CALIFORNIA HIGH-SPEED TRAIN

Technical Report

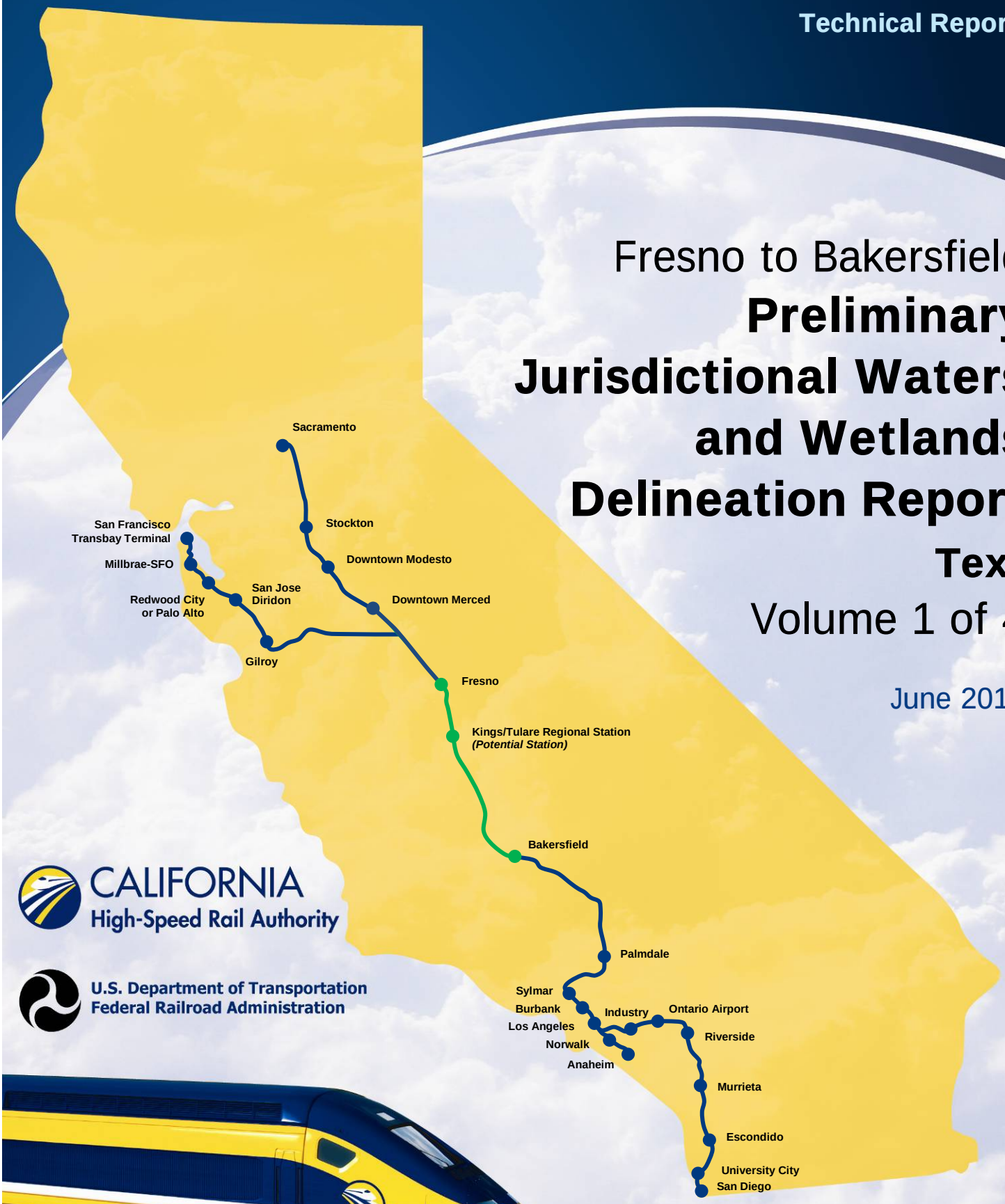
Fresno to Bakersfield

Preliminary Jurisdictional Waters and Wetlands Delineation Report

Text

Volume 1 of 4

June 2011



CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

Preliminary Jurisdictional Waters and Wetlands Delineation Report

Volume 1 of 4

Prepared by:

URS/HMM/Arup Joint Venture

June 2011

PRELIMINARY JURISDICTIONAL DETERMINATION FORM
Sacramento District

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

Regulatory Branch: **California South** File/ORM #: **SPK-2009-01482** PJD Date: **June 2011**

State: **CA** City/County: **Fresno/Kings/Tulare/Kern Counties**
Nearest Waterbody: **Kings River, Cross Creek, Tule River, Poso Creek, Kern River**

Location (Lat/Long): **Northern terminus 36.73987, -119.801 Southern terminus 35.36953,-118.994**

Size of Review Area: **20,688** acres

Name/Address Of Property Owner/ Potential Applicant: **Dan Leavitt**
California High Speed Rail Authority
770 L Street, Suite 800
Sacramento, California 95814

Identify (Estimate) Amount of Waters in the Review Area
Non-Wetland Waters:
Please see Appendix H for all Jurisdicitonal Features
linear feet ft wide acre(s)
Stream Flow: **N/A**

Wetlands: Please see Appendix H for All Jurisdictional Features
acre(s) Cowardin Class: **N/A**

Name of any Water Bodies on the site identified as Section 10 Waters: Tidal: Non-Tidal:

☐ Office (Desk) Determination
☐ Field Determination:
Date(s) of Site Visit(s): **March-July 2010; March 2011**

SUPPORTING DATA: Data reviewed for preliminary JD (check all that apply – checked items should be included in case file and, where checked and requested, appropriately reference sources below)

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
- ☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
- ☐ Data sheets prepared by the Corps.
- ☐ Corps navigable waters' study.
- ☒ U.S. Geological Survey Hydrologic Atlas:
  - ☒ USGS NHD data.
  - ☒ USGS HUC maps.
- ☒ U.S. Geological Survey map(s). Cite scale & quad name:
- ☒ USDA Natural Resources Conservation Service Soil Survey.
- ☒ National wetlands inventory map(s).
- ☐ State/Local wetland inventory map(s).
- ☐ FEMA/FIRM maps.
- ☐ 100-year Floodplain Elevation (if known):
- ☒ Photographs: ☒ Aerial ☐ Other
- ☐ Previous determination(s). File no. and date of response letter:
- ☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and Date of Regulatory Project Manager (REQUIRED)

Signature and Date of Person Requesting Preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

EXPLANATION OF PRELIMINARY AND APPROVED JURISDICTIONAL DETERMINATIONS:

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "preconstruction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

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Acronyms

Authority	California High-Speed Rail Authority
bgs	below ground surface
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
EIR	environmental impact report
EIS	environmental impact statement
°F	degree(s) Fahrenheit
FRA	Federal Railroad Administration
GIS	geographic information system
GPS	global positioning system
HMF	heavy-maintenance facility
HST	high-speed train
HUC	hydrologic unit code
MPH	miles per hour
NEPA	National Environmental Policy Act
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OHWM	ordinary high-water mark
Other Waters	other waters of the U.S.
RPW	relatively permanent waters
RWQCB	Regional Water Quality Control Board
Statewide Program EIR/EIS	*Final Program Environmental Impact Report and Environmental Impact Statement for the Proposed California High-Speed Train System*
Survey Plan	Central Valley Biological Resources and Wetlands Survey Plan
SWRCB	State Water Resources Control Board
TNW	traditionally navigable water

TPS	traction power substations
USACE	U.S. Army Corps of Engineers
U.S. EPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
waters of the state	state waters and California Department of Fish and Game lakes and streambeds
WETS	Wetlands Determination

Section 1.0
Introduction

1.0 Introduction

This Preliminary Jurisdictional Waters and Wetlands Delineation Report describes the regulatory setting, existing conditions, and potential impacts associated with wetlands and non-wetland waters present in or affected by the proposed California High-Speed Train (HST) Project for the section between Fresno and Bakersfield, California.

The HST project is planned to provide intercity high-speed train service on over 800 miles of track throughout California that will connect the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego (**Figure 1-1**). The HST system is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology that will include safety, signaling, and automated train-control systems. The trains will be capable of operating at speeds of up to 220 miles per hour (mph) over a fully grade-separated, dedicated track alignment, with an expected express-trip time between Los Angeles and San Francisco of approximately 2 hours and 40 minutes.

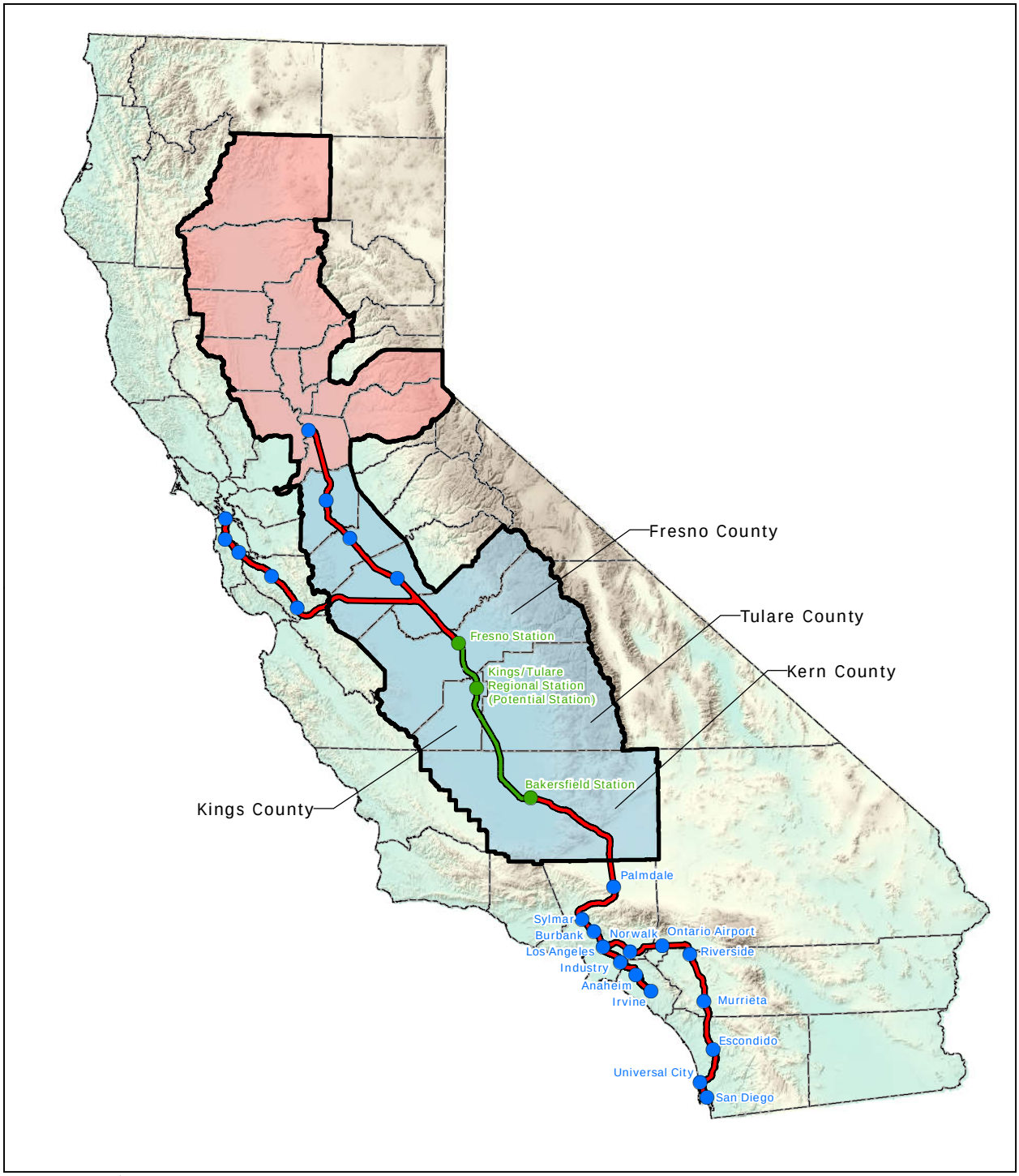
In 2005, the California High-Speed Rail Authority (Authority) and the Federal Rail Authority (FRA) completed a Final Program Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed California HST System (Statewide Program EIR/EIS), as the first phase of a tiered environmental review process. The Authority certified the Final Program EIR under the State California Environmental Quality Act (CEQA); selected the proposed HST system alternative for further project environmental review over the No Project and Modal Alternatives; and made several corridor decisions. The Authority also issued a Notice of Determination and CEQA Findings of Fact (November 2005), and adopted a Mitigation Monitoring and Reporting Plan. The FRA issued a Record of Decision (ROD, November 18, 2005) under the National Environmental Policy Act (NEPA) on the Final Program EIS.

