CALIFORNIA HIGH-SPEED TRAIN

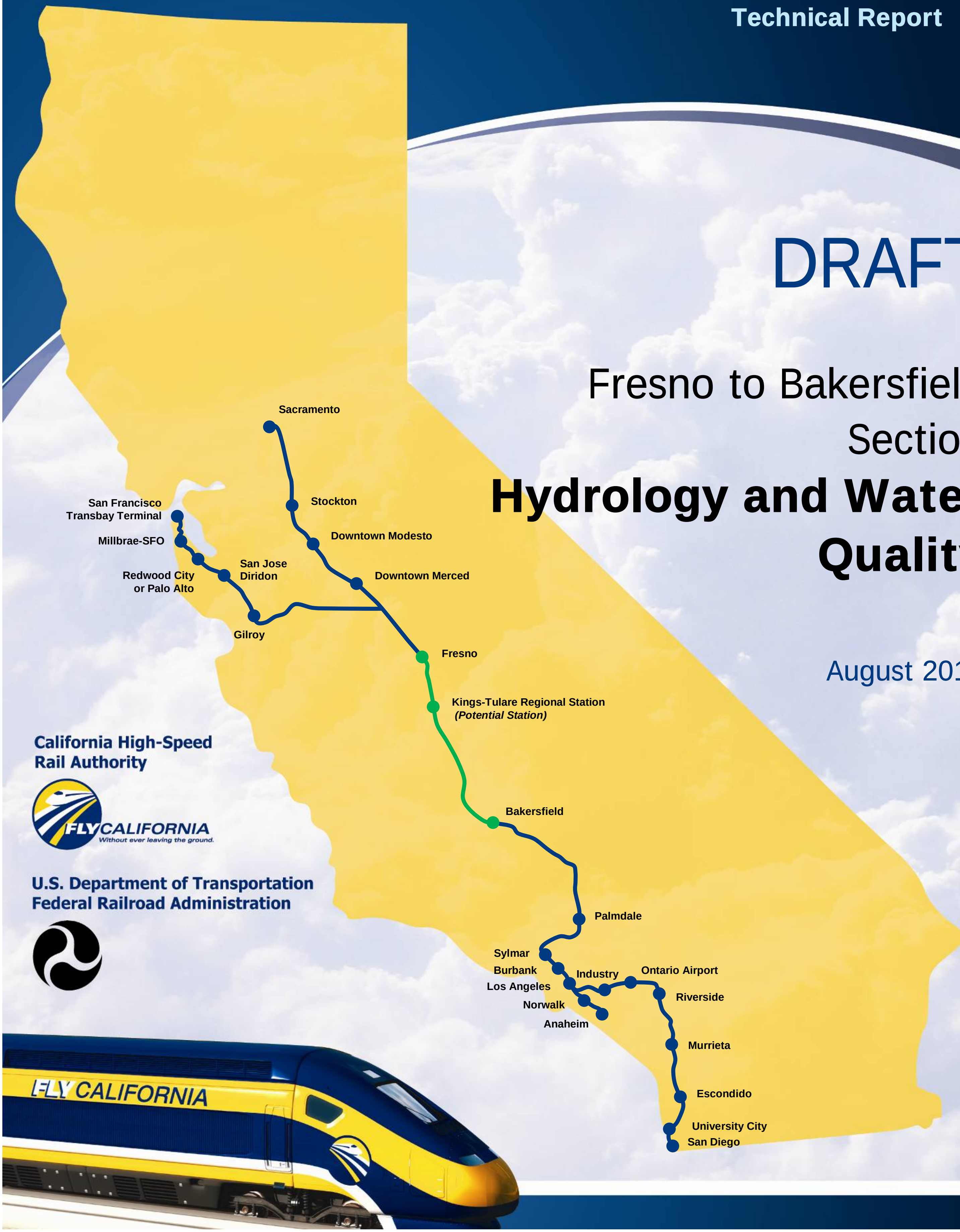
Technical Report

DRAFT

Fresno to Bakersfield Section

Hydrology and Water Quality

August 2011



California High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

Hydrology and Water Quality Technical Report

Prepared by:

URS/HMM/Arup Joint Venture

August 2011

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Acronyms and Abbreviations

°F	degree(s) Fahrenheit
afy	acre-foot/feet per year
ARRA	American Recovery and Reinvestment Act
Authority	California High-Speed Rail Authority
Basin Plan	Water Quality Control Plan for the Tulare Lake Basin
BFE	base flood elevation
bgs	below ground surface
BMP	Best Management Practice
BNSF	BNSF Railway
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CVFPB	Central Valley Flood Protection Board
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
DFRIM	digital flood insurance rate map
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FID	Fresno Irrigation District
FIRM	Flood Insurance Rate Map
FMFCD	Fresno Metropolitan Flood Control District
FRA	Federal Rail Administration
General Permit	NPDES General Permit for Stormwater Discharges Associated with Construction Activity
GIS	Geographic Information System
gpm	gallons per minute
HMF	heavy maintenance facility
HST	high-speed train
IRWMP	Integrated Regional Water Management Plan
KRCD	Kings River Conservation District

kV	kilovolt(s)
MEP	maximum extent practicable
MS4	municipal separate storm sewer systems
NED	National Elevation Dataset
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NWR	National Wildlife Refuge
PCB	polychlorinated biphenyl
ROD	Record of Decision
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SAR	Synthetic Aperture Radar
SDWA	Safe Drinking Water Act
SFHA	special flood hazard area
SR	State Route
SSA	sole-source aquifer
SVF	South Valley Floor
SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TDS	total dissolved solid(s)
TMDL	total maximum daily load
TPSS	traction power supply system
U.S. EPA	U.S. Environmental Protection Agency
U.S.C.	United States Code
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WSS	Web Soil Survey

Section 1.0
Introduction

1.0 Introduction

The California High-Speed Rail Authority (Authority) proposes to construct, operate, and maintain an electric-powered high-speed train (HST) system in California. When completed, the nearly 800-mile train system would provide new passenger rail service to more than 90% of the state's population. More than 200 weekday trains would serve the statewide intercity travel market. The HST would be capable of operating at speeds of up to 220 miles per hour, with state-of-the-art safety, signaling, and automated train control systems. The system would connect and serve the major metropolitan areas of California, extending from San Francisco and Sacramento in the north to San Diego in the south.

In 2005, the Authority and the Federal Railroad Administration (FRA) prepared a Program Environmental Impact Report/Environmental Impact Statement (Statewide Program EIR/EIS) evaluating HST's ability to meet the existing and future capacity demands on California's intercity transportation system (Authority and FRA 2005). This was the first phase of a tiered environmental review process (Tier 1) for the proposed statewide HST system. The Authority and the FRA completed a second Program EIR/EIS in July 2008 to identify a preferred alignment for the Bay Area to Central Valley section (Authority and FRA [2008] 2010).

The Authority and FRA are now undertaking second-tier, project environmental evaluations for sections of the statewide HST system. This Hydrology and Water Quality Technical Report is for the Fresno to Bakersfield Section. The Fresno to Bakersfield Section begins at the proposed Fresno HST station in downtown Fresno and extends east past the proposed Bakersfield HST station in downtown Bakersfield for approximately 1 mile to Union Avenue. Information from this report is summarized in the project EIR/EIS for the Fresno to Bakersfield HST Section and will be part of the administrative record supporting the environmental review of the proposed project.

For the HST system, including the Fresno to Bakersfield Section, the FRA is the lead federal agency for compliance with the National Environmental Policy Act (NEPA) and other federal laws. The Authority is serving as a joint-lead agency under NEPA and is the lead agency for compliance with the California Environmental Quality Act (CEQA). The U.S. Army Corps of Engineers (USACE) is serving as a cooperating agency under NEPA for the Fresno to Bakersfield Section.

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Section 2.0
Project Description

2.0 Project Description

2.1 Project Introduction

The Fresno to Bakersfield Section of the HST project would be approximately 114 miles long, varying in length by only a few miles based on the route alternatives selected. To comply with the Authority's guidance to use existing transportation corridors when feasible, the Fresno to Bakersfield HST Section would be primarily located adjacent to the existing BNSF Railway (BNSF) right-of-way. Alternative alignments are being considered where engineering constraints require deviation from the existing railroad corridor, and to avoid environmental impacts.

The Fresno to Bakersfield HST Section would cross both urban and rural lands and include a station in both Fresno and Bakersfield, a potential Kings/Tulare Regional Station in the vicinity of Hanford, a potential heavy maintenance facility (HMF), and power substations along the alignment. The HST alignment would be entirely grade-separated, meaning that crossings with roads, railroads, and other transport facilities would be located at different heights (overpasses or underpasses) so that the HST would not interrupt nor interface with other modes of transport. The HST right-of-way would also be fenced to prohibit public or automobile access. The project footprint would consist primarily of the train right-of-way, which would include both a northbound and southbound track in an area typically 100 feet wide. Additional right-of-way would be required to accommodate stations, multiple track at stations, maintenance facilities, and power substations.

The Fresno to Bakersfield Section would include at-grade, below-grade, and elevated track segments. The at-grade track would be laid on an earthen rail bed topped with rock ballast approximately 6 feet off of the ground; fill and ballast for the rail bed would be obtained from permitted borrow sites and quarries. Below-grade track would be laid in an open or covered trench at a depth which would allow roadway and other grade-level uses above the track. Elevated track segments would span long sections of urban development or aerial roadway structures and consist of steel truss aerial structures with cast in place reinforced-concrete columns supporting the box girders and platforms. The height of elevated track sections would depend on the height of existing structures below, and would range from 40 to 80 feet. Columns would be spaced 60 feet to 120 feet apart.

2.2 Project Alternatives

2.2.1 Alignment Alternatives

This section describes the Fresno to Bakersfield HST Section project alternatives, including the No Project Alternative. The project EIR/EIS for the Fresno to Bakersfield HST Section examines alternative alignments, stations, and HMF sites within the general BNSF Railway corridor. Discussion of the HST project alternatives begins with a single continuous alignment (the BNSF Alternative) from Fresno to Bakersfield. This alternative most closely aligns with the preferred alignment identified in the Record of Decision (ROD) for the Statewide Program EIR/EIS. Descriptions of the additional five alternative alignments that deviate from the BNSF Alternative for portions of the route then follow. The alternative alignments that deviate from the BNSF Alternative were selected to avoid environmental, land use, or community issues identified for portions of the BNSF Alternative (Figure 2-1).

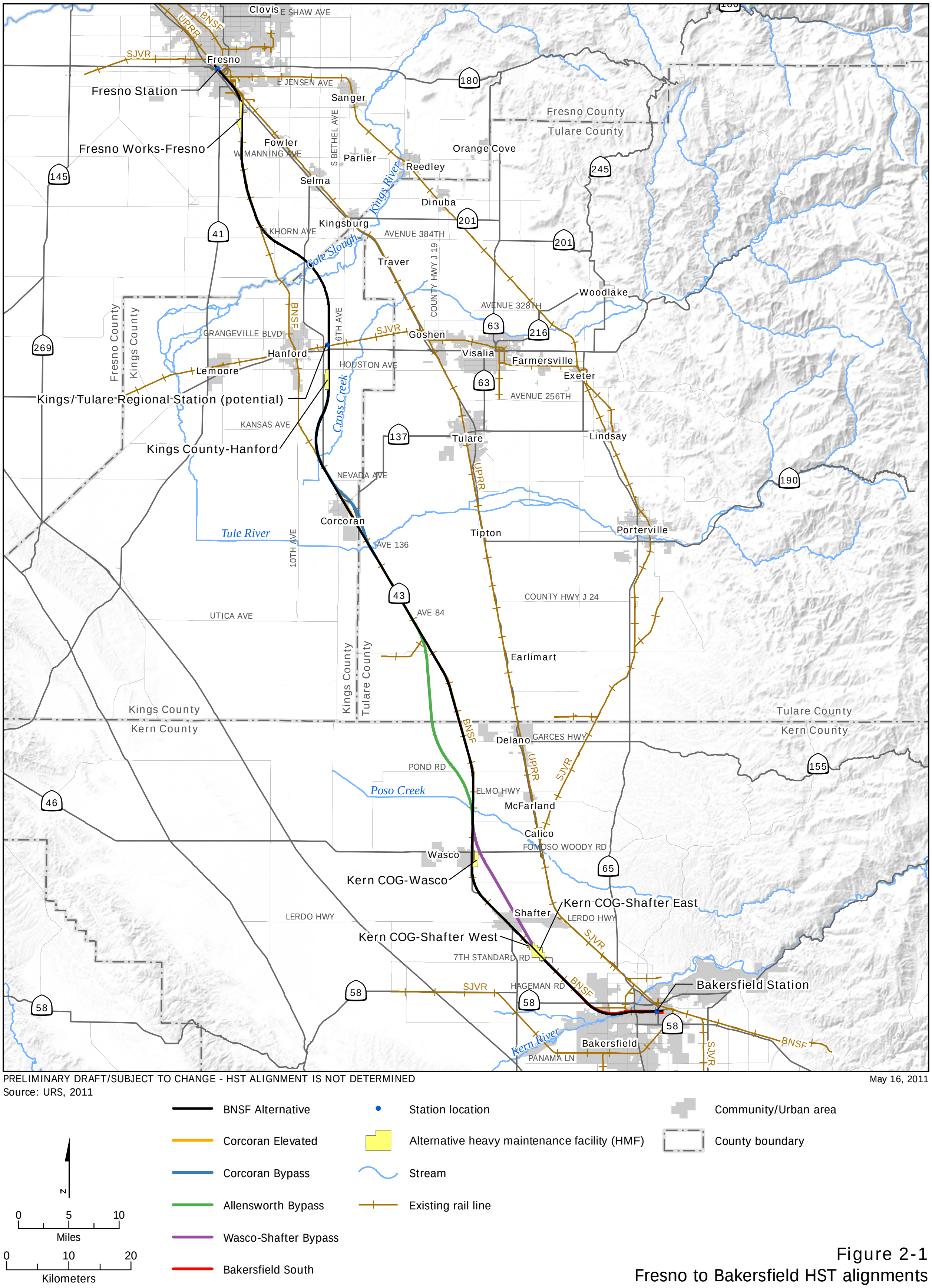


Figure 2-1
Fresno to Bakersfield HST alignments

A. NO PROJECT ALTERNATIVE

Under the No Project Alternative, the HST System would not be built. The No Project Alternative represents the condition of the Fresno to Bakersfield Section as it existed in 2009 (when the Notice of Preparation was issued), and as it would exist without the HST project at the planning horizon (2035). To assess future conditions, it was assumed that all currently known programmed and funded improvements to the intercity transportation system (highway, rail, and transit), and reasonably foreseeable local development projects (with funding sources identified), would be developed by 2035. The No Project Alternative is based on a review of Regional Transportation Plans (RTPs) for all modes of travel, the State of California Office of Planning and Research CEQAnet Database, the Federal Aviation Administration Air Carrier Activity Information System and Airport Improvement Plan grant data, the State Transportation Improvement Program, airport master plans and interviews with airport officials, intercity passenger rail plans, and city and county general plans and interviews with planning officials.

B. BNSF ALTERNATIVE ALIGNMENT

The BNSF Alternative Alignment would extend approximately 114 miles from Fresno to Bakersfield and would lie adjacent to the BNSF Railway route to the extent feasible (Figure 2-1). Minor deviations from the BNSF Railway corridor would be necessary to accommodate engineering constraints, namely wider curves necessary to accommodate the HST (as compared with the existing lower-speed freight line track alignment). The largest of these deviations occurs between approximately Elk Avenue in Fresno County and Nevada Avenue in Kings County. This segment of the BNSF Alternative would depart from BNSF Railway corridor and instead curve to the east on the northern side of the Kings River and away from Hanford, and would rejoin the BNSF Railway corridor north of Corcoran.

Although the majority of the alignment would be at-grade, the BNSF Alternative would include aerial structures in all of the four counties through which it travels. In Fresno County, an aerial structure would carry the alignment over Golden State Boulevard and State Route (SR) 99 and a second would cross over the BNSF Railway tracks in the vicinity of East Conejo Avenue. The alignment would be at-grade with bridges where it crosses Cole Slough and the Kings River into Kings County.

In Kings County, the BNSF Alternative would be elevated east of Hanford where the alignment would pass over the San Joaquin Valley Railroad and SR 198. The alignment would also be elevated over Cross Creek, and again at the southern end of the city of Corcoran to avoid a BNSF Railway spur. In Tulare County, the BNSF Alternative would be elevated at the crossing of the Tule River and at the crossing of the Alpaugh railroad spur that runs west from the BNSF Railway mainline. In Kern County, the BNSF Alternative would be elevated over Poso Creek and through the cities of Wasco, Shafter, and Bakersfield. The BNSF Alternative would be at-grade through the rural areas between these cities.

The BNSF Alternative Alignment would provide wildlife crossing opportunities by means of a variety of engineered structures. Dedicated wildlife crossing structures would be provided from approximately Cross Creek (Kings County) south to Poso Creek (Kern County) in at-grade portions of the railroad embankment at approximately 0.3-mile intervals. In addition to those structures, wildlife crossing opportunities would be available at elevated portions of the alignment, bridges over riparian corridors, road overcrossings and undercrossings, and drainage facilities (i.e., large diameter [60 to 120 inches] culverts and paired 30-inch culverts). Where bridges, aerial structures, and road crossings coincide with proposed dedicated wildlife crossing structures, such features would serve the function of, and supersede the need for, dedicated wildlife crossing structures.

The preliminary wildlife crossing structure design consists of a modified culvert in the embankment that would support the HST tracks. The typical culvert would be 72 feet long from end to end (crossing structure distance), would span a width of approximately 8 feet (crossing structure width), and would provide 4 feet of vertical clearance (crossing structure height). Additional wildlife crossing structure designs could include circular or elliptical pipe culverts, and larger (longer) culverts with crossing structure distances of up to 100 feet. The design of the wildlife crossing structures may change depending on site-specific conditions and engineering considerations.

C. CORCORAN ELEVATED ALTERNATIVE ALIGNMENT

The Corcoran Elevated Alternative Alignment would be the same as the corresponding section of the BNSF Alternative Alignment from approximately Idaho Avenue south of Hanford to Avenue 136, except that it would pass through the city of Corcoran on the eastern side of the BNSF Railway right-of-way on an aerial structure. The aerial structure begins at Niles Avenue and returns to grade at 4th Avenue. Dedicated wildlife crossing structures would be provided from approximately Cross Creek south to Avenue 136 in at-grade portions of the railroad embankment at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of both the Cross Creek and Tule River crossings.

This alternative alignment would cross SR 43 and pass over several local roads on an aerial structure. Santa Fe Avenue would be closed at the HST right-of-way.

D. CORCORAN BYPASS ALTERNATIVE ALIGNMENT

The Corcoran Bypass Alternative Alignment would run parallel to the BNSF Alternative Alignment from approximately Idaho Avenue south of Hanford, to approximately Nevada Avenue north of Corcoran. The Corcoran Bypass Alternative would then diverge from the BNSF Alternative and swing east of Corcoran, rejoining the BNSF Railway route at Avenue 136. The total length of the Corcoran Bypass would be approximately 21 miles.

Similar to the corresponding section of the BNSF Alternative, most of the Corcoran Bypass Alternative would be at-grade. However, one elevated structure would carry the HST over Cross Creek, and another would travel over SR 43, the BNSF Railway, and the Tule River. Dedicated wildlife crossing structures would be provided from approximately Cross Creek south to Avenue 136 in at-grade portions of the railroad embankment at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of each of the Cross Creek and Tule River crossings.

This alternative alignment would cross SR 43, Whitley Avenue/SR 137, and several local roads. SR 43, Waukena Avenue, and Whitley Avenue would be grade-separated from the HST with an overcrossing/undercrossing; other roads would be closed at the HST right-of-way.

E. ALLENSWORTH BYPASS ALTERNATIVE ALIGNMENT

The Allensworth Bypass Alternative Alignment would pass west of the BNSF Alternative, avoiding Allensworth Ecological Reserve and the Allensworth State Historic Park. This alignment was refined over the course of environmental studies to reduce impacts to wetlands and orchards. The total length of the Allensworth Bypass Alternative Alignment would be approximately 19 miles, beginning at Avenue 84 and rejoining the BNSF Alternative at Elmo Highway.

The Allensworth Bypass Alternative would be constructed on an elevated structure only where the alignment crosses the Alpaugh railroad spur and Deer Creek. The alignment would pass through Tulare County mostly at-grade. Dedicated wildlife crossing structures would be provided from approximately Avenue 84 to Poso Creek at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of both the Deer Creek and Poso Creek crossings.

The Allensworth Bypass would cross County Road J22, Scofield Avenue, Garces Highway, Woollomes Avenue, Magnolia Avenue, Palm Avenue, Pond Road, Peterson Road, and Elmo Highway. Woollomes Avenue and Elmo Highway would be closed at the HST right-of-way, while the other roads would be realigned and/or grade-separated from the HST with overcrossings.

The Allensworth Bypass Alternative includes an option to relocate the existing BNSF Railway tracks to be adjacent to the HST right-of-way for the length of this alignment. The possibility of relocating the BNSF Railway tracks along this alignment has not yet been discussed with BNSF Railway; however, if this option is selected, it is assumed that the existing BNSF Railway right-of-way would be abandoned between Avenue 84 and Elmo Highway, and the relocated BNSF Railway right-of-way would be 100 feet wide and adjacent to the eastern side of the Allensworth Bypass Alternative right-of-way.

F. WASCO-SHAFTER BYPASS ALTERNATIVE ALIGNMENT

The Wasco-Shafter Bypass Alternative Alignment would diverge from the BNSF Alternative between Sherwood Avenue and Fresno Avenue, crossing over to the eastern side of the BNSF Railway tracks and bypassing Wasco and Shafter to the east. The Wasco-Shafter Bypass Alternative would be at grade except where it travels over 7th Standard Road and the BNSF Railway to rejoin the BNSF Alternative. The total length of the alternative alignment would be approximately 24 miles.

The Wasco-Shafter Bypass was refined to avoid the Occidental Petroleum tank farm as well as a historic property potentially eligible for listing on the National Register of Historic Places. The Wasco-Shafter Bypass would cross SR 43, SR 46, East Lerdo Highway, and several local roads. SR 46, Kimberlina Road, Shafter Avenue, Beech Avenue, Cherry Avenue, and Kratzmeyer Road would be grade-separated from the HST with overcrossings/undercrossings; other roads would be closed at the HST right-of-way.

G. BAKERSFIELD SOUTH ALTERNATIVE ALIGNMENT

From the Rosedale Highway (SR 58) in Bakersfield, the Bakersfield South Alternative Alignment would run parallel to the BNSF Alternative Alignment at varying distances to the north. At Chester Avenue, the Bakersfield South Alternative curves south, and runs parallel to California Avenue. As with the BNSF Alternative, the Bakersfield South Alternative would begin at grade and become elevated starting at Palm Avenue through Bakersfield to its terminus at the southern end of the Bakersfield station tracks. The elevated section would range in height from 50 to 70 feet. Dedicated wildlife crossing structures would be placed between 100 and 500 feet to the north and south of the Kern River.

The Bakersfield South Alternative would be approximately 9 miles long and would cross the same roads as the BNSF Alternative. This alternative includes the Bakersfield Station–South Alternative.

2.2.2 Station Alternatives

The Fresno to Bakersfield HST Section would include a new station in Fresno and a new station in Bakersfield. An optional third station, the Kings/Tulare Regional Station, is under consideration.

Stations would be designed to address the purpose of the HST, particularly to allow for intercity travel and connection to local transit, airports, and highways. Stations would include the station platforms, a station building and associated access structure, as well as lengths of bypass tracks to accommodate local and express service at the stations. All stations would contain the following elements:

- Passenger boarding and alighting platforms.
- Station head house with ticketing, waiting areas, passenger amenities, vertical circulation, administration and employee areas, and baggage and freight-handling service.
- Vehicle parking (short-term and long-term) and “kiss and ride1”.
- Motorcycle/scooter parking.
- Bicycle parking.
- Waiting areas and queuing space for taxis and shuttle buses.
- Pedestrian walkway connections.

A. FRESNO STATION ALTERNATIVES

Two alternative sites are under consideration for the Fresno Station.

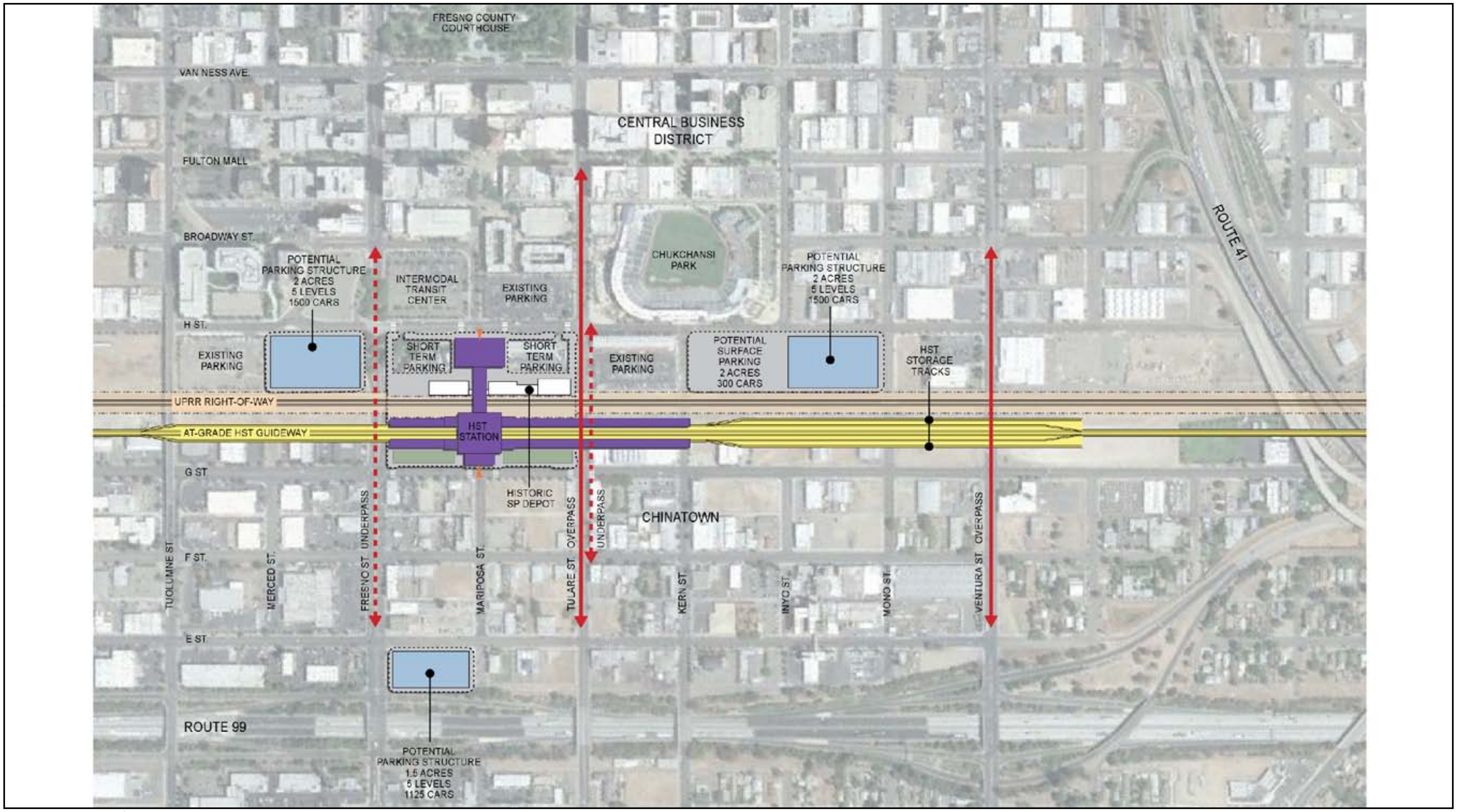
Fresno Station–Mariposa Alternative

The Fresno Station–Mariposa Alternative would be in downtown Fresno, less than 0.5 mile east of SR 99 on the BNSF Alternative. The station would be centered on Mariposa Street and bordered by Fresno Street on the north, Tulare Street on the south, H Street on the east, and G Street on the west. The station building would be approximately 75,000 square feet, with a maximum height of approximately 64 feet.

The two-level station would be at-grade; with passenger access provided both east and west of the HST guideway and the UPRR tracks, which would run parallel with one another adjacent to the station. The first level would contain the public concourse, passenger service areas, and station and operation offices. The second level would include the mezzanine, a pedestrian overcrossing above the HST guideway and the UPRR tracks, and an additional public concourse area. Entrances would be located at both G and H streets. A conceptual site plan of the Fresno Station–Mariposa Alternative is provided in Figure 2-2.

The majority of station facilities would be east of the UPRR tracks. The station and associated facilities would occupy approximately 20.5 acres, including 13 acres dedicated to the station, short term parking, and kiss-and-ride accommodations. A new intermodal facility, not a part of this proposed undertaking, would be located on the parcel bordered by Fresno Street to the north, Mariposa Street to the south, Broadway Street to the east, and H Street to the west (designated “Intermodal Transit Center” in Figure 2-2). Among other uses, the intermodal facility would accommodate the Greyhound facilities and services that would be relocated from the northwestern corner of Tulare and H streets.

[1] “Kiss and ride” refers to the station area where riders may be dropped off or picked up before or after riding the HST.



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

NOT TO SCALE

Figure 2-2
Fresno Station-Mariposa Alternative

The site proposal includes the potential for up to three parking structures occupying a total of approximately 5.5 acres. Two of the three potential parking structures would each sit on 2 acres, and each would have a capacity of approximately 1,500 cars. The third parking structure would be slightly smaller in footprint (1.5 acres), with five levels and a capacity of approximately 1,100 cars. An additional 2-acre surface parking lot would provide approximately 300 parking spaces.

Under this alternative, the historic Southern Pacific Railroad depot and associated Pullman Sheds would remain intact. While these structures could be used for station-related purposes, they are not assumed to be functionally required for the HST project and are thus, not proposed to be physically altered as part of the project. The Mariposa station building footprint has been configured to preserve views of the historic railroad depot and associated sheds.

Fresno Station–Kern Alternative

The Fresno Station–Kern Alternative would be similarly situated in downtown Fresno and would be located on the BNSF Alternative, centered on Kern Street between Tulare Street and Inyo Street (Figure 2-3). This station would include the same components as the Fresno Station–Mariposa Alternative, but under this alternative, the station would not encroach on the historic Southern Pacific Railroad depot just north of Tulare Street and would not require relocation of existing Greyhound facilities.

The station building would be approximately 75,000 square feet, with a maximum height of approximately 64 feet. The station building would have two levels housing the same facilities as the Fresno Station–Mariposa Alternative (Union Pacific Railroad [UPRR] tracks, HST tracks, mezzanine, and station office). The approximately 18.5-acre site would include 13 acres dedicated to the station, bus transit center, short term parking, and kiss-and-ride accommodations.

Two of the three potential parking structures would each sit on 2 acres, and each would have a capacity of approximately 1,500 cars. The third structure would be slightly smaller in footprint (1.5 acres) and have a capacity of approximately 1,100 cars. Surface parking lots would provide approximately 600 additional parking spaces. Like the Fresno Station–Mariposa Alternative, the majority of station facilities under the Kern Alternative would be sited east of the HST tracks.

B. KINGS/TULARE REGIONAL STATION

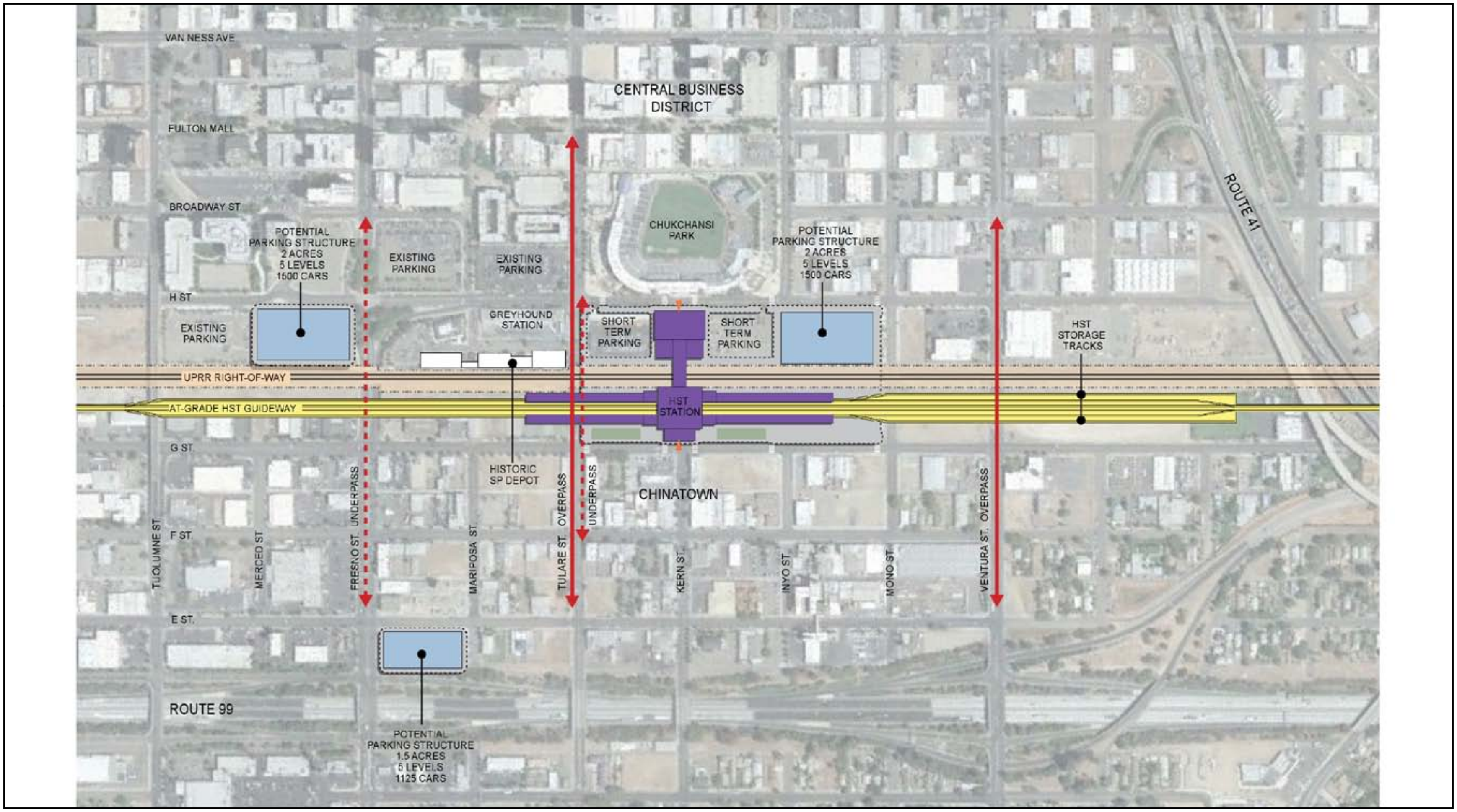
The potential Kings/Tulare Regional Station would be located east of SR 43 (Avenue 8) and north of the Cross Valley Rail Line (San Joaquin Valley Railroad) (Figure 2-4). The station building would be approximately 40,000 square feet with a maximum height of approximately 75 feet. The entire site would be approximately 27 acres, including 8 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride. An additional approximately 19 acres would support a surface parking lot with approximately 1,600 spaces.

C. BAKERSFIELD STATION ALTERNATIVES

Two options are under consideration for the Bakersfield Station.

