraulic effects). Because project design features (described in Section 3.8.6, Project Design Features) would maintain the existing flow conveyance capacity at each of these crossings and minimize effects from pier construction techniques, effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

The HST tracks could divert shallow floods from overflowing channels by serving as an obstacle to the shallow overland flow if sufficient culverts or cross drainage were not provided. In areas where the project is elevated, there would be little potential for such diversion. Where the project is adjacent to existing rail or highway embankments, such flood barriers might already exist. New impacts would be most likely to occur where project tracks do not run parallel to existing embankments or where existing embankments could be overtopped. The project would incorporate adequately sized culverts into the project to avoid the possibility of diverting or redirecting flood flows or increasing the water surface elevation in the 100-year floodplain by more than 1 foot, or as required by state or local agencies. Where FEMA-designated floodways exist, project design features would provide for no increase in water surface elevation.

Bridge abutments associated with bridge crossings or road overpasses, utility relocation areas, and traction power substations are small compared to the overall size of the floodplain, which in some areas can reach up to several miles in width at the crossing. The size of these features would be small compared to the overall size of the associated floodplain, and therefore effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

In the city of Fresno, the HST crossing at the downtown Fresno floodplain will be slightly below-grade. This floodplain near Church Avenue appears to be a local topographic depression that fills with surface runoff during extreme events, due to inadequate local drainage systems. There are no streams associated with this floodplain. Tracks set below grade would have drainage systems to collect stormwater, and stormwater would be pumped to the original ground outside the open cut or trench section and released into a drainage facility.

Freight rail relocation areas are proposed in the city of Wasco and the city of Shafter floodplains. However, these floodplains are defined by small depressions in the topography and have no water body associated with them. Therefore, the effects on floodplains associated with freight rail relocation areas would have negligible intensity under NEPA and less-than-significant impacts under CEQA.

The impacts associated with crossing FEMA-designated areas are discussed below for each stream crossing. For all locations that would not be within FEMA-designated areas effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA because of compliance with design standards.

Table 3.8-18
HST Alternatives Area in the Special Flood Hazard Area (acres)

Alternative	FEMA Zone[a]			
	A	AE	AH	AO
Alternative Alignments[b]				
BNSF Alternative	480	50	70	110
Hanford West Bypass 1, at-grade and below-grade options	90 (100)	60 (20)	0 (0)	0 (0)
Hanford West Bypass 2, at-grade and below-grade options	90 (100)	30 (20)	0 (0)	0 (0)
Corcoran Elevated Alternative	90 (200)	5 (3)	0 (0)	0 (0)
Corcoran Bypass Alternative	70 (200)	5 (3)	0 (0)	0 (0)
Allensworth Bypass Alternative	40 (90)	0 (0)	0 (0)	90 (110)
Wasco-Shafter Bypass Alternative	70 (80)	0 (0)	0 (6)	0 (6)
Bakersfield South Alternative	0 (0)	20 (20)	0 (0)	0 (0)
Bakersfield Hybrid Alternative	0 (0)	20 (20)	0 (0)	0 (0)
Station Options				
Fresno Station–Mariposa Alternative	0	0	0	0
Fresno Station–Kern Alternative	0	0	0	0
Kings/Tulare Regional Station–East Alternative	0	0	0	0
Kings/Tulare Regional Station–West Alternative	0	0	0	0
Bakersfield Station–North Alternative	0	0	0	0
Bakersfield Station–South Alternative	0	0	0	0

Table 3.8-18
HST Alternatives Area in the Special Flood Hazard Area (acres)

Alternative	FEMA Zone[a]			
	A	AE	AH	AO
Bakersfield Station–Hybrid Alternative	0	0	0	0
Heavy Maintenance Facility Alternative				
Fresno Works–Fresno HMF site	1	5	0	0
Kings County–Hanford HMF site	0	0	0	0
Kern Council of Governments–Wasco HMF site	0	0	0	0
Kern Council of Governments–Shafter East HMF site	160	0	0	0
Kern Council of Governments–Shafter West HMF site	150	0	0	0

Notes:
[a] Acreages are rounded to the nearest whole number. Area represents the GIS intersection between the permanent project footprint and FEMA DFIRM. See Table 3.8-9 for special flood hazard zone designations.
[b] Equivalent numbers for the corresponding segment of the BNSF Alternative are presented in parenthesis.