The Authority and FRA are now undertaking second-tier project environmental evaluations for several sections of the statewide system. The project EIR/EIS documents for sections of the California HST system are being prepared to satisfy the environmental review requirements of state and federal laws, and will enable the public and agencies to participate in the review of site-specific alternatives.

The EIR/EIS will also help define appropriate project mitigation measures to minimize and mitigate adverse impacts that tier from the CEQA Findings of Fact (November 2005) and the Record of Decision (November 18, 2005) for the statewide EIR/EIS. The information in the project environmental documents will be used to make decisions about the location of alignments, stations, and facilities to serve the HST and to seek permits and other needed approvals.

In all cases, the project environmental analysis will reference and use the information contained in one or both of the Program EIRs/EISs to ensure consistency with previous decisions and guidance provided by the Authority and FRA. In particular, relevant mitigation strategies for impacts identified in the program—CEQA Findings of Fact and the Record of Decision—will be addressed in each Project EIR/EIS.

The Authority is both the project sponsor and the lead agency under CEQA. The Authority has determined that project EIRs for sections of the statewide HST system are the appropriate documents for this next stage of planning and decision making, which will involve further refinement and evaluation of alignment alternatives, station location options, maintenance facility locations, and phasing options. Coordination and consultation with local and regional agencies needed for project approvals will be part of the project environmental review process.



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

June 20, 2011

Source: URS, 2011

N

0 40 80
Miles

0 80 160
Kilometers

- Proposed station
- Fresno to Bakersfield project section station
- Preliminary_Statewide_Routes
- Proposed High-Speed Train system
- Counties Commonly Associated with the Central Valley
- Sacramento Valley County
- San Joaquin Valley County

Figure 1-1
Fresno to Bakersfield HST Section

FRA is the federal lead agency for the preparation of the EIS. Other federal agencies with major actions or permits may choose to serve as cooperating agencies. The second-tier project EISs under NEPA for sections of the HST system are the appropriate NEPA documents for the nature and scope of the HST project, anticipated approvals and decisions by federal agencies, and the need to further examine alignment alternatives and station location options selected at the program level.

The statewide HST system has been divided into several sections for purposes of developing the second-tier EIR/EIS This Wetlands Delineation Report is for the Fresno to Bakersfield Section. Information from this report will be summarized in the project EIR/EIS and will be part of the administrative record supporting the environmental review of the proposed project.

1.1 Project History

The HST section from Fresno to Bakersfield analyzed in this document starts in downtown Fresno and terminates in downtown Bakersfield (**Figure 1-2**). This HST section crosses through parts of Fresno, Kings, Tulare, and Kern counties.

The Statewide Program EIR/EIS process resulted in selection of the BNSF Railway alignment from Fresno to Bakersfield as the preferred HST corridor for this portion of the Central Valley, with stations in Fresno and Bakersfield. The preferred station locations are in downtown Fresno along the UPRR Railway alignment, and in downtown Bakersfield east of the new Amtrak station near Truxtun Avenue and R Street.

The Statewide Program EIR/EIS indicated that the project environmental review for this part of the HST system would study alignment alternatives between Fresno and Bakersfield to determine whether a station could be provided in the vicinity of Visalia. This EIR/EIS evaluates alternative alignments that would facilitate a potential station in the Hanford/Visalia/Tulare area, hereafter referred to as the Kings/Tulare Regional Station (**Figure 1-3**).

The Project EIR/EIS will also analyze biological resources, focusing on project-specific impacts that reflect more precise definitions of the right-of-way, proposed facility locations, and operations. These subsequent analyses would support the overall biological resources mitigation strategy for the HST system, which includes: (1) field verification of sensitive resources; (2) filling data gaps; (3) project-specific analyses of environmental impacts; (4) consultation with appropriate resource agencies to refine avoidance and mitigation measures, and (5) developing and adopting a mitigation monitoring program.

1.2 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 right-of-way. Alternative alignments are being considered where engineering constraints require deviation from the existing railroad corridor, and to avoid environmental impacts.

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2011

June 15, 2011

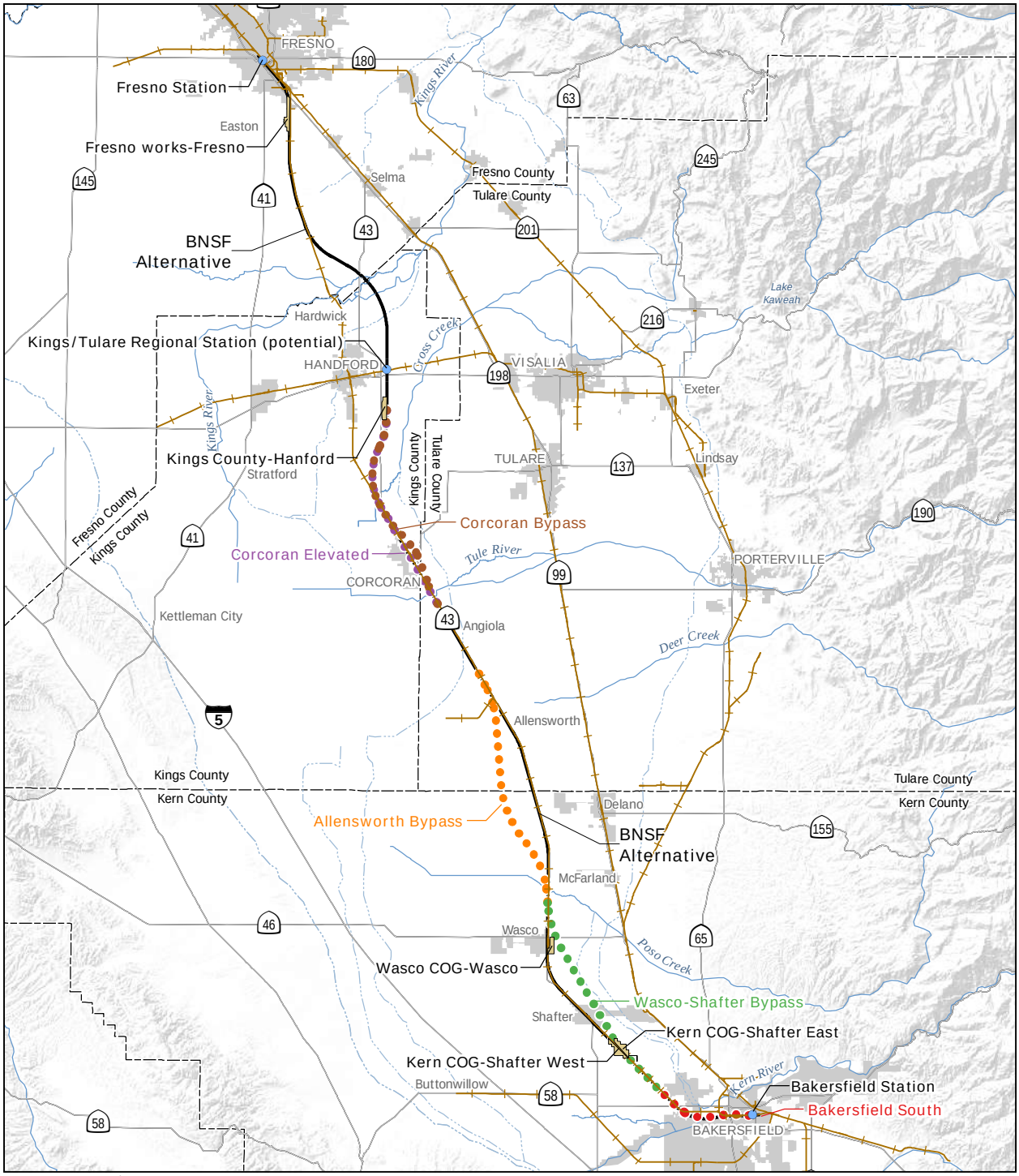
Alternative alignments
Highway
Railroad
River
Public land

N

0 5 10
Miles

0 10 20
Kilometers

Figure 1-2
Overall project study area



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

June 17, 2011

Data source: URS, 2011

BNSF Alternative
Corcoran Elevated
Allensworth Bypass
Bakersfield South
Corcoran Bypass
Wasco-Shafter Bypass
Stations
Alternative heavy maintenance facility (HMF)
Stream/River
Canal/Aqueduct
Existing rail line
County boundary
Community/Urban area

N

0 5 10
Miles

0 10 20
Kilometers

Figure 1-3
Fresno to Bakersfield HST alignments

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.

1.3 Project Alternatives

1.3.1 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 1-3**).

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 1-3**). 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 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 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.

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 except that it would pass through the city of Corcoran on the eastern side of the BNSF Railway right-of-way on an elevated structure. The elevated structure would reach a maximum height of approximately 40 feet to the top of the rail. 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, two elevated structures would carry the HST over Cross Creek 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. 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 rejoin the BNSF Alternative at 7th Standard Road. The total length of the alternative alignment would be approximately 24 miles, and the alignment would be at-grade.

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 but then be 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.

1.3.2 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.

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

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 1-4**.

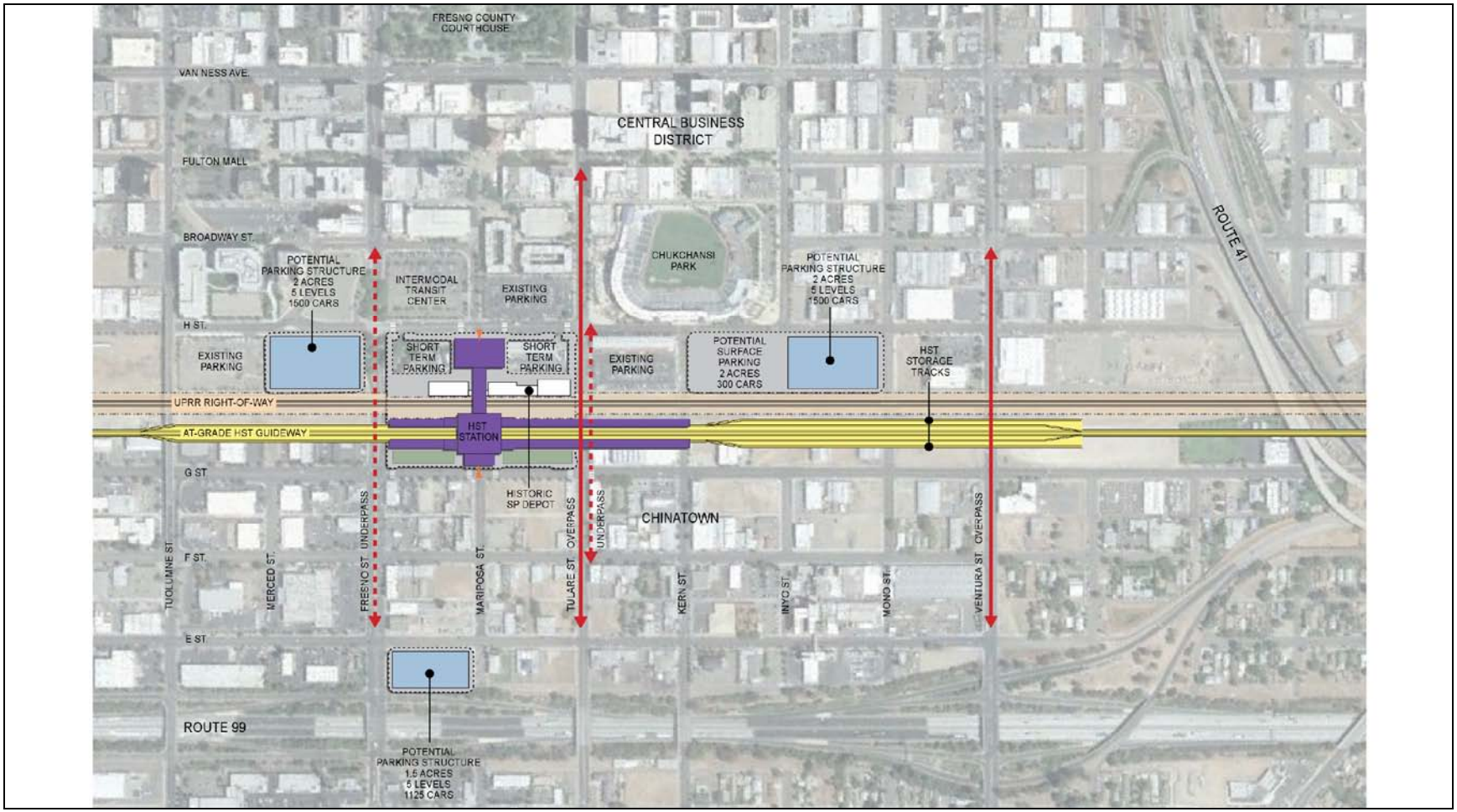
The majority of station facilities would be east of the UPRR tracks. The station and associated facilities would occupy approximately 20.5 acres, including 13 acres dedicated to the station, short term parking, and kiss-and-ride accommodations. A new intermodal facility, not a part of this proposed undertaking, 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 1-4**). 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.