Bakersfield Station–North Alternative

The Bakersfield Station–North Alternative would be located at the corner of Truxtun and Union Avenue/SR 204 along the BNSF Alternative Alignment (Figure 2-5). The three-level station building would be 52,000 square feet, with a maximum height of approximately 95 feet. The first level would house station operation offices and would also accommodate trains running along the BNSF Railway line. The second level would include the mezzanine; the HST platforms and



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

NOT TO SCALE

Figure 2-3
Fresno Station-Kern Alternative

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

STATION ENTRANCE

KEY PEDESTRIAN LINKAGE

OPEN SPACE

STATION CAMPUS BOUNDARY

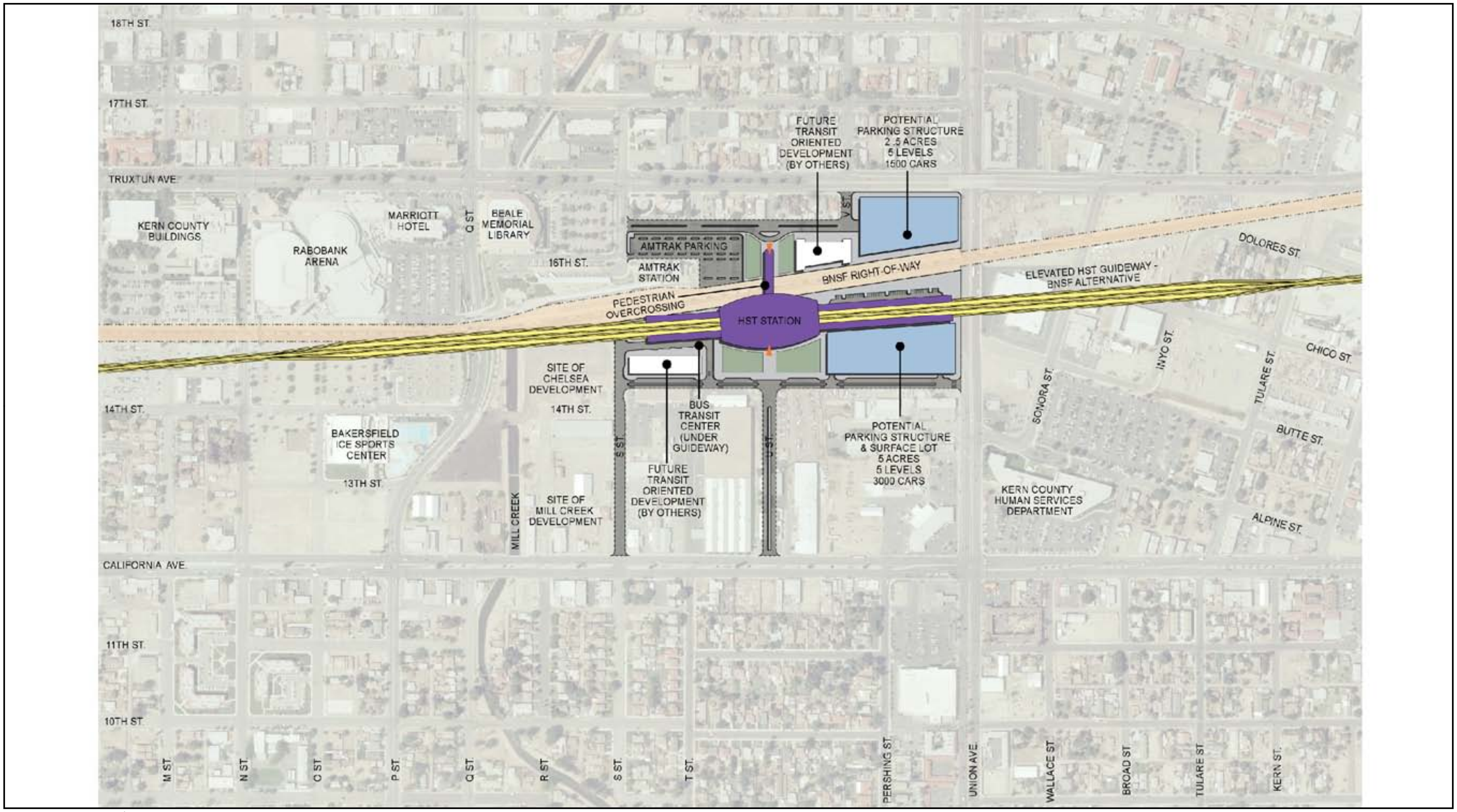
RIGHT-OF-WAY BOUNDARY

ROADWAY MODIFICATION

N

NOT TO SCALE

Figure 2-4
Kings/Tulare Regional Station (potential)



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

NOT TO SCALE

Figure 2-5
Bakersfield Station-North Alternative

guideway would pass through the third level. Under this alternative, the station building would be located at the western end of the parcel footprint. Two new boulevards would be constructed to access the station and the supporting facilities.

The 19-acre site would designate 11.5 acres for the station, bus transit center, short-term parking, and kiss-and-ride. An additional 7.5 acres would house two parking structures that together would accommodate approximately 4,500 cars. The bus transit center and the smaller of the two parking structures (2.5 acres) would be located north of the HST tracks. The BNSF Railway line would run through the station at-grade, with the HST alignment running on an elevated guideway.

Bakersfield Station–South Alternative

The Bakersfield Station–South Alternative would be would be similarly located in downtown Bakersfield, but situated on the Bakersfield South Alternative Alignment along Union and California avenues, just south of the BNSF Railway right-of-way (Figure 2-6). The two-level station building would be 51,000 square feet, with a maximum height of approximately 95 feet. The first floor would house the concourse, and the platforms and the guideway would be on the second floor. Access to the site would be from two new boulevards, one branching off from California Avenue and the other from Union Avenue.

The entire site would be 20 acres, with 15 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride. An additional 5 acres would support one six-level parking structure with a capacity of approximately 4,500 cars. Unlike the Bakersfield Station–North Alternative, this station site would be located entirely south of the BNSF Railway right-of-way.

2.2.3 Heavy Maintenance Facility

One HST heavy vehicle maintenance and layover facility would be sited along either the Merced to Fresno or Fresno to Bakersfield HST section. Before the startup of initial operations, the HMF would support the assembly, testing, commissioning, and acceptance of high-speed rolling stock. During regular operations, the HMF would provide maintenance and repair functions, activation of new rolling stock, and train storage. The HMF concept plan indicates that the site would encompass approximately 150 acres to accommodate shops, tracks, parking, administration, roadways, power substation, and storage areas. The HMF would include tracks that allow trains to enter and leave under their own electric power or under tow. The HMF would also have management, administrative, and employee support facilities. Up to 1,500 employees could work at the HMF during any 24-hour period.

The Authority has determined that one HMF would be located between Merced and Bakersfield; however, the specific location has not yet been finalized. Five HMF sites are under consideration in the Fresno to Bakersfield Section (Figure 2-1):

- The Fresno Works–Fresno HMF site lies within the southern limits of the city of Fresno and county of Fresno next to the BNSF Railway right-of-way between SR 99 and Adams Avenue. Up to 590 acres are available for the facility at this site.
- The Kings County–Hanford HMF site lies southeast of the city of Hanford, adjacent to and east of SR 43, between Houston and Idaho Avenues. Up to 510 acres are available at the site.
- The Kern Council of Governments–Wasco HMF site lies directly east of Wasco between SR 46 and Filburn Street. Up to 420 acres are available for the facility at this site.

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

May 16, 2011

NOT TO SCALE

Figure 2-6
Bakersfield Station-South Alternative

- The Kern Council of Governments–Shafter East HMF site lies in the city of Shafter between Burbank Street and 7th Standard Road to the east of the BNSF Railway right-of-way. This site has up to 490 acres available for the facility.

- The Kern Council of Governments–Shafter West HMF site lies in the city of Shafter between Burbank Street and 7th Standard Road to the west of the BNSF Railway right-of-way. This site has up to 480 acres available for the facility.

2.3 Power

To provide power for the HST, high-voltage electricity at 115 kilovolts (kV) and above would be drawn from the utility grid and transformed down to 25,000 volts. The voltage would then be distributed to the trains via an overhead catenary system. The project would not include the construction of a separate power source, although it would include the extension of power lines to a series of power substations positioned along the HST corridor. The transformation and distribution of electricity would occur in three types of stations:

- Traction power supply stations (TPSSs) transform high-voltage electricity supplied by public utilities to the train operating voltage. TPSSs would be sited adjacent to existing utility transmission lines and the HST right-of-way, and would be located approximately every 30 miles along the route. Each TPSS would be 200 feet by 160 feet.

- Switching stations connect and balance the electrical load between tracks, and switch power on or off to tracks in the event of a power outage or emergency. Switching stations would be located midway between, and approximately 15 miles from, the nearest TPSS. Each switching station would be 120 feet by 80 feet and located adjacent to the HST right-of-way.

- Paralleling stations, or autotransformer stations, provide voltage stabilization and equalize current flow. Paralleling stations would be located every 5 miles between the TPSSs and the switching stations. Each paralleling station would be 100 feet by 80 feet and located adjacent to the HST right-of-way.

2.4 Project Construction

The construction plan developed by the Authority and described below would maintain eligibility for eligibility for federal American Recovery and Reinvestment Act (ARRA) funding. For the Fresno to Bakersfield Section, specific construction elements would include at-grade, below-grade, and elevated track, track work, grade crossings, and installation of a positive train control system. At-grade track sections would be built using conventional railroad construction techniques. A typical sequence includes clearing, grubbing, grading, and compacting of the rail bed; application of crushed rock ballast; laying of track; and installation of electrical and communications systems.

The precast segmental construction method is proposed for elevated track sections. In this construction method, large concrete bridge segments would be mass-produced at an onsite temporary casting yard. Precast segments would then be transported atop the already completed portions of the elevated track and installed using a special gantry crane positioned on the aerial structure. Although the precast segmental method is the favored technique for aerial structure construction, other methods may be used, including cast-in-place, box girder, or precast span-by-span techniques.

Pre-construction activities would be conducted during final design and include geotechnical investigations, identification of staging areas, initiation of site preparation and demolition, relocation of utilities, and implementation of temporary, long-term, and permanent road closures.

Additional studies and investigations to develop construction requirements and worksite traffic control plans would be conducted as needed.

Major construction activities for the Fresno to Bakersfield Section would include earthwork and excavation support systems construction, bridge and aerial structure construction, railroad systems construction (including trackwork, traction electrification, signaling, and communications), and station construction. During peak construction periods, work is envisioned to be underway at several locations along the route, with overlapping construction of various project elements. Working hours and workers present at any time will vary depending on the activities being performed.

The Authority intends to build the project using sustainable methods that:

- Minimize the use of nonrenewable resources.
- Minimize the impacts on the natural environment.
- Protect environmental diversity.
- Emphasize the use of renewable resources in a sustainable manner.

The overall schedule for construction is provided in Table 2-1.

Table 2-1
Construction Schedule

Activity	Tasks	Duration
Mobilization	Safety devices and special construction equipment mobilization	March–October 2013
Site Preparation	Utilities relocation; clearing/grubbing right-of-way; establishment of detours and haul routes; preparation of construction equipment yards, stockpile materials, and precast concrete segment casting yard	April–August 2013
Earthmoving	Excavation and earth support structures	August 2013–August 2015
Construction of Road Crossings	Surface street modifications, grade separations	June 2013–December 2017
Construction of Elevated Structures	Elevated structure and bridge foundations, substructure, and superstructure	June 2013–December 2017
Track Laying	Includes backfilling operations and drainage facilities	January 2014–August 2017
Systems	Train control systems, overhead contact system, communication system, signaling equipment	July 2016–November 2018
Demobilization	Includes site cleanup	August 2017–December 2019
HMF Phase 1[a]	Test track assembly and storage	August–November 2017
Maintenance-of-Way Facility	Potentially co-located with HMF[a]	January–December 2018

Table 2-1
Construction Schedule

Activity	Tasks	Duration
HMF Phase 2[a]	Test track light maintenance facility	June–December 2018
HMF Phase 3[a]	Heavy Maintenance Facility	January–July 2021
HST Stations	Demolition, site preparation, foundations, structural frame, electrical and mechanical systems, finishes	Fresno: December 2014–October 2019 Kings/Tulare Regional: TBD[b] Bakersfield: January 2015–November 2019

Notes:
[a] The HMF would be sited along either the Merced to Fresno or Fresno to Bakersfield section.
[b] ROW would be acquired for the Kings/Tulare Regional Station; however, the station itself would not be part of initial construction.
Acronym: TBD = to be determined

Section 3.0
Regulatory Framework

3.0 Regulatory Framework

Key regulations for hydrology and water resources that are most relevant to the proposed project are summarized below.

3.1 Federal Regulations

3.1.1 Clean Water Act [Section 402(p)]

The federal Clean Water Act (CWA) is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. The primary principle is that any discharge of pollutants 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 further discussed below.

- Permit for Fill Material in Waters and Wetlands [Section 404]
  - Establishes a permit program administered by the USACE, which regulates the discharge of dredged or fill material into waters of the United States (including wetlands).
- National Pollutant Discharge Elimination System Program [Section 402]
  - Establishes a permitting system for the discharge of any pollutant (except dredge or fill material) into waters of the United States. A National Pollutant Discharge Elimination System (NPDES) permit is required for discharges subject to Section 402 of the CWA.
- Clean Water Quality Certification [Section 401]
  - Requires that an applicant for a federal license or permit allowing 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 Regional Water Quality Control Boards (RWQCBs) administer the certification program in California.
- Water Quality Impairments [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 Section 303(d), and to develop total maximum daily loads (TMDLs) from all pollution sources for such impaired water bodies.

3.1.2 Section 10 of Rivers and Harbors Act [33 United States Code (U.S.C.) Section 401 et seq.]

Section 10 of the Rivers and Harbors Act of 1899 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 used, in their natural condition or by reasonable improvements, as means to transport interstate or foreign commerce.

3.1.3 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.” For the USACE facilities, the Section 408 approval, known as Section 408 permit, is required.

3.1.4 Floodplain Management [Executive Order 11988]

Executive Order 11988 requires that federal agency construction, permitting, or funding of a project must 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.

3.1.5 National Flood Insurance Act [42 U.S.C. Section 4001 et seq.]

The National Flood Insurance Act addresses both the need for flood insurance and the need to lessen the devastating consequences of flooding.

3.1.6 Floodplain Management and Protection [U.S. DOT Order 5650.2] and Flood Disaster Protection Act [42 U.S.C. Sections 4001 to 4128]

The Floodplain Management and Protection and Floor Disaster Protection Act requires the identification of flood-prone areas, provide insurance, and require purchase of insurance for buildings in special flood hazard areas.

3.1.7 Safe Drinking Water Act [42 USC § 300 et seq.]

The Safe Drinking Water Act (SDWA) is designed to protect the quality of drinking water in the United States. Section 1424(e) of the SDWA established the sole source aquifer program that allows the U.S. Environmental Protection Agency (U.S. EPA) to review any federally funded project that has the potential to contaminate a sole source aquifer. A sole source aquifer is designated as an aquifer that supplies more than 50% of a community’s drinking water supply. U.S. EPA Region 9, which includes California, contains nine designated sole source aquifers.

3.2 State Regulations

3.2.1 Porter-Cologne Water Quality Act [California 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 reviews of basin plans that designate beneficial uses of California’s major rivers and groundwater basins and establish water quality objectives for those waters. Basin plans are primarily implemented by using the NPDES permitting system to regulate waste discharges so that water quality objectives are met.

3.2.2 State Water Resources Control Board

The State Water Resources Control Board allocates water rights; adjudicates water rights disputes; develops statewide water protection plans; establishes water quality standards, and guides the nine regional RWQCBs in the major watersheds of the state.

3.2.3 Streambed Alteration Agreement [Sections 1601 to 1603] of the California Fish and Game Code

Sections 1601 and 1603 of the California Fish and Game Code requires agencies to notify the California Department of Fish and Game 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.

3.2.4 Colbey-Alquist Floodplain Management Act [California Water Code Section 8400 et seq.]

The Colbey-Alquist Floodplain Management 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.

3.3 Regional and Local Regulations

3.3.1 Regional Water Quality Control Boards

The Fresno to Bakersfield section of the HST is in the southern portion of the California Central Valley within the jurisdiction of the Central Valley Regional Water Quality Control Board (CVRWQCB).

A. BASIN PLANS AND WATER QUALITY OBJECTIVES

The Water Quality Control Plan for the Tulare Lake Basin (Basin Plan) (CVRWQCB 2004) is the applicable basin plan for the project study area. The Basin Plan 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.

Pursuant to the Porter-Cologne Act, the CVRWQCB is authorized to issue individual permits to allow for discharge of specified quantities and qualities of waste to land or surface waters. The limitations placed on the discharge are designed to ensure compliance with water quality objectives in the Basin Plan. To obtain a permit, the discharger must submit a Report of Waste Discharge and the requirements of CEQA must be met. All dischargers must submit monitoring reports. The CVRWQCB can use this approach to regulate any discharge to surface waters. The discharger would be responsible for providing enough information, regarding the chemicals and volumes to be discharged to receiving waters, to allow issuance of a permit.

The CVRWQCB also regulates activities that could result in adverse impacts to groundwater quality. Groundwater-related activities governed by NPDES permits or waste discharge requirements issued by the CVRWQCB include aquifer re-injection, reclaimed water irrigation, and design of waste management facilities, including wastewater treatment plants. The CVRWQCB also oversees local implementation of underground storage tank management programs and other programs related to the prevention and control of groundwater impacts.

In general, California State Water Resources Control Board (SWRCB) policy prohibits degradation of groundwater quality, and in cases where impacts occur, the CVRWQCB typically requires restoration of impacted aquifers such that residual concentrations do not exceed the U.S. EPA's maximum contaminant levels for drinking water. In cases where the aquifer is hydraulically connected to a surface water body, water quality criteria for fresh water aquatic habitats may be imposed as standards for cleanup and restoration efforts.

B. CONSTRUCTION ACTIVITIES: NPDES GENERAL CONSTRUCTION PERMIT

The NPDES program was developed by the U.S. EPA in accordance with Section 303 of the CWA. In California, the NPDES program is administered by the SWRCB, with implementation and enforcement by the RWQCBs. The NPDES program, which was designed to protect surface water quality, is applicable to all discharges to waters of the United States, including stormwater discharges associated with municipal drainage systems, construction activities, industrial operations, and point sources. In general, the NPDES permit program is designed to control, minimize, or reduce surface water impacts.

Currently, the California SWRCB's Water Quality Order 99-08-DWQ, NPDES Permit No. CAS000002, NPDES General Permit for Stormwater Discharges Associated with Construction Activity (General Permit) authorizes a general permit for stormwater discharges associated with construction activities that disturb 1 or more acres. Construction activities subject to the permit include clearing, grubbing, grading, stockpiling, and excavation activities. The revised Statewide Construction General Permit, 2009-0009-DWQ, becomes effective on July 1, 2010 (SWRCB 2009). Before construction begins, the project applicant will be required to prepare and submit Permit Registration Documents that include a Notice of Intent (NOI) to comply with the General Permit, a risk assessment to address project sediment risk and receiving water risk, post-construction calculations, a site map, a Stormwater Pollution Prevention Plan (SWPPP) for construction activities, and the appropriate fees. Best Management Practices (BMPs) that will be implemented during construction must be identified in the SWPPP. Additionally, post-construction management measures must be prepared and a long-term maintenance plan must be implemented (mandatory requirement from September 2, 2012) at the completion of construction.

C. DEWATERING ACTIVITIES: PERMIT VARIES BY RWQCB

The California SWRCB's Water Quality Order 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality, addresses potential discharges of low water quality–threat wastewater, that include construction dewatering discharges. In accordance with this permit, all dischargers must comply with all applicable provisions in the Basin Plan (CVRWQCB 2004), including any prohibitions and water quality objectives governing the discharge. In addition, the discharge of waste may not cause the spread of groundwater contamination. Discharges must be made to land owned or controlled by the discharger, unless the discharger has a written lease or agreement with the landowner. An NOI must be filed with the CVRWQCB prior to activities that would have low water quality–threat discharges. In addition, discharges to land from dewatering activities are covered under the CVRWQCB's 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.

The CVRWQCB allows the discharge to waters of the United States of certain categories of clean or relatively pollutant-free wastewater posing little or no threat to water quality. The General Permit is Order No. R5-2008-0081, NPDES No. CAG995001, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters. The permit covers discharges provided they do not contain significant quantities of pollutants and either (a) the discharge is 4 months or less in duration or (b) the average dry weather discharge does not exceed 0.25 million gallons per day. All pollutants must be properly treated prior to discharge to ensure continuous compliance with applicable water quality requirements. Compliance with RWQCB Order No. R5-2008-0081 serves as compliance with NPDES permit requirements pursuant to Section 402 of the CWA, and amendments thereto.

D. STORMWATER DISCHARGES: INDUSTRIAL NPDES PERMIT

The California SWRCB Water Quality Order No. 97-03-DWQ “General Permit to Discharge Stormwater Associated with Industrial Activity” authorizes a general permit to regulate industrial stormwater discharges. Transportation facilities that conduct any type of vehicle maintenance, such as fueling, cleaning, and repairing, are covered by this general permit. An NOI is filed with the CVRWQCB before operations begin. In accordance with NPDES permit requirements, an SWPPP that addresses stormwater pollution prevention during operations must be developed. The SWPPP must identify BMPs to be used at the facility and describe a stormwater monitoring program.

E. STORMWATER DISCHARGES: CALTRANS NPDES PERMIT

In 1999, the SWRCB issued an NPDES permit (Order No. 99-06-DWQ, CAS0000003) that regulates stormwater discharges from Caltrans facilities. The permit requires Caltrans to comply with the requirements of the Construction General Permit, and regulates stormwater discharges from Caltrans rights-of-way both during and after construction. The permit requires Caltrans to maintain and implement an effective Stormwater Management Plan (SWMP) that identifies and describes BMPs used to control the discharge of pollutants to waters of the United States. Stormwater discharges from Caltrans facilities must meet water quality standards through implementation of permanent and temporary (construction) BMPs and other measures.

F. STORMWATER DISCHARGES: MUNICIPAL SEPARATE STORM SEWER SYSTEM NPDES PERMITS

The Municipal Storm Water Permitting Program regulates stormwater discharges from municipal separate storm sewer systems (MS4s). MS4 permits were issued in two phases. Starting in 1990, the RWQCBs adopted NPDES stormwater permits for medium-sized municipalities (serving between 100,000 and 250,000 people) and large municipalities (serving 250,000 people or more). Most of these Phase I permits are issued to a group of co-permittees encompassing an entire metropolitan area. These permits are reissued as the permits expire. In April 2003, the SWRCB adopted an NPDES Phase II General Permit for the discharge of stormwater from small (fewer than 100,000 people) MS4s (WQ Order No. 2003-0005-DWQ) to provide NPDES permit coverage to municipalities that were not covered under the NPDES Phase I Rule for municipalities serving more than 100,000 people.

The MS4 permits require the discharger to develop and implement a stormwater management plan/program with the goal of reducing the discharge of pollutants to the maximum extent practicable (MEP). MEP is the performance standard specified in Section 402(p) of the Clean Water Act. The management programs specify what BMPs will be used to address certain program areas. The program areas include public education and outreach; illicit discharge detection and elimination; construction and post-construction; and good housekeeping for municipal operations. In general, medium and large municipalities are required to conduct chemical monitoring, though small municipalities are not.

Under MS4 NPDES permits, stormwater discharges shall not cause or contribute to an exceedance of water quality standards contained in a Statewide Water Quality Control Plan, the California Toxics Rule, or the applicable RWQCB Basin Plan. The applicable Basin Plan for the project area is the Water Quality Control Plan for the Tulare Lake Basin (CVRWQCB 2004). The Basin Plan establishes water quality objectives, and implementation programs to meet stated objectives and to protect the beneficial uses of water in the basin, in compliance with the CWA and the state Porter-Cologne Water Quality Control Act.

3.3.2 Senate Bill 5: 200-Year Flood Criteria

Senate Bill 5, implemented in October 2007, required the California Department of Water Resources (DWR) to develop preliminary maps for the 100- and 200-year floodplains in the Sacramento-San Joaquin Valley watershed by July 1, 2008. The maps provide the best available information on flood protection to cities and counties, showing areas protected by state-federal project levees and areas outside the protection of project levees. DWR has prepared preliminary 100- and 200-year maps for 32 counties within the Sacramento-San Joaquin Valley watershed, including Fresno County. Lands within the Tulare Lake Basin are not subject to preliminary mapping under Senate Bill 5 (DWR 2010).

3.3.3 Central Valley Flood Protection Board

In 2008, the State Board of Reclamation became the Central Valley Flood Protection Board (CVFPB). An encroachment permit is required for projects within a CVFPB-designated floodway and within regulated Central Valley streams listed in Table 8.1 in Title 23 of the California Code of Regulations. Work activities such as excavation, cut-and-fill construction, and obstruction within the floodway and on levees adjacent to a regulated stream are not allowed during the flood season, as defined in Title 23. 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 within 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.

A. 33 U.S.C. 408 – TAKING POSSESSION OF, USE OF, OR INJURY TO HARBOR OR RIVER IMPROVEMENTS

33 U.S.C. 408 addresses proposed modifications to USACE projects and is administered by CVFPB in the study area. In accordance with this policy, the USACE Chief of Engineers must approve any significant alterations or modifications to locally or federally maintained USACE projects. The approval of the Chief of Engineers is required for proposed alterations or modifications such as ramps, fill against a levee, bridges, and berms. A technical analysis of applicable hydraulic and hydrology effects is required and may include changes in inflow, changes in water surface profiles and flow distribution, assessment of local and systemwide resultant impacts, upstream and downstream impacts including sediment transport, and/or impacts to existing floodplain management. Additionally, significant alterations must undergo a risk analysis and formal review process prior to approval by the Chief of Engineers under 33 U.S.C. 408 (USACE 2008a). Alterations or modifications must comply with federal and state regulations and will be approved only after they are determined not to adversely affect the public interest or impair the USACE project (USACE 2006).

B. 33 CFR 208.10 – LOCAL FLOOD PROTECTION WORKS; MAINTENANCE AND OPERATION OF STRUCTURES AND FACILITIES

Projects submitted to CVFPB under 33 U.S.C. 408 that propose maintenance and operation modifications may be approved by the USACE District Engineer. Under 33 Code of Federal Regulations (CFR) 208.10a(5), the District Engineer has the authority to approve relatively minor, low impact modifications including pipes, roads, and similar infrastructure if they do not adversely affect the functioning of the project and flood protection measures (USACE 2006).

3.3.4 Stormwater Management Programs

Stormwater discharges are permitted under the NPDES program. The NPDES MS4 permits, which include Phase I individual permits and the Phase II General Permit, require municipalities to develop and implement an SWMP.

The Fresno metropolitan area and Kern County are covered under individual permits under the MS4 NPDES Phase I program, which applies to municipalities of more than 100,000 people. The MS4 NDPES Phase II program covers portions of unincorporated Kings County that are outside of the Fresno metropolitan area covered under the NPDES Phase I Program, Tulare County and the City of Hanford. These areas comply with the MS4 General NPDES Permit.

A. FRESNO METROPOLITAN AREA STORMWATER MANAGEMENT PLAN

The Fresno Metropolitan Area is permitted to discharge stormwater under CVRWQCB Order No. 5-01-048, NPDES Permit No. CA0083500, Waste Discharge Requirements for Fresno Metropolitan Flood Control District (FMFCD), City of Fresno, City of Clovis, County of Fresno, and California State University Fresno for Urban Stormwater Discharges. In accordance with this NPDES permit, the co-permittees have prepared an SWMP that outlines the BMPs that would be implemented to prevent the discharge of pollutants in stormwater.

FMFCD operates an MS4 that collects water from the cities of Fresno and Clovis, the County of Fresno, and California State University at Fresno. The SWMP discusses BMP programs that need to be implemented to remove pollutants from stormwater to the MEP. Specific tasks are described for the BMP programs, which include Public Involvement and Education, Illicit Discharges, Structural Controls, Operations and Maintenance, Construction and Development, Commercial and Industrial, and Source Identification Monitoring.

FMFCD, in coordination with the other local agencies, operates and maintains a stormwater management system that includes storm drains, detention and retention basins, and pump stations. FMFCD's District Services Plan describes stormwater management within the City of Fresno. The District Services Plan identifies 163 adopted or proposed drainage areas covering approximately 1 to 2 square miles and their associated drainage basins within Fresno. Detention and retention basins, located on all but five of the developed drainage areas, are key components of FMFCD's water conservation program, because they generally also function as groundwater recharge basins. FMFCD contracts and coordinates with the Fresno Irrigation District (FID) and the City of Fresno with regard to groundwater recharge efforts (FMFCD 2009). The drainage basins are used in the FMFCD and Fresno County to remove pollutants from urban runoff and prevent pollutants in stormwater from reaching receiving waters. Urban runoff discharges generally enter the San Joaquin River or canals in the Tulare Lake Basin, and are required to comply with water quality objectives and policies in the San Joaquin River Basin and Tulare Lake Basin Plan, respectively.

Approximately 90% of the urban runoff is retained in stormwater basins, approximately 8% is discharged to the San Joaquin River or canals after detention in basins, and the remaining 2% is discharged directly to the San Joaquin River or canals (CVRWQCB 2001a).

B. COUNTY OF TULARE NPDES PHASE II STORMWATER MANAGEMENT PLAN

Tulare County is designated within the NPDES Phase II General Permit. The Tulare County SWMP outlines and directs the county's stormwater-related priorities and activities. The county currently operates and maintains storm drain systems that include drainage channels, 86 detention and retention basins, 24 pump stations, and approximately 6 miles of pipe. Runoff historically has been directed to natural creeks and rivers by gravity flow or by pumping. The county has been working to develop additional infrastructure to drain increased runoff caused by urbanization.

Detention reservoirs and temporary drainage basins have been proposed to address the water quality of runoff. The SWMP describes measurable goals, control measures, and public programs to minimize the amount of pollutants discharged through the stormwater system and to enhance and protect stormwater quality in Tulare County. Tulare County will increase the existing level of stormwater protection by implementing additional BMPs as part of the Phase II Minimum Control Measures.

The SWMP also discusses the development and implementation of programs to involve and increase awareness of the public with regard to stormwater. Programs include development of educational brochures, development of a stormwater website, public stakeholder meetings, and storm drain stenciling. With regard to illicit discharges, the SWMP includes measures such as the development and implementation of a regular maintenance program, specific inspection and illicit discharge source removal procedures, and a storm drainage system map to assist in monitoring, evaluating, and maintaining stormwater. As part of the SWMP, construction activities are required to undergo a site plan review before issuance of a grading permit, submit an NPDES compliance assurance deposit, and comply with the county construction and demolition debris ordinance. Additional planning and training, and enforcement of post-construction controls and pollution prevention, are also planned to satisfy the required minimum control measures (Tulare County 2008).

C. COUNTY OF KERN STORMWATER MANAGEMENT PLAN

The County of Kern, including the City of Bakersfield, is permitted to discharge urban stormwater under CVRWQCB Order No. 5-01-130, NDPES No. CA00883399. Waste Discharge Requirements for the County of Kern and the City of Bakersfield for Urban Stormwater Discharges. The majority of stormwater runoff in the Bakersfield metropolitan area is directed to retention basins, with a small amount of runoff directed to the Kern River or canals. Detention basins treat stormwater in approximately 40% of the drainage area to help meet water quality objectives. Discharges to the Kern River and canals are required to comply with water quality objectives and policies in the Tulare Lake Basin Plan. Kern County and the City of Bakersfield are required to sample discharge from residential, commercial, and industrial areas during two storm events annually to evaluate water quality.

New developments are generally required to include retention or detention basins. Building permits will continue to include stormwater control provisions and ensure compliance with the requirements for the NPDES General Permits for the discharge of stormwater associated with industrial and construction activities.

The SWMP also addresses Illicit Discharge Controls by requiring the reporting of complaints regarding illegal dumping and quantifying of Hazardous Materials Spills (CVRWQCB 2001b).

D. HANFORD STORMWATER MANAGEMENT PLAN

The City of Hanford is a rural community in Kings County that relies on water resources to support its agricultural economy. Hanford depends on groundwater pumped from local wells for water supply (City of Hanford 2005). Hanford, in cooperation with the Peoples Ditch Company and the Kings County Water District, delivers excess flows from the Kings River, along with stormwater runoff, into the 164 acres of drainage and slough basins throughout the city to replenish groundwater (City of Hanford 2005). The city’s existing drainage infrastructure includes natural drainage channels, irrigation canals, retention/recharge basins, piping and pump stations. Peoples Ditch Company receives water from the Kings River and delivers water for agricultural irrigation. During high stormwater flow periods, Peoples Ditch Company also receives stormwater runoff and conveys it to various basins for stormwater retention and groundwater recharge.

Peoples Ditch Company is limited to a maximum discharge of 50 cubic feet per second (cfs) (Valley Planning Consultants, Inc. 2002).

In March 2003, the City of Hanford was designated as a small MS4 under the NPDES Phase II General Permit. The City of Hanford's SWMP (City of Hanford 2005) was prepared to comply with the NPDES Phase II General Permit and addresses the required six Minimum Control Measure categories. The SWMP complements the city's Storm Drain Master Plan and includes BMPs to reduce discharge of pollutants to the MEP, to protect water quality, and to satisfy water quality requirements set forth by the Clean Water Act. The SWMP discusses the implementation of specific BMPs and assigns responsibilities to different city departments for their implementation.

3.3.5 General Plan Policies and Ordinances

A. FRESNO COUNTY GENERAL PLAN

Fresno County's General Plan (adopted October 2000) provides the framework for the protection of the county's water resources and water quality. The Open Space and Conservation Element is concerned with protecting and preserving natural resources. The policies that specifically deal with water resources and water quality within the study area include:

Goal OS-A: To protect and enhance the water quality and quantity in Fresno County's streams, creeks, and groundwater basins.

General

- Policy OS-A.1: The county shall develop, implement, and maintain a plan for achieving water resource sustainability, including a strategy to address overdraft and the needs of anticipated growth.
- Policy OS-A.2: The county shall provide active leadership in the regional coordination of water resource management efforts affecting Fresno County and shall continue to monitor and participate in, as appropriate, regional activities affecting water resources, groundwater, and water quality.
- Policy OS-A.3: The county shall provide active leadership in efforts to protect, enhance, monitor, and manage groundwater resources within its boundaries.
- Policy OS-A.4: The county shall update, implement, and maintain its Groundwater Management Plan.
- Policy OS-A.5: The Fresno County Water Advisory Committee shall provide advice to the Board of Supervisors on water resource management issues.
- Policy OS-A.6: The county shall support efforts to create additional water storage that benefits Fresno County, and is economically, environmentally, and technically feasible.
- Policy OS-A.7: The county shall develop a repository for the collection of county water resource information and shall establish and maintain a centralized water resource database. The database shall incorporate surface and groundwater data and provide for the public dissemination of water resource information.
- Policy OS-A.9: The county shall develop, implement, and maintain a program for monitoring groundwater quantity and quality within its boundaries. The results of the program shall be reported annually and shall be included in the water resource database.

- Policy OS-A.10: The county shall develop and maintain an inventory of sites within the county that are suitable for groundwater recharge. The sites shall be incorporated into the county Geographic Information System (GIS) and included in the water resource database.
- Policy OS-A.11: The county shall develop and implement public education programs designed to increase public participation in water conservation and water quality awareness.

Groundwater Recharge

- Policy OS-A.13: The county shall encourage, where economically, environmentally, and technically feasible, efforts aimed at directly or indirectly recharging the county's groundwater.
- Policy OS-A.14: The county shall support and/or engage in water banking (i.e., recharge and subsequent extraction for direct and/or indirect use on lands away from the recharge area) based on the following criteria:
    - The amount of extracted water will never exceed the amount recharged
    - The water banking program will result in no net loss of water resources within Fresno County
    - The water banking program will not have a negative impact on other water users within Fresno County
    - The water banking program will not create, increase, or spread groundwater contamination
    - The water banking program includes sponsorship, monitoring, and reporting by a local public agency
    - The groundwater banking program will not cause or increase land subsidence
    - The water banking program will not have a negative impact on agriculture within Fresno County, and
    - The water banking program will provide a net benefit to Fresno County
- Policy OS-A.15: The county shall, to the maximum extent possible, maintain local groundwater management authority and pursue the elimination of unwarranted institutional, regulatory, permitting, and policy barriers to groundwater recharge within Fresno County.
- Policy OS-A.16: The county shall permit and encourage, where economically, environmentally, and technically feasible, over-irrigation of surface water as a means to maximize groundwater recharge.
- Policy OS-A.17: The county shall directly and/or indirectly participate in the development, implementation, and maintenance of a program to recharge the aquifers underlying the county. The program shall make use of flood and other waters to offset existing and future groundwater pumping.

Land Use

- Policy OS-A.18: The county shall require that natural watercourses are integrated into new development in such a way that they are accessible to the public and provide a positive visual element and a buffer area between waterways and urban development in an effort to protect water quality and riparian areas.

- Policy OS-A.19: The county shall require the protection of floodplain lands and, where appropriate, acquire public easements for purposes of flood protection, public safety, wildlife preservation, groundwater recharge, access, and recreation.
- Policy OS-A.21: The county shall, where economically, environmentally, and technically feasible, encourage the multiple use of public lands, including county lands, to include groundwater recharge.