Acronyms and Abbreviations:
FEMA = Federal Emergency Management Agency
HMF = heavy maintenance facility
HST = high-speed train

High-Speed Train Alternatives

In the city of Fresno, the BNSF Alternative alignment would be constructed primarily at-grade, which may lead to minor alteration of existing drainage patterns. Culverts or structures would be installed under the right-of-way to allow drainage across the alignments at all locations where channels cross the right-of-way and at each drainage or canal-crossing location where water flows through the existing BNSF alignment to allow cross drainage. These urban culverts would be designed to pass the 100-year event. Culverts would include head walls, wing walls, flared outlets, flared inlets, and BMPs (such as riprap) at the new culvert locations to provide protection against erosive forces and thereby minimize erosion.

The BNSF Alternative alignment follows the alignment of the BNSF railroad for most of its length. The 100-year floodplains that are crossed by the BNSF Alternative alignment are either crossed next to the BNSF crossings or a short distance upstream or downstream of the BNSF, as described below. Crossings would be designed to not interfere with flood flows where possible. Where the alignment is on fill, an opening would be provided in the HST fill that would be as large as, or larger than, the opening in the existing BNSF railroad.

The fill would be engineered and protected by BMPs, such as the use of rock, so the potential for erosion of the fill material would be minor. The fill could cause minor erosion from changes in local drainage patterns that would be temporary. In addition, ground slopes in the study area are very flat, generally less than 0.1%. During storm events, because of the very flat ground slopes, very little local drainage capable of erosion would be generated. Where the right-of-way crosses well-established drainages or canals at-grade or on fill, culverts would be installed under the tracks that comply with the design standards listed in Appendix 2-D and design criteria in the latest version of *Technical Memorandum 2.6.5 Hydraulics and Hydrology Guidelines* (Authority 2011).

Despite minor adjustments to existing drainage patterns, the study area would not have an increased potential to cause erosion or sedimentation. Although runoff and flood flows would still be allowed to drain under the new track through aerial structures or bridges, or through culverts designed to maintain hydraulic conveyance capacity, there could be an increase in flood elevations in areas where the BNSF railroad is overtopped during large flood events. In those locations increased conveyance under the HST would be required using additional culverts, bridged openings, or an aerial structure. Details of the impacts from the alternative alignments on the major river and creek crossings are provided below.

Kings River

The BNSF Alternative alignment crosses the Kings River complex (Cole Slough, Dutch John Cut, and Kings River). The FEMA-designated floodplain at the Kings River complex crossing is 13,700 feet wide. The floodplain is designated as Zone A (no detailed study). The BNSF Alternative alignment would cross the Kings River complex on embankment except where it crosses Cole Slough, Dutch John Cut and the original Kings River channel. At these locations the alignment would cross the channels on bridges. As part of the project design, the soffit of the bridges would be set above the estimated 100-year flood level and the total width of openings in the embankment would pass the 100-year flood flows without increasing the water surface elevation in the floodplain by more than 1 foot, or as required by state or local agencies. Piers would be placed and designed to minimize backwater effects and local scouring. The shape and alignment of the piers would be designed to minimize adverse hydraulic effects. Therefore, permanent floodplain effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Hanford West Bypass 1 and Hanford West Bypass 2 cross Kings River west of the town of Laton on an aerial structure. The floodplain at this crossing is 16,500 feet wide, and designated as Zone A. The aerial structure would be approximately 9,500 feet in length and reach a maximum height of approximately 40 feet to the top of the rail, and would be elevated over Murphy Slough, Grant Canal, and Kings River. Piers would be placed and designed to minimize backwater effects and local scouring. The shape and alignment of the piers would be designed to minimize adverse hydraulic effects. Therefore, permanent floodplain effects from the Hanford West Bypass 1 and Hanford West Bypass 2 would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Cross Creek