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.

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.



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

June 15, 2011

STATION ENTRANCE

KEY PEDESTRIAN LINKAGE

OPEN SPACE

STATION CAMPUS BOUNDARY

RIGHT-OF-WAY BOUNDARY

ROADWAY MODIFICATION

N

NOT TO SCALE

Figure 1-4
Fresno Station-Mariposa Alternative

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 1-5**). 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 (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 1-6**). 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.

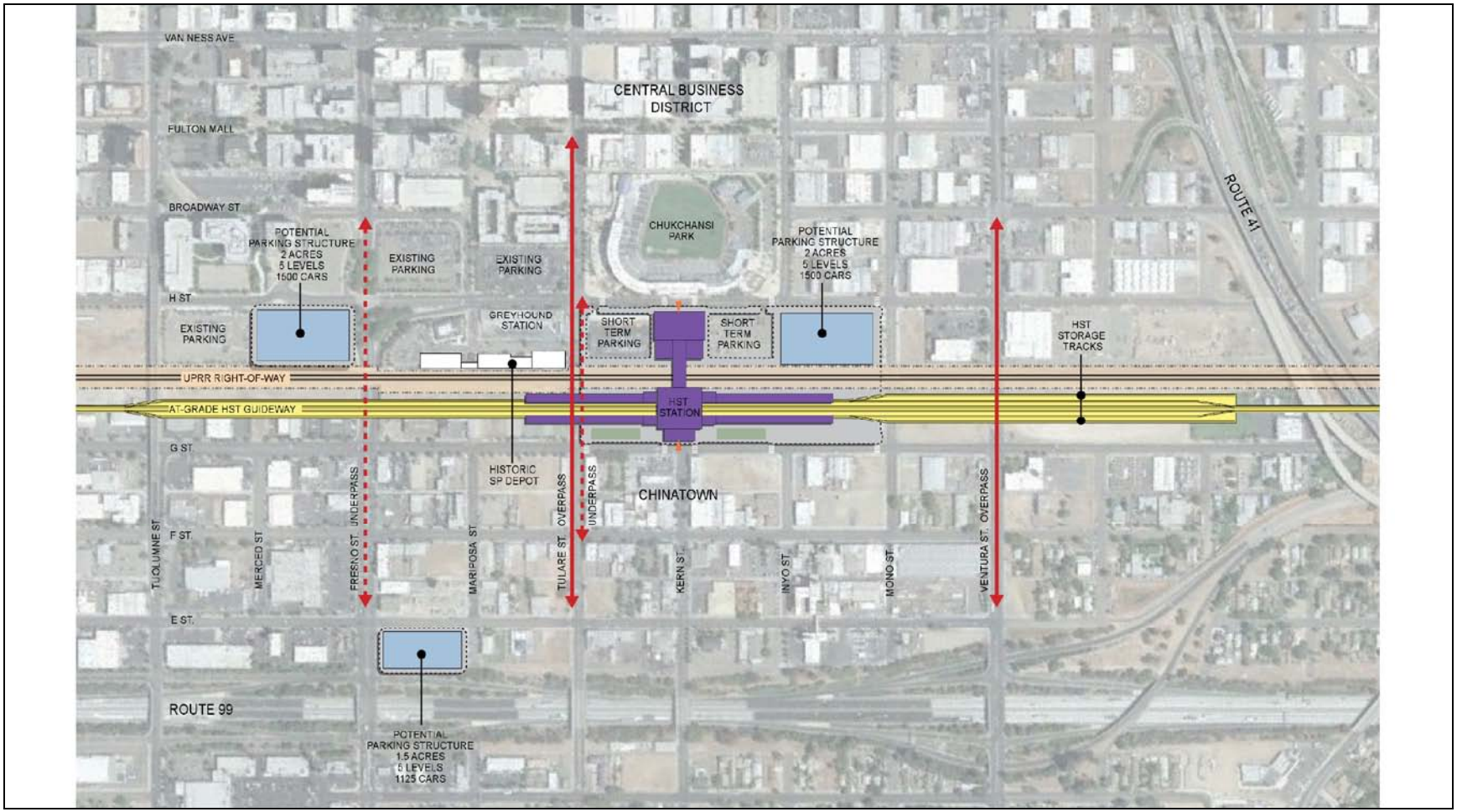
C. BAKERSFIELD STATION ALTERNATIVES

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 1-7**). 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 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.



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

June 15, 2011

STATION ENTRANCE

KEY PEDESTRIAN LINKAGE

OPEN SPACE

STATION CAMPUS BOUNDARY

RIGHT-OF-WAY BOUNDARY

ROADWAY MODIFICATION

NOT TO SCALE

Figure 1-5
Fresno Station-Kern Alternative

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

June 15, 2011

STATION ENTRANCE

KEY PEDESTRIAN LINKAGE

OPEN SPACE

STATION CAMPUS BOUNDARY

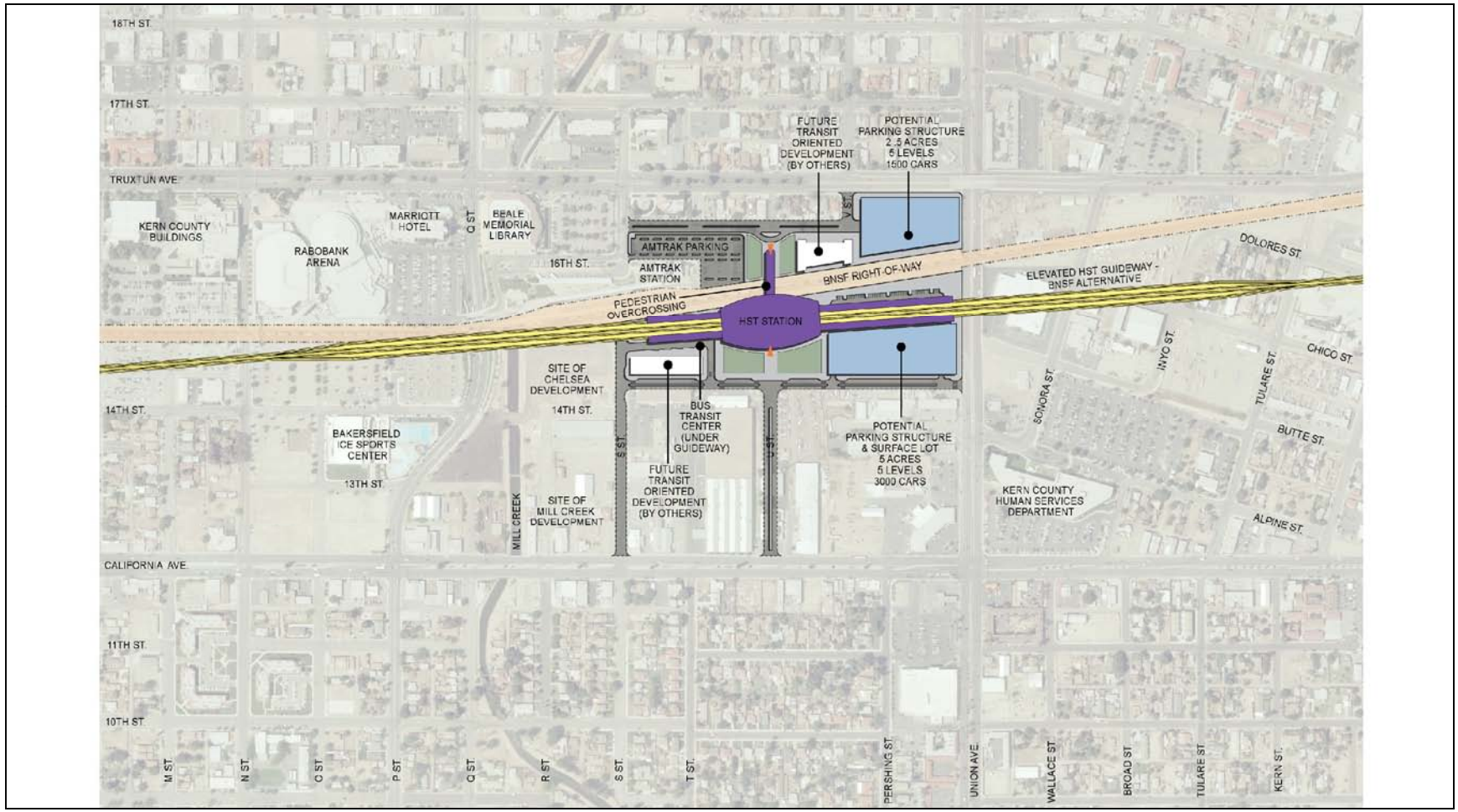
RIGHT-OF-WAY BOUNDARY

ROADWAY MODIFICATION

N

NOT TO SCALE

Figure 1-6
Kings/Tulare Regional Station (potential)