Water Quality

- Policy OS-A.23: The county shall protect groundwater resources from contamination and overdraft by pursuing the following efforts:
  - Identifying and controlling sources of potential contamination
  - Protecting important groundwater recharge areas
  - Encouraging water conservation efforts and supporting the use of surface water for urban and agricultural uses wherever feasible
  - Encouraging the use of treated wastewater for groundwater recharge and other purposes (e.g., irrigation, landscaping, commercial, and non-domestic uses)
  - Supporting consumptive use where it can be demonstrated that this use does not exceed safe yield and is appropriately balanced with surface water supply to the same area
  - Considering areas where recharge potential is determined to be high for designation as open space
  - Developing conjunctive use of surface and groundwater
- Policy OS-A.24: The county shall require new development near rivers, creeks, reservoirs, or substantial aquifer recharge areas to mitigate any potential impacts of release of pollutants in stormwaters, flowing river, stream, creek, or reservoir waters.
- Policy OS-A.25: The county shall minimize sedimentation and erosion through control of grading, cutting of trees, removal of vegetation, placement of roads and bridges, and use of off-road vehicles. The county shall discourage grading activities during the rainy season unless adequately mitigated to avoid sedimentation of creeks and damage to riparian habitat.
- Policy OS-A.26: The county shall continue to require the use of feasible and practical BMPs to protect streams from the adverse effects of construction activities and urban runoff.
- Policy OS-A.27: The county shall monitor water quality regularly and take necessary measures to prevent contamination, including the prevention of hazardous materials from entering the wastewater system.
- Policy OS-A.29: In areas with increased potential for groundwater degradation (e.g., areas with prime percolation capabilities, coarse soils, and/or shallow groundwater), the county shall only approve land uses with low risk of degrading groundwater.

The Public Facilities and Services Element includes storm drainage and flood control (Fresno County 2000). Policies that specifically deal with water resources and water quality within the generalized study area include those listed below.

Goal PF-A: To ensure the timely development of public facilities and to maintain an adequate level of service to meet the needs of existing and future development.

- Policy PF-A.2: The county shall require new industrial development to be served by community sewer, stormwater, and water systems where such systems are available or can feasibly be provided.
- Policy PF-C.2: The county shall actively engage in efforts and support the efforts of others to import flood, surplus, and other available waters for use in Fresno County.
- Policy PF-C.3: To reduce demand on the county's groundwater resources, the county shall encourage the use of surface water to the maximum extent feasible.
- Policy PF-C.4: The county shall support efforts to expand groundwater and/or surface water storage that benefits Fresno County.
- Policy PF-C.5: The county shall develop a county water budget to determine long-term needs and to determine whether existing and planned water resource enhancements will meet the county's needs over the 20-year General Plan horizon.
- Policy PF-C.6: The county shall support water banking when the program has local sponsorship and involvement and provides new benefits to the county.
- Policy PF-C.7: The county shall recommend to all cities and urban areas within the county that they adopt the most cost-effective urban BMPs published and updated by the California Urban Water Agencies, California DWR, or other appropriate agencies as a means of meeting some of the future water supply needs.

Water Quality

- Policy PF-E: To provide efficient, cost-effective, and environmentally sound storm drainage and flood control facilities that protect both life and property and to divert and retain stormwater runoff for groundwater replenishment.
- Policy PF-E.1: The county shall coordinate with the agencies responsible for flood control or storm drainage to assure that construction and acquisition of flood control and drainage facilities are adequate for future urban growth authorized by the county General Plan and city general plans.
- Policy PF-E.2: The county shall encourage the agencies responsible for flood control or storm drainage to coordinate the multiple uses of flood control and drainage facilities with other public agencies.
- Policy PF-E.3: The county shall encourage the FMFCD to spread the cost of construction and acquisition of flood control and drainage facilities in the most equitable manner consistent with the growth and needs of this area.
- Policy PF-E.4: The county shall encourage the local agencies responsible for flood control or storm drainage to require that storm drainage systems be developed and expanded to meet the needs of existing and planned development.

- Policy PF-E.5: The county shall only approve land use-related projects that will not render inoperative any existing canal, encroach upon natural channels, and/or restrict natural channels in such a way as to increase potential flooding damage.
- Policy PF-E.6: The county shall require that drainage facilities be installed concurrently with and as a condition of development activity to ensure the protection of the new improvements as well as existing development that might exist within the watershed.
- Policy PF-E.7: The county shall require new development to pay its fair share of the costs of Fresno County storm drainage and flood control improvements within unincorporated areas.
- Policy PF-E.8: The county shall encourage the local agencies responsible for flood control or storm drainage to precisely locate drainage facilities well in advance of anticipated construction, thereby facilitating timely installation and encouraging multiple construction projects to be combined, reducing the incidence of disruption of existing facilities.
- Policy PF-E.9: The county shall require new development to provide protection from the 100-year flood as a minimum.
- Policy PF-E.10: In growth areas within the jurisdiction of a local agency responsible for flood control or storm drainage, the county shall encourage that agency to design drainage facilities as if the entire areas of service were developed to the pattern reflected in the adopted General Plans to assure that the facilities will be adequate as the land use intensifies.
- Policy PF-E.11: The county shall encourage project designs that minimize drainage concentrations and maintain, to the extent feasible, natural site drainage patterns.
- Policy PF-E.12: The county shall coordinate with the local agencies responsible for flood control or storm drainage to ensure that future drainage system discharges comply with applicable state and federal pollutant discharge requirements.
- Policy PF-E.13: The county shall encourage the use of natural stormwater drainage systems to preserve and enhance natural drainage features.
- Policy PF-E.14: The county shall encourage the use of retention-recharge basins for the conservation of water and the recharging of the groundwater supply.
- Policy PF-E.15: The county should require that retention-recharge basins be suitably landscaped to complement adjacent areas and should, wherever possible, be made available to the community to augment open space and recreation needs.
- Policy PF-E.16: The county shall minimize sedimentation and erosion through control of grading, cutting of trees, removal of vegetation, placement of roads and bridges, and use of off-road vehicles. The county shall discourage grading activities during the rainy season, unless adequately mitigated, to avoid sedimentation of creeks and damage to riparian habitat.
- Policy PF-E.17: The county shall encourage the local agencies responsible for flood control or storm drainage retention-recharge basins in soil strata strongly conductive to groundwater recharge to develop and operate those basins in such a way as to facilitate year-round groundwater recharge.

- Policy PF-E.18: The county shall encourage the local agencies responsible for flood control or storm drainage to plan retention-recharge basins on the principle that the minimum number will be the most economical to acquire, develop, operate, and maintain.
- Policy PF-E.19: In areas where urbanization or drainage conditions preclude the acquisition and use of retention-recharge basins, the county shall encourage the local agencies responsible for flood control or stormwater drainage to discharge storm or drainage water into major canals and other natural watercourses subject to the following conditions:
    - The volume of discharge is within the capacity of the canal or natural watercourse to carry the water.
    - The discharge complies with the requirements of applicable state and federal regulations (e.g., National Pollution Discharge Elimination System).
    - The agency responsible for ownership, operation, or maintenance of the canal or natural watercourse approves of the discharge.
- Policy PF-E.20: The county shall require new development of facilities near rivers, creeks, reservoirs, or substantial aquifer recharge areas to mitigate any potential impacts of release of pollutants in flood waters, flowing rivers, streams, creeks, or reservoir waters.
- Policy PF-E.21: The county shall require the use of feasible and practical best BMPs to protect streams from the adverse effects of construction activities, and shall encourage the urban storm drainage systems and agricultural activities to use BMPs.
- Policy PF-E.22: The county shall encourage the local agencies responsible for flood control or storm drainage to control obnoxious odors or mosquito breeding conditions connected with any agency facility by appropriate measures.

B. FRESNO COUNTY ORDINANCES

Fresno County Ordinance Code, Title 14 Water and Sewage, Chapter 14.03 Groundwater Management

The groundwater management ordinance makes provisions for the protection of the health, welfare, and safety of the County by dedicating the County to proactively assist local water agencies in obtaining and maintaining adequate water supplies and cooperatively implementing joint groundwater management practices consistent with the plan goals of the Fresno County groundwater management plan. Protecting county groundwater resources includes the adoption of a permit addressing the extraction of groundwater for long-term use outside of the county and the insurance of continued vitality of the county's agriculture industry, the economy as a whole, and the general welfare of the citizens of the county.

Fresno County Ordinance Code, Title 14 Water and Sewage, Chapter 14.04 Well Regulations

The well regulations ordinance sets forth well construction, pump installation, and well destruction standards to protect the public health; describes administrative procedures for obtaining permits; and establishes the right for a health officer inspection during any construction, reconstruction, repair, or destruction of water wells.

Fresno County Ordinance Code, Title 14 Water and Sewage, Chapter 14.08 Well Construction, Pump Installation and Well Destruction Standards

The well construction, pump installation, and well destruction standards provide guidance on water well locations with respect to potential sources of contamination and pollution, depths to which well casings shall be sealed, well openings, and disinfection; and establish requirements for well development, repair or deepening, abandonment, and destruction.

Fresno County Ordinance Code, Title 15 Building and Construction, Chapter 15.48 Flooding Hazard Areas

The flooding hazard areas ordinance:

- Restricts or prohibits uses which are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

C. THE FRESNO METROPOLITAN FLOOD CONTROL DISTRICT

The FMFCD Act of 1955 mandates a quasi-joint powers relationship among the City of Fresno, City of Clovis, and Fresno County to provide coordinated and comprehensive stormwater management services for the region. FMFCD requires that stormwater systems be designed for only a 2-year rainfall event, since it is assumed that excess stormwater runoff can be conveyed as overflow on streets. The cities of Fresno and Clovis have agreements with the FMFCD, which, over time, provide for access to an expanding number of master planned flood control basins for groundwater recharge.

The FMFCD Act of 1955 mandates the provision of urban stormwater drainage services and the protection of property from flood, storm and other water flows. While it does not specifically mandate management of stormwater quality as a purpose of FMFCD, management of the quality of stormwater and mitigation of potential pollutant-related impacts is considered essential to carrying out the mandated flood control, drainage, water conservation, and recharge activities. Objectives and purposes of the Act are as follows:

- The objectives and purposes of this act and of the District shall be to provide for the following:
  - The control of flood, storm, and other waste waters of or within the District, including waters which arise outside the District and which flow or drain into or through the District
  - The protection from damage by flood, storm, or waste waters of private property and of public highways and other public property within the District

- The conservation of flood, storm, waste, and other surface waters for beneficial and useful purposes by spreading, storing, retaining, or causing those waters, or any part thereof, to percolate into the soil within or without the District or the saving and conservation in any manner of any or all of those waters

FMFCD, County of Fresno, City of Fresno, and City of Clovis maintain a Master Discharge Agreement with the FID (January 7, 1972). Under the terms of the agreement, FMFCD may discharge stormwater into designated FID canals to prevent flooding. FMFCD's discharges are permissible as long as they do not overtax canal capacity, cause damage, endanger personal property, deposit poor quality water, or interfere with the primary use of the FID system, which is to transport and distribute irrigation water.

D. THE FRESNO METROPOLITAN FLOOD CONTROL DISTRICT ORDINANCES

FMFCD Ordinances 96-1, Chapter 6 Urban Stormwater Quality Management and Discharge Control

Protects and enhances the water quality of watercourses and water bodies in accordance with the CWA by reducing pollutants in urban stormwater discharges to the MEP through the prohibition of non-stormwater discharges to the storm drain system.

E. KINGS COUNTY GENERAL PLAN

The Kings County General Plan regulates development activities and land uses in Kings County. Land use designations and policies provide guidance on community development, encourage efficient land use and public services, and preserve natural resources (Kings County 2009a). Policies addressing preservation of water resources and water quality that are applicable to the study area are listed below.

The Land Use Element discusses objectives and policies regarding the protection of natural waterways and land use for flood protection and drainage.

- LU Objective A1.2: Protect natural waterways to ensure continued water delivery and recharge to surrounding agricultural uses and related home sites, while maintaining the natural aesthetic appeal of the Kings River and Cross Creek waterway channels.
  - LU Policy A1.2.1: Water channels and riparian habitat along the Kings River and Cross Creek shall be designated “Natural Resource Conservation” with a minimum parcel size the same as the surrounding agricultural zone; i.e., AG-20, AG-40, or AX. This designation shall include the natural water channel and outer edge of the riparian vegetation, or to the exterior toe of the bank of the channel where absent of vegetation.
  - LU Policy A1.2.2: Natural Resource Conservation designated areas along waterways shall allow irrigation, flood control, and drainage facilities as “Permitted Uses.”
  - LU Policy A1.2.5: All new temporary and permanent structures proposed by private land owners within designated floodway channels as identified by the Federal Emergency Management Agency (FEMA) shall be submitted to the county for review and required to comply with Kings River Resource Conservation District requirements, and all other applicable federal, state and local agency requirements.

- LU Objective B6.2: Identify agricultural areas that may serve as emergency floodwater storage or drainage areas.
  - LU Policy B6.2.1: Flood zones within the General Agriculture designations shall be considered appropriate land use areas that have the potential to receive emergency floodwater. Specific basin sites shall be determined by the relevant water, irrigation, reclamation, or flood control district having authority over territories along waterways and the Tulare Lake Basin.

The Resource Conservation Element provides guidance on protecting and maintaining groundwater as a water resource and using surface water as a water supply.

- RC Goal A1: Beneficially use, efficiently manage, and protect water resources while developing strategies to capture additional water sources that may become available to ensure long-term sustainable water supplies for the region.
  - RC Policy A1.1.1: Cooperate with water purveyors and water management agencies to manage groundwater resources within the county to assure an adequate, safe, and reliable groundwater supply for existing and future water users.
  - RC Policy A1.1.4: Work cooperatively with state and federal land managers to coordinate watershed management on public land.
  - RC Policy A1.1.5: Encourage and support regional groundwater management strategies such as an Integrated Regional Water Management Plan.
  - RC Policy A1.1.6: Support expansion of joint management of surface water and groundwater supplies that contributes to the protection, reliability, and sustainability of local and regional water supplies.
- RC Objective A1.4: Protect the quality of surface water and groundwater resources in accordance with applicable federal, state, and regional requirements and regulations.
  - RC Policy A1.4.1: Evaluate proposed land uses and development projects for their potential to create surface and groundwater contamination from point and non-point sources. Confer with other appropriate agencies, as necessary, to assure adequate water quality review to prevent soil erosion; direct discharge of potentially harmful substances; ground leaching from storage of raw materials, petroleum products or waste; floating debris; and runoff from the site.
  - RC Policy A1.4.2: Monitor and enforce provisions to control water pollution contained in the U.S. EPA NPDES program as implemented by the California Water Quality Control Board, Central Valley Region.
  - RC Policy A1.4.3: Require the use of feasible and cost-effective BMPs and other measures designed to protect surface water and groundwater from the adverse effects of construction activities and urban and agricultural runoff in coordination with the California Water Quality Control Board, Central Valley Region.

- RC Objective A1.6: Protect groundwater quality by applying development standards which seek to prevent pollution of surface or groundwater and net loss of natural water features.
  - RC Policy A1.6.3: Protect groundwater by enforcing the requirements for installation of wells in conformity with the California Water Code, the Kings County Well Ordinance, and other pertinent state and local requirements.
- RC Objective A2.1: Maintain the existing Kings River water conveyance system as a designated floodway, and encourage the preservation of riparian habitat along the Kings River consistent with state and federally mandated flood control purposes.
  - RC Policy A2.1.1: Recognize the Kings River Conservation District's responsibility to maintain the Kings River channels and levees for flood control purposes. On land within the floodway, allow farming and other uses that are consistent with the designated floodway regulations and any requirements of the Central Valley Flood Protection Board.
  - RC Policy A2.1.2: Apply the "Natural Resource Conservation" land use designation along the Kings River, Cross Creek, and in environmentally sensitive areas having existing natural watercourses, drainage basins, sloughs, or other natural water features. Permitted uses within designated floodway channels shall be limited to uses such as flood control channels, water pumping stations and reservoirs, irrigation ditches, water recharge basins, limited open public recreational uses such as passive riverside parks, related incidental structures, and agricultural crop production that does not include permanent structures. Any construction or development in this designation along the Kings River designated floodway channel shall be subject to the encroachment permit process required by the Central Valley Flood Protection Board.
  - RC Policy A2.1.4: Coordinate the review of all development proposals within or adjacent to designated floodways with relevant resource conservation district entities to ensure compliance with Central Valley Flood Protection Board requirements, and local Floodplain Administration requirements.

The Safety Element gives direction on development as relates to the potential for flooding.

- HS Objective A4.1: Direct new growth away from designated flood hazard risk areas, and regulate new development to reduce the risk of flood damage to an acceptable level.
  - HS Policy A4.1.1: Review new development proposals against current FEMA digital Flood Insurance Rate Maps (FIRMs) and California Department of Water Resources special flood hazard maps to determine project site susceptibility to flood hazard.
  - HS Policy A4.1.3: Determine base flood elevations for new development proposals within or adjacent to 100-year flood zone areas as identified in latest FEMA Digital Flood Insurance Rate Map, to definitively assess the extent of property potentially subject to onsite flood hazards and risks.
  - HS Policy A4.1.4: Direct new urban growth to existing cities and community districts, or away from New Community Discouragement Areas to avoid flood hazard areas and increased risk to people and property.
  - HS Policy A4.1.5: Regulate development, water diversion, vegetation removal, and grading to minimize any increase in flood damage to people and property.

- HS Policy A4.1.6: New development shall provide onsite drainage or contribute towards their fair share cost of offsite drainage facilities to handle surface runoff.

- HS Policy A4.1.7: Consider and identify all areas subject to flooding in the review of all land divisions and development projects.

- HS Policy A4.1.8: Enforce the "Kings County Flood Damage Prevention Ordinance," Chapter 5A of the Kings County Code of Ordinances.

F. KINGS RIVER CONSERVATION DISTRICT

The Kings River Conservation District (KRCD) was formed through special state legislation in 1950 to protect natural resources in the San Joaquin Valley. This resource management agency for the Kings River region provides flood protection and works with other agencies toward a balanced and high-quality water supply (KRCD 2009a). KRCD protects Kings River channels and levees by providing year-round maintenance along approximately 140 levee miles, monitoring levee banks during flood releases, and removing debris during high water (KRCD 2009b). KRCD has monitored Kings River water quality since 1978, and has increased its focus on water quality as the State of California has become increasingly interested in water quality in recent years. KRCD formed the Southern San Joaquin Valley Water Quality Coalition with seven other agencies in the Tulare Lake Basin, with a goal of protecting and preserving water quality (KRCD 2009c).

KRCD cooperates with the Upper Kings Basin Water Forum to implement the Integrated Regional Water Management Plan (IRWMP) (WRIME 2007). The IRWMP sets forth the following goals related to water resources and flooding in the region.

- Halt, and ultimately reverse, the current overdraft, and provide for sustainable management of surface and groundwater.
- Increase the water supply reliability, enhance operational flexibility, and reduce system constraints.
- Improve and protect water quality.
- Provide additional flood protection.

The water resource objectives that relate to the proposed project in the study area include:

- Define local and regional opportunities for groundwater recharge, water reuse/reclamation, and drinking water treatment.
- Develop large-scale regional conjunctive use projects and artificial recharge facilities to:
  - Enhance operational flexibility of existing water facilities, consistent with existing agreements, entitlements, and water rights.
  - Improve the ability to store available sources of surface water in the groundwater basin.
  - Capture stormwater and flood water currently lost in the region.
  - Provide multipurpose groundwater recharge facilities that provide flood control, recreation, and ecosystem benefits.

- Promote 'in-lieu' groundwater recharge to reduce reliance on groundwater through reclamation and reuse of treated wastewater, surface water treatment and delivery for municipal drinking water, and delivery of untreated water for agricultural use.
- Negotiate and develop institutional arrangements and cost sharing for water banking, water exchange, water reclamation, and water treatment.
- Design programs to improve water conservation and water use efficiency by all water users.
- Identify interconnections or improvement of conveyance systems to provide multiple benefits.

G. KINGS COUNTY ORDINANCES

Kings County Code of Ordinances, Chapter 5A Flood Damage Prevention

The flood damage prevention ordinance (Kings County 2009b):

- Restricts or prohibits uses that are dangerous to health, safety and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

Kings County Code of Ordinances, Chapter 14A Water Wells

The water wells ordinance:

- Provides guidelines to protect health, safety, and general welfare in Kings County for work associated with water wells;
- Establishes permit administrative procedures and requirements;
- Regulates construction, repair, reconstruction, and destruction of wells according to state and local standards;
- Designates special protection areas where groundwater quality issues are known to exist;
- Establishes inspection procedures; requires completion reports by drillers; and
- Establishes enforcement of well standards.

H. TULARE COUNTY GENERAL PLAN

The Tulare County General Plan Goals and Policies Report establishes and describes county objectives with regard to water resources, water quality, and flood control (Tulare County 2010).

The agriculture chapter considers water quality in agricultural practices within the county in the following goal and policy.

Goal AG-1: To promote the long-term preservation of productive and potentially productive agricultural lands and to accommodate agricultural-support services and agriculturally related activities that supports the viability of agriculture and further the county's economic development goals.

- Policy AG-1.17: Agricultural Water Resources. The county shall seek to protect and enhance surface water and groundwater resources critical to agriculture.

The health and safety chapter establishes flooding policies to minimize the possibility for the loss of life, injury, or damage to property as a result of flood hazards by requiring compliance with federal, state, and local regulations and regulating development in the 100-year floodplain. Goals and policies applicable to the study area are listed below.

Goal HS-5: To minimize the possibility for loss of life, injury, or damage to property as a result of flood hazards.

- Policy HS-5.1: Development Compliance with federal, state, and local regulations: The county shall ensure that all development within the designated floodway or floodplain zones conforms with FEMA regulations and the Tulare County Flood Damage Prevention Ordinance.
- Policy HS-5.2: Development in Floodplain Zones: The county shall regulate development in the 100-year floodplain zones except as designated on maps prepared by FEMA in accordance with the following:
  - Critical facilities (those facilities which should be open and accessible during emergencies) shall not be permitted.
  - Passive recreational activities (those requiring non-intensive development, such as hiking, horseback riding, picnicking) are permissible.
  - New development and divisions of land, especially residential subdivisions, shall be developed to minimize flood risk to structures, infrastructure, and ensure safe access and evacuation during flood conditions.
- Policy HS-5.3: Participation in federal Flood Insurance Program: The county shall continue to participate in the NFIP.
- Policy HS-5.4: Multi-Purpose Flood Control Measures: The county shall encourage multipurpose flood control projects that incorporate recreation, resource conservation, preservation of natural riparian habitat, and scenic values of the county's streams, creeks, and lakes. Where appropriate the County shall also encourage the use of flood and/or stormwater retention facilities for use as groundwater recharge facilities.
- Policy HS-5.5: Development in Dam and Seiche Inundation Zones: The county shall review projects for their exposure to inundation due to dam failure. If a project presents a direct threat to human life, appropriate mitigation measures shall be taken, including restriction of development in the subject area.
- Policy HS-5.6: Impacts to Downstream Properties: The county shall ensure that new county flood control projects will not adversely impact downstream properties or contribute to flooding hazards.

- Policy HS-5.7: Mapping of Flood Hazard Areas: The county shall require tentative and final subdivision maps and approved site plans to delineate areas subject to flooding during a 100-year flood event.
- Policy HS-5.8: Road Location: The county shall plan and site new roads to minimize disturbances to banks and existing channels and avoid excessive cuts and accumulations of waste soil and vegetative debris near natural drainage ways.
- Policy HS-5.9: Floodplain Development Restrictions: The county shall ensure that riparian areas and drainage areas within 100-year floodplains are free from development that may adversely impact floodway capacity or characteristics of natural/riparian areas or natural groundwater recharge areas.
- Policy HS-5.10: Flood Control Design: The county shall evaluate flood control projects involving further channeling, straightening, or lining of waterways until alternative multipurpose modes of treatment, such as wider berms and landscaped levees, in combination with recreation amenities, are studied.
- Policy HS-5.11: Natural Design: The county shall encourage flood control designs that respect natural curves and vegetation of natural waterways while retaining dynamic flow and functional integrity.

The water resources chapter sets forth goals and policies such as monitoring groundwater, expanding the use of reclaimed water, enforcing the NPDES program, and requiring the use of BMPs to provide for the current and long-range water needs in Tulare County. Policies focus on protecting the quality and quantity of surface water and groundwater resources, providing a sustainable, long-term supply of water resources, and ensuring new development is consistent with available water resources (Tulare County 2010).

Goal WR-1: To provide for the current and long-range water needs of the county and for the protection of the quality and quantity of surface and groundwater resources.

- Policy WR-1.1: Groundwater Withdrawal: The county shall cooperate with water agencies and management agencies during land development processes to help promote an adequate, safe, and economically viable groundwater supply for existing and future development within the county. These actions shall be intended to help the County mitigate the potential impact on groundwater resources identified during planning and approval processes.
- Policy WR-1.2: Groundwater Monitoring: The county shall support the collection of monitoring data for facilities or uses that are potential sources of groundwater pollution as part of project approvals, including residential and industrial development.
- Policy WR-1.3: Water Export Outside County: The county shall regulate the export of groundwater and surface water resources allocated to users within the county to cities and service providers outside the county to the extent necessary to protect the public health, safety and welfare. The county shall strive for a “no net loss” where there may be water exchanges serving a public purpose.
- Policy WR-1.6: Expand Use of Reclaimed Water: The county shall encourage the use of tertiary treated wastewater and household gray water for irrigation of agricultural lands, recreation and open space areas, and large landscaped areas as a means of reducing demand for groundwater resources.

- Policy WR-1.7: Collection of Additional Groundwater Information: The county shall support additional studies focused on furthering the understanding of individual groundwater source areas and basins.
- Policy WR-1.8: Groundwater Basin Management: The county shall take an active role in cooperating in the management of the county's groundwater resources.
- Policy WR-1.9: Collection of Additional Surface Water Information: The county shall support the additional collection of water quality and flow information for the county's major drainages as part of project approvals
- Policy WR-1.10: Channel Modification: Channel modification shall be discouraged in streams and rivers where it increases the rate of flow, rate of sediment transport, erosive capacity, have adverse effect on aquatic life or modify necessary groundwater recharge.

Goal WR-2: To provide for the current and long-range water needs of the county and for the protection of the quality of surface water and groundwater resources.

- Policy WR-2.1: Protect Water Quality: All major land use and development plans shall be evaluated as to their potential to create surface and groundwater contamination hazards from point and non-point sources. The county shall confer with other appropriate agencies, as necessary, to assure adequate water quality review to prevent soil erosion; direct discharge of potentially harmful substances; ground leaching from storage of raw materials, petroleum products, or wastes; floating debris; and runoff from the site.
- Policy WR-2.2: NPDES Enforcement: The county shall continue to support the state in monitoring and enforcing provisions to control non-point source water pollution contained in the U.S. EPA NPDES program as implemented by the Water Quality Control Board.
- Policy WR-2.3: BMPs: The county shall continue to require the use of feasible BMPs and other mitigation measures designed to protect surface water and groundwater from the adverse effects of construction activities and urban runoff in coordination with the Water Quality Control Board.
- Policy WR-2.4: Construction Site Sediment Control: The county shall continue to enforce provisions to control erosion and sediment from construction sites.
- Policy WR-2.5: Major Drainage Management: The county shall continue to promote protection of each individual drainage basin within the county based on the basins unique hydrologic and use characteristics.
- Policy WR-2.6: Degraded Water Resources: The county shall encourage and support the identification of degraded surface water and groundwater resources and promote restoration where appropriate.
- Policy WR-2.7: Industrial and Agricultural Sources: The county shall work with agricultural and industrial concerns to ensure that water contaminants and waste products are handled in a manner that protects the long-term viability of water resources in the county.
- Policy WR-2.8: Point Source Control: The county shall work with the Regional Water Quality Control Board to ensure that all point source pollutants are adequately mitigated (as part of the CEQA review and project approval process) and monitored to ensure long-term compliance.

- Policy WR-2.9: Private Wells: The county shall ensure that private wells are adequately constructed to provide protection from bacteriological and chemical contamination and do not provide a hazard as to contaminate the aquifer.
- Policy WR-3.9: Establish Critical Water Supply Areas: The county shall designate Critical Water Supply Areas to include the specific areas used by a municipality or community for its water supply system, areas critical to groundwater recharge, and other areas possessing a vital role in the management of the water resources in the county.
- Policy WR-3.10: Diversion of Surface Water: Diversions of surface water or runoff from precipitation shall be prevented where such diversions may cause a reduction in surface water available for needed groundwater recharge.
- Policy WR-3.11: Policy Impacts to Water Resources: The county shall monitor actions taken at the federal and state levels that impact water resources in order to evaluate the effects of these actions on the county's resources.

I. TULARE COUNTY ORDINANCES

Tulare County Code Part 4 Health, Safety and Sanitation, Chapter 13 Wells

The wells ordinance establishes standards to ensure that water produced by wells in Tulare County will be of high quality; regulates the entry of substances from the surface into well shafts; and regulates the interchange through well shafts of water between underground strata to protect and preserve the quality of underground waters.

Tulare County Code Part 4 Health, Safety and Sanitation, Chapter 15 Watercourses

The watercourses ordinance establishes standards to protect the health, safety and welfare of Tulare County residents and property through the prevention of flooding from watercourses.

Tulare County Code Part 7 Land Use Regulation and Planning, Chapter 27 Flood Damage Prevention

The flood damage prevention ordinance establishes provisions to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas. Provisions of this chapter are designed to protect human life and health; minimize the need for rescue and relief efforts associated with flooding; minimize the potential property losses in special flood hazard areas; minimize damage to public facilities and utilities in areas of special flood hazard; ensure that potential buyers are notified that a property is in an area of special flood hazard; and ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

J. KERN COUNTY GENERAL PLAN

The policies, goals, and implementation measures in the Kern County General Plan for hydrology and water quality applicable to the project are provided below. The Kern County General Plan, originally adopted on June 15, 2004, and last amended on April 1, 2008, contains additional policies, goals, and implementation measures that are more general in nature and not specific to development such as the proposed project (Kern County Planning Department 2007). Although they are not all listed below, all policies, goals, and implementation measures in the Kern County General Plan are incorporated by reference.

Section 1.3 Physical and Environmental Constraints (Land Use, Open Space, and Conservation Element)

Policies

- Policy 1: Kern County will ensure that new developments will not be sited on land that is physically or environmentally constrained (Map Code 2.1 [Seismic Hazard], Map Code 2.2 [Landslide], Map Code 2.3 [Shallow Groundwater], Map Code 2.5 [Flood Hazard], Map Codes from 2.6 – 2.9, Map Code 2.10 [Nearby Waste Facility], and Map Code 2.11 [Burn Dump Hazard]) to support such development unless appropriate studies establish that such development will not result in unmitigated significant impact.
- Policy 8: Encourage the preservation of the floodplain's flow conveyance capacity, especially in floodways, to be open space/passive recreation areas throughout the county.
- Policy 9: Construction of structures that impede water flow in a primary floodplain will be discouraged.
- Policy 10: The county will allow lands which are within flood hazard areas, other than primary floodplains, to be developed in accordance with the General Plan and Floodplain Management Ordinance, if mitigation measures are incorporated so as to ensure that the proposed development will not be hazardous within the requirements of the Safety Element (Chapter 4) of this General Plan.
- Policy 11: Protect and maintain watershed integrity within Kern County.

Implementation Measures

- Implementation Measure F: The county will comply with the Colbey-Alquist Floodplain Management Act in regulating land use within designated floodways.
- Implementation Measure H: Development within areas subject to flooding, as defined by the appropriate agency, will require necessary flood evaluations and studies.
- Implementation Measure I: Designated flood channels and water courses, such as creeks, gullies, and riverbeds, will be preserved as resource management areas or in the case of urban areas, as linear parks whenever practical.
- Implementation Measure J: Compliance with the Floodplain Management Ordinance prior to grading or improvement of land for development or the construction, expansion, conversion or substantial improvements of a structure is required.
- Implementation Measure N: Applicants for new discretionary development should consult with the appropriate Resource Conservation District and the California Regional Water Quality Control Board regarding soil disturbances issues.

Section 1.9 Resource

Policies

- Policy 11: Minimize the alteration of natural drainage areas. Require development plans to include necessary mitigation to stabilize runoff and silt deposition by imposing grading and flood protection ordinances.

Section 1.10.6 Surface Water and Groundwater

Policies

- Policy 34: Ensure that water quality standards are met for existing users and future development.
- Policy 43: Drainage shall conform to the Kern County Development Standards and the Grading Ordinance.
- Policy 44: Discretionary projects shall analyze watershed impacts and mitigate for construction-related and urban pollutants, as well as alterations of flow patterns and introduction of impervious surfaces as required by CEQA, to prevent the degradation of the watershed to the extent practical.

Implementation Measures

- Implementation Measure Y: Promote efficient water use by using measures such as:
  - Requiring water-conserving design and equipment in new construction.
  - Encouraging water-conserving landscaping and irrigation methods.
  - Encouraging the retrofitting of existing development with water conserving devices.

Section 4.4 Dam Failure, Flooding, and Inundation (Safety Element)

Policies

- Policy 1: Design discretionary critical facilities located within the potential inundation area for dam failure in order to mitigate the effects of inundation on the facility; promote orderly shutdown and evacuation (as appropriate); and prevent onsite hazards from affecting building occupants and the surrounding communities in the event of dam failure.
- Policy 2: Design discretionary critical facilities in the potential dam inundation area used for the storage, or use of hazardous materials to prevent onsite hazards from affecting surrounding communities in the event of inundation.
- Policy 3: Require emergency response plans for the planning area to include specific procedures for the sequential and orderly evacuation of the potential dam inundation area.
- Policy 4: Encourage critical and high occupancy facilities as well as facilities for the elderly, handicapped, and other special care occupants of the potential inundation area below the dam, to develop and maintain plans for the orderly evacuation of their occupants.

Implementation Measures

- Implementation Measure A: Facilities used for the manufacture, storage, and use of hazardous materials shall comply with the Uniform Fire Code, with requirements for siting or design to prevent onsite hazards from affecting surrounding communities in the event of inundation.
- Implementation Measure B: Discretionary critical facilities within potential inundation areas shall be designed to mitigate or prevent effects of inundation.

K. KERN COUNTY ORDINANCES

Kern County Code Title 14 Utilities, Chapter 14.08 Water Supply Wells

The water supply wells ordinance provides standards and requirements for the design, construction, reconstruction, abandonment, and destruction of water wells.

Kern County Code Title 14 Utilities, Chapter 14.26 Stormwater Ordinance

The stormwater ordinance:

- Sets forth standards and requirements to comply with the county's NPDES permit for discharge of its municipal separate stormwater system as well as discharges regulated by a NPDES industrial permit;
- Provides for the maximum possible beneficial public use of the county's storm drain facilities through adequate regulation of storm drain construction and storm drain use; and
- Regulates storm drain construction, the quantity and quality of stormwater discharge, the approval of plans for storm drain constructions, and the issuance of required permits.

Kern County Code Title 17 Building and Construction, Chapter 17.48 Floodplain Management

The floodplain management ordinance:

- Restricts or prohibits uses that are dangerous to health, safety, and property loss due to water or erosion hazards, or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters;
- Controls filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert flood waters or that may increase flood hazards in other areas.

Kern County Code Title 19 Zoning, Chapter 19.50 Floodplain Primary District

- The floodplain primary district:
  - protects public health and safety and minimizes property damage by designating areas subject to flooding with high velocities or depths and by establishing reasonable restrictions on land use in such areas;
  - applies to areas within the "Floodway" as shown on the Flood Boundary Floodway Map or within the "Designated Floodway" as delineated by the CVFPB, formerly the State of California's Board of Reclamation; and

– restricts uses to those not involving buildings, structures, and other activities that have the potential to adversely affect or be adversely affected by flow of water in the floodway.

L. FRESNO CITY GENERAL PLAN

The City of Fresno's *General Plan* (adopted February 2002) includes citywide goals and policies to address water resources and water quality (City of Fresno 2002). The *Public Facilities Element* covers stormwater drainage and flood control facilities. The objectives and policies relevant to the study area are listed below.

Public Facilities Element — Drainage and Flood Control

E-23. Objective: Provide facilities to protect lives and property from stormwater runoff hazards.

- E-23-a. Policy: The Storm Drainage and Flood Control Master Plan of the FMFCD shall be consistent with and incorporated in the general plan including updating and revising as necessary to accommodate intensified urban uses within established areas and development within the designated North and Southeast Growth Areas. Planned stormwater drainage basin locations are identified by the 2025 General Plan Land Use and Circulation Map (Exhibit 4), and those stormwater drainage basins not yet acquired by FMFCD have been assigned alternative land use designations, as shown on Table 6 in the plan.
- E-23-b. Policy: The City of Fresno shall continue to support and assist in the implementation of the FMFCD's Storm Drainage and Flood Control Master Plan including expansion of the District's service area boundaries to include the planned growth areas of the general plan.
- E-23-c. Policy: The City of Fresno shall coordinate with the FMFCD in updating the Flood Control Master Plan as necessary to determine the optimum locations for drainage basins and other facilities necessary to serve urban development including planned urban intensification and the planned North Growth and Southeast Growth Areas.
- E-23-d. Policy: The City of Fresno shall coordinate construction with other public and private agencies, particularly with respect to streets, sewerage, water, gas, electric, and irrigation improvements, with flood control facilities to seek the greatest public benefit at the least public cost.
- E-23-f. Policy: The City of Fresno shall encourage that, as a minimum standard, the perimeter of all permanent stormwater ponding basins be improved with a landscaped buffer.
- E-23-g. Policy: The City of Fresno shall identify and pursue all available or potential funding sources to expedite the completion of landscape amenities and recreation improvements planned or appropriate for basin sites.
- E-23-h. Policy: The City of Fresno shall pursue installation of curbing and gutters on existing developed roadways which are lacking drainage facilities.
- E-23-i. Policy: The City of Fresno shall work with the FMFCD to prevent and reduce the existence of urban stormwater pollutants to the maximum extent practical, and ensure that surface and groundwater quality, public health and the environment will not be adversely affected by urban runoff, pursuant to the requirements of the National Pollution Discharge Elimination Systems Act.