The BNSF Alternative, Hanford West Bypass 1 Alternative, and Hanford West Bypass 2 Alternative traverse Cross Creek. (Hanford West Bypass 2 is located on the eastern side of the BNSF Railway tracks to connect with either the Corcoran Elevated Alternative or the Corcoran Bypass Alternative.) The 100-year floodplain of Cross Creek is designated as Zone AE on both the upstream and downstream side of the existing BNSF. This flood zone is approximately 15,000 feet wide and bounded by about 3,000 feet of designated Zone A.

The BNSF Alternative alignment, Hanford West Bypass 1 Alternative and Hanford West Bypass 2 Alternative would traverse Cross Creek on an aerial structure. The minimum soffit of the structure would be above the 100-year flood elevation. These aerial structures cross both the FEMA- and CVFPB-designated floodways and would pass the 100-year flood flows without increasing the water surface elevation in the floodplain by more than 1 foot, or as required by state or local agencies. Where FEMA-designated floodways exist, project design features would provide for no increase in the water surface elevation. Therefore, effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Tule River

The BNSF Alternative alignment, Corcoran Elevated Alternative alignment and the Corcoran Bypass Alternative alignment cross Tule River south of the city of Corcoran. The FEMA-designated floodplain at the Tule River crossing is about 13,000 to 18,000 feet wide, mostly on the northern side of the river upstream of the BNSF railroad. The floodplain is designated as Zone A (no detailed study). Although the FEMA maps show the floodplain as being mostly restricted to one side of the BNSF railroad north of the river, the BNSF railroad has two undercrossings and one canal crossing in the floodplain that allow the flood waters to pass through the railroad alignment. The two undercrossings consist of bridges about 90 feet long; the canal crossing consists of about a 60-foot-long bridge.

The BNSF Alternative, Corcoran Elevated Alternative, and the Corcoran Bypass Alternative alignments would cross Tule River on an aerial structure. The BNSF Alternative and Corcoran Elevated Alternative would be elevated for about 12,600 feet, and the Corcoran Bypass Alternative would be elevated for about 18,000 feet. The minimum soffit elevation of the aerial structure would be above the 100-year water surface elevation. Therefore, permanent floodplain effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

Deer Creek

The BNSF Alternative alignment and the Allensworth Bypass Alternative alignment cross Deer Creek. The 100-year floodplain of Deer Creek is designated as Zone A on the upstream side of the existing BNSF bridge and is approximately 33,000 feet wide. On the downstream side, the floodplain becomes shallow flooding Zone AO and narrows to 28,000 feet wide.

Both alignments would be constructed on an aerial structure approximately 8,500 feet in length. Because the aerial structures provide clearance and conveyance for the flood flows, effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

County Line Creek

The BNSF Alternative Alignment crosses the County Line Creek at the Tulare-Kern county line. The 100-year floodplain associated with the county line creek is also designated as Zone A and is approximately 21,000 feet wide at the upstream side of the existing BNSF railroad alignment. The floodplain narrows on the downstream side of the BNSF bridge to two separate, smaller floodplains and eventually terminates approximately 6,000 feet downstream at a topographically low area designated as Zone AO.

As discussed above, the County Line Creek appears to be a remnant of an alluvial fan or distributary drainage system that likely discharged from the Sierra Nevada to Tulare Lake at one time. However, its connection with its original headwaters appears to be disrupted by agricultural fields and highways. It now drains locally and runoff passes under Highway 43 and the BNSF through two sets of culverts for the highway and two underpasses for the railroad located about 1.4 miles apart. The HST would include bridge overpasses or culverts at the same locations with the capacity to pass the same design flows. Therefore, effects would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

Poso Creek

There are four potential alternative crossings of Poso Creek:

1. The BNSF Alternative.
2. The Allensworth Bypass Alternative connecting to the BNSF Alternative.
3. The BNSF Alternative connecting to the Wasco-Shafter Alternative.
4. The Allensworth Bypass Alternative connecting to the Wasco-Shafter Alternative.