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

June 15, 2011

STATION ENTRANCE

KEY PEDESTRIAN LINKAGE

OPEN SPACE

STATION CAMPUS BOUNDARY

RIGHT-OF-WAY BOUNDARY

ROADWAY MODIFICATION

N

NOT TO SCALE

Figure 1-7
Bakersfield Station-North Alternative

D. 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 1-8**). 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.

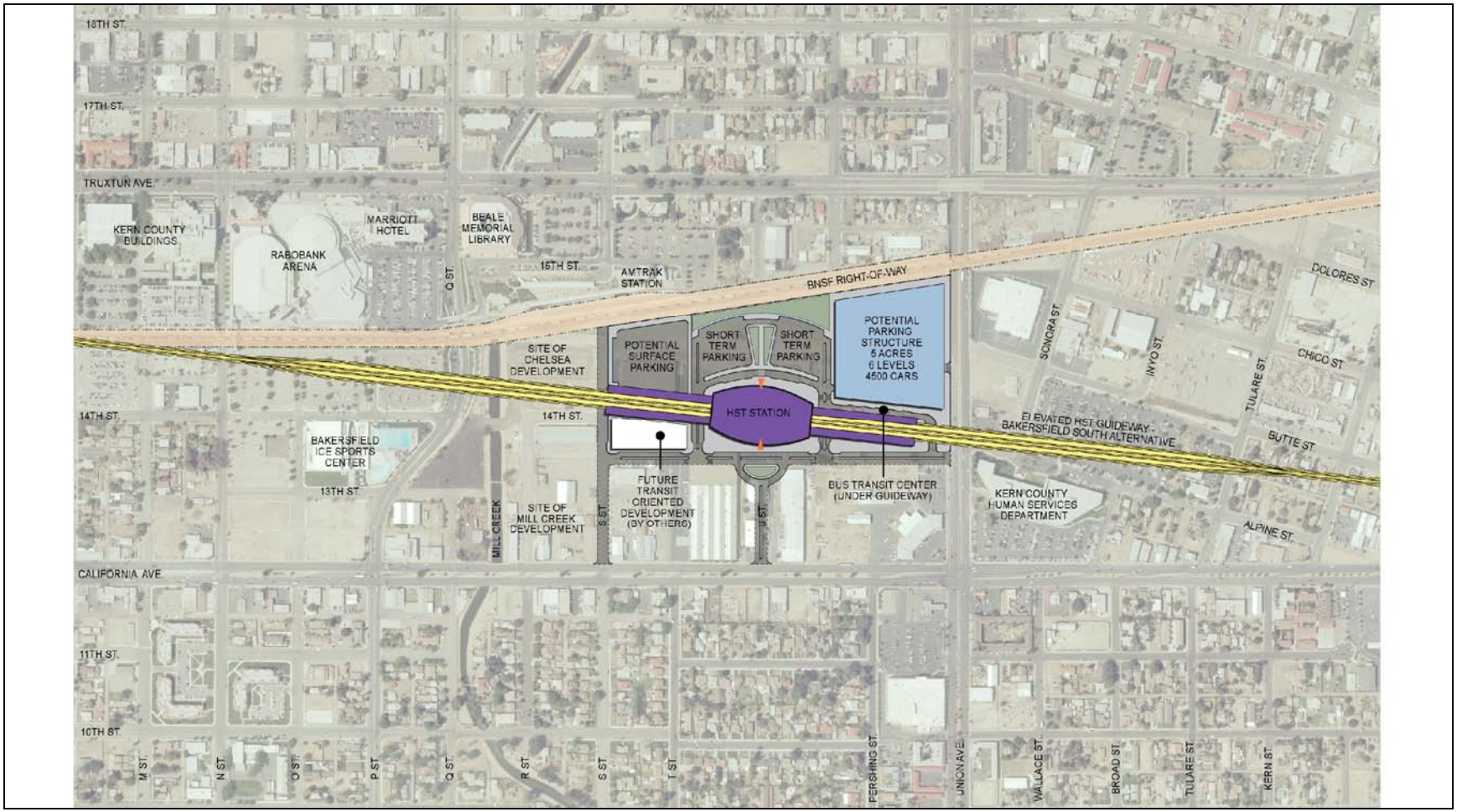
The entire site would be 20 acres, with 15 acres designated for the station, bus transit center, short-term parking, and kiss-and-ride. An additional 5 acres would support one six-level parking structure with a capacity of approximately 4,500 cars. Unlike the Bakersfield Station–North Alternative, this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

1.3.3 Heavy Maintenance Facility (HMF)

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 1-3**):

- 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.
- 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.



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

June 15, 2011

STATION ENTRANCE

KEY PEDESTRIAN LINKAGE

OPEN SPACE

STATION CAMPUS BOUNDARY

RIGHT-OF-WAY BOUNDARY

ROADWAY MODIFICATION

N

NOT TO SCALE

Figure 1-8
Bakersfield Station-South Alternative

1.4 Power

To provide power for the HST, high-voltage electricity at 115 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.

1.5 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 viaduct 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 1.5-1**.

Table 1.5-1
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	Viaduct 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
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

1.6 Purpose of the Wetland Delineation

Both the Statewide HST System Program EIR/EIS and the Bay Area to Central Valley HST Program EIR/EIS require subsequent analysis of the potential impact on various biological resources (i.e., special aquatic resources) at the Project level (Authority and FRA 2005 and 2008). A project-level study is needed to obtain more reliable assessments of potential impacts on biological resources identified in the resource study areas. The subsequent analysis required for the special aquatic resources includes a delineation of special aquatic resources to determine the extent of U.S. Army Corp of Engineers (USACE), Regional Water Quality Control Board (RWQCB), and California Department of Fish and Game (CDFG) jurisdiction, and to conduct consultation with these agencies regarding appropriate mitigation. Wetland scientists conducted a detailed delineation of special aquatic resources of the Wetland Study Area with the intent of obtaining a Preliminary Jurisdictional Determination, as described in USACE Regulatory Guidance Letter No. 08-02 (USACE 2008c) and Attachment 1 of the USACE letter to Dan Leavitt dated February 17, 2011 (USACE 2011). The intention of the delineation was also to satisfy RWQCB and CDFG mapping criteria for any additional waters of the state.

This report provides the results of the wetland delineation, a summary of the consultation with the regulatory agencies, and a summary of the unavoidable impacts on the special aquatic resources in the project footprint. While this report will be submitted to all relevant regulatory agencies, the primary goal of the report is to obtain a preliminary jurisdictional determination, per regulatory guidance, from the Sacramento District of the USACE.

1.7 Applicant and Property Owner Contact Information

Applicant contact information:

California High Speed Rail Authority
c/o Lupe Jimenez
Senior Environmental Planner
770 L Street, Suite 800
Sacramento, CA 95814
Direct: (916) 384-9523
Cell: (916) 204-1168
Email: ljimenez@hsr.ca.gov

There are several thousand private and public properties located in the Wetland Study Area. At this time, a complete list of the various property owners is not available. A complete list of property owners and the associated contact information will be provided as part of the Section 404 Individual Permit Application.

Section 2.0
Project Setting

2.0 Project Setting

This section describes the definitions used in this report, and describes the project environmental settings, including the physical and biological conditions found in the Wetland Study Area.

2.1 Definitions

Several distinct but related terms are used in this Wetlands Delineation Report: special aquatic resources, project footprint, and Wetland Study Area. These terms are defined and described in more detail below:

- Special aquatic resources: As used in this report, the term "special aquatic resources" refers to jurisdictional features regulated under Sections 404 and 401 of the Clean Water Act (CWA), CDFG Code Section 1600 et seq., and the Porter-Cologne Water Quality Control Act. Section 404 of the CWA defines federal jurisdiction for wetlands and other waters, cumulatively termed "waters of the U.S." Section 401 of the CWA regulates water quality and is administered in California by the California State Water Resources Control Board (SRWCB). State waters are not clearly defined and a policy for regulating impacts has not been officially adopted, although a draft definition has been developed. The federal, state (as proposed), and CDFG lake and streambed (under Section 1600 et seq.) regulatory definitions are provided in Appendix A (Regulatory Requirements).

- The project footprint is the area directly affected by the proposed project activities and includes all permanent and temporary ground disturbing activities. The project activities include but would not be limited to, the stations, track, maintenance and equipment storage areas, temporary access roads, road overcrossings, construction staging areas and substations.

- The Wetland Study Area is the area that contains the project footprint plus a 250-foot buffer to accommodate for project indirect effects. It is further described in Section 3.

2.2 Wetland Study Area

The Wetland Study Area is located in the San Joaquin Valley of California including portions of Fresno, Kings, Tulare, and Kern counties (**Figure 2-1**). The Wetland Study Area occurs in the vicinity of the cities of Fresno and Bakersfield, and passes near or through multiple smaller, rural communities, including Hanford, Corcoran, Wasco, and Shafter. The northern extent of the Fresno to Bakersfield Alignment begins at Stanislaus Street in Fresno. The southern extent of the alignment terminates at Baker Street in downtown Bakersfield. The alternative alignments occur along portions of the BNSF Railway existing railroad and SR 43. In a few locations the route diverges from both the BNSF Railway and SR 43.

The Wetland Study Area is defined by the extent of the BNSF Alternative, and the five alternative alignments: Corcoran Bypass, Corcoran Elevated, Allensworth Bypass, Wasco-Shafter Bypass, and Bakersfield South (20,687.76 acres). The Wetland Study Area is composed of the proposed project footprint plus a 250-foot buffer around the footprint to accommodate the project's indirect impacts. The 250-foot buffer was established based on the U.S. Fish and Wildlife Service (USFWS) *Programmatic Formal Endangered Species Act Consultation on Issuance of 404 Permits for Project with Relatively Small Effects on Listed Vernal Pool Crustaceans Within the Jurisdiction of the Sacramento Field Office, California* (USFWS 1996). This formal consultation determined that all habitat for vernal pool crustaceans within 250 feet of a proposed development may be considered to be indirectly affected.

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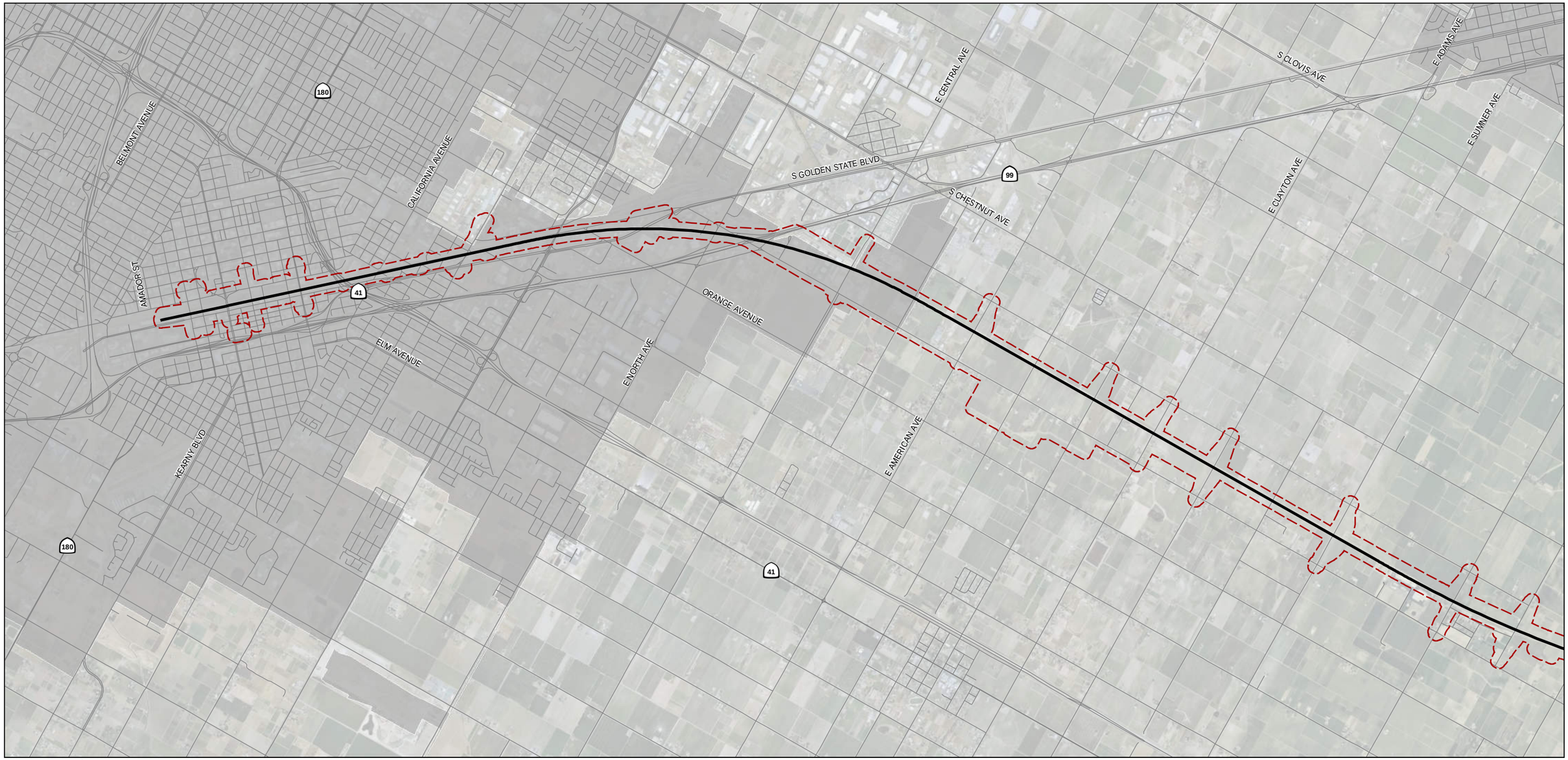