The *Natural Resource Conservation Element – Water Resources* addresses the Fresno area's needs for adequate quantities of water suitable for human consumption, recreation, and agriculture. In conjunction with the Metropolitan Water Resources Management Plan and the 2025 General Plan Regional Cooperation and Public Facilities Elements, this Resource Conservation Element provides policy direction toward ensuring that these needs will be met in the long term (City of Fresno 2002). The objectives and policies relevant for the study area include those listed below.

G-2. Objective: Maintain a comprehensive, long-range water resources management plan that provides for appropriate management of all sources of water available to the planning area and ensure that sufficient and sustainable water supplies of good quality will be economically available to accommodate existing and planned urban development.

- G-2-a. Policy: Support cooperative, multi-agency regional water resource planning efforts involving the cities of Fresno and Clovis, Fresno County, FMFCD, the Department of Water Resources, the Regional Water Quality Control Board, irrigation districts, and other agencies and stakeholders in the area.
- G-2-b. Policy: Implement the Fresno Metropolitan Water Resources Management Plan, and update this plan as necessary, to ensure cost-effective use of water resources and continued availability of good-quality groundwater and surface water supplies.
- G-2-c. Policy: Continue interagency efforts toward completion of a Groundwater Management Plan, pursuant to the provisions added to the California Water Code by Assembly Bill 3030.
- G-2-d. Policy: Maintain and expand cooperative multi-agency planning and programs for water conservation.
- G-2-e. Policy: The conclusions, recommendations, and mitigation measures of the Metropolitan Water Resource Management Plan and its Environmental Impact Report shall be used to evaluate land use and development project proposals.

G-3. Objective: Protect water resources in the area from further degradation in quality.

- G-3-a. Policy: Monitor key water pollutants to determine directions and rates of contaminant travel, to achieve cost-effective and timely intervention for containment and remediation of contamination, and to indicate which areas may require water treatment to supply acceptable-quality drinking water.
- G-3-b. Policy: Continue to participate in interagency committees and task forces (with local, state, and federal representation, as may be needed) to share information, to efficiently use financial resources devoted to evaluating water quality problems, and to facilitate cost-effective management of water pollution.
- G-3-c. Policy: Support continued efforts to identify and mitigate detriments to surface and ground water quality that may result from stormwater discharge from urbanized areas.
- G-3-d. Policy: Continue to implement water system policies that ensure compliance with federal and state Safe Drinking Water Standards.
- G-3-e. Policy: Support and encourage actions of the Regional Water Quality Control Board, the State Environmental Protection Agency, and the local health department to control and prevent water contamination, including leaking underground storage tank and abandoned storage tank abatement programs.
- G-3-f. Policy: Continue programs to collect and treat sewage to enhance water quality and reclaim water resources in a manner that protects the Fresno Sole Source Aquifer.

- G-3-g. Policy: Restrict urban development in areas that are not served by a wastewater treatment/management system that is capable of preventing the buildup of compounds that would degrade the aquifer. Oppose the development of new sewage disposal facilities either within the planning area or upgradient (north and east) of the planning area, unless the treatment facilities produce effluent that:
  - Will not degrade the aquifer in the long term
  - Will not introduce contaminants into surface water that would negatively affect its potential economic use for drinking water
  - Will not deleteriously affect downstream agricultural and urban uses
  - Will not degrade sensitive riparian habitat
- G-3-i. Policy: Continue to protect areas of beneficial natural groundwater recharge by preventing uses which can contaminate soil or groundwater.

G-4. Objective: Manage, use, and replenish water resources to maintain a balanced "water budget" in the Fresno area.

- G-4-a. Policy: Preserve the city's surface water entitlements to the fullest extent possible and augment surface water supplies as may be necessary.
  - Use surface water, as necessary, to balance the aquifer's long-term sustainable yield with projected demand.
  - Use surface water, as necessary, to maintain the overall high quality of Fresno's underground reservoir.
  - Protect, develop and maintain areas and facilities necessary for groundwater recharge, including in-lieu recharge achieved through use of a surface water treatment plant.
  - Promote use of surface water for landscape irrigation when this is practical and beneficial to overall water management objectives.
- G-4-b. Policy: In cooperation with other agencies, enhance the recharge of groundwater as may be necessary.
- G-4-c. Policy: Address localized groundwater deficiencies and groundwater quality problems that exist or may arise in portions of the planning area.

The *Safety Element – Flooding Hazard* is intended to protect lives and property from flood hazards (City of Fresno 2002). The objectives and policies that specifically deal with stormwater and flooding within the study area include those listed below.

I-5. Objective: Protect the lives and property of current and future residents of the Fresno Clovis Metropolitan Area from the hazards of periodic floods. Recognize and institute adequate safeguards for the particular flooding hazards of areas on the San Joaquin river bottom and bluffs.

- I-5-a. Policy: Support the full implementation of the FMFCD's Storm Drainage and Flood Control Master Plan, the completion of planned flood control and drainage system facilities, and the continued maintenance of stormwater and floodwater retention and conveyance facilities and capacities.

- I-5-d. Policy: Ensure implementation of the FMFCD's urban drainage program, including completion of the urban storm drainage systems to provide protection to the urban community from waters originating within the urban area.
- I-5-e. Policy: Ensure implementation of land grading and development policies which protect area residents from flooding caused by urban runoff produced by events which exceed the capacity of the Storm Drainage and Flood Control Master Plan system of facilities.

M. FRESNO CITY ORDINANCES

Fresno Municipal Code Chapter 6 Municipal Services and Utilities, Article 4 Wells

The wells ordinance regulates the installation of wells within the City of Fresno; prohibits the drilling of wells for purposes other than furnishing water for refrigeration, air conditioning, irrigation, or monitoring; requires permits and Health Officer supervision for well drilling; and requires that drainage, supply, and monitoring wells be sealed to prevent surface water or other drainage water seepage into wells.

Fresno Municipal Code Chapter 6 Municipal Services and Utilities, Article 7 Urban Stormwater Quality Management and Discharge Control

The urban stormwater quality management and discharge control ordinance establishes regulations and requirements to ensure the health, safety, and general welfare of citizens, and protect the water quality of watercourses and water bodies pursuant to the CWA by reducing pollutants in urban stormwater discharges to the MEP and by effectively prohibiting non-stormwater discharges to the storm drain system.

Fresno Municipal Code Chapter 10 Regulations Regarding Public Nuisances and Real Property Conduct and Use, Article 9 Canals and Ponding Basins

The canals and ponding basins ordinance prohibits swimming in canals and ponding basins; and requires piping of irrigation or drainage canals that can be accommodated by 54-inch inside diameter pipe for new developments.

Fresno Municipal Code Chapter 11 Building Permits and Regulations, Article 6 Fresno Floodplain Ordinance

The Fresno floodplain ordinance:

- Restricts or prohibits uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

N. CITY OF HANFORD GENERAL PLAN

The City of Hanford General Plan provides goals and objectives regarding urban growth and development scenarios (City of Hanford 2002). Elements in the General Plan set forth objectives and policies regarding water resources that are applicable to the proposed project.

The City of Hanford Open Space, Conservation, and Recreation Element discusses the significance of water resources, particularly groundwater resources, for the well-being of the city. The General Plan establishes objectives, policies, and programs to protect water resources, encourage groundwater recharge, and maintain acceptable water quality. Objectives, policies, and programs applicable to the proposed project include those listed below.

- Objective OCR 8: Promote the conservation of water within the Hanford community.
  - Policy OCR 8.3: Explore use of alternative water sources within the Hanford Community.
- Objective OCR 9: Ensure adequate groundwater reserves are maintained for present and future domestic, commercial, and industrial uses.
  - Policy OCR 9.1: Require proponents of non-agricultural water intensive land uses, which are determined to use more water than the previous use, to mitigate groundwater impacts.
  - Policy OCR 9.2: Protect existing groundwater recharge basins and seek the establishment of new basins within and around the City of Hanford.
  - Program OCR 9.2-A: Coordinate flood control efforts within new development to promote establishment of detention basins which enhance local groundwater recharge.
- Objective OCR 10: Ensure groundwater quality is maintained at a satisfactory level for domestic water consumption.
  - Policy OCR 10.1: Avoid degradation of groundwater reserves by domestic and industrial land uses.
  - Program OCR 10.1-A: Seek to connect unincorporated development within the urban fringe to the sewage treatment network.
  - Program OCR 10.1-B: Require proponents of industrial-oriented projects to submit proposals for water use. Encourage the reuse of water within industrial systems.

The Public Facilities and Services Element addresses impacts to water and storm drainage associated with development.

- Objective PF 8: Maintain storm drainage facilities to preserve their function and capacity.
  - Policy PF 8.1: Natural and manmade channels, detention basins, and other drainage facilities shall be maintained to ensure that their full use and carrying capacity is not impaired.
  - Policy PF 8.2: Continue to require new development to discharge stormwater runoff at volumes no greater than the capacity of any portion of the existing downstream system by using detention or retention or other approved methods, unless the project is providing drainage pursuant to an adopted drainage plan.

- Policy PF 8.3: All drainage improvements shall comply with the City of Hanford Public Works Construction Standards.

O. CITY OF HANFORD ORDINANCES

Hanford Municipal Code Title 15 Buildings and Construction, Chapter 15.52 Flood Damage Prevention Regulation

The flood damage prevention regulation (City of Hanford 2009):

- Restricts or prohibits uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

P. CORCORAN GENERAL PLAN

The Corcoran General Plan provides a planning framework for the community's development goals and future land uses based on existing conditions (City of Corcoran 2007). Several of the General Plan elements, listed below, address objectives and policies regarding water resources that are applicable to the proposed project.

Land Use Element

Industrial Land Use

- Objective A: Promote industrial sites which are functional, have adequate public services, and have access to major streets and railroads.
- Policy 1.43: To achieve a high-quality natural environment, it shall be the policy of the City to encourage industries that demonstrate minimum air and water quality impacts and to discourage air and water quality impacts that cannot be offset.

Open Space, Conservation and Recreation Element

Natural Resources

- Objective A: Protect natural resources including groundwater, soils, and air quality, to meet the needs of present and future generations.
- Objective B: Ensure that environmental hazards including potential flooding and impacts from agricultural practices are adequately addressed in the development process within the City and the Corcoran Planning Area.

- Policy 5.1: The City of Corcoran shall work cooperatively with other local agencies to expand programs that enhance groundwater recharge to maintain the groundwater supply, including the installation of retention/detention ponds in new growth areas.
- Policy 5.3: The city shall continue to participate in programs to encourage, and, in some instances to require, ongoing water conservation practices.

Public Services and Facilities Element

Public Facility Improvement

- Objective C: Facilities and services shall be consistent with the General Plan land use goals and objectives.
- Policy 8.5: Stormwater runoff drainage structures shall be designed to limit erosion.

Q. CITY OF CORCORAN ORDINANCES

Corcoran Municipal Code Title 9 Building Regulations, Chapter 9 Floodplain Management Regulations

The floodplain management regulations establish provisions to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas. Provisions of this chapter are designed to:

- Protect human life and health;
- Minimize expenditure of public money for costly flood control projects; minimize the need for rescue and relief efforts associated with flooding;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities, utilities, streets, and bridges in areas of special flood hazard;
- Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future blighted areas caused by flood damage
- Ensure that potential buyers are notified that property is in an area of special flood hazard; and
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

Corcoran Municipal Code Title 12 Subdivision Regulations, Chapter 1-31 Drainage Area

The drainage area regulations adopt the area within the urban improvement boundary delineated on the Land Use Element of the General Plan as one complete drainage area and require fees to defray the estimated cost of drainage facilities for the removal, transportation, and disposal of storm drain waters (City of Corcoran 2009).

R. CITY OF WASCO GENERAL PLAN

The City of Wasco General Plan Policies Statement is part of the General Plan Update which incorporates and addresses growth issues, opportunities, and constraints of development in the

City of Wasco (City of Wasco 2002). Policies and standards regarding development that relate to both water resources and the proposed project are listed below.

Conservation and Open Space Element

Natural Resources

- Objective A: Protect natural resources including groundwater, soils, and air quality, to meet the needs of present and future generations.
- Objective B: Ensure that environmental hazards including potential flooding and impacts from agricultural practices are adequately addressed in the development process within the City and the Wasco Planning Area.
  - Policy 1: Protect areas of natural groundwater recharge from land uses and disposal method, which would degrade groundwater quality. Promote activities, which combine stormwater control, and water recharges.
  - Policy 2: Expand programs that enhance groundwater recharge to maintain the groundwater supply, including the installation of detention ponds in new growth areas.
  - Policy 3: No urban level development shall be approved in the City unless the development is, or will be served by the City sewer system, except in the Rural Residential zone.
  - Policy 4: Water conservation methods shall be continued.
  - Policy 9: To protect human health, the City groundwater resources will be monitored on a regular basis to test for bacteriological and toxic chemical components.

Safety Element

Flooding

- Objective A: Protect the lives and property of residents from the hazards of flooding.
  - Policy 1: Consistent with federal standards, the City shall plan for storm drainage facilities sufficient to address a 100-year flood event and require adequate storm drainage facilities to prevent flooding within the community.
  - Policy 2: The City will maintain the storm drain master plan for the City, including planned growth areas and require that development conform to it.
  - Policy 3: Development proposals shall be analyzed according to the Storm Drain Collection System Study and Master Plan. Development not within an existing Master Plan watershed area may be included in the boundaries of an adjacent area and subject to a revision of facilities and cost allocation thereof.

S. CITY OF WASCO ORDINANCES

Wasco Municipal Code Title 15 Buildings and Construction, Chapter 15.28 Drainage Area

The Wasco drainage area ordinance adopts the area within the urban improvement boundary delineated on the land use element of the General Plan as one complete drainage area. It also requires fees to defray the estimated cost of drainage facilities for the removal and transportation of storm drain water (City of Wasco 2009).

Wasco Municipal Code Title 15 Buildings and Construction, Chapter 15.32 Flood Damage Prevention

The Wasco flood damage prevention ordinance:

- Restricts or prohibits uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

T. CITY OF SHAFTER ORDINANCES

Shafter Municipal Code Title 15 Buildings and Construction, Chapter 15.44 Floodplain Management

The City of Shafter floodplain management ordinance (City of Shafter 2009)

- Restricts or prohibits uses that are dangerous to health, safety and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

U. METROPOLITAN BAKERSFIELD GENERAL PLAN/UPDATE AND EIR

The Conservation Element of the Metropolitan Bakersfield General Plan sets forth goals and policies for the planning area, including the conservation of groundwater quantities and the preservation of water quality. The policies require protection of groundwater supplies by recharge and minimization of groundwater diversions to locations outside the planning area. Support programs are planned for the conveyance of water from the Kern River and from sources other than the San Joaquin Valley basin. In addition, the Conservation Element encourages prioritization of water resource usage and the implementation of water conservation measures.

The Safety Element includes flooding policies that require adequate maintenance of levees along the Kern River channel, urban development to avoid encroachment of impeding Kern River flood flows, maintenance of the Kern River channel, and the implementation of a flood prevention program as relates to new development (City of Bakersfield and County of Kern 2002a).

The Metropolitan Bakersfield General Plan Update EIR sets forth goals and policies to maintain water quality and groundwater supplies as Metropolitan Bakersfield develops in accordance with the General Plan Update. The goals and policies aim at preventing further quality degradation of both groundwater and surface water by developing and maintaining groundwater recharge facilities, supplying additional water resources to the planning area, and requiring the design of land use patterns, grading, and landscaping practices to minimize soil erosion. Applicable policies also require the implementation of programs that promote water conservation, continuance of existing water sources, and water conveyance from additional sources (City of Bakersfield and County of Kern 2002b).

The Metropolitan Bakersfield General Plan (City of Bakersfield and County of Kern 2002a) includes countywide goals, policies, and implementation measures for the conservation of groundwater quantities, the preservation of water quality, and flood control (City of Bakersfield and County of Kern 2002a.) The Draft Metropolitan Bakersfield General Plan Update (April 2009) highlights issues, challenges, and recommended changes to the General Plan (City of Bakersfield and County of Kern 2009). The policies listed below (Conservation and Safety Elements) are found in both the General Plan and General Plan Update and specifically apply to the Proposed Project.

Conservation Element

Water Resources Goals

- Conserve and augment the available water resources of the planning area.
- Assure that adequate groundwater resources remain available to the planning area.
- Assure that adequate surface water supplies remain available to the planning area.
- Continue cooperative planning for and implementation of programs and projects which will resolve water resource deficiencies and water quality problems.
- Achieve a continuing balance between competing demands for water resource usage.
- Maintain effective cooperative planning programs for water resource conservation and use in the planning area by involving all responsible water agencies in the planning process.

Water Resources Policies

- Develop and maintain facilities for groundwater recharge in the planning area.
- Minimize the loss of water that could otherwise be used for groundwater recharge purposes and benefit planning area groundwater aquifers from diversion to locations outside the area.
- Support programs to convey water from other San Joaquin Valley basin sources to the planning area.
- Support programs and policies which assure continuance or augmentation of Kern River surface water supplies.
- Protect planning area groundwater resources from further water quality degradation.

- Provide substitute or supplemental water resources to areas already impacted by groundwater quality degradation by supporting facilities construction for surface water diversion.
- Consider each proposal for water resource usage within the context of total planning area needs and priorities—major incremental water transport, groundwater recharge, flood control, recreational needs, riparian habitat preservation, and conservation.
- Encourage and implement water conservation measures and programs.

Safety Element

Flooding Policies

- Develop specific standards that apply to development in flood hazard areas, as defined by the Flood Insurance Rate Maps and most recent information as adopted by the responsible agency.
- Maintain adequate levees along the Kern River channel throughout the planning area.
- Prevent urban development encroachment which would impede flood flows in the Kern River designated floodway.

Seismic Policies: Dam Failure Inundation Risk

- Design discretionary critical facilities in the potential inundation area for dam failure to mitigate the effects of inundation on the facility; promote orderly shutdown and evacuation (as appropriate); and prevent onsite hazards from affecting building occupants and the surrounding communities in the event of dam failure.
- Design discretionary critical facilities in the potential dam inundation area used for the manufacture, storage, or use of hazardous materials to prevent onsite hazards from affecting surrounding communities in the event of inundation.
- Require emergency response plans for the planning area to include specific procedures for the sequential and orderly evacuation of the potential dam inundation area.

V. BAKERSFIELD ORDINANCES

Bakersfield Municipal Code Title 8 Health and Safety, Chapter 8.34 Industrial Stormwater

The Bakersfield industrial stormwater ordinance sets forth standards and requirements for industrial activities to comply with NPDES industrial stormwater permits and the City's NPDES permits for discharge to its municipal separate stormwater system.

Bakersfield Municipal Code Title 8 Health and Safety, Chapter 8.35 Stormwater System

The Bakersfield stormwater system ordinance prohibits illicit discharges into stormwater system, and requires compliance with permits, contracts, and orders of the public works director relative to control of discharges into, and operation of, the City's stormwater facilities and systems.

Bakersfield Municipal Code Title 8 Health and Safety, Chapter 8.70 Regulation of Wells and Water Systems

The Bakersfield regulation of wells and water systems adopts Kern County Ordinance Code G-5006, Section 14.08 for regulation of wells and water systems; and establishes City of Bakersfield authority to approve construction of water wells.

Bakersfield Municipal Code Title 15 Buildings and Construction, Chapter 15.74 Flood Damage Prevention

The Bakersfield flood damage prevention ordinance:

- Restricts or prohibits uses that are dangerous to health, safety, and property due to water or erosion hazards or that result in damaging increases in erosion or in flood heights or velocities;
- Requires that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Controls the alteration of natural floodplains, stream channels, and natural protective barriers that help accommodate or channel floodwaters;
- Controls such filling, grading, dredging, and other development that may increase flood damage; and
- Prevents or regulates the construction of flood barriers that will unnaturally divert floodwaters or that may increase flood hazards in other areas.

Bakersfield Municipal Code Title 17 Zoning, Chapter 17.42 FP-P Floodplain Primary Zone

The Bakersfield floodplain primary zone ordinance regulates uses in areas of the city that lie within natural streambeds and those portions of adjacent floodplains through which high velocity flows are channelized during a flood to prevent loss of life, minimize property damage, and maintain satisfactory conveyance capacities of waterways.

Bakersfield Municipal Code Title 17 Zoning, Chapter 17.44 FP-S Floodplain Secondary Zone

The Bakersfield floodplain secondary zone ordinance regulates uses in areas of the city that lie within the fringe area of the floodplain and are subject to less severe inundation during flooding than occurs in the FP-P zone, to protect life and property from hazards and damages that may result from floodwaters.

3.3.6 Grading Codes

A. FRESNO COUNTY ORDINANCE CODE, CHAPTER 15.28 GRADING AND EXCAVATION

The Fresno County grading and excavation ordinance:

- Establishes standards for grading and excavation within unincorporated Fresno County;
- Sets forth rules and regulations to control excavation, grading, and earthwork construction, including fills and embankments;

- Establishes the administrative procedure for issuance of permits; and
- Provides for approval of plans and inspection of grading construction.

B. TULARE COUNTY CODE PART 7 LAND USE REGULATION AND PLANNING, CHAPTER 15 BUILDING REGULATIONS, ARTICLE 7 EXCAVATION AND GRADING

The Tulare County excavation and grading ordinance:

- Establishes standards to safeguard the public, minimize hazards to property, control erosion and protect against sedimentation of watercourses, and protect the safety, use and stability of public rights of way;
- Provides regulations to control excavation, grading, and earthwork construction; and
- Establishes procedures for issuance of grading permits.

C. KERN COUNTY GRADING CODE, CHAPTER 17.28

The Kern county grading code:

- Regulates grading on private property to safeguard life, limb, property, and the public welfare;
- Sets forth rules and regulations to control excavation, grading, and earthwork construction, including fills and embankments;
- Establishes the administrative procedure for issuance of permits; and
- Provides for approval of plans and inspection of grading construction.

D. CITY OF SHAFTER MUNICIPAL CODE, TITLE 15 BUILDINGS AND CONSTRUCTION, CHAPTER 15.28 GRADING CODE

The City of Shafter grading code:

- Regulates grading on private property to safeguard life, limb, property, and the public welfare;
- Sets forth rules and regulations to control excavation, grading, and earthwork construction, including fills and embankments;
- Establishes the administrative procedure for issuance of permits; and
- Provides for approval of plans and inspection of grading construction.

Section 4.0
Existing Water Resources

4.0 Affected Environment

The project study area for water resources stretches from the southern edge of the San Joaquin River in the city of Fresno through the counties of Fresno, Kings, Tulare, and Kern to the city of Bakersfield. The limits of the project study area are the northern end of the proposed Fresno Station tracks south to approximately Union Avenue in east Bakersfield.

The project study area is within California's Central Valley; specifically, within the southern portion of the San Joaquin Valley. The San Joaquin Valley is bordered by the Coast Ranges to the west, the San Emigdio and Tehachapi Mountains to the south, the Sierra Nevada to the east, and the Sacramento-San Joaquin Delta and Sacramento Valley to the north. The total drainage area of the San Joaquin Valley is approximately 34,100 square miles, and is divided into the San Joaquin River Basin and the Tulare Lake Basin (CVRWQCB 2004).

The project study area is entirely within the South Valley Floor (SVF) subwatershed of the Tulare Lake Basin (see Figure 4.0-1). The SVF subwatershed covers approximately 8,235 square miles (ICF Jones & Stokes 2008). The subwatershed boundaries within the Tulare Lake Basin shown on Figure 4.0-1 were derived from the California Interagency Watershed Map of 1999 (CalWater 2.2.1) (ICF Jones & Stokes 2008). Updated in May 2004, CalWater 2.2.1 is the State of California's working definition of watershed boundaries, beginning with the division of the state's 101 million acres into 10 hydrologic regions. The Tulare Lake Basin hydrologic region is subdivided into 10 subwatersheds: the South Valley Floor, Kings River, Kaweah River, Kern River, Southern Sierra, Grapevine, Coast Range, Fellows, Temblor Valley, and Sunflower Valley watersheds.

The Tulare Lake Basin is essentially an endorheic basin that forms the terminus of the Kings, Kaweah, Tule, and Kern rivers, which flow to the dry lake beds of Tulare, Buena Vista, and Kern lakes. Its only outlet is to the north into the San Joaquin River, which only drains during periods of extreme rainfall. The entire Tulare Lake Basin covers an area of approximately 17,400 square miles (CVRWQCB 2004). Much of the topography is characterized by steep river canyons and large mountains, which is typical of the Sierra Nevada and Coast Ranges. Approximately one-third of the basin is used for agriculture. Most of the agricultural land is located in the SVF watershed, which is relatively flat. Concerns related to water quality in the Tulare Lake Basin generally occur in the SVF watershed because of the agricultural operations that take place there (ICF Jones & Stokes 2008).

Prior to agricultural development, the Tulare Lake Basin was dominated by four large, shallow, and mainly temporary inland lakes (Gronberg et al. 1998). The project study area lies in the part of the Tulare Lake Basin previously dominated by Tulare Lake and Goose Lake. Tulare Lake was the most northerly of these lakes and was fed by the Kings, Kaweah, and Tule Rivers, and sometimes the Kern River. This historic lake bed has a bottom elevation of 175 feet, and one natural outlet north to the San Joaquin River at an elevation of 207 feet (ICF Jones & Stokes 2008). The Tulare Lake bed is usually dry due to irrigation diversions in the Kings, Kaweah, Tule, and Kern rivers. The Tulare Lake bed has been developed into a system of levees and irrigation canals to direct flooding away from farmed tracts of land. Approximately 103 miles of levees with 35-foot-wide crowns, 110-foot-wide bases, and 19-foot heights have been built in the Tulare Lake bed (USACE 1996).

The 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. During wet years, Buena Vista Lake would overflow into northerly flowing sloughs and drain into Tulare Lake. As the climate became drier, water evaporated in low-lying areas, forming saline-alkaline soils.

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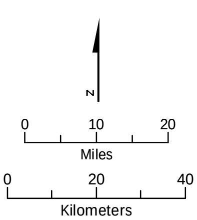
July 22, 2011

Source: National Hydrography Dataset, 2008; URS, 2011



- Tulare Lake Basin boundary
- Subwatershed boundary
- Aqueduct/Canal
- Footprint of heavy maintenance facility (HMF)
- Alternative alignments
- County boundary

Figure 4.0-1
Regional hydrologic setting

The California Aqueduct and Friant-Kern Canal are major water conveyance systems that cross through the region. The California Aqueduct is approximately 30 miles west of the alternative alignments. It was constructed in the 1970s and supplies agricultural and municipal areas in Southern California. The California Aqueduct generally runs north-south and is the major conveyance feature for the California State Water Project, which transports water from northern to southern California. The aqueduct is 444 miles long and is mostly an open, concrete-lined canal. The canal's width and depth vary along the length of the aqueduct, but the canal is generally approximately 50 feet wide and 30 feet deep.

The Friant-Kern Canal transports water south from Millerton Lake, a reservoir on the San Joaquin River north of Fresno created by Friant Dam, and joins the Kern River approximately 4 miles west of Bakersfield. The 152-mile-long Friant-Kern Canal is east of the alternative alignments and is part of the Central Valley Project, a U.S. Bureau of Reclamation project that stores and transports water for irrigation and drinking water purposes, and protects land from flooding. The canal capacity near Millerton Lake is 5,000 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 Lake bed. Where the canal is full or downstream demand is low, the Friant-Kern Canal may not be used for flood control purposes (USACE 1996).

4.1 Floodplains

The eastern side of the Tulare Lake Basin is drained primarily by the Kings, Kaweah, Tule, and Kern rivers. Small streams drain the foothills, which are usually dry except during winter and spring runoff. Historically, runoff from large storm events flowed from the foothills, terminating on the valley floor. As areas were developed, natural flow paths were altered and encroached upon by agricultural practices and urban development. Natural streams and creeks were modified to convey irrigation water, and flow pathways were either re-routed along property lines or road rights-of-way, or obliterated completely. Natural vegetation, no longer "managed" by periodic high discharge events, has now encroached into stream channels in a manner that unnaturally impedes floodwater events, magnifying damage to adjacent properties. Over time, 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 2004).

Flooding is 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. The two types of flooding that can occur in the valley are general rainfall floods occurring in the late fall and winter in the foothills and on the valley floor, and snowmelt floods occurring in the late spring and early summer. Major flood events also are produced by extended periods of rain or snow during the winter months.

FEMA has identified special flood hazard areas on FIRMs for all communities that participate in the NFIP. Fresno, Kings, Tulare, and Kern counties participate in this program. These FIRMs are used by state and local governments for administering floodplain management programs, enforcing building codes, and mitigating flooding losses in their communities. The floodplain information on the FIRM is based on historical data and hydrologic and hydraulic computations. The 100-year floodplain, or the areas inundated by a storm having a 1% annual chance of occurrence, is the regulatory standard used by federal, state, and local agencies. Within the study area, the special flood hazard areas subject to the inundation by the 100-year flood include the following FEMA designations:

- Zone A: no detailed studies were performed and no base flood elevations (BFEs) were determined.
- Zone AE: BFEs were determined.
- Zone AH: flood depths are 1 to 3 feet and BFEs were determined.
- Zone AO: flood depths are 1 to 3 feet and average depth of flooding was determined.

As delineated by FEMA, 100-year floodplains exist along many of the minor creeks and streams in the rural areas of the region. In urban areas and along most of the reaches of the major rivers, the 100-year floodplains generally are contained within the riverbanks. Levees and floodwalls have been constructed in urban areas, restricting the rivers' flows, many of which also are controlled by upstream dams. Throughout the rural portion of the region, the land is low-lying and subject to frequent shallow flooding. The floodplains within the project study area are shown on Figure 4.1-1 and summarized in Table 4.1-1.

FEMA defines a floodway as the channel of a stream plus any adjacent floodplain area that must be kept free of encroachment so that the 100-year flood can be conveyed without a substantial increase in the BFE (e.g., less than 1 foot) (FEMA 2009d). A FEMA-designated floodway has been delineated for Cross Creek. For Kern River in the city of Bakersfield limits, FEMA did not compute a floodway, because the city has adopted the floodway designated by CVFPB, which is based on a peak flow that exceeds the 1% annual chance flood determined by FEMA (FEMA 2008b). The peak discharges for the 1% and 0.2% annual chance floods as determined by FEMA for the Kern River in Bakersfield are 10,200 cfs and 28,700 cfs, respectively. The CVFPB floodway is based on a peak discharge of 15,000 cfs (FEMA 2008b).

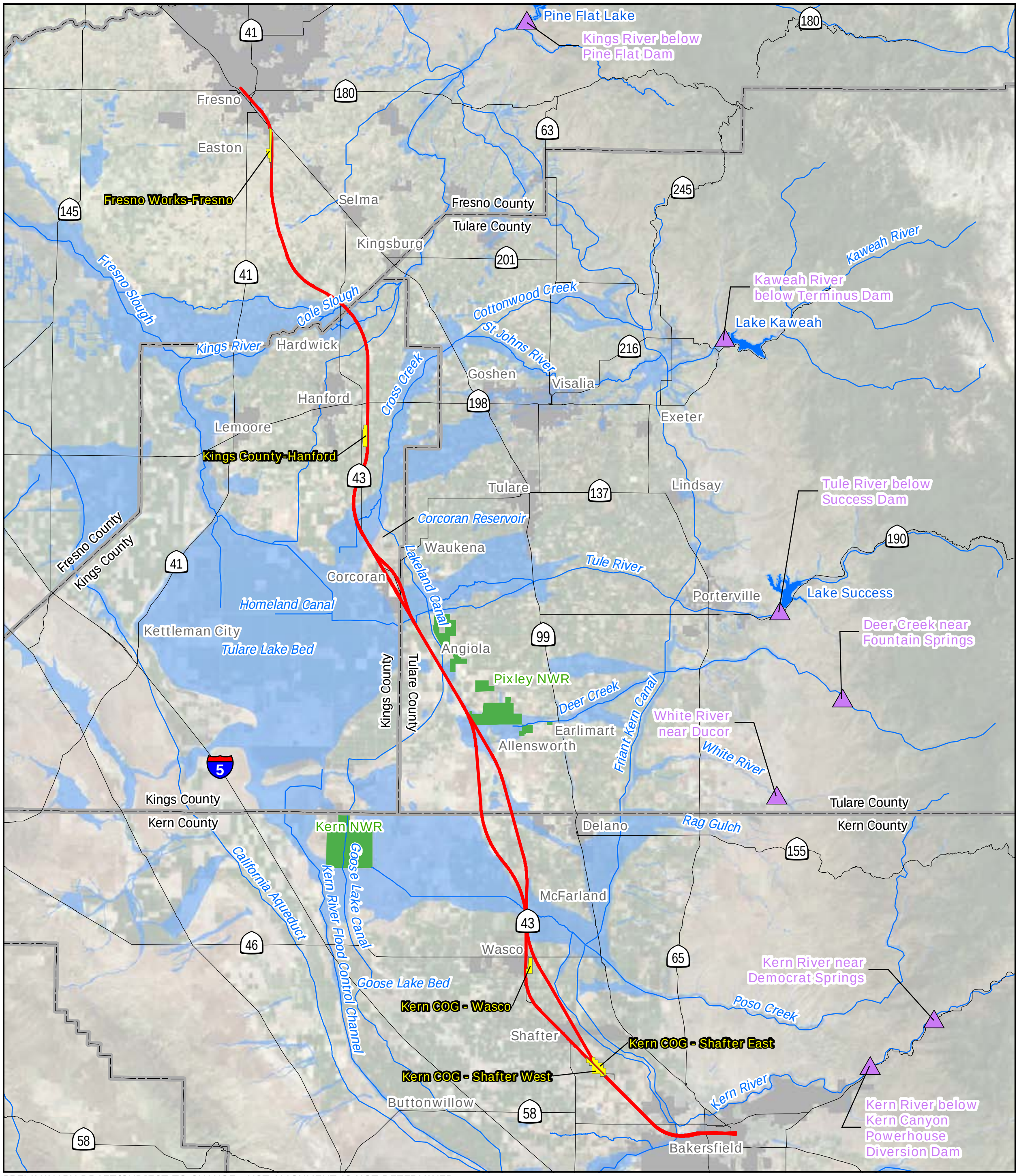
The existing conditions with respect to floodplains are based on available data, reports, studies, and topographic and floodplain mapping. The FEMA-designated 100-year floodplain areas were identified and mapped using GIS and are based on FEMA's FIRMs for Fresno, Kings, Tulare, and Kern counties. The special flood hazard area designations and BFE information were obtained from the FIRMs. 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).

The project study area has experienced several record flood events within the past 55 years. In Fresno County, record floods caused millions of dollars of property damage in December 1955, January 1956, and January/February 1969. Significant street flooding and property damage also occurred in 1978, 1983, 1986, 1991, 1992, 1993, and 1995 (FMFCD 2004).

The most severe flooding problems on the Kern River near Bakersfield resulted from high-intensity winter rainstorms, which generally occur from November through April. Snowmelt floods, which usually occur in the late spring and early summer, generally have a longer period of runoff and also a lower peak than rain floods. As a result, these spring events have rarely caused significant damage (City of Bakersfield and County of Kern 2009).

CVFPB-designated floodways within the project study area include Cole Slough, Kings River, Cross Creek, and Kern River. The flood season as defined by CVFPB for these floodways is November 1 through July 15. Floodway widths and their correspondence with the FEMA-designated 100-year floodplain are summarized in Table 4.1-1.

CVFPB-designated floodways were identified using designated floodway maps, which are available on the CVFPB website but are not digitized. The floodway maps have adoption dates of June 25, 1971 for Cole Slough and Kings River, June 12, 1985 for Cross Creek, and April 19, 1976 for Kern River (CVFPB 1971a, 1971b, 1976, 1985).