There is also a potential road crossing at Poso Creek, which is associated with a traction power substation on the BNSF Alternative.

The 100-year floodplain associated with Poso Creek is FEMA-designated as Zone A, and is approximately 30,000 feet wide at the upstream side of the existing BNSF bridge and approximately 9,000 feet wide on the downstream side of the BNSF bridge.

The BNSF Alternative connection to the Wasco-Shafter Alternative and the Allensworth Bypass Alternative connection to the Wasco-Shafter Alternative would both be on aerial structures that would provide adequate clearance and conveyance of the flood flows. Therefore, permanent floodplain effects from these alternative combinations would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

The BNSF Alternative runs adjacent to the existing BNSF track on the downstream side. The BNSF Alternative would cross Poso Creek by bridge. The BNSF Alternative would result in backwater effects similar to those caused by the existing BNSF railroad because it would be located adjacent to the existing railroad (which, according to the FEMA map, is already impeding flood flows) and would not result in a significant increase in water levels. Therefore, permanent floodplain effects from the BNSF Alternative would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

The Allensworth Bypass Alternative connecting to the BNSF Alternative crosses Poso Creek on an embankment approximately 1,000 to 2,000 feet downstream of the existing BNSF railroad crossing. The total width of openings in the embankment would be designed to pass the 100-year flood flows without increasing the water surface elevation in the floodplain by more than 1 foot, or as required by state or local agencies. Therefore, permanent floodplain effects would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

Moving the BNSF railroad to parallel the Allensworth Bypass would result in water surface elevations similar to the Allensworth Bypass Alternative connecting to the BNSF Alternative; therefore, permanent floodplain effects would have negligible intensity under NEPA, and impacts would be less than significant under CEQA.

A traction power substation would be built north of Poso Creek within the floodplain. A vehicle bridge at Blankenship Avenue would be built to allow access to the traction power substation along the BNSF Alternative. (A vehicle bridge would not be needed for the traction power station along the Allensworth Bypass Alternative.) The access road would cross Poso Creek approximately 3,000 feet downstream of the existing BNSF railroad crossing. The bridge would span the main flow channel and be designed to pass the 100-year flood flows without increasing the water surface elevation in the floodplain by more than 1 foot, or as required by state or local agencies. Therefore, permanent floodplain effects would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

Kern River

The BNSF Alternative, Bakersfield South Alternative, and Bakersfield Hybrid Alternative cross Kern River in the city of Bakersfield. Kern River would be crossed by an aerial structure of sufficient length to provide adequate clearance and conveyance of the flood flows. Piers would be placed and designed to minimize backwater effects and local scouring. The shape and alignment of the piers would be designed to minimize adverse hydraulic effects. Therefore, permanent effects to floodplains would have negligible intensity under NEPA and impacts would be less than significant under CEQA.

Heavy Maintenance Facility Alternatives

The proposed footprint of the Fresno Works–Fresno facility is crossed by Central Canal, which has a FEMA floodplain associated with it. The floodplain is mostly contained within the canal banks. If an HMF is constructed at this site, structures would not be placed within the canal banks. The Shafter East and Shafter West HMF sites are partially located in FEMA-designated Zone A floodplains. However, these floodplains are defined by small depressions in the topography, and have no water body associated with them. The Kings County–Hanford and the Kern Council of Governments–Wasco HMF sites are not within a designated floodplain. Therefore, there would be effects with negligible intensity on floodplains associated with the HMF facility alternatives under NEPA, and less-than-significant impacts under CEQA.