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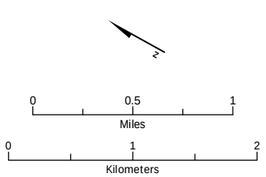
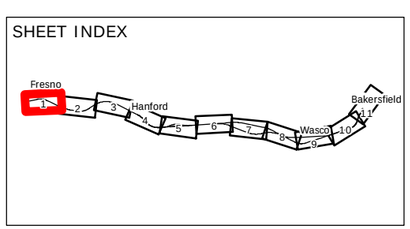
Source: URS, 2011

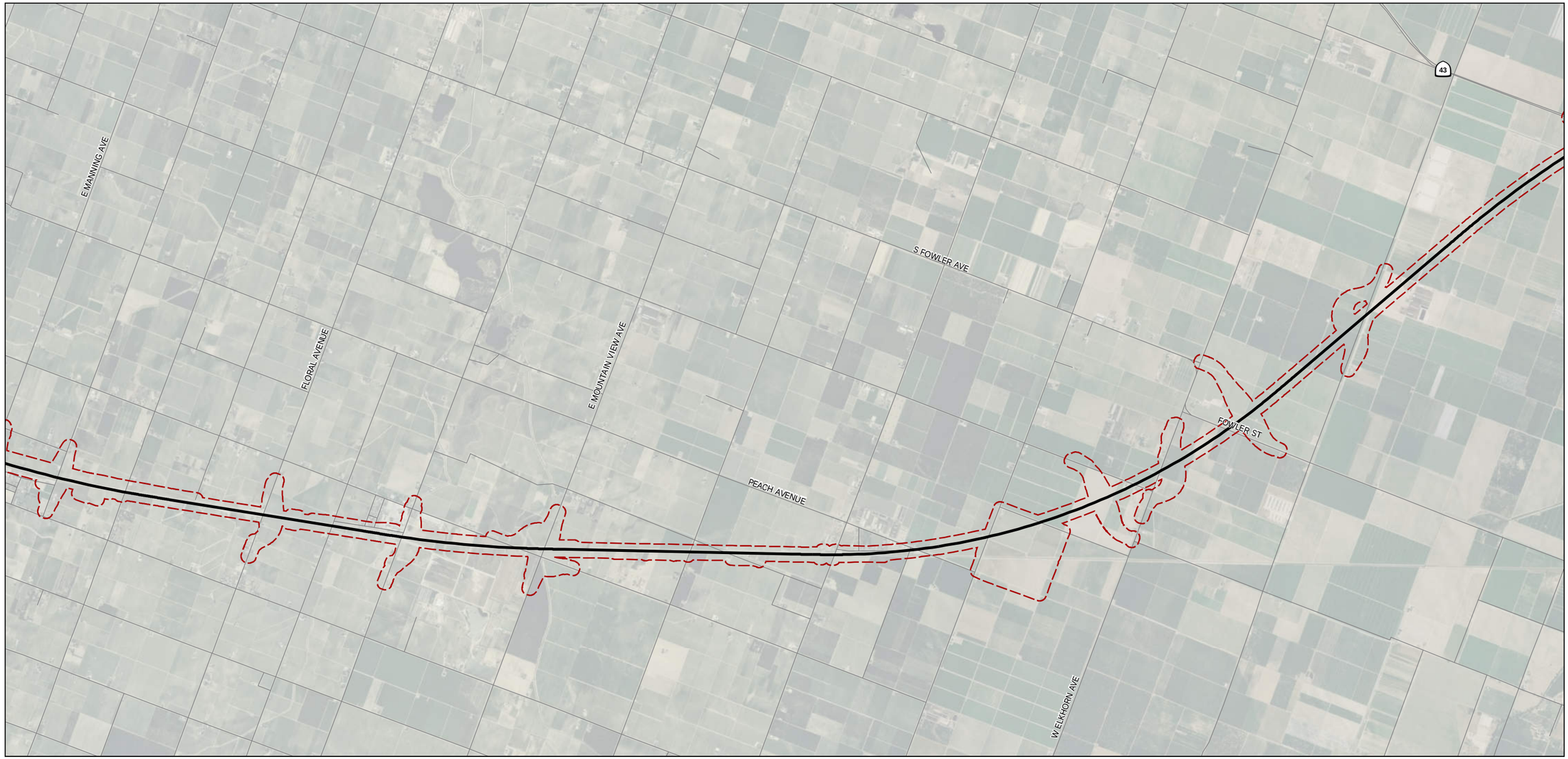
June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 1
Fresno to Bakersfield Wetland Study Area



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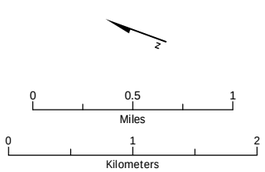
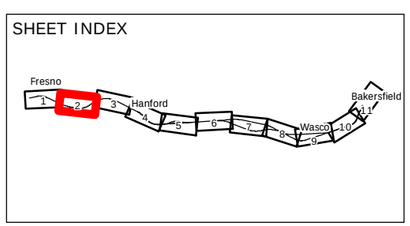
Source: URS, 2011

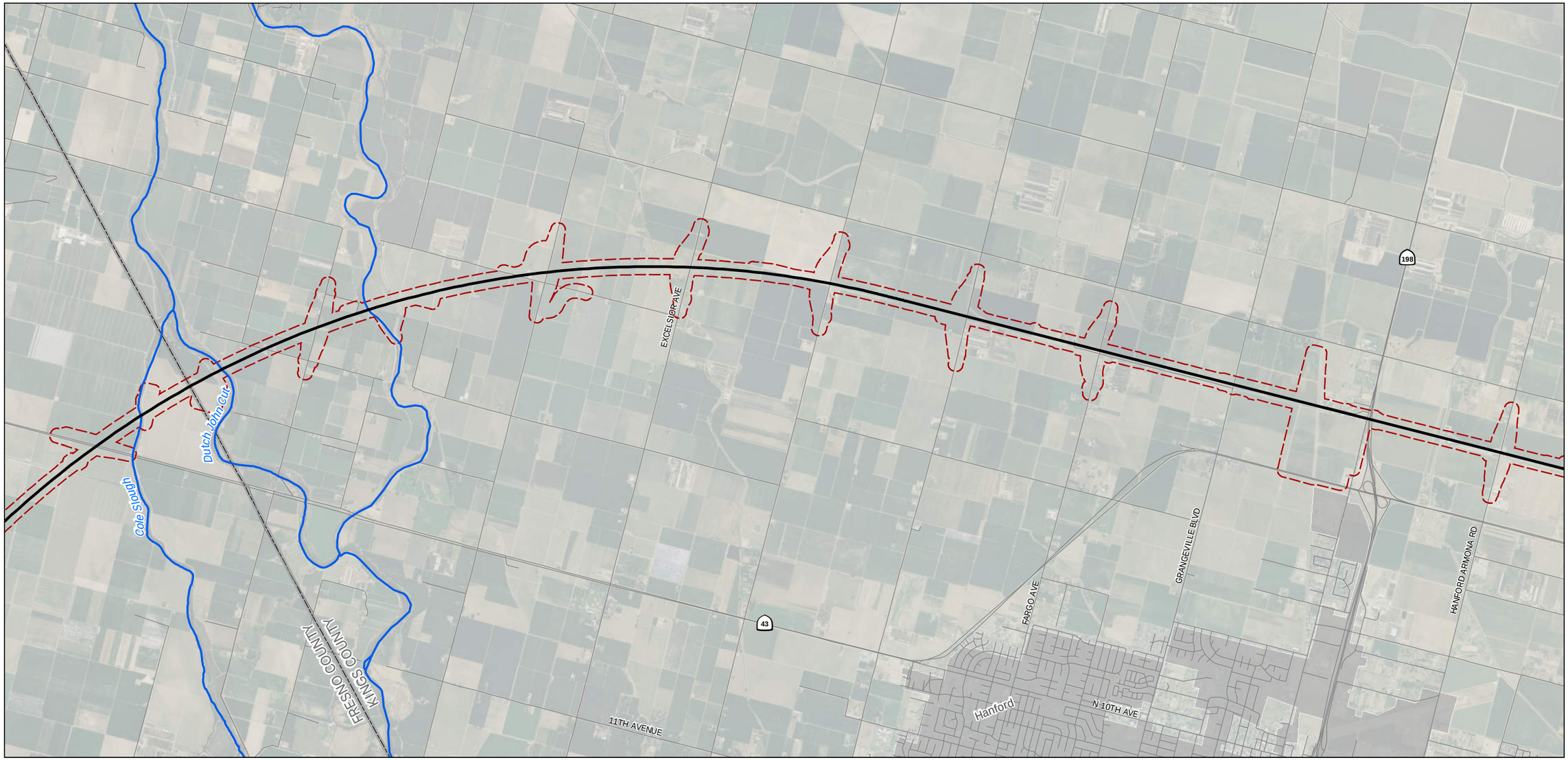
June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 2
Fresno to Bakersfield Wetland Study Area



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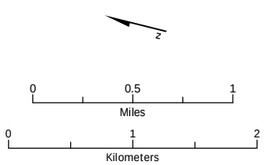
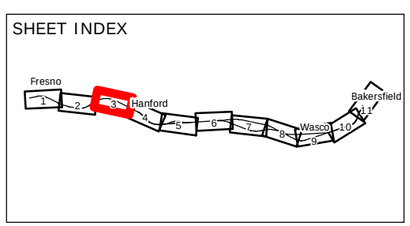
Source: URS, 2011

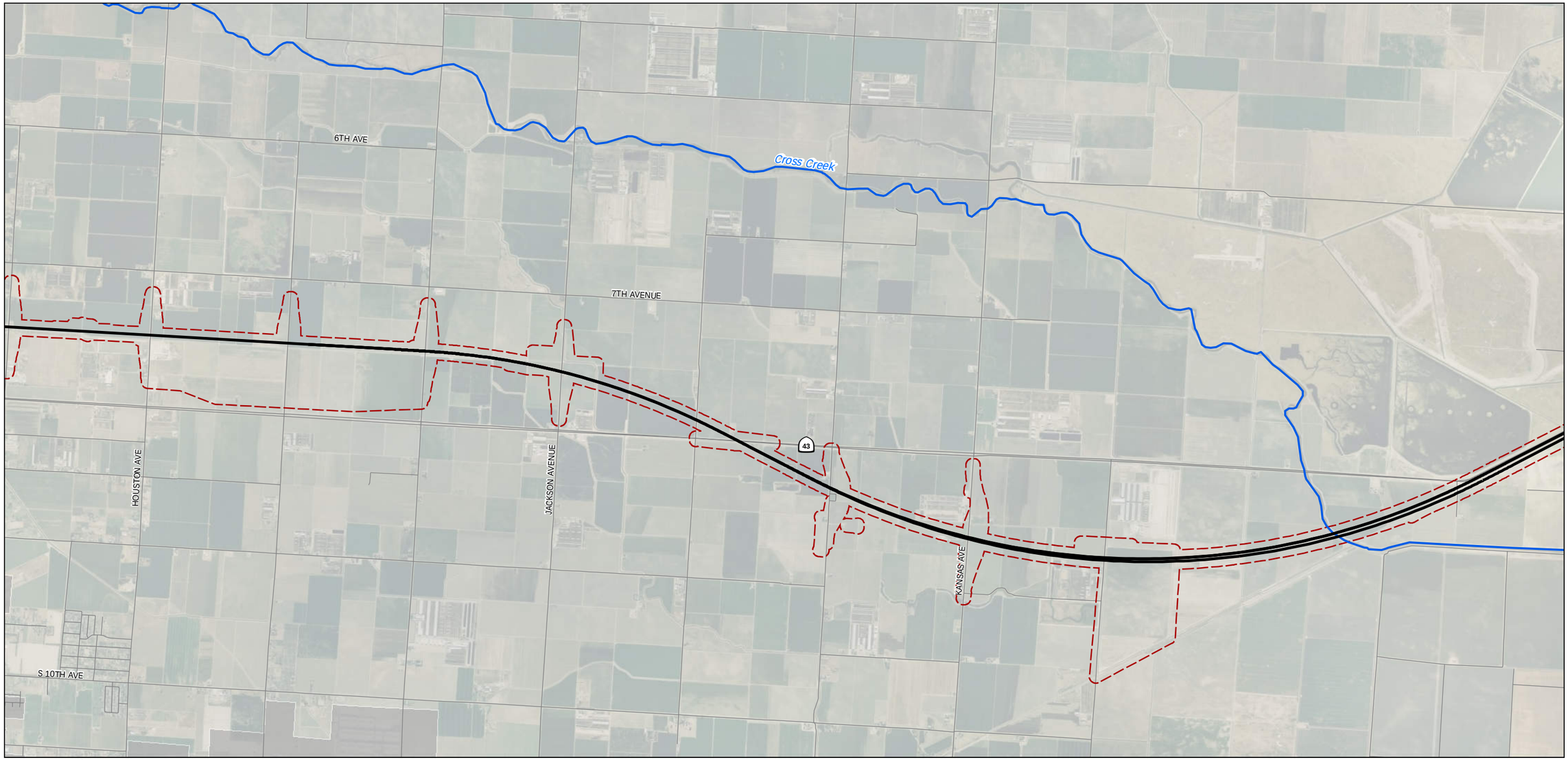
June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 3
Fresno to Bakersfield Wetland Study Area