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

August 2, 2011

Data source: FEMA, 2009; CaSIL, 2005; URS, 2011

Base map source: Microsoft Corporation, 2009 and USGS NED

N

Miles: 0, 5, 10

Kilometers: 0, 10, 20

- USGS gaging station
- Alternative alignments
- Alternative heavy maintenance facility (HMF)
- Public land
- Stream/Canal
- Lake
- 100-year floodplain
- Highway
- Community/Urban area
- County boundary

Figure 4.1-1
Floodplains within Fresno to Bakersfield study area

Table 4.1-1
Floodplains and Floodways Crossed by the California High-Speed Train Alternative Alignments: Fresno to Bakersfield Section

Water Body	County	Alternative	FEMA Special Flood-Hazard Area[1]	Approximate Length of Floodplain Crossed (mile[s])	Crossing Type and Length (mile[s])	FEMA Base Flood Elevation or Depth near Crossing (feet)[2]	Approximate Length of FEMA Floodway Crossed (feet)[3]	CVFPB-Designated Floodway Width (feet)	FEMA FIRM Panel
Downtown Fresno	Fresno	BNSF Alternative	Zone AH	0.62	At-grade	El = 287 to 288	N/A	N/A	06019C2110H
Central Canal	Fresno	BNSF Alternative	Zone A Zone AE	0.02 0.03	Elevated, 0.02 At-grade	N/A El = 288	N/A	N/A	06019C2125H
Cole Slough	Fresno	BNSF Alternative	Zone A	0.38	Elevated, 0.06	N/A	N/A	200	06019C2950H
Dutch John Cut	Kings	BNSF Alternative	Zone A	0.35	Elevated, 0.13	N/A	N/A	500	06031C0100C
Kings River	Kings	BNSF Alternative	Zone A	1.86	Elevated, 0.12	N/A	N/A	400	06031C0100C
Cross Creek	Kings	Corcoran Bypass (and BNSF Alternative)[4]	Zone A Zone AE	2.03 (1.25) 1.85 (1.25)	At-grade (elevated, 0.64) Elevated, 1.65 (1.22)	N/A El = 212 to 214	2,000	9,000	06031C0375C
Tule River	Kings & Tulare	Corcoran Bypass (and BNSF Alternative)[4] Corcoran Elevated (BNSF Alternative)	Zone A Zone A	3.49 (3.81) 0.01 (0.01)	Elevated, 1.21 (0.06) Elevated, 0.01 (0)	N/A N/A	N/A	N/A	06031C0525, 06017C1550E
Local flooding (near Angiola)	Tulare	BNSF Alternative	Zone A Zone AH	1.47 1.08	At-grade At-grade	N/A El = 207	N/A	N/A	06107C1900E
Deer Creek[5]	Tulare	Allensworth Bypass (and BNSF Alternative)	Zone A Zone AO	0.41 (3.14) 3.18 (1.97)	At-grade Elevated, 0.96 (0.97)	N/A Depth = 1 to 2	N/A	N/A	06107C1900E, 06107C2250E
County Line Creek	Tulare & Kern	BNSF Alternative	Zone A	0.47	At-grade	N/A	N/A	N/A	06107C2275E, 06029C0200E
Poso Creek	Kern	Allensworth Bypass (BNSF Alternative) Wasco-Shafter Bypass	Zone A Zone A	2.76 (1.77) 0.89	Elevated, 0.03 (0.55) At-grade	N/A N/A	N/A	N/A	06029C0725E

Table 4.1-1
Floodplains and Floodways Crossed by the California High-Speed Train Alternative Alignments: Fresno to Bakersfield Section

Water Body	County	Alternative	FEMA Special Flood-Hazard Area[1]	Approximate Length of Floodplain Crossed (mile[s])	Crossing Type and Length (mile[s])	FEMA Base Flood Elevation or Depth near Crossing (feet)[2]	Approximate Length of FEMA Floodway Crossed (feet)[3]	CVFPB-Designated Floodway Width (feet)	FEMA FIRM Panel
Local flooding (City of Shafter)	Kern	BNSF Alternative	Zone AH Zone AO	0.31 0.003	Elevated, 0.31 Elevated, 0.003	El = 349 Depth = 1	N/A	N/A	06029C1275E, 06029C1775E
Local flooding (South of Shafter)	Kern	Wasco-Shafter Bypass (and BNSF Alternative)	Zone A	1.44 (1.84)	Elevated, 0.91 (0)	N/A	N/A	N/A	06029C1800E
Kern River	Kern	Bakersfield South (and BNSF Alternative)	Zone AE	1.13 (1.66)	Elevated, 1.13 (1.66)	El = 387 to 396	1,100–1,500	900–1,200	06029C2277E, 06029C2281E

[1] Special Flood-Hazard Areas (i.e., 100-year flood areas) 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

[2] 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.

[3] Crossing lengths estimated using GIS based on FEMA DFIRMs. Sources: CVFPB 1971a, 1971b, 1971c, 1976, 1985; FEMA 2008b, 2009a, 2009b, 2009c.

[4] The length of floodplain crossed by the Corcoran Elevated Alternative Alignment is the same as that of the BNSF Alternative; however, the Corcoran Elevated Alternative would replace 3.69 miles of at-grade track with an aerial structure.

[5] 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.

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

DWR manages FloodSAFE California, a program to improve flood management in California, particularly as it relates to the State/Federal flood protection system in the Central Valley (DWR 2008). One of the foundational objectives of the FloodSAFE program is to provide 200-year level (or greater) flood protection to all urban and urbanizing areas in the Sacramento–San Joaquin Valley by the end of 2025. Currently, the FloodSAFE program's southernmost boundary is located at the San Joaquin River, which is north of the project area (DWR 2003a).

4.2 Surface Water Hydrology

4.2.1 Climate

The climate within the project study area can be characterized as semi-arid, with the valley experiencing long, hot, dry summers and relatively mild winters. Monthly average, maximum, and minimum temperature data and daily maximum and minimum temperature data based on long-term records for several weather stations are presented in Table 4.2-1. Based on these long-term records, the average annual temperature for the project study area ranges from 62.4 to 65.2 degrees Fahrenheit (°F), the minimum daily temperature ranges from 14 to 20°F, and the maximum daily temperature ranges from 112 to 116°F.

The San Joaquin Valley and Sierra Nevada foothills commonly experience winds, generally from the northwest. Winds typically blow upward in the drainage basin in the early mornings and downward toward the valley in the evenings. The valley floor often experiences fog in late November through mid-February (USACE 1996).

The project study area is characterized by long, dry summers and intermittent wet periods. Heavy rainfall and snow in the western Sierra Nevada is the major source of water in the Tulare Lake Basin (Gronberg et al. 1998). Based on the long-term records of precipitation, the average annual precipitation in the project study area ranges from approximately 6.23 to 10.94 inches (see Table 4.2-2). Over 80% of precipitation in the project 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 over 20 inches (Gronberg et al. 1998).

Climate change has the potential to increase air temperatures and modify precipitation patterns in ways that would affect snowpack and runoff. Changes in the timing and amount of flow in streams could affect flooding and water supplies. As air temperatures increase, precipitation would likely fall as rain instead of snow. Heavier rains and increased runoff during winter months could increase the intensity and frequency of floods, which could damage housing, transportation, and infrastructure. The warmer temperatures may also cause the snow that does fall and accumulate to melt faster and earlier, making it more difficult to store and use runoff in the reservoirs upstream of the study area during the dry months in California. Projections indicate that temperatures could increase by 3°F to 9°F (CNRA 2009) and the snowpack in the Sierra Nevada could be reduced by at least 25% by 2050 (Luers and Mastrandrea 2008). A recent study conducted by DWR concluded that groundwater pumping would likely increase under climate change to augment reduced surface water supplies. The study estimated that annual groundwater pumping in the Sacramento Valley would be expected to increase by 5% to 9% by 2050 and by 13% to 17% by the end of the century (DWR 2009b). Due to the inland location of the study area and its elevation, predicted sea level rise due to climate change would not be expected to affect the proposed project. DWR addresses climate change in its California Water Plan, Update 2009 (DWR 2009a). The Water Plan, which is updated every 5 years, provides a framework for water managers, legislators, and the public to consider options, make decisions, and implement adaptation strategies (e.g., operational changes for reservoirs) to ensure that Californians have an adequate water supply, reliable flood control, and healthy ecosystems.

Table 4.2-1
Temperature Summary

Temperature (°F)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Fresno, California (1948-2005)													
Mean Monthly	46.0	51.1	55.3	61.2	68.8	76.0	81.8	80.0	74.9	65.4	53.7	45.9	63.3
Average Max.	54.4	61.5	66.9	74.6	83.4	91.6	98.1	96.2	90.5	79.8	65.2	54.6	76.4
Average Min.	37.6	40.6	43.7	47.8	54.1	60.2	65.4	63.7	59.3	50.9	42.2	37.2	50.2
Daily Max. Extreme	78.0	80.0	90.0	100.0	107.0	110.0	112.0	112.0	111.0	102.0	89.0	76.0	112.0
Daily Min. Extreme	18.0	24.0	26.0	32.0	36.0	44.0	50.0	49.0	37.0	27.0	26.0	18.0	18.0
Hanford, California (1927-2005)													
Mean Monthly	45.0	50.2	55.0	60.9	68.2	74.7	80.0	78.2	73.0	64.2	52.5	45.1	62.4
Average Max.	54.4	61.5	67.6	75.3	83.7	91.0	97.4	95.7	90.1	80.4	66.2	55.2	76.6
Average Min.	35.7	38.8	42.4	46.6	52.7	58.3	62.6	60.6	55.8	47.8	38.8	35.0	47.9
Daily Max. Extreme	76.0	86.0	89.0	98.0	107.0	111.0	116.0.	115.0	110.0	101.0	92.0	77.0	116.0
Daily Min. Extreme	15.0	22.0	25.0	31.0	34.0	39.0	47.0	45.0	35.0	28.0	18.0	15.0	15.0
Visalia, California (1927-2005)													
Mean Monthly	46.4	51.6	56.3	61.9	68.6	75.6	80.9	79.3	74.3	65.8	54.4	46.7	63.4
Average Max.	55.5	62.3	68.3	75.4	832.	91.3	97.2	96.0	90.1	80.6	66.6	56.1	76.9
Average Min.	37.3	40.9	44.5	48.5	54.0	59.8	64.5	62.6	58.4	51.0	42.2	37.3	50.1
Daily Max. Extreme	79.0	87.0	90.0	99.0	108.0	111.0	115.0	115.0	110.0	104.0	94.0	80.0	115.0
Daily Min. Extreme	20.0	24.0	27.0	32.0	37.0	42.0	50.0	49.0	39.0	31.0	26.0	21.0	20.0
Corcoran, California (1948-2005)													
Mean Monthly	45.5	50.8	55.4	61.3	69.0	75.9	81.1	79.4	74.3	65.1	53.2	45.4	63.0
Average Max.	54.5	61.9	68.0	76.1	85.3	93.0	98.9	96.9	91.2	81.1	66.0	54.9	77.3
Average Min.	36.5	39.7	42.7	46.5	52.7	58.6	63.3	61.8	57.3	49.2	40.4	35.8	48.7
Daily Max. Extreme	75.0	81.0	88.0	100.0	107.0	114.0	115.0	112.0	109.0	105.0	89.0	78.0	115.0
Daily Min. Extreme	14.0.	22.0	26.0	29.0	36.0	44.0	49.0	49.0	38.0	27.0	21.0	17.0	14.0
Wasco, California (1948-2005)													
Mean Monthly	46.0	51.5	56.5	62.4	69.8	76.9	82.3	80.5	75.3	65.7	83.8	45.9	63.9
Average Max.	56.1	63.5	69.8	77.31	85.5	93.5	99.3	97.5	91.9	81.9	67.2	56.6	78.3
Average Min.	35.8	39.5	43.5	47.9	54.2	60.4	65.4	63.4	58.7	49.6	40.4	35.2	49.5
Daily Max. Extreme	81.0	86.0	93.0	101.0	109.0	113.0	114.0	113.0	111.0	105.0	92.0	780	114.0
Daily Min. Extreme	19.0	22.0	26.0	31.0	39.0	43.0	49.0	46.0	41.0	29.0	23.0	14.0	14.0

Table 4.2-1
Temperature Summary

Temperature (°F)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Bakersfield, California (1937-2005)													
Mean Monthly	47.9	52.8	57.1	62.8	70.4	77.7	83.8	82.1	76.9	67.3	55.6	48.2	65.2
Average Max.	57.4	63.6	68.8	75.8	84.2	92.1	98.6	96.6	90.9	80.7	67.3	57.9	77.8
Average Min.	38.5	42.1	45.4	49.7	56.5	63.1	69.0	67.5	62.9	54.0	44.0	38.5	52.6
Daily Max. Extreme	82.0	87.0	94.0	101.0	107.0	114.0	115.0	112.0	112.0	103.0	91.0	83.0	115.0
Daily Min. Extreme	20.0	25.0	31.0	33.0	37.0	44.0	52.0	52.0	45.0	29.0	28.0	19.0	19.0

Notes:
ºF = degree(s) Fahrenheit
max. = maximum
min. = minimum
Source: Western Region Climate Center 2009.

Table 4.2-2
Average Monthly Precipitation

Station	Period of Record	Eleva-tion (feet)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Fresno	1948-2005	340	2.13	1.88	1.97	1.00	0.37	0.15	0.01	0.01	0.17	0.53	1.17	1.58	10.94
Hanford	1927-2005	250	1.58	1.53	1.46	0.72	0.24	0.08	0.01	0.01	0.13	0.37	0.82	1.28	8.22
Visalia	1927-2005	330	1.94	1.88	1.72	0.98	0.33	0.09	0.01	0.01	0.13	0.51	1.03	1.62	10.26
Corcoran	1948-2005	200	1.51	1.35	1.18	0.65	0.23	0.05	0.01	0.01	0.16	0.32	0.76	0.99	7.20
Wasco	1948-2005	350	1.29	1.30	1.25	0.68	0.24	0.10	0.01	0.02	0.13	0.31	0.67	0.83	6.83
Bakersfield	1937-2005	490	1.08	1.17	1.16	0.68	0.22	0.08	0.01	0.04	0.11	0.30	0.61	0.80	6.23

Notes:
Precipitation measured in inches.
ºF = degrees Fahrenheit
Source: Western Region Climate Center 2009.

4.2.2 Surface Water Features

As described above and shown on Figure 4.0-1, the project study area is entirely within the SVF subwatershed of the Tulare Lake Basin. Major surface water features in the Tulare Lake Basin include the Kings, Kaweah, Tule, and Kern rivers. These rivers flow westward from the Sierra Nevada and provide the majority of natural surface water supply in the Basin. The downstream reaches of these rivers, many of which have been altered, cross the alternative alignments within the SVF watershed. Due to storage and diversions upstream (i.e., east) of the project study area, the downstream reaches of these rivers are often dry. Elevations within the SVF watershed range from 154 feet to 4,131 feet (ICF Jones & Stokes 2008). Smaller 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. The canals are packed earth or concrete-lined, and generally lack the meanders, vegetation, biota, and other features of natural streams. No significant lakes or reservoirs are adjacent to or within the project footprint along the alternative alignments, although small farm ponds are relatively common.

The project study area crosses or is close to several water bodies. These water bodies are summarized in Table 4.2-3, and described from north to south in this section.

Table 4.2-3
Water Bodies Crossed by the California High-Speed Train Alternative Alignments: Fresno to Bakersfield Section

Water Body[1]	Type[2]	Alternative(s)	Approximate Crossing Width (feet)[3]	Crossing Method[4]
Braley Canal	C	BNSF	<50	Culvert
Fresno Colony Canal	C	BNSF	<50	Culvert
North Central Canal	C	BNSF	<50	Aerial structure
Central Canal	C	BNSF	<50	Culvert
Unnamed irrigation canal	C	BNSF	<50	Culvert
Unnamed irrigation canal	C	BNSF	<50	Culvert
Unnamed irrigation canal	C	BNSF	<50	Culvert
Harlan Stevens Ditch	C	BNSF	<50	Culvert
Davis Ditch	C	BNSF	<50	Culvert
Elkhorn Ditch	C	BNSF	<50	Culvert
Cole Slough	I	BNSF	250 for levees; 150 for main channel	Bridge
Dutch John Cut	I	BNSF	600 for levees; 100 for main channel	Bridge
Kings River	I	BNSF	500 for bank; 100 for main channel	Bridge
Riverside Ditch	C	BNSF	<50	Culvert or bridge
Peoples Ditch	C	BNSF	<50	Culvert or bridge
East Branch of Peoples Ditch	C	BNSF	<50	Culvert
Lakeside Ditch	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Melga Canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Guernsey Slough	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure

Table 4.2-3
Water Bodies Crossed by the California High-Speed Train Alternative Alignments: Fresno to Bakersfield Section

Water Body[1]	Type[2]	Alternative(s)	Approximate Crossing Width (feet)[3]	Crossing Method[4]
East Branch Lakeside Ditch	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Cross Creek	I	BNSF, Corcoran Elevated, Corcoran Bypass	100	Bridge
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
West Branch Lakeland Canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Sweet Canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Unnamed irrigation canal	C	BNSF, Corcoran Elevated, Corcoran Bypass	<50	Culvert or aerial structure
Tule River	I	BNSF, Corcoran Elevated, Corcoran Bypass	150	Bridge
Taylor Canal	C	BNSF	<50	Culvert
Unnamed irrigation canal	C	BNSF	<50	Culvert
Lakeland Canal	C	BNSF	<50	Culvert
Deer Creek	I	BNSF, Allensworth Bypass	50	Aerial structure
Stream crossing	I	BNSF	<50	Culvert
Unnamed creek	I	BNSF	<50	Aerial structure
Unnamed irrigation canal	C	Allensworth Bypass	<50	Culvert
Unnamed irrigation canal	C	Allensworth Bypass	<50	Culvert
Unnamed irrigation canal	C	BNSF, Allensworth Bypass	<50	Culvert
Poso Creek	I	BNSF, Allensworth Bypass	150	Bridge
Unnamed irrigation canal	C	BNSF, Wasco-Shafter Bypass	<50	Culvert
Unnamed irrigation canal	C	BNSF	<50	Culvert
Arvin Edison Canal	C	BNSF	<50	Aerial structure
Friant-Kern Canal	C	Bakersfield South	75	Aerial structure
Emery Ditch	C	BNSF	<50	Aerial structure
Cross Valley Canal	C	BNSF, Bakersfield South	100; 125 and 75	Aerial structure

Table 4.2-3
Water Bodies Crossed by the California High-Speed Train Alternative Alignments: Fresno to Bakersfield Section

Water Body[1]	Type[2]	Alternative(s)	Approximate Crossing Width (feet)[3]	Crossing Method[4]
Kern River[5]	P	BNSF, Bakersfield South	950; 750	Aerial structure
Carrier Canal	C	BNSF, Bakersfield South	150	Aerial structure
Stine Canal	C	BNSF, Bakersfield South	<50	Aerial structure
Kern Island Canal	C	BNSF, Bakersfield South	75	Aerial structure

Notes:
[1] Features identified from review of U.S. Geological Survey topographic maps and aerial photographs.
[2] Type: B = drainage or recharge basin, C = irrigation canal, I = intermittent, P = perennial.
[3] Crossing widths subject to change once HST alternative alignments are finalized.
[4] Based on 15% Conceptual Design. Where water bodies are crossed on fill (earthworks), culverts have been assumed to be the crossing method. Crossing method is subject to change as design progresses.
[5] HST alternative alignments do not cross perpendicularly to the Kern River; therefore, approximate crossing width is greater than the perpendicular width of Kern River.
HST = high-speed train

A. FRESNO AREA

Within the city of Fresno, and as part of the local stormwater drainage program, FMFCD operates and maintains a system that includes storm drains, detention and retention basins, and pump stations. Approximately 163 adopted or proposed drainage basins within the city of Fresno are (or will be) used for stormwater management and groundwater recharge. Additionally, the basins are part of the flood control program within the metropolitan area of Fresno (FMFCD 2009). The project study area passes through the drainage areas of several of the drainage basins within the city. One of the drainage basins (e.g., CE) is adjacent to the footprint of the project alternatives. See Table 4.2-4 for details on this drainage basin and other basins in the vicinity of the alternative alignments (see also Figure 4.2-1 for floodplains in Fresno) (FMFCD 2000, 2009).

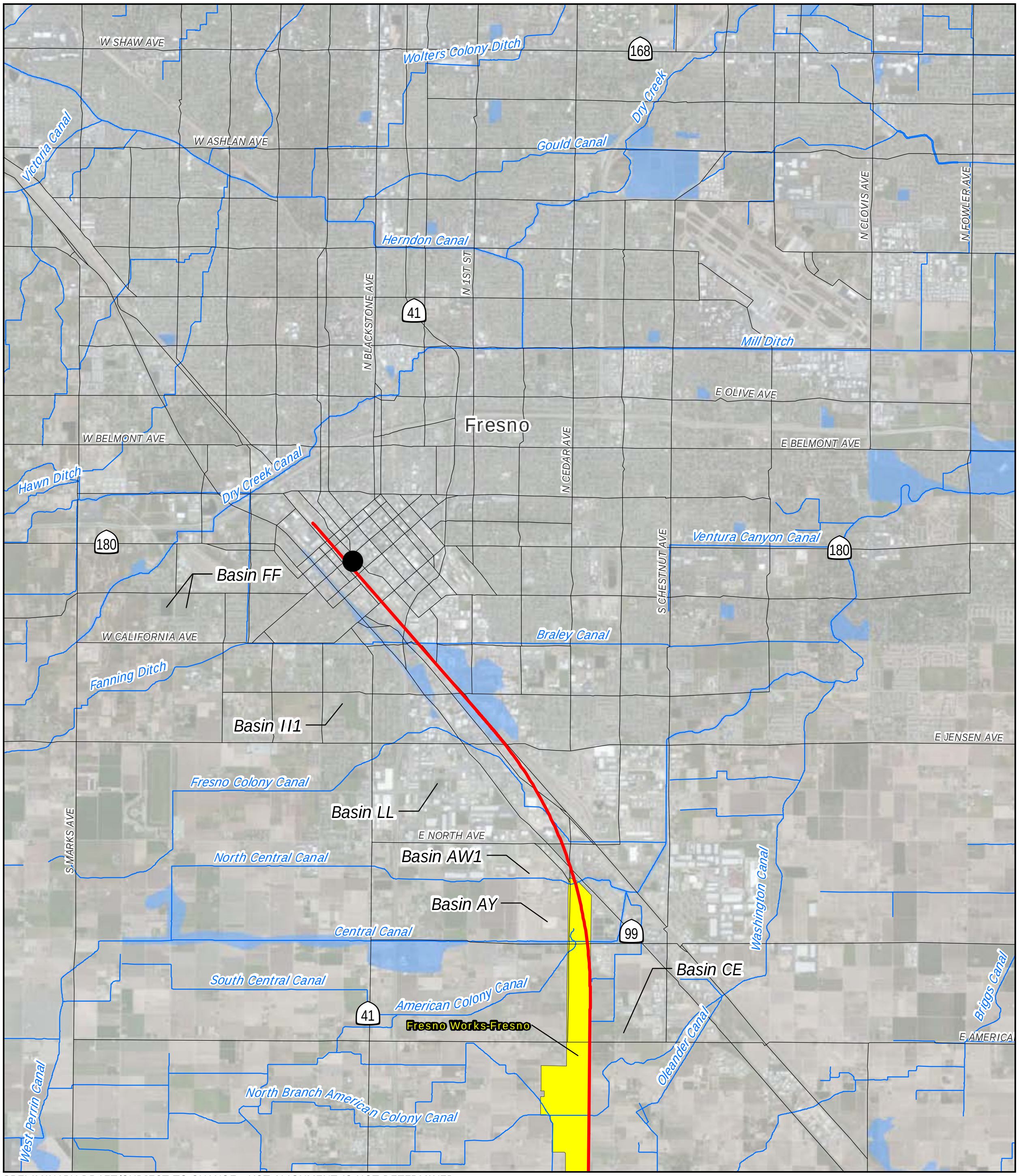
In addition to drainage basins, a canal system operated and maintained by FID is within the city of Fresno and is primarily used for the distribution of irrigation water. As part of an agreement among the city of Fresno, FID, and FMFCD, the canals are also used for flood control, as described in Section 3.3.2, and for transporting water to retention basins for the purpose of groundwater recharge. Braley, Fresno Colony, North Central, and Central canals cross the alternative alignments within the city limits (see Figure 4.2-1). One of the drainage basins near the alternative alignments discharges to one of these canals. Basin AW1 discharges to Fresno Colony Canal. However, stormwater is generally not discharged from retention basins unless necessary for flood control, which allows the majority of stormwater to percolate to groundwater (FMFCD 2009).

South of the city of Fresno limits, the alternative alignments cross Harlan Stevens, Davis, and Elkhorn ditches, approximately 5 miles south of the city of Fresno in unincorporated Fresno County. These ditches are irrigation canals.

Table 4.2-4
Fresno Metropolitan Flood Control District Basins in Vicinity of Alternative Alignments

FMFCD Basin ID[1, 2]	Approximate Distance from Alignment (feet)	Planned/ Proposed Secondary Use(s) of Basin[3]	Total Area of Basin (acres)[3]	Est. Area Available for Recharge (Typ. 75% Total)[3]	Expected Recharge Capacity (AF/yr.)[3]	Status of Basin Excavation (July 2000)[3]	Currently Intertied w/FID[3]	Drainage Area Size (acres)[4]
FF	6,000	Dual purpose	42.6	32.0	3,200	Complete	Yes	1983.3
II1	5,000	Dual purpose	14.6	11.0	750	Complete	Yes	2,072.6
LL	3,500	Recharge	18.7	14	800	Incomplete	Yes	523.3
AW1	1,500	Undetermined	9.8	7.4	N/A	Incomplete	No	276
AY	1,500	Undetermined	10.4	7.8	N/A	Incomplete	No	409.5
CE	0	Undetermined	16.9	12.7	N/A	Incomplete	No	535.2

Notes:
[1] This table includes basins within or adjacent to the project footprint and basins with drainage areas crossed by the alignments. See Figure 4.2-1 for the basin locations.
[2] The locations and names of the basins are from the FMFCD District Services Plan (FMFCD 2009).
[3] Secondary Uses of FMFCD Basins for Recreation and Recharge (FMFCD 2000).
[4] CVRWQCB, Order No. 5-01-048 (CVRWQCB 2001a).
AF/yr = acre-feet per year
CVRWQCB = Central Valley Regional Water Quality Control Board
FID = Fresno Irrigation District
FMFCD = Fresno Metropolitan Flood Control District
N/A = not available



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED

August 2, 2011

Data source: FEMA, 2009; CaSIL, 2005; URS, 2011

Base map source: Microsoft Corporation, 2009

N

0 1 2 Miles

0 2 4 Kilometers

- Station
- Alternative alignments
- Stream/Canal
- Alternative heavy maintenance facility
- 100-year floodplain

Figure 4.2-1
Floodplains in Fresno

B. COLE SLOUGH

Cole Slough is the primary river channel of the Kings River from Peoples Weir, approximately 7 miles northeast of the BNSF Alternative alignment, through northeastern Kings County to approximately 2 miles west of the BNSF Alternative (see Figure 4.1-1). Cole Slough was originally a small stream near the Kings River but became the main course of the river after floods in 1861 and 1867 (KRCD and KRWA 2009). The original Kings River channel is now known as Old River. Cole Slough is a CVFPB-designated floodway where it crosses the BNSF Alternative near the Fresno-Kings County boundary. See the Kings River description below for more details.

C. DUTCH JOHN CUT

Dutch John Cut connects Cole Slough with the Old River. Flow into Dutch John Cut is controlled by Dutch John Weir, which is approximately 2 miles east of the BNSF Alternative alignment. Dutch John Cut was created during the 1867 flood. The flow through Dutch John Cut to the Old River becomes the main flow of the Kings River, which continues downstream and eventually reaches the Tulare Lake bed (KRCD and KRWA 2009).

D. KINGS RIVER

The Kings River originates in the Sierra Nevada within the Kings River watershed and flows southwest approximately 125 miles from the foothills to the Tulare Lake bed. Elevations within the Kings River watershed range from 832 to 11,599 feet, with a mean elevation of 6,670 feet. The North, Middle, and South forks of the Kings River converge in the foothills upstream of Pine Flat Dam. Pine Flat Reservoir provides 475,000 acre-feet of flood control storage (see Figure 4.0-1 for location of Pine Flat Reservoir). Upstream of Pine Flat Dam, the Kings River drains approximately 1,545 square miles (USACE 1999). Downstream of dam, the 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. As described above, Cole Slough and Dutch John Cut are part of the Kings River system.

Streamflow data for the Kings River were collected at a U.S. Geological Survey (USGS) gaging station downstream of Pine Flat Dam and are summarized in Table 4.2-5. The river capacity is approximately 50,000 cfs downstream of Pine Flat Dam and decreases to 11,000 cfs approximately 55 miles downstream of Pine Flat Dam due to canal diversions (ICF Jones & Stokes 2008). At this location, the flow in the Kings River is divided into the Kings River North and Kings River South, which flow to the San Joaquin River and Tulare Lake bed, respectively. The Kings River North has a capacity of 4,750 cfs and flows into James Bypass, which, after extended wet periods, conveys water to Fresno Slough, approximately 30 miles east of Fresno. Water in Fresno Slough flows into the Mendota Pool on the San Joaquin River. The Kings River South has a flood channel capacity of 3,200 cfs, which is used for flood control after the Kings River North capacity has been reached (USACE 1999). The Kings River South merges with the Tule River Canal before entering the Tulare Lake bed. The Kings River flow typically ranges from 5,000 cfs in high-flow months to 0 cfs in low-flow months (ICF Jones & Stokes 2008). South of the Kings River crossing, the alignment crosses Riverside and Peoples ditches approximately 1 and 3 miles south of the Kings River crossing, respectively. These ditches are irrigation canals.

Table 4.2-5
Kings River Flows, 1983 to 1990

Month	USGS Gaging Stations[1] Kings River Below Pine Flat Dam, California[2] (cfs)		
	Minimum	Mean	Maximum
January	32	957	3,792
February	89	908	4,369
March	827	2,340	5,735
April	150	2,830	7,737
May	385	3,710	9,357
June	4,000	6,740	12,150
July	3,687	6,010	9,278
August	884	2,910	5,669
September	146	990	3,164
October	58	759	2,895
November	51	419	2,538
December	49	406	2,451

Notes:
[1] See Figure 4.1-1 for gaging station locations.
[2] Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11221500 - Kings River below Pine Flat Dam, California. The drainage area above the gaging station is 1,545 square miles. Data available only through September 1990 (USGS 2009a).
cfs = cubic feet per second
USGS = U.S. Geological Survey

E. KAWEAH RIVER

The Kaweah River, in Tulare County, originates in the Sierra Nevada and flows to Lake Kaweah, a reservoir formed by the Terminus Dam (see Figure 4.1-1). Elevations in the Kaweah River watershed range from 12,569 feet at the headwaters to 400 feet at the dam, with a mean elevation of 4,080 feet. The Kaweah River drainage area upstream from Terminus Dam covers approximately 561 square miles. The Terminus Dam was constructed in 1961 with a 142,000-acre-foot storage capacity (USACE 1999). The land surrounding Lake Kaweah is at an elevation just under 3,000 feet and has moderate to steep slopes.

Streamflow data for the Kaweah River were collected at a USGS gaging station downstream of Terminus Dam and are summarized in Table 4.2-6. The Kaweah River flows into the San Joaquin Valley, where it is joined by Dry Creek approximately 1 mile downstream of the Terminus Dam. Dry Creek drains approximately 82 square miles in the western Sierra Nevada, and ranges in elevation from 7,650 feet to 480 feet at its confluence with Kaweah River. The Kaweah River system has an average annual runoff of 442,200 acre-feet, and Dry Creek has an average annual runoff of 19,059 acre-feet (USACE 1996).

The Kaweah River divides into St. Johns River and Kaweah River 3 miles downstream of the Terminus Dam at the McKay's Point Weir, where the Kaweah River drainage area covers approximately 647 square miles (USACE 1999). Because of water management structures regulating the channel, several areas along the St. Johns River have standing water during periods when no water is released from the Terminus Dam. Additionally, St. Johns River receives flow from the Friant Kern Canal near Redbanks, California. The St. Johns River flows westward and meets Cottonwood Creek 23 miles west of McKays Point Weir to form Cross Creek, which crosses the BNSF Alternative Alignment. The Kaweah River continues westward and divides into many smaller distributary channels with capacities ranging from approximately 9 to 700 cfs. Mehrten and Yokohl creeks, which drain approximately 93 square miles, also flow into the Kaweah River below McKays Point (USACE 1996). Because much of the Kaweah River water is diverted for agricultural purposes, Kaweah River water reaches the Tulare Lake bed only under extended wet periods, including winter rain and spring snowmelt floods. Winter rain floods result from heavy precipitation and generally produce high peaks of short duration and comparatively small volumes between November and March. Spring snowmelt floods occur between March and July, and have longer durations and larger runoff volumes than winter floods (USACE 1996).

Table 4.2-6
Kaweah River Flows, 1983 to 1990

Month	USGS Gaging Stations[1] Kaweah River Below Terminus Dam, California[2] (cfs)		
	Minimum	Mean	Maximum
January	53	487	1,473
February	65	686	2,050
March	25	828	2,885
April	50	588	2,520
May	53	753	2,380
June	599	1,550	3,562
July	632	1,260	2,687
August	59	561	2,025
September	20	208	1,241
October	8.2	89	494
November	14	98	281
December	48	295	747

Notes:
[1] See Figure 4.1-1 for gaging station locations.
[2] Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11210950 - Kaweah River below Terminus Dam, California. The drainage area above the gaging station is 561 square miles. Data available only through September 1990 (USGS 2009b).
cfs = cubic feet per second
USGS = U.S. Geological Survey

F. CROSS CREEK

Cross Creek, a reach of the Kaweah River, is formed from the merging of Cottonwood Creek and St. Johns River in the eastern San Joaquin Valley. Cottonwood Creek flows from the foothills of the Sierra Nevada, and St. Johns River branches off the Kaweah River approximately 3 miles below the Terminus Dam. Cross Creek flows southwest approximately 35 miles through Tulare and Kings counties to the Tulare Lake bed. The creek is a CVFPB-designated floodway where it crosses the BNSF Alternative Alignment, the Corcoran Elevated, and the Corcoran Bypass Alternatives just north of Corcoran Reservoir and east of Highway 43.

The Corcoran Reservoir is located east of the alignment alternatives, approximately 3 miles north of the city of Corcoran. The reservoir is operated by Corcoran Irrigation District and is used for storage and recharge.

At the southern city limit of Corcoran, the BNSF Alternative Alignment crosses Sweet Canal. This canal is used for distribution of irrigation water and generally runs north-south.

The Lakeland Canal conveys water north-south to the east of the BNSF Alternative Alignment near Cross Creek and the city of Corcoran. The Lakeland Canal crosses the BNSF Alternative Alignment, Corcoran Elevated, and Corcoran Bypass approximately 3 miles north of Corcoran.

G. TULE RIVER

As shown on Figure 4.0-1, the headwaters of the Tule River are in the Southern Sierra subwatershed, along with the headwaters of Deer Creek, White River, and Poso Creek. The total drainage area of the Southern Sierra subwatershed is approximately 1,040 square miles (ICF Jones & Stokes 2008).

The Tule River originates in the Sierra Nevada Mountains 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 acre-feet. The Tule River drainage area upstream from Success Dam covers approximately 393 square miles (USACE 1999). From Lake Success, the Tule River flows generally westward across the San Joaquin Valley floor to the Tulare Lake bed. Streamflow data for the Tule River were collected at a USGS gaging station below Success Dam, and are summarized in Table 4.2-7. During summer, the 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. The Friant-Kern Canal also provides flow to the Tule River during summer. Tule River water that reaches the Tulare Lake bed either is stored for irrigation or evaporates (ICF Jones & Stokes 2008).

H. 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 at an elevation just below 500 feet. Streamflow data for Deer Creek were collected at a USGS gaging station in the Sierra Nevada foothills, and are summarized in Table 4.2-8. Deer Creek flows through the Pixley National Wildlife Refuge (NWR), which is on the valley floor east of Highway 43, and crosses the BNSF Alternative Alignment and the Allensworth Bypass Alternative. Deer Creek is a small ditch at the Pixley NWR, and discharges to Homeland Canal approximately 2 miles west of the BNSF Alternative Alignment.

Table 4.2-7
Tule River Flows, 1983 to 1990

Month	USGS Gaging Stations[1] Tule River Below Success Dam, California[2] (cfs)		
	Minimum	Mean	Maximum
January	20	218	626
February	0.3	355	1,496
March	10	441	1,983
April	44	225	1,113
May	20	187	1,059
June	34	245	1,151
July	84	261	440
August	46	224	687
September	22	135	520
October	8.1	113	285
November	0.5	58	184
December	2.7	117	318

Notes:

[1] See Figure 4.1-1 for gaging station locations.