3.8.6 Project Design Features

The Authority and FRA have considered avoidance and minimization measures consistent with commitments in the Program EIR/EIS documents. During project design and construction, the Authority and FRA would ensure that the measures outlined below are implemented to reduce impacts on water resources, as discussed in Section 3.8.5, Environmental Consequences. Applicable design standards for hydrology and water resources that would be used for the project are provided in Appendix 2-D. These measures and standards are discussed in greater detail in supporting documents prepared for the preliminary design, including the following:

- *Technical Memorandum 2.6.5 Hydraulics and Hydrology Guidelines* (Authority 2011)
- *Fresno to Bakersfield Section Hydrology, Hydraulics, and Drainage Report* (Authority 2012a).
- *Fresno to Bakersfield Section Floodplains Impact Report* (Authority 2012b).
- *Fresno to Bakersfield Section Stormwater Quality Management Report* (Authority 2012c).

These measures are considered to be part of the project and are described in the following text. Additionally, the project would require an Individual Section 404 Permit from the USACE. This permit would have conditions to further minimize water quality impacts.

Project Design Features for Stormwater Management and Treatment

During the detailed design phase, each receiving stormwater system's capacity will be evaluated to accommodate project runoff for the design storm event. As necessary, onsite stormwater management measures, such as detention or selected upgrades to the receiving system, will be designed to provide adequate capacity and to comply with the design standards in Appendix 2-D and the latest version of *Technical Memorandum 2.6.5 Hydraulics and Hydrology Guidelines* (Authority 2011). Onsite stormwater management facilities will be designed and constructed to capture runoff and provide treatment prior to discharge of pollutant-generating surfaces, including station parking areas, access roads, new road over- and underpasses, reconstructed interchanges, and new or relocated roads and highways. Low-impact development (LID) techniques will be used to detain runoff onsite and to reduce offsite runoff. Constructed wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated systems (biofilters) such as vegetated swales and grass filter strips will be used, where appropriate. Portions of the HMF site will be used for onsite infiltration of runoff, if feasible, or for stormwater detention if not feasible. Stormwater infiltration or detention facilities are to be built in compliance with the design standards indicated in Appendix 2-D. Vegetated set-backs from streams will be used.

Project Design Features for Flood Protection

The project will be designed to both remain operational during flood events and to minimize increases in 100-year flood elevations. Design standards will include the following:

- Establish track elevation to prevent saturation and infiltration of stormwater into the sub-ballast.
- Minimize development within the floodplain, to such an extent that water surface elevation in the floodplain would not increase by more than 1 foot, or as required by state or local agencies, during the 100-year flood flow. Avoid placement of facilities in the floodplain (e.g., at the Shafter East and Shafter West HMF sites) or raise the ground with fill above the base-flood elevation.

The floodplain crossings will be designed to maintain a 100-year floodwater surface elevation of no greater than 1 foot above current levels, or as required by state or local agencies, and will not increase existing 100-year floodwater surface elevations in FEMA-designated floodways.

The following design standards would minimize the effects of pier placement on floodplains and floodways:

- Design site crossings to be as nearly perpendicular to the channel as feasible to minimize bridge length.
- Orient piers to be parallel to the expected high-water flow direction to minimize flow disturbance.
- Elevate bridge crossings at least 3 feet above the high-water surface elevation to provide adequate clearance for floating debris, or as required by local agencies. (The CVFPB requires that the bottom members [soffit] of a proposed bridge be at least 3 feet above the design floodplain. The required clearance may be reduced to 2 feet on minor streams at sites where significant amounts of stream debris are unlikely.)
- Conduct engineering analyses of channel scour depths at each crossing to evaluate the depth for burying the bridge piers and abutments. Implement scour-control measures to reduce erosion potential.
- Use quarry stone, cobblestone, or their equivalent for erosion control along rivers and streams, complemented with native riparian plantings or other natural stabilization alternatives that would restore and maintain a natural riparian corridor.
- Place bedding materials under the stone protection at locations where the underlying soils require stabilization as a result of stream-flow velocity.