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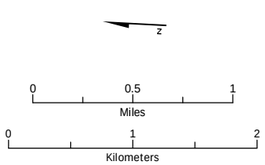
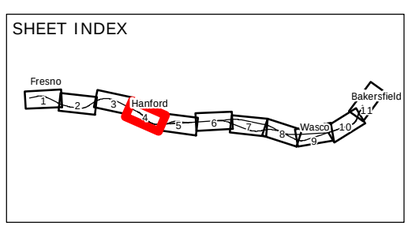
Source: URS, 2011

June 22, 2011



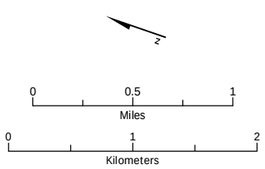


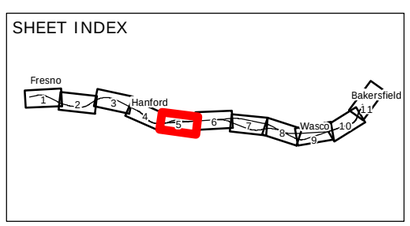
Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 4
Fresno to Bakersfield Wetland Study Area

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2011

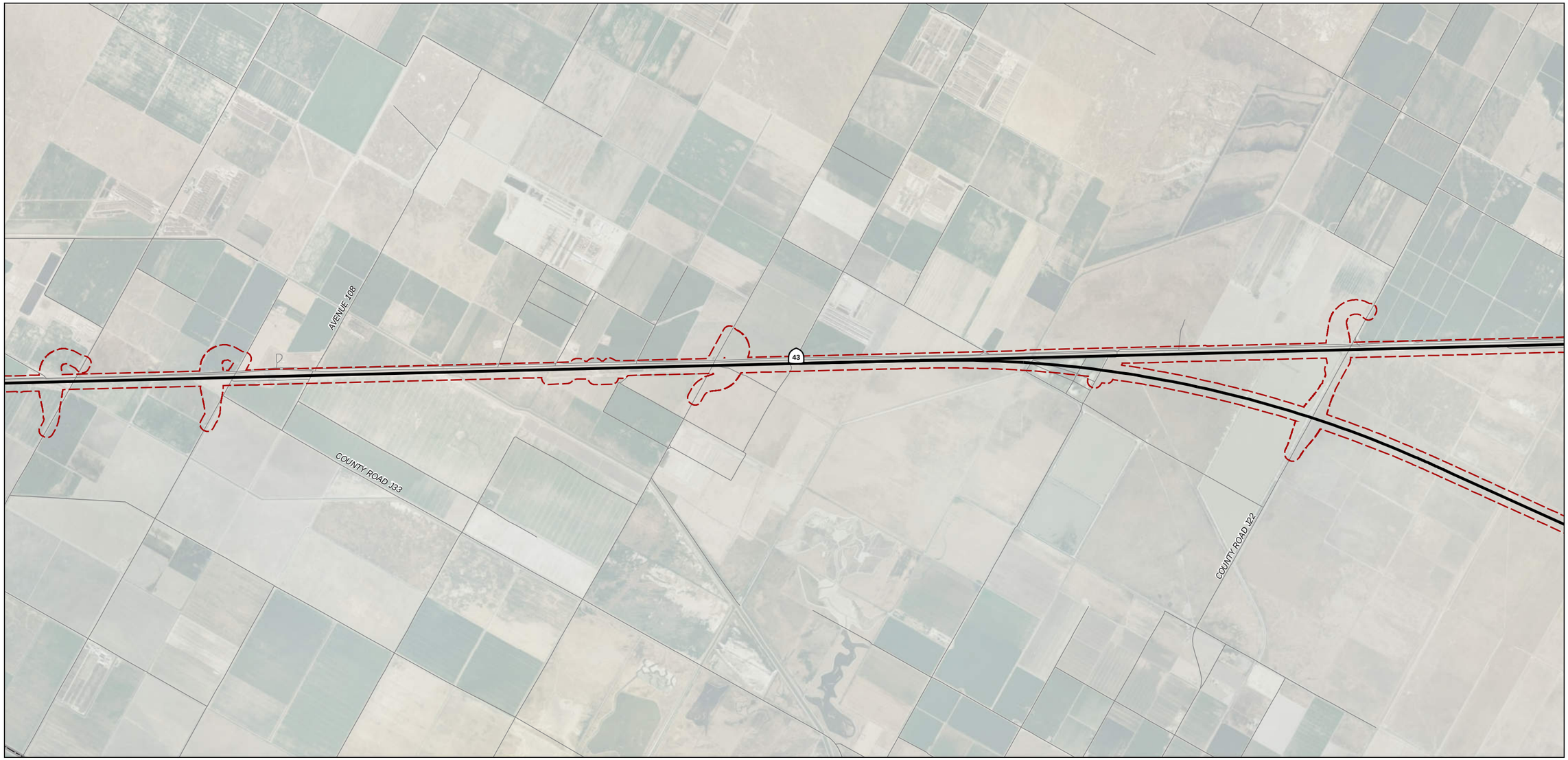
June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 5
Fresno to Bakersfield Wetland Study Area



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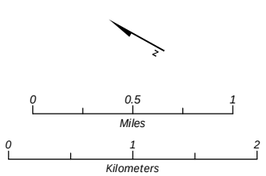
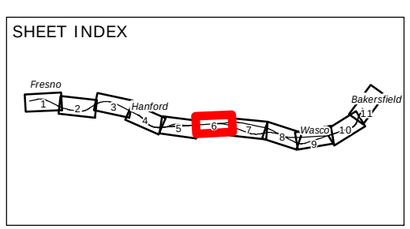
Source: URS, 2011

June 22, 2011





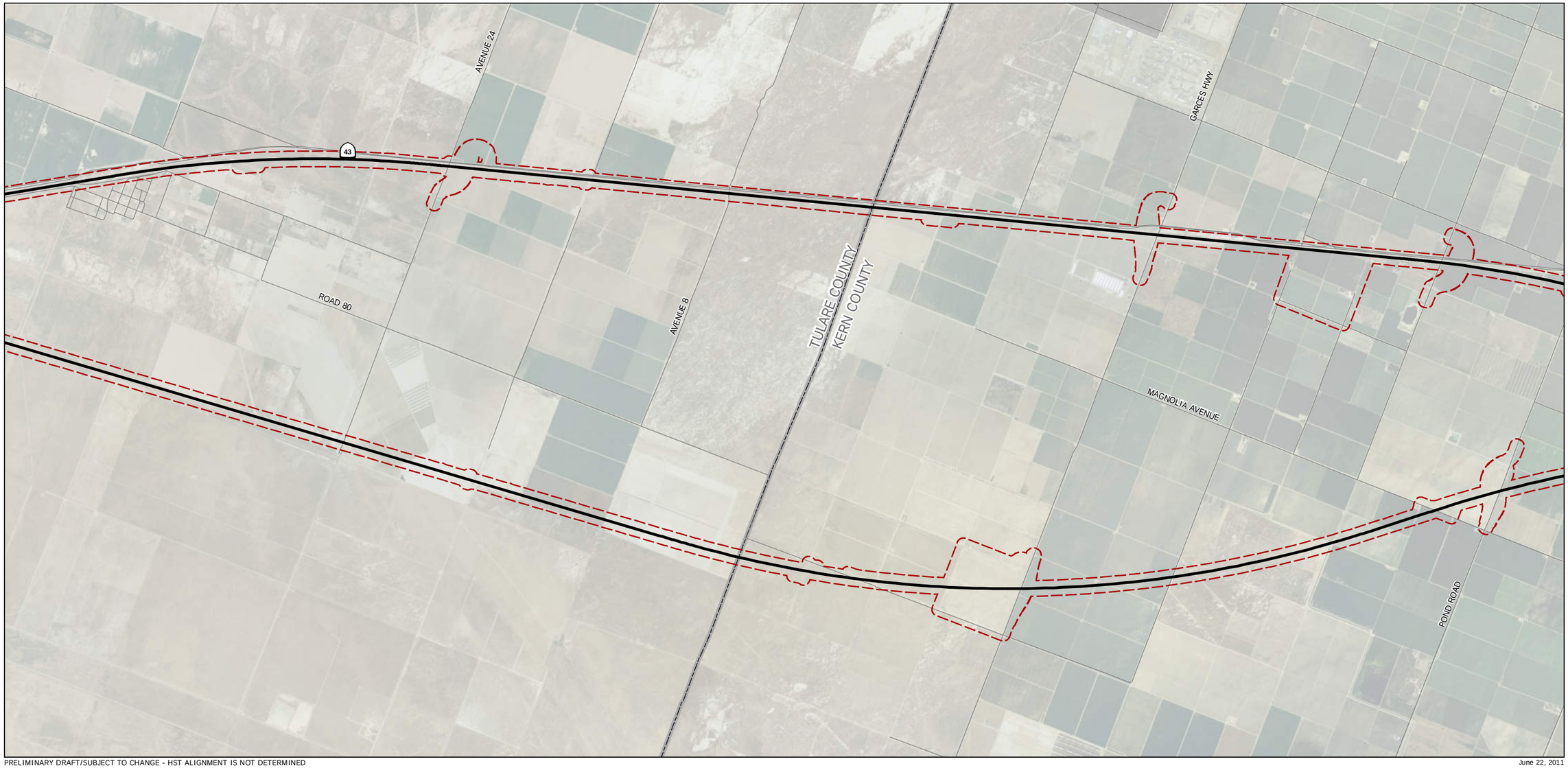
Alternative alignments

Road

Urban area

Wetland Study Area

Figure 2-1
Sheet 6
Fresno to Bakersfield Wetland Study Area



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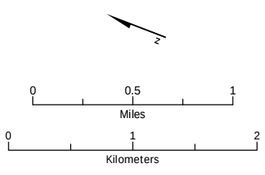
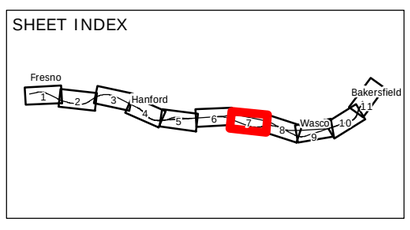
Source: URS, 2011