[2] Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11204900 – Tule River below Success Dam, California. The drainage area above the gaging station is 393 square miles. Data available only through September 1990 (USGS 2009c).

cfs = cubic feet per second

USGS = U.S. Geological Survey

Table 4.2-8
Deer Creek Flows, 1998 to 2007

Month	USGS Gaging Station[1] Deer Creek Near Fountain Springs, California[2] (cfs)		
	Minimum	Mean	Maximum
January	12	29	68
February	15	63	364
March	22	59	213
April	13	76	318
May	6.1	52	211
June	2.1	27	153
July	0.1	10	67
August	0	4.5	29
September	0	3.4	20
October	1.6	5.1	19
November	3.1	13	45
December	8.5	15	26

Notes:
[1] See Figure 4.1-1 for gaging station location.
[2] Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11200800 – Deer Creek near Fountain Springs, California. The drainage area above the gaging station is 83 square miles (USGS 2009d).
cfs = cubic feet per second
USGS = U.S. Geological Survey

I. WHITE RIVER

White River flows west from the foothills of the Sierra Nevada in the southern part of Tulare County (see Figure 4.1-1). Streamflow data for White River were collected at a USGS gaging station in the Sierra Nevada foothills and are summarized in Table 4.2-9. Flow gradually decreases as White River flows westward (DWR 2004b), and is generally dry by the time it reaches the valley east of the alternative alignments.

Table 4.2-9
White River Flows, 1998 to 2005

Month	USGS Gaging Station White River Near Ducor, California (cfs)[1]		
	Minimum	Mean	Maximum
January	3.6	16.0	21.0
February	3.4	32.0	155.0
March	7.6	28.0	107.0
April	2.9	32.0	165.0
May	0.4	22.0	88.0
June	0.9	9.3	59.0
July	0.9	2.8	21.0
August	0.9	0.9	6.9
September	0.0	0.7	5.4
October	0.0	1.1	7.7
November	0.0	4.0	12.0
December	2.1	10.0	25.0

Note:
[1] See Figure 4.1-1 for gaging station location. Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11199500 – White River near Ducor, California. The drainage area above the gaging station is 91 square miles. Data available only through September 2005 (USGS 2009e).
cfs = cubic feet per second
USGS = U.S. Geological Survey

J. RAG GULCH

Rag Gulch flows westward from the foothills of the Sierra Nevada in northern Kern County (see Figure 4.1-1). Although generally dry by the time it reaches the alternative alignments, the flows from Rag Gulch contribute to flooding where the BNSF Alternative Alignment and the Allensworth Bypass Alternative cross the FEMA 100-year floodplain at the Tulare/Kern County border. Flows from Dyer Creek—a small stream approximately 5 miles south of Rag Gulch—also contribute to flooding.

K. 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 Cawelo Water District's Reservoir B for the purpose of intentional recharge (CVRWQCB 2007b). Water produced during oil operations at Poso Creek Oil Field is also discharged to Poso Creek via an unnamed ephemeral stream. Poso Creek flows to the Kern National Wildlife Refuge (CVRWQCB 2007c; SWRCB 2008), which is approximately 15 miles downstream of the project study area (see Figure 4.1-1).

L. KERN RIVER

The Kern River headwaters are in the Sierra Nevada within the Kern River watershed. The watershed is characterized by steep river canyons and large mountains, and elevations range from 489 feet to 14,478 feet, with a mean elevation of 6,791 feet. The Kern River, its forks, and Lake Isabella are the major water features within the watershed (see Figure 4.1-1) (ICF Jones & Stokes 2008). The Kern River flows generally southwest through the city of Bakersfield to the Buena Vista Lake bed. Isabella Dam was constructed in 1953 and is on the Kern River approximately 35 miles northeast of Bakersfield. The Kern River drainage area upstream of Isabella Dam covers approximately 2,074 square miles (USACE 1999). The primary purpose of the dam and the reservoir created by the dam, Lake Isabella, is to provide flood control and is operated so that the maximum flow in the Kern River at the Pioneer Turnout near Bakersfield does not exceed the capacity of the river channel, which is 4,600 cfs (USACE 2008b). Lake Isabella has a capacity of approximately 570,000 acre-feet, and also provides water for irrigation (Gronberg et al. 1998). Streamflow data for the Kern River downstream of Lake Isabella were collected at USGS gaging stations and are summarized in Table 4.2-10. In the valley, the Kern River is bordered by conveyance and diversion canals for much of its length, and its water is diverted for consumptive use or groundwater recharge (ICF Jones & Stokes 2008).

Within Bakersfield, the project study area crosses the Kern River, which has regulated uses per the Bakersfield Zoning Code. The city of Bakersfield Planning Division has zoned the Kern River and adjacent land as Floodplain Primary and Floodplain Secondary zones, respectively. Within the Floodplain Primary Zone, which includes the Kern River's natural streambed, the city restricts uses that will obstruct flood flow or cause peripheral flooding of other properties. The city also regulates uses of the land adjacent to the Kern River in the Floodplain Secondary Zone, and requires conditional use permits for most development projects.

Within the valley floor, many canals distribute water throughout the Bakersfield area. Beginning in the 1800s, thousands of miles of canals and laterals (i.e., small, often hand-dug canals) were constructed to drain wetlands and provide water for agricultural irrigation. By 1900, the Kern River had been diverted by a series of canals constructed to serve agricultural lands throughout the southern San Joaquin Valley (Gronberg et al. 1998). Over time, portions of some of the original canals are now underground pipes, and others have been abandoned.

Within the project study area, the Kern River is adjacent to several canals. The alternative alignments cross the Friant-Kern and Cross Valley canals within Bakersfield, in addition to various other diversion canals, including the Arvin Edison Canal, Emery Ditch, Cross Valley Canal, Carrier Canal, Stine Canal, Kern Island Canal, and East Side Canal. The Cross Valley Canal conveys water from the California Aqueduct eastward for agricultural purposes and westward to Bakersfield for treatment and groundwater recharge (KCWA 2004). The canal crossings are shown on Figure 4.2-2 and summarized in Table 4.2-3.

Table 4.2-10
Kern River Flows, 1998 to 2007

Month	USGS Gaging Stations[1] (cfs)					
	Kern River near Democrat Springs, California[2]			Kern River below Kern Canyon Powerhouse Diversion Dam near Bakersfield, California[3]		
	Min	Mean	Max	Min	Mean	Max
January	48	269	873	30	206	630
February	22	326	1,123	73	355	1,234
March	20	282	1,052	49	227	852
April	60	392	1,600	26	243	1,543
May	152	1,160	4,403	29	951	3,378
June	511	1,730	4,175	229	1,490	4,191
July	626	1,460	3,393	307	1,190	3,375
August	264	955	2,711	50	675	2,667
September	54	480	1,470	18	259	1,442
October	23	310	1,089	27	181	1,134
November	23	261	1,146	23	165	1,093
December	24	160	492	22	65	227

Notes:

[1] See Figure 4.1-1 for gaging station locations.

[2] Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11192500 – Kern River near Democrat Springs (river only), California. The drainage area above the gaging station is 2,258 square miles (USGS 2009f).

[3] Streamflow data are monthly mean discharges based on daily averages for USGS Gaging Station No. 11192950 – Kern River below Kern Canyon Powerhouse Diversion Dam near Bakersfield, California. (USGS 2009g).

cfs = cubic feet per second
max = maximum
min = minimum
USGS = U.S. Geological Survey

The Kern River Intertie connects the Kern River with the California Aqueduct to allow diversion of flood flows when capacity is available in the California Aqueduct. The Intertie is downstream from the Buena Vista inlet and provides flood protection to the Tulare Lake bed (USACE 1999).

The Kern River is on the USACE Sacramento District's list of "navigable-in-fact" traditionally navigable waters. 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 Part 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 Part 329.14). The other rivers crossed by the HST are not listed as navigable or navigable-in-fact.

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Data source: FEMA, 2009; CaSIL, 2005; URS, 2011

Base map source: Microsoft Corporation, 2009

Figure 4.2-2

Floodplains in Bakersfield

4.3 Surface Water Quality

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

The CVRWQCB identified the following beneficial uses for natural surface waters within Tulare Lake Basin: 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; cold freshwater habitat; wildlife habitat; rare, threatened, or endangered species; spawning, reproduction, and/or early development; groundwater recharge; and freshwater replenishment (CVRWQCB 2004). None of the natural streams within Tulare Lake Basin are designated for navigational use. The CVRWQCB has not identified beneficial uses for the canals in the area; however, canals that are connected to natural surface waters generally have the same designations as the natural feature. Table 4.3-1 summarizes the beneficial uses of water bodies in the study area.

A few of the water bodies crossed by the alternative alignments are on the Section 303(d) list and require TMDL limits (CVRWQCB 2007a, 2009) (see Table 4.3-1). These water bodies include the Kings River, Cross Creek, and Deer Creek in the project area, as well as Kaweah River upstream of the project study area. The Kings River, Cross Creek, and Deer Creek are identified as being impaired with an unknown toxicity as stated in the 2009 Proposed Changes to the 303(d) List (CVRWQCB 2009). The proposed changes to the 303(d) list also include an impairment of high pH for Deer Creek in the study area (CVRWQCB 2009). Approximately 10 miles downstream of the alternative alignments from Island Weir to Stinson and Empire weirs, the lower portion of the Kings River is identified as impaired for electrical conductivity, molybdenum, and toxaphene. Approximately 55 miles downstream of the alternative alignments crossings, the Kings River North discharges to the Mendota Pool and San Joaquin River after extended wet periods through Fresno Slough. The Mendota Pool and San Joaquin River (between Friant Dam and Mendota Pool) are identified as impaired for selenium and exotic species, respectively. Lake Kaweah, approximately 50 miles upstream from the alternative alignments, drains into the Kaweah River, St. John's River, and Cross Creek, and is listed as impaired for mercury (CVRWQCB 2007a).

The Kaweah River and Lake Kaweah are used for fish and wildlife habitat, irrigation water, hydropower, and recreation. Concentrations of pesticides, herbicides, and polychlorinated biphenyls (PCBs) are below reportable levels in the lake. Potential sources of contamination at Lake Kaweah include septic facilities for a nearby campground and rural community, and the former site of a leaking underground gasoline storage tank owned by Tulare County (USACE 1996).

Table 4.3-1
Surface Water Quality

Water Body [1]	Approximate Milepost or Station (TBD)	Tulare Lake Basin Plan Beneficial Uses [2]														303(d) Listed Pollutants
		MUN	AGR	IND	PRO	POW	REC-1	REC-2	WARM	COLD	WILD	RARE	SPWN	GWR	FRSH	
Cole Slough																
Kings River (Peoples Weir to Stinson Weir on North Fork and to Empire Weir No. 2 on South Fork)			X				X	X	X		X			X		Electrical conductivity, molybdenum, toxaphene unknown toxicity[3, 4]
Cross Creek (Kaweah River, Below Lake Kaweah)[5]		X	X	X	X		X	X	X		X			X		Unknown toxicity[6]
Corcoran Reservoir[7]																
Tule River (Below Lake Success)		X	X	X	X		X	X	X		X			X		
Lakeland Canal/ Homeland Canal[7]																
Deer Creek																pH, unknown toxicity[8]
White River																
Stream Crossing																
Poso Creek			X				X	X	X	X	X			X	X	
Kern River (Below KR-1)		X	X	X	X	X	X	X	X		X	X		X		

Notes:
1 Features identified from review of USGS topographic maps and aerial photographs.
2 Surface water beneficial uses identified in the Tulare Lake Basin Plan (CVRWQCB 2004).

MUN = municipal and domestic water supply
AGR = agricultural supply
IND = industrial service supply
PRO = industrial process supply
POW = hydropower generation
REC-1 = water contact recreation
REC-2 = noncontact water recreation
WARM = warm freshwater habitat
COLD = cold freshwater habitat
WILD = wildlife habitat
RARE = rare, threatened, or endangered species
SPWN = spawning, reproduction, and/or early development
GWR = groundwater recharge
FRSH = freshwater replenishment

3 Kings River is impaired approximately 10 miles downstream of study area (from Island Weir to Stinson and Empire Weirs). After extended wet periods, Kings River conveys water to Mendota Pool and San Joaquin River (from Friant Dam to Mendota Pool), approximately 55 miles downstream of the study area (CVRWQCB 2007a).
4 Kings River has a proposed impairment of unknown toxicity in the study area (from Pine Flat Reservoir to Island Weir) per the 2009 Proposed Changes to the 303(d) List (CVRWQCB 2009).
5 Lake Kaweah, which provides flow to the Kaweah River and Cross Creek, is impaired approximately 50 miles upstream of study area (CVRWQCB 2007a).
6 Cross Creek has a proposed impairment of unknown toxicity in the study area (Kings and Tulare counties) per the 2009 Proposed Changes to the 303(d) List (CVRWQCB 2009).
7 CVRWQCB has not identified beneficial uses for these manmade water features.
8 Deer Creek has a proposed impairment of pH (high) and unknown toxicity in the study area (Tulare County) per the 2009 Proposed Changes to the 303(d) List (CVRWQCB 2009).

4.4 Erosion

Erosion is a major contributing factor to the degradation of surface water quality in the Central Valley. Silt and sand carried by stormwater runoff are the products of continuing soil erosion within the Sierra Nevada watersheds. As the topography flattens across the alternative alignments, soil is deposited and accumulates slowly in the channels. The accumulated material gradually decreases the channel capacity and forces floodwaters increasingly farther into the surrounding floodplain. Additionally, urbanization and suburbanization create impervious surfaces that result in increased stormwater runoff and increased flow velocities that can increase the potential to erode natural stream channels. Upland erosion also causes sedimentation in the floodplains adjacent to the smaller streams and creeks, slowly decreasing their capacity to alleviate downstream flooding. According to Figure 3.14-7, Erodible Soils Statewide (North) in the Statewide Programmatic EIR/EIS (Authority and FRA 2005), the HST Fresno to Bakersfield corridor, which includes all of the alternative alignments evaluated in this report, does not cross any areas of erodible soils.

4.5 Groundwater

Groundwater in the region is present in unconfined or semi-confined conditions as a part of the San Joaquin Valley groundwater basin. Most of the San Joaquin Valley floor is underlain by several thousand feet of Tertiary or older sediments, which were deposited on a basement complex of granitic and metamorphic rocks. Water is stored in relatively coarse-grained geologic units, such as the Mehrten Formation, which are sand and gravel zones.

Groundwater levels fluctuate with seasonal rainfall, withdrawal, and recharge. The large demand for groundwater has caused subsidence in some areas of the Valley, primarily along its western side and southern end (DWR 2003b). Depth to groundwater in the San Joaquin Valley ranges from a few inches to more than 100 feet. The project 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. Table 4.5-1 summarizes the groundwater subbasins crossed by the alternative alignments, and Figure 4.5-1 shows where the alternative alignments pass through those subbasins. The aquifers in the subbasins are generally thick, with wells often extending 1,000 feet below ground surface (bgs). Freshwater-bearing deposits reach their maximum thickness of 4,400 feet at the southern end of the San Joaquin Valley (DWR 2003b).

Groundwater is a major water supply source in the region. Numerous large- and small-scale districts provide domestic water service to the communities. The predominant water supply source for domestic use within unincorporated communities is the individual private well system. Additional information on water supply is provided in the public utilities discussion of the EIR/EIS.

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 2003b). Septic disposal systems and leach fields are potential sources of nitrate contamination in groundwater, and such uses generally must be approved at a local level, based on local soil conditions and the potential for contamination.

Table 4.5-1
Groundwater Subbasins Crossed by the California High-Speed Train Alignment Alternatives: Fresno to Bakersfield Section

Groundwater Basin (Name)[1]	Total Groundwater Basin Area (Acres)[1]	Groundwater Storage (AF)[1]	Typical Well Depths (feet)[1]	Approximate Length of Groundwater Basin Crossed (miles)[2]	Approximate Area of Groundwater Basin Crossed by HST (acres)[3]	Designated Sole-Source Aquifer[4]
Kings Subbasin	976,000	93,000,000	100 to 500	17	206	Yes
Tulare Lake Subbasin	524,000	12,100,000	150 to 2000	25	300	No
Kaweah Subbasin	446,000	15,400,000	100 to 500	5	60	No
Tule Subbasin	467,000	14,600,000	200 to 1400	25	300	No
Kern County Subbasin	1,945,000	40,000,000	150 to 1200	40	485	No

[1] Basin areas, storage, and well depths are from Bulletin 118 (DWR 2004a, 2004b, 2006a, 2006b, 2006c).

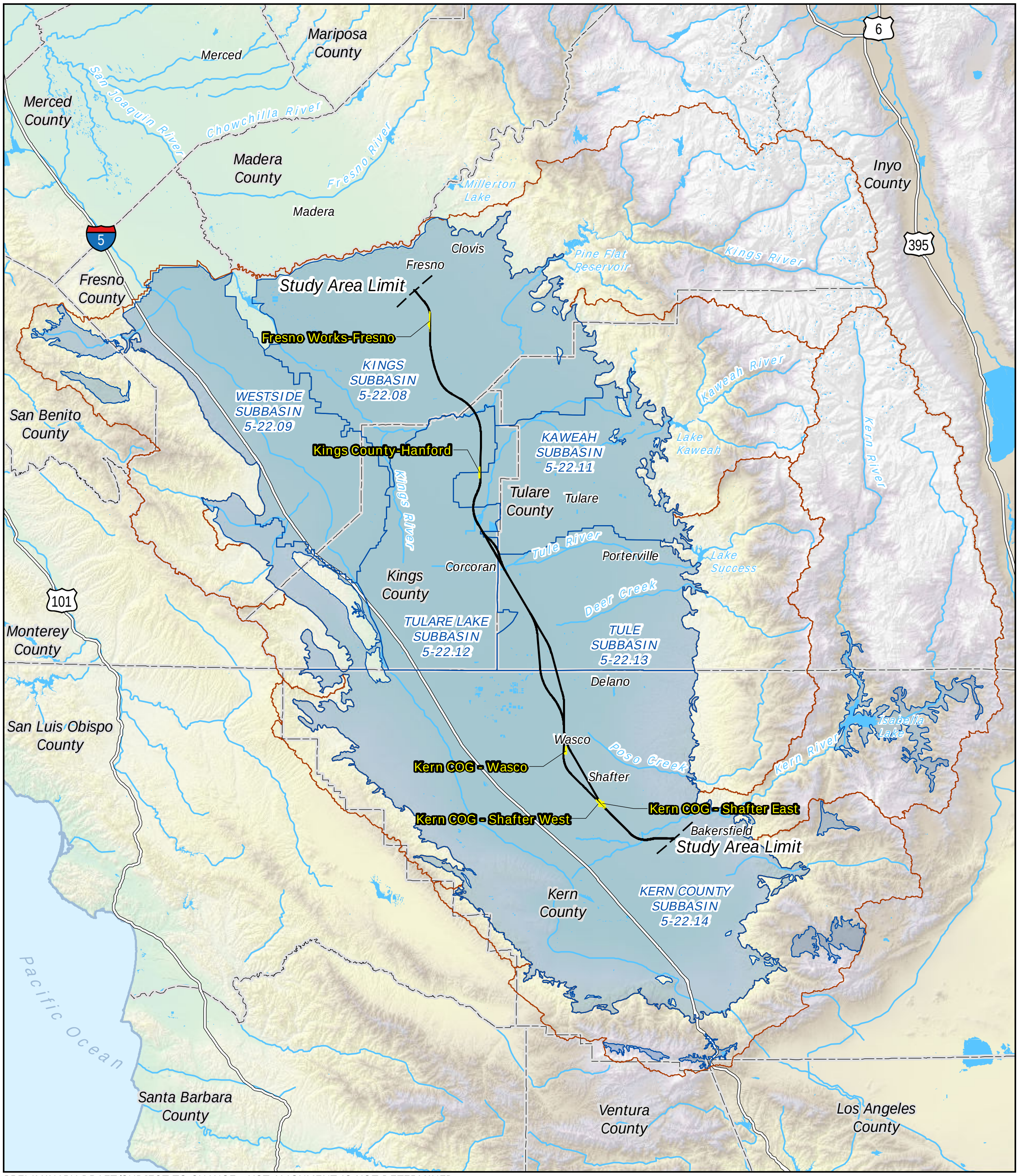
[2] Length subject to change once HST alignment is finalized.

[3] Area based on length of groundwater basin crossed multiplied by width of HST alignment corridor. Corridor width assumed to be 100 feet.

[4] The U.S. 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).

AF = acre-feet

HST = high-speed train



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Source: Department of Water Resources, Division of Mines and Geology, 2000; URS, 2011

N

0 10 20
Miles

0 20 40
Kilometers

Groundwater basin

Subwatershed boundary

Footprint of heavy maintenance facility (HMF)

Alternative alignments

County boundary

Figure 4.5-1
Groundwater basins

4.5.1 Kings Subbasin

The Kings Subbasin is bounded by both natural features and irrigation district boundaries. Natural boundaries include the San Joaquin River to the north, the Delta-Mendota and Westside subbasins to the west, and the Sierra Nevada foothills to the east. The northern portion of the project study area is in the Kings Subbasin in the San Joaquin Valley Groundwater Basin. In Fresno, depth to groundwater ranges from approximately 90 to 150 feet bgs. In the vicinity of the alternative alignments, depth to groundwater is approximately 60 feet bgs south of Fresno to the southern boundary of the subbasin. However, depth to groundwater is as shallow as 10 feet bgs in the eastern portion of the subbasin near the Friant-Kern Canal, and as deep as 190 feet bgs in the western portion of the subbasin (DWR 2005). Groundwater flows generally southwest.

Groundwater storage in the Kings Subbasin was estimated to be approximately 93,000,000 acre-feet to a depth of approximately 1,000 feet in 1961. Water levels in the subbasin have declined up to 50 feet since 1976 in response to droughts, and are currently recovering to mid-1980s levels (DWR 2006a). The Kings Subbasin benefits from groundwater recharge by river and stream seepage, deep percolation of irrigation water, canal seepage, and intentional recharge.

The City of Fresno partners with FID and FMFCD to replace lost groundwater through artificial recharge. Excess surface water is directed into the ground at Leaky Acres Groundwater Recharge Facility, and smaller facilities in southeast Fresno, to replenish the underlying aquifer. Leaky Acres is a 200-acre facility that receives approximately 55 acre-feet per day for the purpose of recharging groundwater supply (City of Fresno 2009). Leaky Acres is approximately 5 miles northwest of the alternative alignments. Recharge basins within or near the study area are summarized in Table 4.2-4.

Groundwater in the eastern portion of the subbasin contains dibromochloropropane, a soil fumigant nematicide, and nitrates. The western portion of the Kings Subbasin contains shallow brackish groundwater. Localized areas within the Kings Subbasin contain elevated concentrations of fluoride, boron, and sodium (DWR 2006a).

The city of Fresno depends on groundwater for its water supply, and the Fresno County Aquifer, in Kings Subbasin, is considered a U.S. EPA-designated sole-source aquifer (U.S. EPA 2009). Within the project study area, the state has identified the following beneficial uses for groundwater in the subbasin: municipal and domestic supply, agricultural supply, industrial service supply, industrial process supply, and water recreation (both contact and non-contact).

4.5.2 Tulare Lake Subbasin

The alternative alignments run through Tulare Lake Subbasin, which comprises a total area of 524,000 acres, primarily in Kings County (ICF Jones & Stokes 2008). The subbasin is bounded by the Kings Subbasin to the north, the Kings-Kern county line to the south, and the Kaweah and Tule Subbasins to the east. The California Aqueduct, Westside Subbasin, and Tertiary marine sediments of the Kettleman Hills make up the western boundary. Depth to groundwater is approximately 115 feet bgs near Hanford, and approximately 110 feet bgs near Corcoran (DWR 2005).

Recharge is primarily from infiltration along stream channels and from applied irrigation water. On an average annual basis, natural recharge from streams is estimated to be approximately 89,200 acre-feet per year (afy), and recharge from applied irrigation water is estimated to be approximately 195,000 afy. Storage capacity in the subbasin is estimated at approximately 17,100,000 acre-feet to a 300-foot depth, and 82,500,000 acre-feet to the base of fresh groundwater. Tulare Lake Subbasin storage was estimated at 12,100,000 acre-feet to a depth of 300 feet in 1995, and at 37,000,000 acre-feet to depths up to 1,000 feet in 1961 (DWR 2006c).

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

Groundwater in the Tulare Lake Subbasin has typical TDS values ranging from 200 to 600 micrograms per liter. In drainage problem areas, shallow groundwater TDS values can be as high as 40,000 micrograms per liter. The southern portion of the subbasin has areas of shallow, saline groundwater and localized areas of high arsenic. Additionally, the presence of hydrogen sulfide has been reported in Hanford (DWR 2006c).

The Tulare Lake Subbasin is not a U.S. EPA-designated or state-designated sole-source aquifer (U.S. EPA 2009; CVRWQCB 2004). Within the project study area, the state has identified the following beneficial uses for groundwater in the subbasin: municipal and domestic supply, agricultural supply, industrial service supply, and industrial process supply.

4.5.3 Kaweah Subbasin

The Kaweah Subbasin is south of the Kings Subbasin and covers approximately 446,000 acres, primarily in Tulare County, with a small area in Kings County. The Kaweah Subbasin is bounded on the north by the Kings Subbasin, on the south by the Tule Subbasin, on the west by the Tulare Lake Subbasin, and on the east by bedrock beneath the Sierra Nevada foothills (ICF Jones & Stokes 2008). Depth to groundwater ranges from approximately 30 feet bgs in the eastern portion of the subbasin to approximately 100 feet bgs in the western portion near the proposed alignment south of Hanford (DWR 2005).

Groundwater recharge in the Kaweah Subbasin is primarily from stream seepage from the Sierra Nevada and percolation of applied irrigation water (ICF Jones & Stokes 2008). Annual natural recharge is approximately 62,400 acre-feet. Approximately 286,000 acre-feet of applied irrigation water enters the subbasin annually. The Lakeside Irrigation District has recharged the subbasin in quantities ranging from 7,000 afy to 30,000 afy depending on the amount of precipitation received that year. Urban and agricultural groundwater extractions are estimated at 58,800 and 699,000 afy, respectively (DWR 2004a). Groundwater levels in the Kaweah Subbasin declined 12 feet from 1970 to 2000. Groundwater levels were observed to fluctuate as much as 60 feet over the 30-year period (DWR 2004a). Storage capacity in the subbasin is estimated at approximately 15,400,000 acre-feet to a depth of 300 feet and 107,000,000 acre-feet to the base of fresh groundwater (DWR 2004a).

Groundwater within the Kaweah Subbasin flows generally to the southwest with possible outflow westward and southward to the Tulare Lake Subbasin (ICF Jones & Stokes 2008). The eastern portion of the subbasin has high concentrations of nitrates. Additionally, high-salinity groundwater has been detected east of Visalia (DWR 2004a).

The Kaweah Subbasin is not a U.S. EPA-designated or state-designated sole source aquifer (U.S. EPA 2009; CVRWQCB 2004). Within the project study area, the state has identified the following beneficial uses for groundwater in the subbasin: municipal and domestic supply, agricultural supply, industrial service supply, industrial process supply, and water recreation (both contact and non-contact).

4.5.4 Tule Subbasin

The alternative alignments pass over the 467,000-acre Tule Subbasin. The Tule Subbasin is in Tulare County and bounded on the north by Kaweah Subbasin, on the south by the Kern County Subbasin, on the west by the Tulare Lake Subbasin, and on the east by bedrock beneath the

Sierra Nevada foothills (ICF Jones & Stokes 2008). Depth to groundwater ranges from approximately 40 feet bgs in the northeastern part of the subbasin to approximately 200 feet bgs near Pixley NWR (DWR 2005).

Groundwater in Tule Subbasin is extracted for urban and agricultural purposes, estimated at 19,300 and 641,000 afy, respectively. Recharge to the groundwater system occurs by stream recharge and deep percolation of applied irrigation water. Approximately 34,400 afy enters the subbasin through natural recharge, and approximately 201,000 afy enters the subbasin through applied water. According to DWR measurements, groundwater levels in the subbasin fluctuated up to 36 feet from 1970 to 2000; water levels in 2000 were approximately 4 feet above 1970 levels (DWR 2004b). Storage capacity in the subbasin is estimated at approximately 14,600,000 acre-feet to a depth of 300 feet and 94,100,000 acre-feet to the base of fresh groundwater (DWR 2004b).

Groundwater in the Tule Subbasin generally flows westward. Groundwater in the western part of the subbasin is shallow and has elevated saline levels. High concentrations of nitrate are localized in the eastern portion of the subbasin (DWR 2004b).

The Tule Subbasin is not a U.S. EPA-designated or state-designated sole source aquifer (U.S. EPA 2009; CVRWQCB 2004). Within the project study area, the state has identified the following beneficial uses for groundwater in the subbasin: municipal and domestic supply, agricultural supply, industrial service supply, industrial process supply, and wildlife habitat.

4.5.5 Kern County Subbasin

The alternative alignments in Kern County overlie the Kern County Subbasin. This subbasin is bounded on the north by the Kern County line and the Tulare Lake and Tule subbasins, on the east and southeast by the granitic bedrock of the Sierra Nevada foothills and the Tehachapi Mountains, and on the southwest and west by the marine sediments of the San Emigdio Mountains and Coast Ranges. Depth to groundwater ranges from approximately 300 feet bgs to 140 feet bgs in the vicinity of the alternative alignments within the Kern County Subbasin. Depth to groundwater in Bakersfield is approximately 150 feet bgs and deeper (DWR 2005).

The Kern County Subbasin comprises an area of approximately 1,945,000 acres (ICF Jones & Stokes 2008) and is internally drained by the Kings, Tule, and Kern rivers into the Tulare, Buena Vista or Kern dry lake beds. Recharge to the groundwater system consists of applied irrigation water and from stream seepage along the eastern boundary of the subbasin and the Kern River (DWR 2006b). In addition, water banking to recharge the groundwater subbasin has been used since 1978 (ICF Jones & Stokes 2008). Several water storage districts in the Bakersfield area store or bank water in underground aquifers for future use. The alternative alignments pass through the North Kern, Rosedale-Rio Bravo, and Arvin Edison Water Storage Districts (City of Bakersfield and County of Kern 2009). The North Kern Water District uses Kern River, Poso Creek, and supplies from State Water Project and/or federal Central Valley Project sources (North Kern Water Storage District 2010).

The Kern Water Bank Authority recharges, stores, and recovers groundwater in the Bakersfield area. The western boundary of the approximately 20,000-acre water bank property is more than 7 miles southeast of the project study area. The Kern Water Bank, which receives water from the California Aqueduct, the Kern River, and the Friant-Kern Canal, can store over 1 million acre-feet of water and can recover up to 240,000 acre-feet of water per year (KWBA 2010).

The dominant recharge source in the subbasin is applied irrigation water (DWR 2006b). On a regional scale, the development of irrigated agriculture has significantly altered the groundwater flow system. Percolation of irrigation water from agricultural fields, drainage ditches, and canals has replaced infiltration of intermittent streamflow as the primary mechanism of recharge. Pumping of groundwater from wells and crop evapotranspiration have replaced natural evapotranspiration and seepage to streams in the valley trough as the primary mechanisms of discharge. Although water levels in different parts of the subbasin have varied over the last several decades, the average groundwater level in the subbasin has been relatively stable since 1970 (DWR 2006b).

Groundwater quality in the Kern County Groundwater Subbasin is considered to be generally suitable for most urban and agricultural uses with only local impairments. According to the DWR, the primary constituents of concern in the region included high TDS, nitrate, arsenic, and organic compounds (DWR 2006b). The high TDS levels are generally the result of salt concentration due to evaporation and poor drainage, as well as dissolution of salts as groundwater moves through marine-derived deposits from the Coast and Temblor ranges. Nitrates may be naturally occurring or may be due to fertilizers and human or animal wastes. Elevated levels of arsenic have been reported in the Tulare Lake, Kern Lake, and Buena Vista Lake bed areas.

The quality of the groundwater along the central and eastern portions of the subbasin is considerably better than the water quality in the western portion. This is most likely due to the pronounced influence of Sierra Nevada–derived recharge to and movement of Kern Fan area groundwater from east to west. This condition results in a thick layer of fresh groundwater in the eastern Kern County Subbasin (DWR 2006b).

The Kern County Subbasin is not a U.S. EPA–designated or state-designated sole-source aquifer (U.S. EPA 2009; CVRWQCB 2004). The state has identified the following beneficial uses for groundwater in the subbasin: municipal and domestic supply, agricultural supply, and industrial service supply. Groundwater in the Etchegoin Formation and groundwater below a depth of approximately 3,000 feet bgs is not suitable for municipal or domestic supply (CVRWQCB 2004).

Section 5.0
Impact Analysis

5.0 Impact Analysis

5.1 Impact Methodology

The following information sources (and GIS data) were used to describe the project's affected environment:

- Climate, precipitation, and topography – Sources of information for these elements included the Program EIR/EIS, California Data Exchange Center, Western Regional Climate Center, California Irrigation Management Information System (CIMIS), USGS topographic maps, 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 Program EIR/EIS, USGS topographic maps, FEMA maps, FIRMs, CWA Section 303(d) lists of water quality–impaired reaches; and the National Resource Conservation Service (NRCS) Web Soil Survey (WSS) (USDA-NRCS 2010).

To evaluate potential impacts on hydrology and water resources, both quantitative and qualitative analyses were performed. Conceptual-level plans 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, and protect drinking water systems, aquifers, and floodplain and floodway values.

A review of available documents from various agencies, including the USGS, FEMA, CVFPB, and the RWQCB, were used to determine whether water quality and/or water resources would be impacted by the proposed project and alternatives. These documents included floodplain and floodway maps from FEMA and CVFPB. Floodplain boundaries were determined using digital flood insurance rate maps (DFRIMs) obtained from FEMA. The county and city general plans and ordinances were also reviewed for applicable policies and regulations to determine whether implementation of the proposed project or alternatives would result in potential impacts. The FEMA-designated 100-year floodplain areas and 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 part of the alignment. Detailed data were not available for wider areas of the project vicinity; therefore, information was based on available USGS topographic maps, National Elevation Dataset (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. The data represent bare ground.

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

- NED 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 evaluation considered both direct and indirect impacts. For example, a direct effect occurs through increased turbidity and erosion during construction and increased runoff, or an increase in the base flood elevation. An indirect effect occurs when changes in the planned development of an area result in increased water needs or reduced water quality.

Topic-specific evaluation methods are discussed below.

5.1.1 Floodplains

The location of project facilities within a designated floodplain could expose the project to risks related to flooding, as well as subject other areas to impacts resulting from changes in the location and/or direction of flood flows.

Railroad track, bridges, and culverts that cross a designated floodplain may encroach into the floodplain and affect the hydraulics of the creek and its associated floodplain. Conceptual-level plans (15% design reports) for each of the project alternatives were reviewed and compared with information on existing floodplains. Portions of the HST would be constructed on grade, fill, bridges, or aerial structures. Although a detailed analysis would be required to evaluate the effects of the potential encroachment, the type of crossing and the estimated amount of floodplain that may be affected by the project provides an indication of the potential magnitude of the encroachment for comparing the alternatives.

The channel of a watercourse designated as a floodway by a public agency (e.g., FEMA or CVFPB) must be kept free of encroachment so that the 100-year flood flow can be conveyed without increasing the water surface elevation. Within the portion of the floodplain outside the floodway, referred to as the floodway fringe, development and other forms of encroachment may be permitted and small increases in water surface elevation may result. A substantial encroachment on the 100-year floodplain would be one that increases the base-flood elevation by 1 foot, consistent with FEMA requirements.

The quantitative evaluation of potential impacts to floodplains from the proposed HST and alternatives includes the following analyses:

- The length and acreage of floodplains defined as Special Flood Hazard Areas (SFHAs) within the project study area were estimated using GIS and the proposed HST alternatives.

- The length and acreage of regulatory floodways within the project study area were estimated using GIS.

- The extent of longitudinal encroachment of the floodplain was estimated using GIS mapping. For purposes of this evaluation, longitudinal encroachment is defined as any floodplain crossing that occurs at an angle greater than 45 degrees from the perpendicular.

- The distance of the nearest upstream community or housing that could be affected by backwater effects due to floodplain encroachment was estimated using GIS.
- The potential for each alternative to increase flood height and/or divert flood flows using flood information from the FEMA flood insurance studies and the available topographic data.
- Flow data were primarily obtained from FEMA flood insurance studies from the study area. Table 5.1-1 shows the flow data available from these studies.

Table 5.1-1
Flow Data from FEMA Flood Insurance Studies

Location[1]	Flow (1% annual chance)	FIS	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	—

[1] No information for Deer Creek.

Acronyms and Abbreviations:
FEMA = Federal Emergency Management Agency
FIS = flood insurance study
SR = state route

5.1.2 Surface Water Hydrology

Operational impacts could result from either ongoing activities of the HST system or the physical impact on the landscape by project facilities such as the track, stations, parking structures/lots, or support facilities. Conditions that could potentially lead to an impact include:

- Increases in impervious surfaces as a result of the project, leading to increases in the timing and volume of runoff.
- Changes to or interruptions in the local drainage infrastructure as a result of the proposed project design, potentially leading to localized or regional drainage impacts.

The quantitative evaluation of potential impacts to surface waters from the proposed HST and alternatives includes the following analyses:

- The length of rivers, creeks, and canals within the project study area were estimated using GIS.