Construction Stormwater Pollution Prevention Plan

The SWRCB Construction General Permit (Order No. 2009-0009 DWQ, NPDES No. CAS000002) establishes three project risk levels that are based on site erosion and receiving-water risk factors. Risk Levels 1, 2, and 3 correspond to low-, medium-, and high-risk levels for a project. A preliminary analysis indicates that most of the project would fall under Risk Level 1, the lowest risk level. However, sections of the project may be more appropriately categorized as Risk Level 2 due to the combination of local rainfall, soil erodibility, and the lengths of the constructed slopes. For example, the portion of the project draining to Kings River would fall under Risk Level

2. Risk Level 2 measures also would be carried out anywhere in the project vicinity where construction activities are conducted within or immediately adjacent to sensitive environmental areas such as streams, wetlands, and vernal pools.

The Construction General Permit requires preparation and implementation of a SWPPP, which would provide BMPs to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for affected stream crossings. These BMPs will include measures to provide permeable surfaces where feasible and to retain or detain and treat stormwater onsite. Other BMPs include strategies to manage the overall amount and quality of stormwater runoff. The Construction SWPPP will include measures to address, but are not limited to, the following:

- Hydromodification management to ensure maintenance of pre-project hydrology by emphasizing onsite retention of stormwater runoff using measures such as flow dispersion, infiltration, and evaporation, supplemented by detention, where required. Additional flow control measures will be implemented where local regulations or drainage requirements dictate.
- Implementing practices to minimize the contact of construction materials, equipment, and maintenance supplies with stormwater.
- Limiting fueling and other activities using hazardous materials to areas distant from surface water, providing drip pans under equipment, and daily checks for vehicle condition.
- Implementing practices to reduce erosion of exposed soil, including soil stabilization, watering for dust control, perimeter silt fences, and sediment basins.
- Implementing practices to maintain current water quality including silt fences, stabilized construction entrances, grass buffer strips, ponding areas, organic mulch layers, inlet protection, and Baker tanks and sediment traps to settle sediment.
- Implementing practices to capture and provide proper offsite disposal of concrete washwater, including isolation of runoff from fresh concrete during curing to prevent it from reaching the local drainage system, and possible treatment with dry ice or other acceptable means to reduce the alkaline character of the runoff (high pH) that typically results from new concrete.
- Developing and implementing a spill prevention and emergency response plan to handle potential fuel or other spills.
- Using diversion ditches to intercept offsite surface runoff.
- Where feasible, avoiding areas that may have substantial erosion risk, including areas with erosive soils and steep slopes.
- Where feasible, limiting construction to dry periods when flows in water bodies are low or absent.

Implementation of a SWPPP is the responsibility of the construction contractor's Qualified SWPPP Practitioner (QSP) or designee. As part of that responsibility, the effectiveness of construction BMPs must be monitored before and after storm events. Records of these inspections and monitoring results are submitted to the SWRCB/RWQCB as part of the annual report required by the Statewide Construction General Permit. The reports are available to the public online. The SWRCB and RWQCB have the opportunity to review these documents.

Regional Dewatering Permit

The Central Valley RWQCB, Order No. R5-2008-0081, *Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters*, is a permit that covers construction dewatering discharges and some other listed discharges that do not contain significant quantities of pollutants, and that either (1) are 4 months, or less, in duration, or (2) have an average dry-weather discharge that does not exceed 0.25 million gallons per day.