June 22, 2011



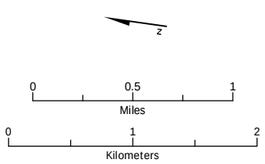


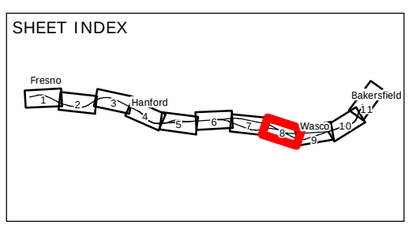
Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 7
Fresno to Bakersfield Wetland Study Area

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2011

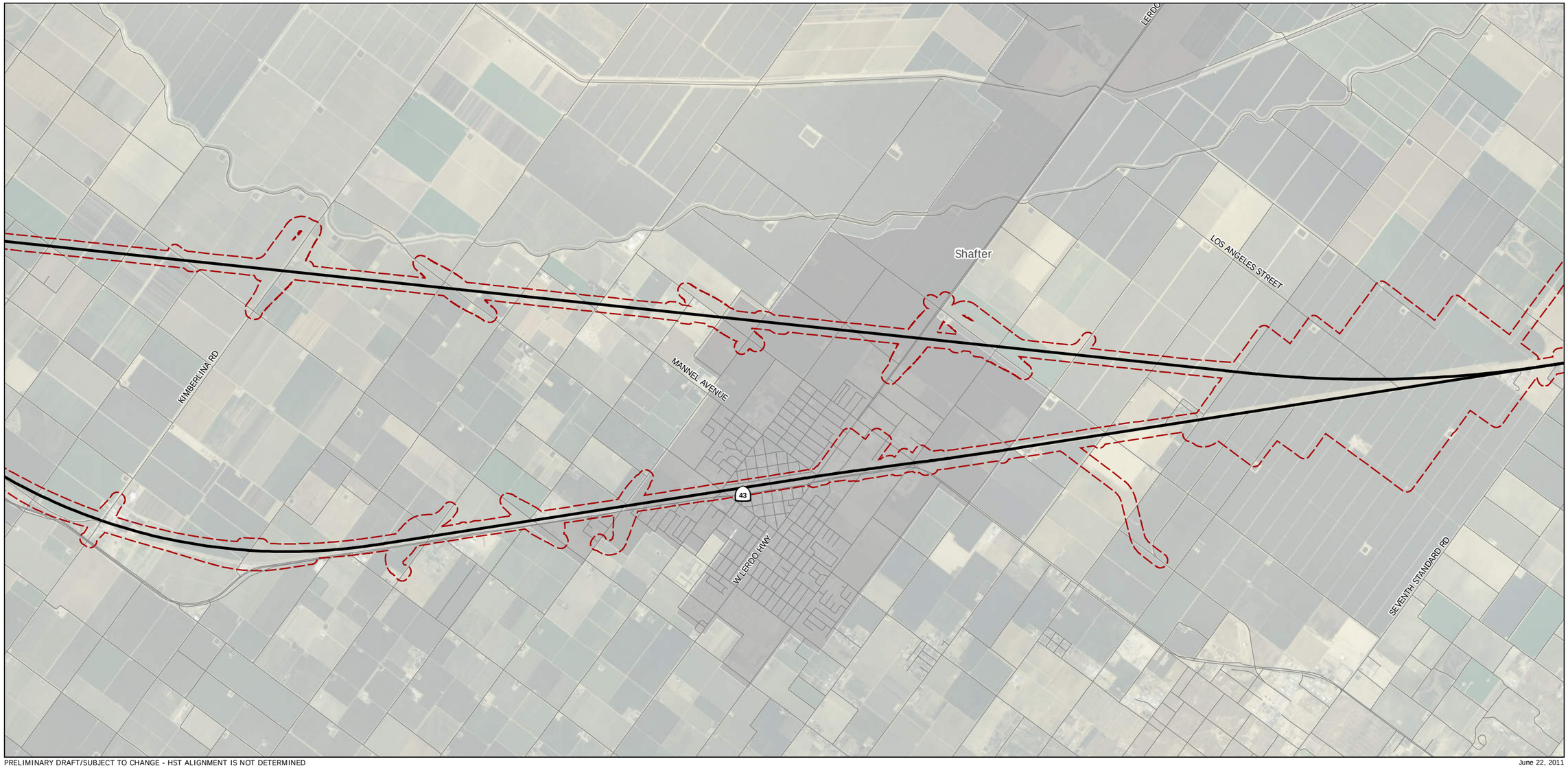
June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 8
Fresno to Bakersfield Wetland Study Area



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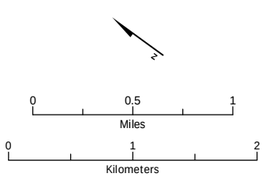
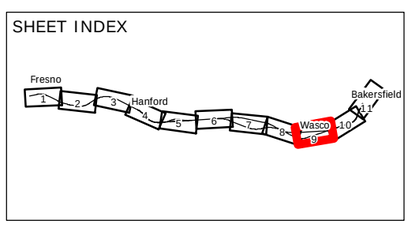
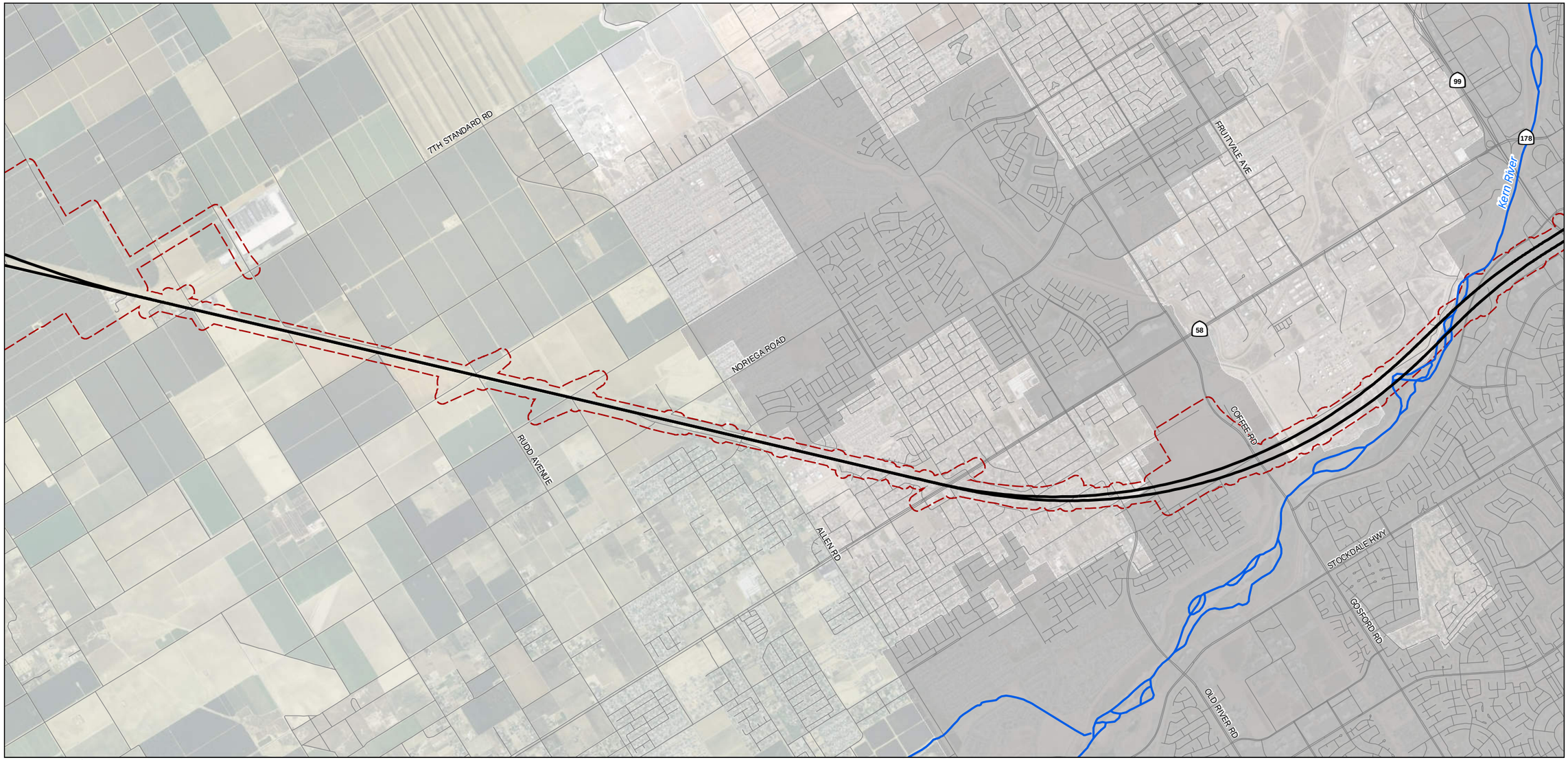
June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 9
Fresno to Bakersfield Wetland Study Area



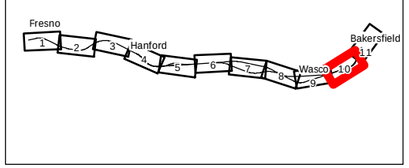
PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2011

June 22, 2011

0 0.5 1
Miles

0 1 2
Kilometers

SHEET INDEX

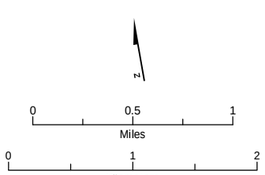


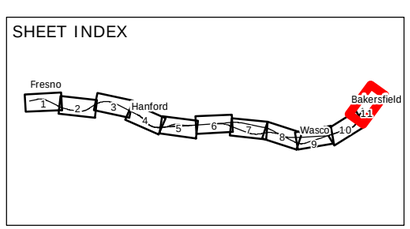
Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 10
Fresno to Bakersfield Wetland Study Area

PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2011

June 22, 2011





Alternative alignments
Road
Urban area
Wetland Study Area

Figure 2-1
Sheet 11
Fresno to Bakersfield Wetland Study Area

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The alignment trends in an overall northwest-to-southeast direction for approximately 114 miles. At its narrowest, the Wetland Study Area is 560 feet wide (this includes a 60-foot-wide track and a 250-foot buffer on either side). The Wetland Study Area crosses a number of major rivers, canals, agricultural ditches, smaller creeks and ephemeral drainages, including the Kings River (Cole Slough, Dutch John Cut), Cross Creek, Deer Creek, Poso Creek, Tule River, and Kern River. The Wetland Study Area is primarily composed of agricultural lands, urban and rural communities, and scattered fragments of natural habitat.

Major land uses between Fresno and Bakersfield include urban (industrial, commercial, and residential), rural residential, agricultural, and some undeveloped, natural areas in the vicinity of the Colonel Allensworth State Historic Park, Allensworth Ecological Reserve, and Pixley National Wildlife Refuge.

2.3 Climate and Topography

The Wetland Study Area is located in the San Joaquin Valley between Highway 99 and Interstate 5. The San Joaquin Valley trends northwest from the Tulare basin at the southern end to the Sacramento-San Joaquin delta to the north. The eastern edge of the valley meets the western slope of the Sierra Nevada, and the western edge of the valley meets the eastern slope of the Temblor and Diablo ranges that together comprise the southern interior Coast Ranges.

Elevations within the Wetland Study Area range from a minimum of 203 feet to a maximum of 430 feet above mean sea level. The Tehachapi Mountains create a biological and geological connection between the southern Sierra Nevada and the interior Coast Ranges and define the southern limit of the San Joaquin Valley. Large segments of the San Joaquin Valley floor are at or near sea level, whereas areas in the southeastern corner are upwards of 1,000 feet in elevation.

Nearly half of the valley floor has undergone varying levels of subsidence due to a variety of causes, including groundwater-mining–induced aquifer-system compaction, hydro-compaction of dry soils, fluid removal due to oil and gas exploration, and tectonic activity (USGS 1998).