- Analysts overlaid GIS layers for the proposed HST alternatives on the GIS layers for surface waters and flood-prone areas to identify the potential impacts on surface waters. Analysts then used these GIS layers to identify project crossings of streams and irrigation canals.

- The amount of impervious area that would be created by the HST was based on the width of the track (40 feet) and the aerial structures (50 feet).

5.1.3 Surface Water Quality

Construction activities with potential for impacts to water quality include:

- Soil-disturbing activity (e.g., excavation and grading) that can lead to erosion and sedimentation.

- Use of construction-related hazardous materials, which could result in spills that would impact surface waters.

Operational impacts could result from either ongoing activities of the HST system or the physical impact on the landscape by project facilities such as the track, stations, parking structures/lots, or support facilities. Conditions that could potentially lead to an impact include:

- Creation of substantial new sources of pollutants, such as parking lots and maintenance facilities, leading to new sources of contaminated runoff.

The quantitative evaluation of potential impacts to surface water quality from the proposed HST and alternatives includes the following analyses:

- The location of stream segments with impaired water quality in relation to the proposed HST and alternatives.

- 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.

- 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 HMF.

5.1.4 Groundwater

Potential impacts to groundwater resources were evaluated using documents available from DWR, CVRWQCB, FMFCD, the counties, and other agencies. During construction, excavation in areas of high groundwater could potentially impact groundwater quality or quantity from dewatering activities. In general, however, depth to groundwater within the project area is typically on the order of 60 feet or more.

For construction-related impacts, the following were evaluated:

- Potential for contaminated site runoff to percolate to the aquifer.

- Excavation activities that could result in excursions below the groundwater table and provide a direct mechanism for contaminants to enter groundwater.

- Dewatering activities that could potentially deplete groundwater supplies.

For operational impacts, the following were evaluated:

- Increases in impervious surfaces as a result of the project, which could reduce groundwater recharge.
- Creation of substantial new sources of pollutants, such as parking lots and maintenance facilities, leading to new sources of contaminated runoff that could percolate to the aquifer.
- Location of project facilities below the naturally occurring water table, which could result in potential impacts to groundwater quality and/or quantity.

The quantitative evaluation of potential impacts to groundwater from the proposed HST and alternatives includes the following analyses:

- The length and acreage of groundwater basins within the project study area were estimated using GIS.
- The depth to groundwater within the project study area was estimated based on available documentation from DWR.
- The potential to cause depletion of groundwater owing to the project's use of groundwater at the HMF sites was estimated using the Theis Equation for unsteady flow to a well (Kruseman and de Ridder 1991).

5.2 Impacts

The HST Fresno to Bakersfield corridor would pass through Fresno, Kings, Tulare, and Kern counties. The BNSF Alternative Alignment would stretch south from Fresno, through several small cities, including Corcoran, Wasco, and Shafter, to Bakersfield. The alignment would cross several streams and rivers, as well as a number of irrigation canals and ditches from Fresno to Bakersfield. The BNSF Alternative Alignment would also cross several extensive floodplains associated with the streams and rivers (see Table 5.2-1). The track would be at-grade, on fill, on aerial structures, or on bridges at major watercourse crossings. The exact track elevations and type of support would depend on railroad grade during final design. The alternatives for specific sections along the BNSF Alternative Alignment, ranging from approximately 9 to 23 miles, are also being evaluated: Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter Bypass, and Bakersfield South alternatives. The alternatives would generally cross the same floodplains, watercourses, and groundwater basins as the BNSF Alternative Alignment, but would have varying crossing lengths (see Tables 5.2-2 and 5.2-3). The alternative alignments have the potential to affect existing floodplains, watercourses, and water quality. The potential impacts of the alternative alignments and the No Project Alternative are evaluated below.

5.2.1 Floodplains

A. IMPACT WTR-1: FLOODING IMPACTS ASSOCIATED WITH IMPEDING OR REDIRECTING FLOOD FLOWS

FEMA-designated 100-year floodplains have been identified at several locations within the project area and are generally shallow, fairly extensive, and cover a large portion of the project area. Redirecting or impeding flood flows has the potential to redefine flood hazard areas and cause flooding in areas previously not at risk to the 100-year flood. Existing agriculture or structures could be flooded as a result of redirected flood flows. In addition to agriculture, redirected flood flows also have the potential to affect other floodplain values such as conservation of existing flora and fauna, archeological sites, natural beauty, and open space.

Table 5.2-1
Floodplain Crossings: Fresno to Bakersfield Section

Alternative	County	Waterway	Crossing Method[1]	Nearest Upstream Community (Approximate distance in miles)
BNSF Alternative	Fresno	No Waterway – Downtown Fresno at Church Avenue	At-grade	Fresno (0 miles)
BNSF Alternative	Fresno	Central Canal	Elevated at channel (0.02 miles)	Fresno (0 miles)
BNSF Alternative	Kings	Cole Slough	Elevated at channel (0.06 miles)	Kingsburg (7 miles)
BNSF Alternative	Kings	Kings River/Dutch John Cut Complex	Elevated at channel (0.13/0.12 miles)	Kingsburg (7 miles)
BNSF Alternative	Kings	Cross Creek	Elevated at channel (1.86 mile); fill at floodplain (0.64 mile)	Goshen (> 10 miles)
Corcoran Elevated	Kings	Cross Creek	Elevated	Goshen (> 10 miles)
Corcoran Bypass	Kings	Cross Creek	Elevated at channel (1.65 mile); fill at floodplain (2.23 miles)	Goshen (> 10 miles)
BNSF Alternative	Tulare	Tule River	Elevated at channel (0.06 miles); fill at floodplain (4.75 mile)	Tulare (> 10 miles)
Corcoran Elevated	Tulare	Tule River	Elevated	Tulare (> 10 miles)
Corcoran Bypass	Tulare	Tule River	Elevated at channel (1.21 miles); fill at floodplain (2.28 miles)	Tulare (> 10 miles)
Allensworth Bypass	Tulare	Deer Creek	Elevated at channel (0.96 miles); fill at floodplain (2.62 miles)	Earlimart (8 miles)
BNSF Alternative	Tulare	Deer Creek	Elevated at channel (0.97 miles); fill at floodplain (4.14 miles)	Earlimart (8 miles)
BNSF Alternative	Tulare, Kern	County Line Creeks	At-grade	Delano (9 miles)
BNSF Alternative	Kern	Poso Creek	Elevated at channel (0.55 miles); fill at floodplain (1.22 miles)	McFarland (5 miles)
Allensworth Bypass	Kern	Poso Creek	Elevated at channel (0.03 miles); fill at floodplain (2.73 miles)	McFarland (5 miles)
Wasco-Shafter Bypass	Kern	Poso Creek	Fill in floodplain (0.89 miles)	McFarland (5 miles)
BNSF Alternative, Bakersfield South	Kern	Kern River	Elevated	Bakersfield (0 miles)

[1] Crossing method and approximate lengths are from the 15% Conceptual Design.

Table 5.2-2
Floodplains and Floodways Crossed by the Alternatives Compared with the BNSF Alternative Alignment

Alternative	Project Alternative Length through Floodplains (miles)[1]	Approximate Project Area in 100-Year Floodplains (acres)[1,2]	Approximate Project Area in CVFPB Designated Floodway (acres)[1,2]
BNSF Alternative Alignment	23	722	26
Corcoran Elevated	+0	+0	+0
Corcoran Bypass	+1	-95	+0
Allensworth Bypass	-1	-24	N/A
Wasco-Shafter Bypass	+0.2	-33	N/A
Bakersfield South	-0.5	-5	-1

Notes:

[1] Values shown for the alternatives (i.e., Corcoran Elevated through Bakersfield South) represent deviations from the BNSF Alternative Alignment values.

[2] Approximate study areas in 100-year floodplains (Zone A, Zone AE, Zone AH, and Zone AO) were calculated using GIS by overlaying GIS layers for the proposed HST alternative on the GIS layers for the floodplain and floodway areas. Approximate study areas in CVFPB-designated floodways were calculated by multiplying the floodway crossing length by an assumed alignment corridor width of 100 feet.

CVFPB = Central Valley Flood Protection Board
GIS = Geographic Information System
HST = high-speed train
N/A = not applicable, because alternative does not cross a CVFPB floodway.

Table 5.2-3
Acres Disturbed During Construction of HST Alternatives

Alternative	Acres Temporarily Disturbed	Acres of Permanent Footprint	Acres of Estimated Impervious Surface
Alternative Alignments[1, 2, 3, 4]			
BNSF Alternative	4,820	2,851	691
Corcoran Elevated	63 (108)	50 (105)	114 (114)
Corcoran Bypass	960 (1,026)	537 (607)	114 (114)
Allensworth Bypass	513 (483)	359 (325)	132 (132)
Wasco-Shafter Bypass	989 (1,031)	485 (476)	123 (128)
Bakersfield South	371 (441)	151 (221)	57 (57)
Station Options[5]			
Fresno Station–Mariposa Alternative	18	21	21
Fresno Station–Kern Alternative	18	19	19
Kings/Tulare Regional Station	22	27	27
Bakersfield Station–South Alternative	21	19	19
Bakersfield Station–North Alternative	24	20	20
Heavy Maintenance Facility Alternatives[6]			
Fresno Works–Fresno HMF Site	590	150	65
Kings County–Hanford HMF Site	510	150	65
Kern Council of Governments–Wasco HMF Site	420	150	65
Kern Council of Governments–Shafter East HMF Site	490	150	65
Kern Council of Governments–Shafter West HMF Site	480	150	65

Notes:
[1] Temporary areas include the permanent footprint, construction staging areas, gas line relocation areas, oil line relocation areas, power line transmission relocation areas, and precast concrete yards.
[2] Equivalent numbers for the corresponding segment of the BNSF Alternative are presented in parenthesis.
[3] Permanent areas include HST tracks, roadway crossings, traction power stations, and relocation of existing BNSF tracks and related features.
[4] Estimated impervious areas were calculated by multiplying the project alternative length by approximate impervious width, assumed to be 50 feet for the purpose of this calculation.
[5] Existing parking structures are included in the permanent station area but not the disturbed area.
[6] Approximately 150 acres would be disturbed at any of the HMF alternative sites, of which 65 acres would be impervious.

Acronyms:
HMF = heavy maintenance facility
HST = high-speed train

The proposed project would cross several floodplains, as discussed under Section 4.1. The topography in the Central Valley is generally flat, and the floodplains are extensive, each covering large areas (see Figure 4.1-1). The floodplains in the project area are generally shallow, with depths ranging from less than 1 foot to approximately 3 feet, where detailed analyses have been conducted by FEMA. Although detailed analyses have not been conducted for the floodplains crossed, the 100-year floodplains throughout the project area are expected to be shallow, with average depths of 3 feet or less, due to the generally flat topography of the study area. Floodplains within the study area are summarized in Table 4.1-1.

A FEMA-designated floodway has been delineated for Cross Creek. CVFPB-designated floodways within the project area include Cole Slough, Kings River, Cross Creek, and Kern River. Within the city of Bakersfield boundaries, FEMA has adopted the CVFPB-designated floodway for the Kern River. The floodway is the portion of the floodplain that is the channel of a river or watercourse that conveys the flood waters. As such, encroachment into a floodway has the highest potential to impede, retard, or change the direction of the flow of water.

Between Fresno and Bakersfield, the existing BNSF rail and highways cross the floodplains and currently impede flood flows at various locations. Portions of the proposed HST and its alternative alignments may be located either upstream or downstream of the existing rail and highways. Where the proposed HST or its alternatives are located downstream, placement of fill or structures in the floodplains could potentially increase the flood risk to the upstream rail or highway.

From Fresno to Bakersfield, the HST would be elevated up to approximately 80 feet above existing grade. The track would be built on grade, on fill, with the support of retaining walls, or on an aerial structure or bridge structure to elevate the track to the desired elevation. The general design concepts for the proposed HST and its alternative alignments include the following:

- A bridge or aerial structure span on the order of 60 to 120 feet.
- For spans exceeding 120 feet, assume one column approximately 10 feet in diameter would be located every 120 feet.
- For aerial structures and bridges that span rivers, creeks, floodplains, and floodways, a minimum of 2 feet of freeboard above the 100-year flood elevation would be provided; however, for structures that cross CVFPB-jurisdictional floodways, at least 3 feet of freeboard would be provided above the 100-year flood elevation.
- 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 affects.
- Designated floodways would be crossed on an elevated structure with piers provided for crossings greater than approximately 120 feet in length.

Although the majority of the alignment would be at-grade, the BNSF Alternative would include elevated structures in all of the four counties through which it travels. In Fresno County, an elevated structure would carry the alignment over Golden State Boulevard and SR 99, and a second structure would cross over the BNSF Railway tracks in the vicinity of East Conejo Avenue. The alignment would be at-grade, with bridges where it crosses Cole Slough and the Kings River into Kings County. In Kings County, the BNSF Alternative would be elevated east of Hanford, where the alignment would pass over the San Joaquin Valley Railroad and SR 198. The alignment would also be elevated over Cross Creek, and again at the southern end of the city of Corcoran to avoid a BNSF Railway spur. In Tulare County, the BNSF Alternative would be elevated at the crossing of the Tule River and at the crossing of the Alpaugh railroad spur that runs west from the BNSF Railway mainline. The BNSF Alternative would be elevated in Kern County across both Poso Creek and the Kern River, continuing through the city of Bakersfield.

Where an upstream hydraulic constriction, such as the BNSF rail, already controls flood flows and elevations, the proposed project would provide cross drainage to meet or exceed the existing upstream hydraulic conveyance capacity. Therefore, the proposed project would not cause an increase in flow velocity or flood elevations at existing BNSF stream crossings.

Culverts or structures would be located at existing streams, canals, or ditches, and adjacent to culverts on the BNSF railroad where the alignments are parallel. Culverts would be designed to maintain the hydraulic conveyance capacity of the existing stream, canal, ditch, or adjacent culvert.

The BNSF Alternative Alignment would provide wildlife crossing opportunities by means of a variety of engineered structures. These crossings would also serve as hydraulic features where the HST crosses creeks, canals, or other drainage features. Where bridges, aerial structures, and road crossings coincide with proposed dedicated wildlife crossing structures, such features would serve the function of, and supersede the need for, dedicated wildlife crossing structures. The preliminary wildlife crossing structure design consists of a 30- to 60-foot-long bridge to allow wildlife to cross over the tracks or a large box culvert to allow wildlife to pass through. The size of the box culvert would depend on the height of the track embankment at the proposed location (e.g., 5-foot high by 10-foot wide where the embankment height is above 7 feet or 4-foot high by 8-foot wide where the embankment height is 7 feet or less. The design of the wildlife crossing structures may change depending on site-specific conditions and engineering considerations.

Along the alignment, the track would be elevated at least 2 feet above the expected 100-year flood elevations, as calculated from available flow data and the FEMA BFEs, where they have been determined. Where the track crosses CVFPB-jurisdictional floodways, the minimum freeboard would be 3 feet. The freeboard would allow floating debris to pass under the track. At USACE project levees, the track may be further elevated above the levees to allow for maintenance on the levees. Aerial structures and bridges would be designed to span the stream or canal channel to the extent practicable. Piers or columns with a typical diameter of 10 feet would be placed within the primary flow channel, the floodplain, and designated floodway as needed to support the aerial or bridge structure. The piers or columns would have a relatively small cross-sectional area compared to the channel, floodplain, and floodway areas and would be spaced approximately 120 feet apart. If columns are required, they would fill less than 9% of the crossing length and would be designed to minimize adverse hydraulic effects that could result in substantial backwater effects. As designed, flood waters would be expected to remain within the currently defined floodways and floodplains.

Fill required to elevate the track and column locations and sizes would be designed to minimize changes in flood levels within the 100-year floodplain, in accordance with 44 CFR Sections 59-65; and FEMA, state, and local regulations.

The placement of fill, culverts, bridges, or aerial structures within a CVFPB-designated floodway, or any construction that involves cutting into a CVFPB or USACE levee must be approved by the CVFPB. The project would prepare an encroachment permit application and submit it to CVFPB for approval prior to construction. To obtain an encroachment permit for federal levees, consultation and design review by USACE would be required.

The project would install bridges, aerial structures, or culverts at natural water body crossings, floodplains, and floodways. Although the pier construction methods have not been determined and would be based on local conditions, it is probable that some crossings would require in-water work for pier construction. Construction in a water body, floodplain, or floodway 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 majority of this area lies within shallow (1 to 3 feet of inundation) flood zones. Construction staging areas are proposed within the Kings River complex floodplain. All construction activities would be temporary.

According to Title 23 of the CCR, work activities such as excavation, cut-and-fill construction, and obstruction within the floodway and on levees adjacent to a regulated stream would not be allowed during the flood season unless specifically permitted by CVFPB, pending weather forecasts and river flood conditions. CVFPB allows placement of equipment, material, and structures within a designated floodway as long as the free flow of water is not inhibited and public safety is not jeopardized. Stockpiled material, temporary buildings, and construction equipment that obstruct streamflows would be required to be removed from floodways before the flood season, unless otherwise permitted by CVFPB. Construction adjacent to a regulated stream would comply with the provisions of Title 23 of the CCR. Table 5.2-1 shows the floodplain crossings by alternatives. In addition, 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.

BNSF Alternative Alignment

The majority (more than 80%) of the BNSF Alternative Alignment would be supported by fill, with the remaining portion elevated on aerial structures. The HST would cross approximately 23 miles of floodplains, and approximately 80% of this length would be located on fill and have the potential to impede or redirect flood flows. The remaining portion would be elevated on aerial structures or bridges. Both the tracks on fill and on aerial structures would be at least 2 feet above the expected 100-year flood level within the floodplains. The aerial structures would be supported on piers that also could impede flows.

FEMA BFEs and flood depths are available at select locations along the BNSF Alternative Alignment. Where available, BFEs and depths are summarized in Table 4.1-1. The floodplain crossings generally stretch over a mile, and the floodplains generally cover a relatively large area.

In the city of Fresno, the BNSF Alternative Alignment would be constructed at-grade and include culverts or bridges at floodplain crossings, existing canals, and low-lying areas. None of these designated floodplains contain a FEMA- or CVFPB-designated floodway. The track would be elevated at least 2 feet above the 100-year flood level, and the culverts and bridges would be designed to have minimal impact on flood flows, flooding, and water quality.

North Central and Central Canals cross through the Fresno Works–Fresno HMF site footprint and have 100-year floodplains associated with them. Buildings, parking lots, and other facilities associated with the HMF would be located outside the 100-year floodplain.

South of Fresno, the BNSF Alternative Alignment would cross the 100-year floodplains and CVFPB-designated floodways associated with Cole Slough and Kings River. The HST would cross the floodplain on fill 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. The track would be a minimum of 3 feet above the expected 100-year flood level. Culverts and pipes would also be installed at irrigation ditch or canal crossings. The total width of openings in the embankment would be sufficient to pass the 100-year flood flows without increasing the flood elevation by more than 1 foot in the floodplain. Where floodways exist, project design features would minimize the increase of the water surface elevation to less than 0.1 foot.

The BNSF Alternative Alignment would also cross USACE project levees adjacent to Cole Slough and Kings River. Work in this area would require approval from USACE. The columns required to support the aerial structure would be located at least 15 feet from the toe of USACE project levees. The aerial structure would be elevated above the USACE project levees. Construction of the aerial structure and track in this area would comply with 33 USC 408, if applicable, and 33 CFR 208.10, administered by CVFPB, which require USACE approval for work at USACE project levees. 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. 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 approval of 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 application with the USACE and with other agencies, as needed. 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.

The potential Kings/Tulare Regional Station would not be located within the 100-year floodplain and therefore would have no flooding impact.

The Kings County–Hanford HMF site is on the western side of the BNSF Alternative Alignment southeast of the city of Hanford. This HMF site alternative is not located within a designated floodplain.

At Cross Creek, the BNSF Alternative Alignment would cross a FEMA-designated 100-year floodplain and CVFPB- and FEMA-designated floodway. The BNSF Alternative Alignment would cross this floodway and part of the associated floodplain on an aerial structure. The floodplain of Cross Creek, designated as Zone AE (detailed study with estimated baseline flood elevation), is approximately 14,000 feet wide at the HST crossing. This zone is bounded on both overbanks by about 4,000 feet of designated Zone A (no detailed study). Columns with a typical diameter of 10 feet would support the aerial structure, and the number of columns would be minimized to the extent practicable; therefore, the columns would displace a relatively small volume of flood water. Most of the Cross Creek floodplain would be crossed on fill; however, this is at the edge of the floodplain and is mostly in an “A” zone or approximate floodplain. Features to allow flood flows to cross the HST would be implemented as necessary to maintain existing hydraulic conveyance capacity. The crossings would be designed to pass the 100-year flood flows without increasing the flood elevation by more than 1 foot in the floodplain. Where floodways exist, project design features would minimize the increase of the water surface elevation to less than 0.1 foot. The project would submit an encroachment permit application to the CVFPB for crossing this CVFPB-designated floodway.

The BNSF Alternative Alignment would cross the Tule River and its associated 100-year floodplain near the Kings/Tulare County border. The FEMA-designated floodplain at the Tule River crossing is about 21,000 feet wide. No detailed FEMA studies have been conducted for this location; therefore, no FEMA BFEs or expected flood depths are available. There are no designated floodways associated with the Tule River. The BNSF Alternative Alignment would cross the Tule River and its associated floodplain on fill, with bridges installed to correspond with existing bridges along the BNSF railroad to maintain hydraulic conveyance. 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 be sufficient to pass the 100-year flood flows without increasing the flood elevation by more than 1 foot in the floodplain.

The BNSF Alternative Alignment would cross floodplains associated with Deer Creek and two unnamed small streams at the Tulare/Kern county border. There are no designated floodways associated with these floodplains. The 100-year floodplain of Deer Creek is designated 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 a shallow flooding zone (Zone AO) and narrows to 27,000 feet wide. The BNSF Alternative Alignment would be located adjacent to and downstream of the existing BNSF railroad at these floodplain crossings. The track would be constructed on fill and an aerial structure. The proposed aerial structure would provide sufficient clearance and conveyance for flood flows. Culverts would be located where existing culverts are located along the BNSF railroad and would be sized to allow drainage and flood flows to continue across the proposed alignment. These cross-flow features would be designed to prevent increases to base flood elevations, and to maintain hydraulic conveyance capacity. Therefore, there would not be a substantial increase in the 100-year flood elevation due to the proposed project.

South of the Tulare/Kern County border, the BNSF Alternative Alignment would cross the floodplain associated with Poso Creek. There is no designated floodway associated with Poso Creek. The floodplain is designated as an “A” or approximate floodplain, and is approximately 30,000 feet wide at the upstream side of the existing BNSF bridge. The BNSF Alternative Alignment would be located downstream and adjacent to the existing BNSF railroad at the Poso Creek floodplain. Culverts, as well as wildlife crossings, would be located where existing culverts are located along the BNSF railroad and would be sized to allow drainage and flood flows to continue across the proposed alignment. These cross-flow features would be designed to maintain hydraulic conveyance capacity. Culverts may feature head walls, wing walls, flared outlets, or flared inlets to reduce erosion, and BMPs such as riprap would be provided at the discharge end of the culvert to minimize erosion. The BNSF Alternative Alignment would result in backwater effects similar to those caused by the existing BNSF railroad, such that there would not be any substantial difference in water levels due to this alternative.

The HST would cross localized areas of flooding within the cities of Wasco and Shafter and south of Shafter. The BNSF Alternative Alignment would be mostly at-grade through this portion of the alignment.

The Kern Council of Governments–Wasco HMF site alternative is located directly east of the BNSF Alternative Alignment and the city of Wasco. This HMF alternative is not within a designated floodplain. Both the Kern Council of Governments–Shafter East and the Kern Council of Governments–Shafter West HMF site alternatives are located along the BNSF Alternative Alignment south of Shafter. They are located on the eastern and western sides of the BNSF Alternative, respectively. Approximately half of each HMF footprint would be located in a FEMA-designated floodplain. However, the floodplain consists of ponded water in a depression along the highway and existing railroad tracks so construction of the HMF would have no impact on flooding.

Localized FEMA-designated 100-year floodplain areas are situated close to the BNSF Alternative Alignment south of the city of Shafter. These designated floodplains consist of local depressions that may pond water during storm events. The project would have no impact on flooding at these locations.

In the city of Bakersfield, the BNSF Alternative Alignment would cross the Kern River, the designated floodway and the adjacent floodplain on an aerial structure for approximately 2 miles. Approximately 13 columns would be required in the Kern River floodway. The project would submit an encroachment permit application to the CVFPB for crossing this CVFPB-designated floodway. The bridge crossing and placement of columns would be designed to minimize impacts. Columns would have a typical diameter of 10 feet, which is small compared to the size of the floodplain, and the number of columns within the floodway would be minimized to the extent practicable. Therefore, the columns would displace a relatively small volume of flood water.

Because portions of the alignment are located in FEMA-designated floodplains, the requirements set forth in Executive Order 11988, Floodplain Management, would apply. The floodplain and floodway crossings would be designed and engineered to meet these criteria. This will require documentation of the alternatives analysis and a description of the methods that will be used in the floodplain, such as maintaining existing conveyance that minimizes the risk of flood loss and impacts of floods on human safety, health, and welfare, and preserves the natural and beneficial values served by floodplains. Additionally, in-kind replacement storage, as needed, would be incorporated into the design to minimize impacts to the extent practicable from fill placement that would result in loss of floodplain storage. Some of the encroachments could result in a finding of only practicable alternative under Executive Order 11988. If an encroachment is found to be the only practicable alternative, the design must minimize potential harm to or within the floodplain in accordance with Executive Order 11988, and a notice must be prepared to explain why the action is proposed to be located in the floodplain.

The project would incorporate design elements to avoid impacts to floodplains and floodways. The railroad would be elevated on aerial structures or when located on fill would maintain the existing conveyance of flood flows crossing the HST. Structures would be located outside the designated floodways to the extent practicable. The volume of flood flows and locations of floodplains would generally be the same after project implementation and would therefore have minimal impacts on floodplain values.

Corcoran Elevated Alternative

The Corcoran Elevated Alternative would elevate a portion of the HST track through the city of Corcoran. The track alignment would be the same as the BNSF Alternative Alignment. The elevated structure would reach a maximum height of approximately 40 feet to the top of the rail. The alternative starts at Niles Avenue in the north and ends at 4th Avenue in the south. The total length of this alternative would be about 3.5 miles long. Dedicated wildlife crossing structures would be provided from approximately Cross Creek south to Avenue 136 in at-grade portions of the railroad embankment at intervals of approximately 0.3 mile. Dedicated wildlife crossing structures would also be placed between 100 and 500 feet to the north and south of each of the following river/creek crossings: Cross Creek and Tule River. The HST would be elevated over both Cross Creek and the Tule River, similar to the BNSF Alternative Alignment. The HST would cross Cross Creek on an aerial structure at least 2 feet above the 100-year base flood elevation. The HST would be elevated through Corcoran on an aerial structure that would extend south of the Tule River. The effect on floodplains would be similar to that described for the BNSF Alignment Alternative.

Corcoran Bypass

The Corcoran Bypass would cross the same floodplains as the BNSF Alternative Alignment. Overall, this alternative would cross the floodplains for a slightly longer distance than the BNSF Alternative Alignment, but slightly less floodplain area and about the same amount of CVFPB-designated floodway due to the location of the crossing, as shown in Table 5.2-2. The HST would be elevated on an aerial structure for approximately 1.6 miles over the CVFPB and FEMA floodways adjacent to Cross Creek. The remainder of the Cross Creek floodplain would be crossed on fill. Culverts or other features would be installed to allow flood flows to cross the fill and maintain hydraulic conveyance capacity. Where the bypass would cross the floodplain associated with the Tule River, the length of the crossing would be longer than the BNSF Alternative Alignment. The type of crossing would be similar. There are no designated floodways associated with the Tule River. The Corcoran Bypass would have similar effects on the 100-year water elevations as the BNSF Alignment Alternative.

Allensworth Bypass

The Allensworth Bypass would bypass the Allensworth Ecological Reserve to the west and cross a shorter length of floodplains associated with the two unnamed streams near the Tulare/Kern county border. The amount of floodplain area crossed by this alternative would be less than the BNSF Alternative Alignment, as shown in Table 5.2-2. There are no designated floodways associated with these streams. The Allensworth Bypass Alternative would cross approximately 11,000 feet of the floodplains on fill with features to allow flood flows to pass through the fill, as described for the BNSF Alternative Alignment. Similar to the BNSF Alternative Alignment, the Allensworth Bypass would be located downstream of the existing BNSF railroad, and culverts would be located where existing culverts are located along the BNSF railroad, and would be sized to allow drainage and flood flows to continue across the proposed alignment.

At Poso Creek, the Allensworth Bypass crosses the creek and its associated floodplain approximately 1,000 to 2,000 feet downstream of the existing BNSF crossing. The total width of openings in the embankment would be sufficient to pass the 100-year flood flows without increasing the flood elevation by more than 1 foot in the floodplain.

If the BNSF tracks are relocated to be adjacent and parallel to the HST tracks in this area, the backwater effect and resulting water surface elevation would be similar to the Allensworth Bypass Alternative, since the hydraulic conveyance through the new BNSF railroad and HST alignment would be the same as currently exists through the BNSF railroad. The length of the floodplain crossed by the Allensworth Bypass and the relocated BNSF tracks would be about 11,000 feet. Openings in the embankment would be sufficient to pass the 100-year flood event such that the flood elevation and size of the floodplain would not be affected.

Wasco-Shafter Bypass

The Wasco-Shafter Bypass alternative would cross to the eastern side of the BNSF railroad. The amount of floodplain area crossed by this alternative would be less than the BNSF Alternative Alignment, as shown in Table 5.2-2. There is no designated floodway crossed by this alternative. Similar to the BNSF Alternative Alignment, most of the Wasco-Shafter Bypass would be at-grade. The alternative would bypass the floodplains in Wasco and Shafter, and run parallel to the BNSF Alternative Alignment beginning in a localized flooding area south of Shafter, through which the alternative would be elevated on an aerial structure.

Bakersfield South

The Bakersfield South alternative would cross the same floodplain and floodway as the BNSF Alternative Alignment at the Kern River. The amount of floodplain area crossed by this alternative would be slightly greater than the BNSF Alternative Alignment, as shown in Table 5.2-2; however, the amount of CVFPB floodway crossed would be slightly less. The HST would be elevated on an aerial structure in Bakersfield similar to the BNSF Alternative Alignment. Impacts on the floodplain and floodway would be similar to those described for the BNSF Alternative Alignment.

No Project Alternative

Under the No Project Alternative, the HST would not be built, and there would be no encroachment in the floodplains. Flows at rivers and streams in the project area would not be redirected, and no impacts related to flooding would occur as a result of the No Project Alternative.

B. IMPACT WTR-2: FLOODING IMPACTS CAUSING HOUSING TO FALL WITHIN A 100-YEAR FLOOD HAZARD AREA AS MAPPED ON A FEDERAL FLOOD HAZARD BOUNDARY OR FLOOD INSURANCE RATE MAP OR OTHER FLOOD HAZARD DELINEATION MAP

The proposed project passes through downtown Fresno and Bakersfield. In general, development along the alignment between Fresno and Bakersfield is relatively sparse. Most of the land is agriculture or rural. As discussed under Impact WTR-1, fill located within floodplains has the potential to affect flood levels in the floodplains upstream of the HST. Because the floodplains are broad and shallow, major constrictions to flow due to the HST have the potential to increase base flood elevations and backwater effects. However, most of the floodplain areas crossed by the HST are in areas with little to no flow (i.e., ponded areas) or sheet flow. Although there may be isolated residences close to the HST, communities between Fresno and Bakersfield that could be affected by backwater effects from the proposed project are generally located several miles upstream (see Table 5.2-1). Most of these communities, such as Kingsburg, Tulare, and Earlimart, are also located well outside the floodplain inundation areas (see Figure 4.1-1). Because there are few residences near the HST alignments and communities are located far from the HST and are currently not within the designated floodplains, backwater impacts from the HST are not expected to affect housing.

5.2.2 Surface Water Hydrology

A. IMPACT WTR-3: SUBSTANTIALLY ALTER THE EXISTING DRAINAGE PATTERN OF THE SITE OR AREA, INCLUDING THROUGH THE ALTERATION OF A STREAM OR RIVER, IN A MANNER THAT WOULD RESULT IN SUBSTANTIAL EROSION OR SILTATION ONSITE OR OFFSITE

The alteration of drainage patterns could include redirecting a stream or river and increasing impervious surface, which could increase runoff volumes and rate. Redirecting the flow in a stream or river would alter drainage patterns and increase the potential for erosion along the new drainage paths. Increased erosion would lead to siltation in the flow channel and degradation in water quality at and downstream of the alteration location. Introducing impervious surfaces where they currently do not exist has the potential to increase the rate and amount of stormwater runoff and cause erosion at areas adjacent to the new impervious surface.

Soil's potential to erode is dependent on a number of factors, including the type of soil, the topography, and the amount and type of precipitation. Steeper slopes and greater amounts of precipitation are two factors that increase the potential for erosion. Because the project area lacks soils that are highly erodible and the topography is generally flat, the Statewide Program EIR/EIS found the Fresno to Bakersfield project to have minimal impacts on erosion (Authority and FRA 2005).

Along the alignment alternatives, some of the track in the flood-prone areas would be on aerial structures with only support piers exposed to flow. In other areas, fill would be used to support several sections of the HST track. Drainage ditches would run parallel to the track adjacent to the embankment to capture runoff from the track, minimize alteration of drainage patterns, and minimize the potential for erosion. BMPs such as riprap would be provided at the discharge end of culverts for erosion control. Because culverts would allow drainage across the alternative alignments and BMPs would be implemented, substantial erosion and sedimentation impacts associated with alteration of drainage patterns would be minor for all alternatives. The introduction of non-native soil with the placement of fill could increase the potential for erosion in the project area. Fill would be compacted, and side slopes would be vegetated or protected with riprap.

Additionally, the project would comply with federal, state, and local regulations. Where fill is planned at or adjacent to streams or rivers, the project would comply with Section 404 of the Clean Water Act and Section 10 of the Rivers and Rivers and Harbors Act, which both require permits for fill activities at specific surface water features, as described under Section 3.1.2 of this report. Prior to construction, the California Department of Fish and Game would be notified of planned alterations within channels pursuant to Sections 1601 to 1603 of the Streambed Alteration Agreement (California Department of Fish and Game 2009). To comply with federal, state, and local regulations, the project would be required to implement BMPs to reduce the potential for erosion.

The placement of columns, fill, or other structures, such as wingwalls or abutments, in the floodplain or within channels, has the potential to alter drainage patterns and cause localized scour. The columns, fill, or other features located in the floodplain or channel would be designed to minimize scour. The shallow slope of the valley floor in the project area results in generally low-flow velocities, and therefore, low potential for scour in most waterways. Cole Slough, Kings River, and Kern River have the greatest potential for scour because of their larger flows, and greater velocities. Columns located within these channels would be designed to allow hydraulically smooth flow, and to minimize erosion. Erosion control measures would be implemented at the columns and bridge structures to minimize scour and siltation. The HST would include design features and the use of BMPs, which would reduce impacts related to alteration of drainage patterns resulting in erosion and siltation.

A hardened surface may be installed at channel crossings where levees require maintenance, and sufficient vertical clearance cannot be provided. These crossings would generally include shallow canal crossings where the HST is at or near grade. The hardened crossing would reduce or eliminate the need for levee maintenance at the HST crossing. The channel would be lined with concrete, and BMPs such as riprap would be installed downstream of the concrete-lined portion of the channel to dissipate energy and minimize the potential for erosion and sedimentation. The hardened crossing would be designed to maintain the channel shape and existing hydraulic conveyance capacity. Therefore, the existing drainage pattern would not be substantially altered, and erosion and siltation impacts related to altering existing drainage patterns would be minor for all alternatives.

The downtown Fresno and Bakersfield stations would be constructed within developed urban areas, would not be adjacent to water bodies, and would have limited, if any, vegetation clearing. The potential Kings/Tulare Regional Station would introduce less than 30 acres of impervious surface in a generally flat topographic area. The topography and implementation of BMPs such as drainage ditches and basins would minimize the alteration of drainage patterns and potential for erosion.

The HMF would cover approximately 150 acres, which would include approximately 65 acres of new impervious surfaces. Site drainage would be designed to capture runoff from impervious areas. Captured runoff would be directed to pervious areas for infiltration, such as drainage ditches or basins; or, if available, directed to nearby existing storm drainage systems. The storm drain system at the HMF would minimize alterations to the existing drainage pattern and implement BMPs to minimize the potential for erosion.