Flood Protection

The CVFPB regulates specific river, creek, and slough crossings for flood protection. These crossings must meet the provisions of Title 23 of the CCR. Title 23 requires that new crossings maintain hydraulic capacity through such measures as in-line piers, adequate streambank height (freeboard), and measures to protect against streambank and channel erosion. Section 208.10 requires that improvements, including crossings, be constructed in a manner that does not reduce the channel's capacity or functionality, or that of any federal flood control project. The CVFPB reviews applications for encroachment permits for approval of a new channel crossing or other channel modification. For a proposed crossing or placement of a structure near a federal flood control project, the CVFPB coordinates review of the encroachment permit application with USACE pursuant to assurance agreements with USACE and the USACE Operation and Maintenance Manuals under Title 33 CFR, Section 208.10 and Title 33 U.S.C., Section 408. Under Section 408 of the Rivers and Harbors Act, the USACE must approve any proposed modification that involves a federal flood control project. A Section 408 permit would be required if construction modifies a federal levee. A Section 208.10 permit would be required where the project encroaches on a federal facility but does not modify it.

Industrial Stormwater Pollution Prevention Plan

The stormwater general permit (Order No. 97-03-DWQ, NPDES No. CAS000001) requires preparation of a SWPPP and a monitoring plan for industrial facilities that discharge stormwater from the site, including vehicle maintenance facilities associated with transportation operations. The permit includes performance standards for pollution control. The HMF would meet the stormwater treatment requirements of the Industrial General Permit.

3.8.7 NEPA Impact Summary

The affected environment has been substantially altered by human activity and no longer functions as a natural hydrologic system. Water is managed to supply irrigation water, using both natural watercourses and canals, and to drain runoff from the project vicinity.

Under the No Project Alternative, increased population would result in more traffic and increased pollutants in stormwater from roadways that do not have adequate stormwater facilities, which could degrade water quality. Some portion of the development needed for the increased population would likely occur on the urban fringe rather than in the urban centers served by the project. Development in the urban fringe would result in an increase in impervious area, an associated increase in stormwater runoff, and potential decrease in groundwater recharge; however stormwater facilities associated with urban fringe development would reduce potential effects on local streams. The demand for domestic water supply would increase and agricultural demand would decrease, as a result of increased population and a reduction in irrigated acreage. Net water demand is generally predicted to decrease (DWR 2009); however, aquifers could continue to experience drawdown effects because groundwater withdrawals would still exceed recharge rates (DWR, 2009).

Project alternatives would result in construction of HST track and facilities. Effects during construction on drainage and stormwater runoff patterns, flood flows, and surface and groundwater quality would be reduced to negligible levels of intensity with implementation of BMPs (e.g., detention basins, bioswales) and adherence to water quality regulations, as outlined in Section 3.8.6, Project Design Features. Because of the context of existing regulations and the negligible intensity of the effects, impacts during construction would not be significant under NEPA.

The project has been designed to minimize disruptions to the movement of water through the project area, for example by providing elevated sections of track, bridges, or culverts at all water crossings. Also, other site-specific design refinements (e.g., pier and abutment sizes and shapes) would occur, consistent with regulations, as the project advances beyond preliminary design. Effects on floodplains and the hydraulic capacity of channels during project operation would have negligible intensity because crossings not conducted on aerial structures would contain openings in embankments sufficient to pass the 100-year flood flows without increasing the water surface elevation by more than 1 foot, or as required by state or local agencies. Because of the context of a highly managed hydrologic system and the negligible intensity of the project effects, impacts on floodplains and hydraulic capacity of channels would not be significant under NEPA.

The HST would run parallel to the existing BNSF Railway for a considerable portion of the Fresno to Bakersfield Section and would not introduce new types of pollutants to the Tulare Lake Basin. The project will follow all required water pollution control regulations and has committed to following sustainability practices (e.g., LID). Effects on surface water and groundwater quality and groundwater recharge during project operation would be reduced to negligible levels of intensity with implementation of BMPs and adherence to water quality regulations. Because of the context of existing water quality regulations and the negligible intensity of the effects, impacts on surface water and groundwater quality would not be significant under NEPA.

The overall context and intensity of the project effects indicate that the project would not have a significant impact to water resources under NEPA.

3.8.8 CEQA Significance Conclusions

All construction and operation impacts related to hydrology and water quality as a result of implementing the Fresno to Bakersfield Section of the HST alternatives would be less than significant because of compliance with design standards.