B. IMPACT WTR-4: SUBSTANTIALLY ALTER THE EXISTING DRAINAGE PATTERN OF THE SITE OR AREA, INCLUDING THROUGH THE ALTERATION OF A STREAM OR RIVER, OR SUBSTANTIALLY INCREASE THE RATE OR AMOUNT OF SURFACE RUNOFF IN A MANNER THAT WOULD RESULT IN FLOODING ONISTE OR OFFSITE

Alteration of a stream or river has the potential to affect the hydraulics of the watercourse or redirect flows, and thereby cause flooding. The project would not substantially alter existing drainage patterns. Cross-drainage through the embankments along the alignment would be accomplished by installing culverts or a bridge to convey the flow from one side of the right-of-way to the other. In general, culverts would be used at ditches and canals that are less than 25 feet wide. Bridges or aerial structures would be used at natural channel crossings or for spanning wider ditches and canals. As discussed under IMPACT WTR-3, some of the rivers and canals would be crossed via aerial structures due to the extensive floodplains.

Where hardened crossings are installed, the existing shape of the channel and hydraulic conveyance capacity would be maintained. BMPs would be installed downstream of the concrete-lined section to dissipate energy. The drainage pattern would not be altered substantially.

A large portion of the alignments within Fresno are located in areas of urbanized undeveloped land. Although the project would increase the impermeable footprint, most of the area likely has low permeability due to the urbanized nature of the project area. Stormwater runoff along the alignment would be captured and piped to new drainage basins that would be designed for recharge. Although the new impervious surface has the potential to increase the rate or amount of surface runoff, the drainage basins would capture the runoff and allow it to percolate. Because the runoff would be recharged, the new impervious area would not substantially increase the rate or amount of surface runoff that would result in flooding onsite or offsite.

The new station, parking lot, and portions of the track would be located in downtown Fresno, which has existing impervious surfaces. Therefore, there would be no substantial increases in impervious surface at the station location. Because there would be no increase in impervious surfaces, there would be no increase in the rate or amount of surface runoff.

The Fresno to Bakersfield Section would include at-grade and elevated track segments. The at-grade track would be laid on an earthen rail bed topped with rock ballast approximately 6 feet off of the ground; fill and ballast for the rail bed would be obtained from permitted borrow sites and quarries.

Although the track ballast is pervious, the compacted ground beneath that is necessary to support the facility would have reduced infiltration. Runoff from at-grade track would be collected for discharge to drainage swales running parallel to the track. Drainage systems within the portions of elevated track would collect and discharge stormwater to the local stormwater system in urban areas, or to the local drainage system via swales in rural areas. Where the alignment travels through urban areas, impermeable surfaces are common because of past land development; therefore, in most cases, existing stormwater systems would convey track runoff.

The potential Kings/Tulare Regional Station is planned where the BNSF Alternative Alignment would pass east of the City of Hanford. The station would introduce impervious surface to an existing pervious area. However, the runoff from the station would be directed to recharge basins so the site runoff would be unaffected.

The track would be elevated on an aerial structure approximately 50 to 70 feet above existing grade through the city of Bakersfield. Stormwater captured on the new aerial structures would be conveyed to the existing city stormwater drainage system, which would be upgraded as necessary to accommodate any increased flows generated by the new impervious surface of the aerial structure. Because any increased rates and amounts of runoff would be accommodated by the stormwater drainage system, the potential for flooding in the vicinity of the track and aerial structure as a result of these increased flows would be minor. The alternative alignments would cross directly above the Kern River, its associated floodplain, and several canals on an aerial structure. Because the track would be elevated on an aerial structure and columns would be placed outside the channels, alterations to drainage patterns and the potential flooding would be minor. The amount of impervious surface area by alternative compared to the BNSF Alternative Alignment is provided in Table 5.2-3.

At the HMF site alternatives, alterations to drainage patterns would be minimized, and BMPs such as drainage ditches and infiltration basins would be implemented to handle runoff. The proposed footprint of the Fresno Works–Fresno facility is crossed by the Central Canal, which has a FEMA floodplain associated with it. The floodplain is contained within the canal banks. The Kern Council of Governments–Shafter HMF facility is 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. The Kings County–Hanford and the Kern Council of Governments–Wasco HMF sites are not within a designated floodplain. Therefore, there would be negligible effects on flooding associated with these HMF site alternatives.

C. IMPACT WTR-5: CREATE OR CONTRIBUTE RUNOFF WATER THAT WOULD EXCEED THE CAPACITY OF EXISTING OR PLANNED STORMWATER DRAINAGE SYSTEMS OR PROVIDE SUBSTANTIAL ADDITIONAL SOURCES OF POLLUTED RUNOFF

Operational activities along the rail alignment and at stations and parking lots could contribute additional polluted runoff to stormwater drainage systems or receiving waters.

In Fresno, new station facilities would include parking lots. The parking lot could be an additional source of polluted runoff, potentially generating pathogens, heavy metals, nutrients, pesticides, organic compounds, sediments, trash, debris, and oil and grease. Project-specific BMPs, such as oil/sand separators or infiltration basins, would be developed and implemented to treat runoff from the parking lots before entering the stormwater drainage system or recharge basins.

South of Fresno to the city of Bakersfield limits, most of the alternative alignments are located in unincorporated areas of Fresno, Kings, Tulare, and Kern counties (see Figure 4.0-1). These areas do not have existing stormwater drainage infrastructure. The project could potentially increase the nature and kind of pollutants into the Tulare Lake Basin from rail operations. The land use in the area would be similar to existing uses, which include rail operations. Pollutants of concern generated by the HST could include heavy metals, organic compounds, sediments, trash and debris, and oil and grease. BMPs such as infiltration trenches or basins would be implemented to minimize the potential for polluted runoff to reach receiving waters. Because these pollutants would be generated in small quantities and BMPs would be implemented to minimize the discharge of these pollutants to receiving waters, the potential for introducing new sources of polluted runoff is minor.

Within the unincorporated area in Kings County, the potential Kings/Tulare Regional Station would include an approximately 20-acre parking lot. Similar to the Fresno facilities, the parking lot could be an additional source of polluted runoff. Project-specific BMPs similar to those described for the Fresno Station would be implemented and sized to accommodate expected runoff. Therefore, runoff would be treated before entering drainage basins or a nearby existing stormwater drainage system.

Similar to the situation in Fresno, a large parking lot would serve the Bakersfield Station, and BMPs would be implemented as appropriate to treat stormwater prior to entering the existing stormwater drainage system.

The HST would cross more than 100 roads along the alternative alignments between Fresno and Bakersfield. New or rerouted roads would be required where the HST would cross existing roads, which would have the potential to increase runoff to existing stormwater drainage systems and introduce new sources of pollutants. Four road crossing options have been identified: 1) the road would remain and the HST would pass over; 2) the road would be closed or rerouted to an adjacent roadway; 3) the road would become an overpass over the HST; and 4) the road would become an underpass beneath the HST tracks at-grade.

Where existing roadways would remain and the new HST would pass over, existing stormwater drainage methods would be maintained. Runoff from the HST track would be conveyed to infiltration basins or to the existing stormwater drainage system, depending on its capacity and the preference of the local jurisdiction. No new sources of pollutants would be introduced because the existing roadway would remain, and no new activities would be introduced to the existing roadway.

At road closures, the impervious surface would be decreased; therefore, runoff would be reduced. Drainage facilities would be retained where they are necessary to maintain existing flow patterns. Existing drainage ditches at road closures may be maintained and may require the installation of new culverts where they cross the HST tracks. The upgrade to these drainage ditches would enable the existing ditches to handle runoff. The road closures would not introduce any new operational activities or substantial sources of polluted runoff. Rather, the road closures would reduce the amount of polluted runoff.

At rerouted roads, impervious surfaces would increase slightly due to additional pavement. The amount of impervious area introduced by these new roads would be small when compared to the size of the South Valley Floor Watershed, and would therefore not increase runoff or contribute to runoff in a way that would exceed stormwater drainage facilities. Runoff would be handled either by infiltration basins or by a connection to an existing stormwater drainage system that has sufficient capacity to handle volumes of runoff generated. Although a roadway would not have previously existed in the footprint of the new roadway, the rerouted road would be near the existing roadway and would not substantially increase impervious surfaces or polluted runoff. Runoff from the new road would be captured in infiltration basins or an existing stormwater drainage system. Vehicular traffic, and therefore pollutants on the rerouted roads, would be approximately the same as those expected at the closed roadway. Therefore, the rerouted roads would not produce substantial amounts of additional polluted runoff.

Frontage roads would also be built at some roadway crossing locations. Frontage roads are anticipated to be 32-foot-wide paved roads with drainage ditches on each side of the roadway. The amount of impervious area introduced by these new roads would be small when compared to the size of the South Valley Floor Watershed, and would therefore not increase runoff or contribute to runoff in a way that would exceed stormwater drainage facilities. The drainage ditches would allow stormwater runoff to infiltrate or convey water to a nearby existing stormwater drainage system if it has sufficient capacity. Impacts resulting from the frontage roads would be similar to those described for rerouted roads.

At roadway overpasses, the existing road alignment would either travel directly over the HST, or be modified to curve along a new alignment that would allow construction of the overpass, while the existing road would be in service. The curved overpass would slightly increase impervious surfaces, but not increase runoff or pollutants substantially. Runoff along the roadway would be handled according to current drainage methods. Where roadway overpasses would be constructed, embankments would introduce minimal increases in impervious surface. At the toe of each embankment, detention basins would generally be used to capture stormwater. The runoff may be conveyed to a nearby existing stormwater drainage system if it has sufficient capacity.

Subgrade roadway underpasses would be located only where no other roadway crossing options would be feasible. Subgrade underpasses would require a vertical realignment of the existing road. Runoff on the road would be captured by curb gutters and inlets, and would be directed to a sump pump. At least two pumps would be located in the sump for redundancy purposes and would direct water to either an infiltration basin or a nearby stormwater drainage system. The roadway length would not increase substantially, and roadway use is not anticipated to increase as a result of the project.

In cities along the BNSF Alternative Alignment, new drainage basins or upgraded stormwater drainage systems would handle any additional runoff generated by the proposed project. In unincorporated areas, drainage ditches and basins would be installed within the project area to handle additional runoff.

At the HMF, the new storm drain system would be sized to handle expected runoff at the new facility so that runoff does not exceed its capacity. Maintenance activities have the potential to introduce pollutants to the runoff. However, runoff from maintenance areas and parking lots would not be discharged directly to water bodies. Rather, it would be directed to existing storm drain systems or discharged to BMPs such as drainage ditches or infiltration basins.

Discharges and stormwater runoff in cities, unincorporated areas, and at the HMF would be treated with BMPs as described for sections of the BNSF Alternative. The discharges would also comply with Section 401 of the Clean Water Act, which requires a certification for discharges to waters of the United States. Certifications for discharges to receiving waters that are categorized as waters of the United States would be obtained from the CVRWQCB prior to the implementation of the project.

5.2.3 Surface Water Quality

A. IMPACT WTR-6: POTENTIAL FOR SHORT-TERM DEGRADATION OF WATER QUALITY ASSOCIATED WITH CONSTRUCTION ACTIVITIES THAT VIOLATE WATER QUALITY STANDARDS OR WASTE DISCHARGE REQUIREMENTS

Construction activities have the potential to cause erosion or degrade water quality in a manner that violates water quality standards or waste discharge requirements.

Construction activities associated with the proposed project would involve the clearing and grubbing of existing land; the handling, storage, hauling, and placing of fill; driving piles; and installing culverts in order to construct the stations, HMF, elevated structures, and concrete track bed. Placement of fill would disturb the ground surface, decrease vegetative cover, and temporarily increase the potential for erosion and sedimentation. In addition, leakage of fuel, oils, or hydraulic fluid from vehicles and equipment used during construction has the potential to degrade water quality. Increased erosion and sedimentation and any equipment fluid leakage also have the potential to exceed water quality standards and waste discharge requirements. These construction activities have the potential to degrade (by erosion and/or sedimentation) water bodies that receive surface runoff from construction along the alternative alignments. Such impacts could be exacerbated during the wet season.

Project construction activities involving the disturbance of one or more acres are required to apply for coverage under the SWRCB's NPDES General Permit for Storm Water Discharges Associated with Construction Activities. At least 30 days prior to the start of construction, the High Speed Rail Authority would submit PRDs to the SWRCB that include a risk assessment to address project sediment risk and receiving water risk, post-construction calculations, a site map, an SWPPP for construction activities, and the appropriate fees. The SWPPP would include strategies for preventing impacts to water quality through the use of project-specific structural and/or operation BMPs during construction.

The Contractor would be required to implement erosion and sedimentation controls tailored to the project site. The Contractor would also be required to comply with erosion, sedimentation, and spill control measures that would be identified in the SWPPP as required by the NPDES

Construction General Permit. The SWPPP would also include BMPs to prevent the discharge of pollutants (e.g., spills) to the environment. In accordance with the NPDES General Permit for Stormwater Discharges Associated with Construction Activity, a monitoring program would be required during construction. The Construction General Permit also requires preparation and implementation of post-construction management measures and a long-term maintenance plan. The project would meet specific post-project performance standards, where project runoff would discharge to a stream or river and post-project runoff hydrology of the project site would match that under pre-project conditions.

Spill control measures would be described in the SWPPP and would outline how contractors handle, store, label, and dispose of hazardous substances (i.e., fuel, waste oil, solvents, and other hydrocarbon-based products) in accordance with federal, state, and local regulations. The spill prevention plan would mitigate potential impacts to water quality due to construction. It would require an emergency response plan that would include spill response materials, such as absorbent pads, booms, and other materials to contain spills, to be available at all times to ensure rapid response to spills in order to protect groundwater and nearby surface water. The Contractor would be responsible for reporting any discharges.

Ground-disturbing activities would occur during the dry season (April through October) to the extent practicable in order to minimize the potential for erosion. The contractor would practice good housekeeping during construction. Industry standard BMPs would be implemented to prevent discharge of sediments offsite. These may include, but are not limited to, silt fences, rice straw bales, and sediment basins. Erosion control measures and BMPs would reduce runoff velocities and help to protect nearby water bodies from sediment and construction-related pollutants. Implementation of BMPs such as designated vehicle maintenance and washing areas, and proper storage of equipment and vehicle fluids, would reduce the potential for impacts from leakage of vehicle and equipment fluids on groundwater quality.

Construction-related hazardous materials would be stored, handled, and used, although in relatively small quantities, during construction. The potential release of hazardous materials to the environment could also result in the degradation of water bodies, affecting water quality. The *Fresno to Bakersfield: Hazardous Wastes and Materials Technical Report* presents an analysis of the potential release of hazardous materials during construction (Authority and FRA 2011a).

At bridges and hardened crossings, construction activities would occur within channels. BMPs and the spill prevention plan would be implemented to reduce the potential for short-term water-quality impacts. BMPs would be used to minimize erosion and sedimentation, and store and use construction-related hazardous materials safely to protect the water quality of the channels. Construction activities would comply with NPDES regulations regulated by CVRWQCB, as described below. Alterations to streams would comply with the requirements of Sections 10 and 14 of the Rivers and Harbors Act where modifications occur at navigable waters or flood control facilities, respectively. The California Department of Fish and Game would be notified of proposed changes, and an agreement would be reached prior to any stream modifications in accordance with the requirements of the Streambed Alteration Agreement. Construction activities within watercourses would comply with these regulations and the federal, state, and local requirements described below.

The proposed project would comply with water quality standards established in the Tulare Lake Basin Plan (CVRWQCB 2004) and guidelines set forth in the project-specific SWPPP for construction activities. The proposed project would also comply with federal, state, and local standards, as discussed above. Additionally, prior to the commencement of construction activities, the contractor would prepare and implement an SWPPP, including BMPs and good housekeeping practices.

Water produced during construction dewatering could contain sediments and contaminants that could degrade water quality if the water were to be discharged directly to surface water. However, construction activities are not expected to require dewatering. In the unlikely event that dewatering is required, adherence to the permitting requirements would ensure the water discharged to surface water would not degrade existing surface water quality. The groundwater could be discharged to surface water in accordance with Order No. R5-2008-0081, General Order for Dewatering and Other Low Threat Discharges to Surface Waters, as described in Section 3.3.1, although an individual NPDES permit, or waiver, might be required. In agricultural areas or other areas where the groundwater would be discharged to land, the discharges could be made under Order No. 2003-003-DWQ, Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality, although individual waste discharge requirements or a waiver could be required.

In accordance with the requirements of these permits or waivers, the Contractor would be required to implement control measures to ensure adequate quality of the discharged water, conduct the appropriate sampling to demonstrate permit compliance, and regulate flow rates to prevent erosion or downstream flooding in the receiving water. A groundwater treatment unit would be used, as needed, to comply with discharge requirements.

Implementation of control measures in compliance with the permitting requirements described above would ensure that construction-related discharges would not degrade water quality or violate any water quality standards or waste discharge requirements. Shallow groundwater is not anticipated along the BNSF Alternative Alignment. Additionally, disturbed areas would be restored to minimize the potential for erosion and siltation at the completion of construction. Vegetated areas disturbed during construction would be revegetated, and the project area would be restored to pre-construction conditions.

B. IMPACT WTR-7: POTENTIAL FOR LONG-TERM DEGRADATION OF WATER QUALITY ASSOCIATED WITH OPERATION THAT VIOLATES WATER QUALITY STANDARDS OR WASTE DISCHARGE REQUIREMENTS

Because the BNSF Alternative Alignment runs parallel to the BNSF railway for a considerable portion of the Fresno to Bakersfield section, 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 these pollutants that may already exist in the watershed by introducing additional track, increasing rail service, and introducing new stations, parking lots, and maintenance facilities. Main sources of pollution from the rail alignment include litter and spills, train lubrication system losses, train brake system losses, train/rail wear, and surface treatments for embankments and right-of-way (to control vegetation and erosion). Similar sources of pollution could be generated at the HMF during train washing, maintenance, and testing. 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 in the project area. These new sources of road runoff from the new crossings, relocated highways, or frontage roads could negatively affect water quality. However, the project would be subject to the water quality design requirements of the RWQCB and the local agencies to reduce the potential for adverse water quality impacts.

The SWRCB identifies TMDLs for water bodies that contain high levels of specific pollutants. TMDLs have not been identified for most of the surface-water features in the vicinity of the alternative alignments. Exceptions include Lake Kaweah, approximately 50 miles upstream of the

HST, and the Kings River, approximately 10 and 55 miles downstream of the crossing. At the HST crossing, the Kings River, Cross Creek, and Deer Creek are identified as being impaired with an unknown toxicity as defined in the 2009 Proposed Changes to the 303(d) List (CVRWQCB 2009). The proposed changes to the 303(d) list also include an impairment of high pH for Deer Creek in the study area (CVRWQCB 2009).

Because Lake Kaweah is located approximately upstream of the alignments, Lake Kaweah would not be considered a receiving water of any discharges associated with the HST. Therefore, impacts from the implementation of the BNSF Alternative Alignment or bypasses would not apply to water quality at Lake Kaweah.

Downstream of the HST, TMDLs have been identified for the Kings River. TMDLs for the Kings River approximately 10 miles downstream of the alignment alternatives include electrical conductivity, molybdenum, and toxaphene. Approximately 55 miles downstream, the Mendota Pool and San Joaquin River are identified as impaired for selenium and exotic species, respectively. Implementation of the HST would not be expected to introduce substantial quantities, if any, of these pollutants.

With respect to the pollutants listed on the 303(d) list, the project would not contribute toxaphene, a pesticide which is presently banned in the United States and whose use has been severely restricted since the 1980s. 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, so it may exist in the materials used to construct and operate the HST. However, molybdenum would not be in a form or in a quantity that would contribute to water quality degradation. Electrical conductivity 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 the Kings River. Because operational activities associated with the HST would conform to federal, state, and local regulations, implementation of the HST would not be expected to introduce substantial quantities, if any, of these pollutants, including any pollutants that would increase pH or any unknown toxicities as reported in the 2009 Proposed Changes to the 303(d) List (CVRWQCB 2009). In addition to the low amount of pollutants that would be available to be contributed by the HST to receiving waters, the runoff from the HST would be collected in infiltration/detention ponds so would contribute only a minor volume of flow to the receiving waters during storm events.

Beneficial uses have not been identified for many of the existing water bodies adjacent to or within the project area. Exceptions include Kings River, Cross Creek, Tule River, Poso Creek, and Kern River, as summarized in Table 4.3-1. At each of these crossings, the HST would bridge the primary flow channel. Because the train would be elevated above the water body, pollutants are not anticipated to be introduced into the rivers and creeks or adversely affect the existing identified beneficial uses. During storm events, runoff from the track could come into contact with pollutants and transport them into the river or creek. No runoff from the project would be discharged directly to any surface water bodies. Runoff from bridges, overpasses, underpasses, and aerial structures would be collected and conveyed to a detention basin, infiltration basin, or nearby stormwater collection system, or dispersed in a non-erosive manner onto agriculture or rural areas. Along portions of the track at-grade or on fill, most of the stormwater runoff would be expected to infiltrate near the tracks. In addition, drainage swales would generally be located along each side of the track bed to collect stormwater at the toe of the embankments and convey the runoff to detention or infiltration basins; therefore, there would be no discharge directly into a surface water body.

Operations at the HMF would include maintenance and servicing, and would have the potential to introduce pollutants at a localized area. The HMF, including its fueling facilities, would be subject to state and federal hazardous materials regulations. Operational discharges from the

HMF would be treated by BMPs such as infiltration basins or water quality inlets with oil/sand separators to protect water quality of receiving waters. 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 will 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. For the Fresno Works–Fresno HMF alternative, several canals would be located within the HMF footprint. The HMF would be designed so that there would be no direct discharges of pollutants into the existing canals. No water bodies cross the proposed locations of the Kings County–Hanford, Kern Council of Governments–Wasco, Kern Council of Governments–Shafter East, or Kern Council of Governments–Shafter West alternatives. Therefore, the HMF facility alternatives would have minimal impacts on water quality. The main sources of pollution from parking areas are litter and spillages, vehicle lubrication system losses, vehicle/tire wear, vehicle exhaust emission, and road surface wear. Potential pollutants generated by the new parking lots include heavy metals, organic compounds, trash and debris, oil and grease, nutrients, pesticides, and sediments. In the Fresno area, urban stormwater runoff is currently collected in FMFCD recharge basins, which is the preferred stormwater management practice. Therefore, stormwater runoff from the proposed project's parking areas in Fresno would be managed in a similar manner by directing the runoff from the parking areas to existing or new recharge basins. The project would comply with the FMFCD's requirements that protect water quality. In Bakersfield, stormwater runoff from the parking areas would be collected in detention basins, or conveyed to the city's existing storm sewer system in accordance with the city's requirements for stormwater management and water quality protection.

The project would comply with the SWRCB Water Quality Order No. 97-03-DWQ "General Permit to Discharge Stormwater Associated with Industrial Activity". This permit regulates stormwater discharges from sites that could impact water quality and beneficial uses of receiving waters, as defined in the Tulare Lake Basin Plan. In order to comply with this permit, the project will be required to prepare an SWPPP that would be submitted to the CVRWQCB prior to the start of operations. The SWPPP must describe the project-specific BMPs that the project will implement to protect water quality during operation of the HST. Industry-standard BMPs would be identified and implemented for the general purpose of runoff treatment and pollutant removal, as well as for erosion control. These BMPs may include, but are not limited to, infiltration basins or trenches, oil/sand separators, extended detention basins, biofiltration strips or swales, subsurface infiltration vaults, media filters, and drain inserts. Erosion control BMPs may include preservation of existing vegetation, soil surface protection, soil binders, or velocity dissipation devices.

Impervious surfaces have the potential to increase the amount and rate of stormwater runoff. Because impervious surfaces do not allow water to infiltrate into the ground, both the quantity and rate of runoff would increase. Increases in impervious surfaces along would be small compared to the size of the drainage basins in which they are located, as described under IMPACT WTR-5. Additionally, BMPs such as riprap would be installed to minimize erosion resulting from increased quantity and rate of runoff, as described under IMPACT WTR-3.

Additionally, discharges associated with the operation of the HST would comply with the respective county general plans, ordinances, and stormwater requirements to minimize impacts to water quality. The alignment would also comply with municipal requirements, where applicable, along the alignment. In Fresno, discharges from operational activities and stormwater runoff would comply with the City of Fresno General Plan policies, Fresno municipal ordinances, and FMFCD stormwater requirements. New drainage basins would be designed to remove pollutants from urban runoff and prevent pollutants in stormwater from reaching receiving waters, in accordance with the Fresno municipal and FMFCD water quality and discharge requirements. In Corcoran and Wasco, the HST would be designed to minimize degradation of water quality in accordance with the city general plan policies and municipal codes. In Bakersfield, the HST would be designed to comply with water quality and waste discharge requirements set forth in the Metropolitan Bakersfield General Plan goals and policies, and the Bakersfield Municipal Code. The potential for long-term degradation of water quality associated with HST operations would be minimized due to compliance with federal, state, and local water quality regulations.

5.2.4 Groundwater

A. IMPACT WTR-8: 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.

Substantial depletion of groundwater resources such that there would be a net deficit in aquifer volume or a lowering of the groundwater table could occur where groundwater is encountered or dewatering is required during construction activities. Dewatering during construction could affect groundwater levels in shallow or first-encountered groundwater-bearing zones in areas with a high water table.

Construction associated with the proposed project is not anticipated to require dewatering. Construction activities would include placing fill on existing grade, driving piles for station and aerial structure foundations, and limited excavation. Groundwater levels in the project area are generally deep (e.g., deeper than approximately 50 feet), as described in Section 4.5. As such, it is not expected that much dewatering would be required during construction of the at-grade sections of the HST. The aerial structure sections of the railroad would be supported by piers. The piers could be either drilled or driven. In the unlikely event that groundwater is encountered, any effects from the lowering of groundwater levels or depletion of groundwater resources would be temporary, because once construction was completed, dewatering would cease. The natural recharge of the affected groundwater zones would then be re-established.

Increases in impervious surfaces have the potential to result in a net deficit in aquifer volume or a lowering of the groundwater table because of substantial interference with groundwater recharge. Substantial interference with recharge has the potential to deplete groundwater. Impervious surfaces would be created by the project as a result of new concrete track bed, aerial structures, roads, parking structures, and the HMF (see Table 5.2-3). However, the amount of impervious surface introduced would be small compared to the groundwater subbasin areas. Additionally, stormwater runoff from the track bed, aerial structures, and roads would be directed into drainage ditches or basins for infiltration or conveyance to an existing stormwater drainage system.

The HMFs would increase impervious surfaces in the study area because they would be located primarily on agricultural land. The new impervious surfaces in the study area created by the HMFs would be surrounded by permeable areas and would also be small compared to the groundwater subbasin areas. The HMF sites would have outdoor washing and fuel storage areas, as well as parking lots, which could generate polluted stormwater runoff. However, none of the HMF alternatives is located in areas of shallow groundwater so percolation of stormwater into groundwater would not affect groundwater quality.

The current land use at the HMF sites is primarily agriculture. Water supply is primarily surface water provided by local irrigation companies, and may be supplemented with local groundwater. Current water use on the HMF sites is estimated to range from 1,500 acre-feet per year (the Fresno Works–Fresno HMF site) to 1,960 acre-feet per year (the Kern Council of Governments–Shafter East HMF site). In comparison, the estimated water use associated with a 150-acre portion of the HMF site ranges from 394 acre-feet per year for the Fresno Works–Fresno HMF site to 609 acre-feet per year for the Kern Council of Governments–Shafter East HMF site. (For additional details, see the Water Supply Technical Memorandum [Authority and FRA 2011b]).

Because the irrigation companies may not be able to provide water for non-agricultural uses and the HMF sites may not be able to connect to a municipal water supply, it is assumed that the HMF will be supplied by local groundwater. A groundwater well(s) would be installed at the HMF. If pumping rates are high enough, they could influence the water level in neighboring wells or deplete groundwater supplies. The Fresno Works–Fresno HMF would pump groundwater from the Kings Subbasin, the Kings County–Hanford HMF would pump from the Tulare Lake Subbasin. and the three Kern Council of Governments HMF alternatives would pump from the Kern County Subbasin. A new well (or wells) would be constructed at the HMF. Approximately 52 acre-feet per year, would be used at the HMF for domestic water needs, train washing and landscape irrigation. This amount of groundwater would be considered negligible compared with the amount of groundwater stored in the groundwater basins, as shown in Table 4.5-1. Preliminary drawdown calculations based on typical specific yield and storativity values for the aquifers indicate that drawdown resulting from pumping continuously at an equivalent pumping rate of 32 gallons per minute (gpm) (assuming pumping 24 hours per day continuously) or about 65 gpm (assuming that pumping occurs for 12 hours per day) would be expected to be negligible (e.g., less than 6 inches of drawdown at a distance of 100 feet from the pumping well).

Based on well location information available from the California Department of Water Resources water data library (http://www.water.ca.gov/waterdatalibrary/index.cfm), no wells were located within 100 feet of the HMF property boundaries. For the Kern Council of Governments–Wasco, -Shafter East, and –Shafter West sites, however, several wells were located either within the HMF footprint or immediately adjacent to it. The status of these wells after construction of the HMF is unclear.

Because the increase in impervious surface is small compared to the size of the groundwater subbasins, the runoff from impervious surfaces would be directed to a storm drain system that would convey the runoff to a detention or infiltration basin, recharge would not be substantially inhibited by impervious surfaces, and the amount of recharge would be approximately the same compared with existing conditions. In addition, the amount of groundwater that would be pumped at the HMF would be expected to have minimal effects on aquifer volumes or water levels.

5.2.5 Cumulative Impacts

The cumulative analysis for hydrology and water resources includes the evaluation of floodplains, surface water, and groundwater, as described below.

A. FLOODPLAINS

The study area for the cumulative floodplain evaluation consists of FEMA designated 100-year floodplains crossed by the project alternative alignments and the land adjacent to these floodplains. As stated in Section 4.1 (Existing Water Resources: Floodplains), the alternative alignments cross several FEMA designated floodplains. Since the crossings will be on aerial structures, and/or run parallel and adjacent to the existing BNSF alignment or Highway 43, and/or will include conveyance structures to allow 100-year flows to pass through the alternative alignments, impacts will be minor. Besides existing development in floodplains from past projects, other present and reasonably foreseeable future projects are in the floodplains affected by the proposed project (e.g., the Laton Community Plan Update, the Self Help Enterprises project, the Delano Marketplace project). All of the project alternatives would be designed to prevent increases greater than 1 foot in the base flood elevation and prevent increases in the flood elevation in floodways in accordance with FEMA. Other ongoing and future federal projects would be required to comply with Executive Order 11988 and NEPA, and state and local projects would be required to comply with CEQA. Also, county general plan policies, programs, and ordinances are intended to offset the potential direct and cumulative flooding problems that may arise from development (e.g., Fresno, Kings, Tulare, and Kern counties have ordinances that limit construction in floodplains). All ongoing and reasonably foreseeable future projects are subject to and would be required to comply with these policies, programs, and ordinances.

B. SURFACE WATER

The South Valley Floor Watershed defines the boundaries of the cumulative impact analysis for surface water. The development of other present and reasonably foreseeable future projects would result in an increase in impervious surfaces in the watershed. The Fresno to Bakersfield Section would result in an increase in impervious area of approximately 1.5 square miles regardless of which alternative alignment is implemented, a small impact when compared to the total area of the watershed of approximately 34,100 square miles. Runoff from the impervious areas would generally be directed to drainage ditches or basins for infiltration or conveyance to a stormwater drainage system. Other present and reasonably foreseeable future projects could have construction schedules that overlap with that of the Fresno to Bakersfield Section. Construction in, across, and/or over streams and canals has the potential to degrade water quality, and this degradation of water quality could be exacerbated by concurrent construction schedules for multiple projects. However, the identified present and reasonably foreseeable future projects are generally in developed locations (e.g., urban areas, near SR 99), and the cumulative increase in impervious surface associated with these projects would be small compared to the total area of the South Valley Floor Watershed. Most of the identified present or reasonably foreseeable future projects are greater than 1 acre in area and therefore, pursuant to federal, state, and local regulations (e.g., the Clean Water Act), would include best management practices that would control runoff and protect water quality (e.g., use of infiltration basins or vegetated swales to minimize impacts to water quality). Projects affecting areas of less than 1 acre are not expected to increase peak flows substantially and would adhere to local regulations to protect water quality.

C. GROUNDWATER

The study area for cumulative impacts to groundwater is the five groundwater subbasins crossed by the project alternatives. These subbasins are described in Section 4.5 (Existing Water Resources: Groundwater). Over 90% of the identified cumulative projects shown on Figure 3.19-1 of the EIR/EIS would occur within these five groundwater subbasins.

Planned development and roadway widening projects would increase the impervious surface areas in the groundwater subbasins, as would the proposed HST project. Runoff from all these projects would generally discharge to the ground surface or unlined drainage ditches or basins. Because surface soils throughout the region are typically pervious, runoff would infiltrate to the groundwater aquifer. New impervious surface areas associated with the HST alternative alignments and other foreseeable future projects outside the urban areas would be small compared with the size of the subbasins, each of which is over 440,000 acres. The amount of groundwater pumped from underlying aquifers for water supply at the HMF would be small (approximately 52 acre-feet per year) compared to the estimated storage capacities of the subbasins, each of which is over 12 million acre-feet

Section 6.0
Avoidance and Minimization Measures

6.0 Avoidance and Minimization Measures

The Authority and FRA have considered avoidance and minimization measures consistent with the Statewide and Bay Area to Central Valley Program EIR/EIS commitments. During project design and construction, the Authority and FRA would implement measures to reduce impacts on water resources. These measures are considered to be part of the project and are described in the following text. The project would also require an Individual Section 404 Permit from the USACE. This permit would have conditions to further minimize water quality impacts.

6.1 Project Design Features for Stormwater Management and Treatment

During the detailed design phase, evaluate each receiving stormwater system's capacity to accommodate project runoff. As necessary, design onsite stormwater management measures, such as detention or selected upgrades to the receiving system, to provide adequate capacity. Design and construct onsite stormwater management facilities to capture runoff and provide treatment prior to discharge for pollutant-generating surfaces, including station parking areas, access roads, new road over- and underpasses, reconstructed interchanges, and new or relocated roads and highways. Consider the use of oil/water separators, 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. Use portions of the HMF site for onsite infiltration of runoff, if feasible, or for stormwater detention, if not. Incorporate vegetated set-backs from streams.

6.2 Project Design Features for Flood Protection

Design the project both to remain operational during flood events and to minimize increases in 100-year flood elevations, including the following:

- In SFHAs, raise the track above the 100-year flood elevation.
- Minimize development within the floodplain as appropriate. Avoid placement of facilities in the floodplain or raise the ground with fill above the base-flood elevation.
- 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 must 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.)
- Design of the crossings would maintain a 100-year floodwater surface elevation increase of no greater than 1.0 foot in the floodplain or 0.1 foot in the floodway. The following design considerations would minimize the effects of the HST 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 above the high-water surface elevation to provide adequate clearance for floating debris.

- Conduct engineering analyses of channel scour depths at each crossing to evaluate the depth for burying the bridge piers. 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, where feasible.

- Place bedding materials under the stone protection at locations where the underlying soils require stabilization as a result of streamflow velocity.

6.3 Construction Stormwater Pollution Prevention Plan

The SWRCB Construction General Permit (2009-0009 DWQ) establishes three erosion 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 Erosion 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 the Kings River would fall under Erosion Risk Level 2. Erosion 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 (Authority and FRA [2008] 2010).

The Construction General Permit requires preparation and implementation of an 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 could include measures to provide permeable surfaces where feasible, and to retain and treat stormwater onsite. Other BMPs include strategies to manage the overall amount and quality of stormwater runoff. Typical BMPs include:

- 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, placement of rice straw bales, and sediment basins.

- Implementing practices to maintain 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 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.
- Limiting construction to dry periods when flows in water bodies are low or absent.

6.4 Central Valley Regional Water Quality Board Order No. R5-2008-0081, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters

This order 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.

6.5 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 CCR 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 crossing proposed for a federal flood control project, the CVFPB coordinates review of the application with the USACE and other agencies, as necessary. 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.

Where the alignments cross floodplains on embankments, additional hydraulic analyses will be conducted to determine the size of openings required to pass the 100-year event without a significant increase in water surface elevation. These openings will be incorporated into the design of the project. Where it is not possible to construct a portion of the alignment without significantly affecting the floodplain, a Conditional Letter of Map Revision should be completed before construction to provide an opportunity for affected communities to respond to proposed changes in the floodplain.

6.6 Maintain Pre-Project Hydrology

Increases in the existing peak stormwater flows from the project site will be avoided. This avoidance would be accomplished by emphasizing onsite retention of stormwater runoff using measures such as flow dispersion, infiltration, and evaporation and supplementing these measures with detention, where required. Additional flow control measures could be implemented where local regulations or drainage requirements dictate.

6.7 Industrial Stormwater Pollution Prevention Plan

The stormwater general permit (97-03-DWQ) requires preparation of an 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.

Section 7.0
References

7.0 References

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Section 8.0
Preparer Qualifications

8.0 Preparer Qualifications

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