The Wetland Study Area is in an arid to semi-arid climate. Summers are generally hot and dry, with the majority of rain falling during the mild winter months. Rainfall stations show that upwards of 80% of annual precipitation occurs between the months of November and April. Rainfall in the San Joaquin Valley and the eastern flanks of the interior Coast Ranges is limited due to the Coast Range rain shadow effect. Generally speaking, rainfall increases from south to north across the valley floor.

Adiabatic cooling causes the warm, moisture-laden air masses generated over the Pacific Ocean to condense and cool as they are pushed upward over the Sierra Nevada, resulting in heavy precipitation on the western slopes. The resulting snowpack ranges from 20 to 80 inches as elevation increases from the lower foothills to the Sierran crest. Snowmelt during the spring and summer provides the majority of the valley's water. Mean annual precipitation records from the San Joaquin Valley range from less than 5 inches in the south to upwards of 16 inches in the northern reaches of the valley (USGS 1999).

The northern and southern portions of the San Joaquin Valley are similar regarding daily temperatures throughout the year. Northern valley and southern valley temperature records were collected at the National Climate Data Center stations in Fresno and Bakersfield, respectively. Average daily temperature fluctuation in the Wetland Study Area (as measured between the coolest and hottest months) varies annually by approximately 36°F between December (average air temperature=46°F) and July (average air temperature=83°F). Temperature extremes in the Wetland Study Area have been recorded as high as 115°F and as low as 18°F (WRCC 2010).

2.4 Soils

Soils are natural bodies that develop over time through the integration of parent materials, organisms, relief, aspect, and climate—the classic "soil forming factors" (Jenny 1941). This section is intended to provide a general conceptual framework for understanding the dominant influences on soil development in the Wetland Study Area, and why certain (particularly hydric) soils occur where they do.

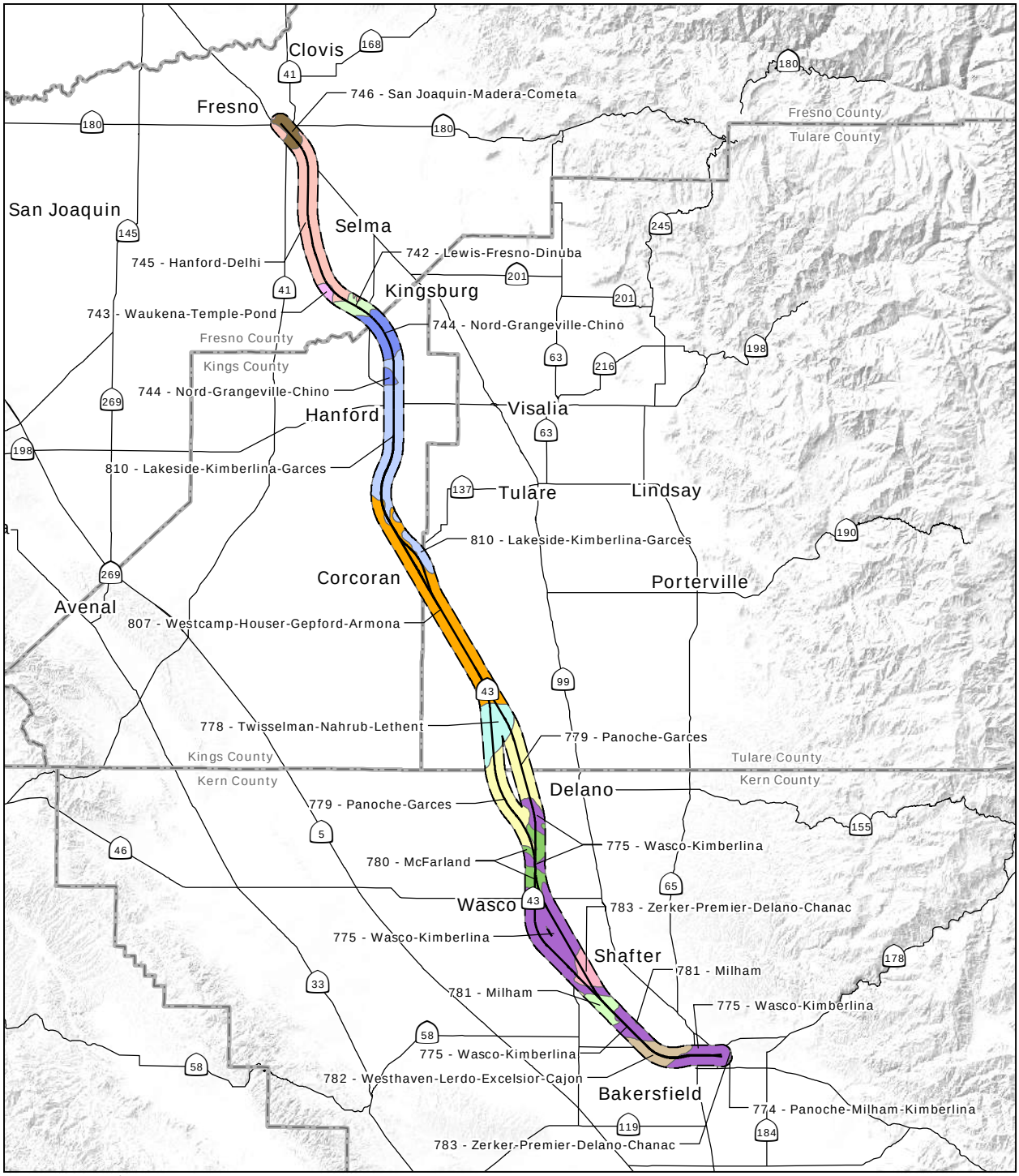
The framework for understanding the soil landscape (how topography and aspect affect soil formation), and how that soil landscape affects the formation of seasonal wetlands and vernal pools in the Wetland Study Area, relies on the analysis of Smith and Verrill (1996). **Table 2.4-1** applies the framework to soils in the Wetland Study Area and is based on information contained in soil surveys, official series descriptions, hydric soils lists, and field data forms. The location of the general soil types within a 1-mile buffer of the Wetland Study Area is illustrated in **Figure 2-2**.

Table 2.4-1
Soil Landscapes in the Wetland Study Area

Landform	County	Parent Material	Soil Classification	Soil Series
Low Terraces and Basin Rims	Fresno	Pleistocene-age alluvium	Durixerepts	El Peco
Low Terraces	Fresno	Pleistocene-age alluvium	Durixeralfs	Madera
Low Terraces	Fresno	Pleistocene-age alluvium	Durixeralfs	San Joaquin
Dunes / Wind-Modified Low Terraces	Fresno	Wind-laid sands	Xeropsamments	Calhi
Dunes / Wind-Modified Low Terraces	Fresno	Wind-laid sands	Psammaquents	Dello
Basin Rims	Kings, Tulare, Kern	Pleistocene-age alluvium	Natrargids	Garces
Basins	Tulare	Holocene-age alluvium	Vertic Torriorthents	Nahrub
Basins	Tulare	Holocene-age alluvium	Natraquerts	Gepford
Low Terraces and Basin Rims	Tulare	Pleistocene-age alluvium	Natridurids	Jerryslu
Basin Rims	Tulare, Kern	Pleistocene-age alluvium	Natrargids	Lethent

A. BASIN

The San Joaquin Valley consists of a broad, younger alluvial basin encircled by older coalescing alluvial fans and fan terraces. The bottom landform position is known as a basin. Basin parent materials are recent (Holocene age – within the last 12,000 years) alluvial deposits. Due to their relatively young age, soils in these positions have not had time to develop restrictive layers, and therefore tend to lack vernal pools. One exception is basins, which occur in the central part of the Wetland Study Area and contain Vertisols, or vertisol-like soils. These are relatively young soils with high shrink-swell clays. The Gepford and Nahrub soils historically supported vernal pools (NRCS 1999a, 1999b).



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

June 15, 2011

*Note: General soil classifications are labeled within the map

Source: URS, 2011; USDA, Soil Conservation Service, 1994

USDA/NRCS - National Cartography & Geospatial Center, 1999

Alternative alignments

Highway

NRCS general soil types with 1-mile buffer*

Urban area

County boundary

N

0 5 10 Miles

0 10 20 Kilometers

Figure 2-2

Environmental setting:

Soils, watersheds, and topography

B. BASIN RIM

The geomorphic surface above the basin is known as the basin rim, which occupies the gradually transitioning area between the older alluvial fans upslope and the younger basin downslope. Parent material in these positions is Pleistocene-age (2.6 million to 12,000 years old) alluvium. The soils are better developed and commonly have a layer of clay accumulation (Argillic horizon). Soils in this position also tend to have high concentrations of sodium and soluble salts. Sodium in the soil disperses clay particles, which results in increased clay movement and clay accumulation (Natric horizon), and decreased permeability in the soil profile. These conditions, along with the mound-depression topography commonly found on these surfaces, result in the appearance of vernal pools.

C. LOW TERRACE

The highest and oldest geomorphic surface in the Wetland Study Area is the low terrace. Parent materials in these positions are Pleistocene-age alluvium. Soils developed on these surfaces commonly have clay-enriched layers, and/or silica-cemented hardpans known as duripans. Clay pans and duripans perch water in the soil, and where associated with the mound-depression topography, are responsible for the occurrence of vernal pools. Agricultural development occurred first and most extensively on the low terraces; therefore, wetlands are extremely rare on these surfaces. Based on the soil surveys, duripans are less common in the southern San Joaquin Valley than they are further north. Two soil series containing duripans, the San Joaquin and Madera series, are mapped in the northern part of the Wetland Study Area (near Fresno). Extensive agricultural practices (e.g., deep ripping) may have eliminated the pans where they historically occurred.

D. DUNES

Dunes consist of wind-blown sandy deposits in the northern part of the Wetland Study Area, south of Fresno. They originally had highly undulating topography, with the wind-scoured lower positions becoming seasonally ponded. The Dello soil series developed in dunal deposits. The Calhi map unit indicates inclusions of ponded depressions. These landscapes have been completely altered by leveling and drainage within the Wetland Study Area.

2.4.1 Soil Surveys

The Wetland Study Area extends over four counties and four soil survey areas:

- Soil Survey of Eastern Fresno Area (1971).
- Soil Survey of Tulare County, Western Part (1982).
- Soil Survey of Kings County (1986).
- Soil Survey of Kern County, Northwestern Part (1988).

A general map of soil map units within the Wetland Study Area is provided in **Figure 2-2**, and Appendix B (General Soil Survey Map Unit Descriptions) provides descriptions of the soil map units shown on **Figure 2-2** (NRCS 2009, 2010b; California Soil Resource Lab 2005). Soil map units are a conglomeration of soil series within a given area. (The soil series is the lowest [most-specific] category of the national soil classification system.) The names of the primary soil series or the phases of a soil series are the most common reference terms used in soil map unit names (USDA and NRCS 1999).

Most of the soils and/or landscapes in the Wetland Study Area have been disturbed by development for agriculture, transportation, or other infrastructure. Many of the soils have been leveled, drained, and/or protected from floods for agricultural purposes. Drainage systems and levees in the San Joaquin Valley date back many decades, but these were not always as efficient

as modern systems in de-watering soils. Local water tables have also dropped as a result of groundwater extraction (URS/HMM/Arup Joint Venture 2010; USDA 1971, 1982, 1986, 1988). Soils that previously had high water tables, or frequent flooding or ponding, are still considered hydric soils by convention even if they are no longer wet. Some of these soils would revert to their prior condition if the drainage or flood protection were removed. These hydric soils that are no longer wet are designated in the soil surveys by drained or partially drained phases.

A total of 96 detailed soil map units occur within the Wetland Study Area; of these, only 21 have named dominant (greater than 50% composition) components that are hydric (Appendix C [Hydric Soil Map Unit Descriptions and Hydric Soil Maps]). Although only 21 map units are named for hydric soils, there are an additional 30 map units with hydric soil inclusions that are listed in the NRCS state hydric soils lists (NRCS 2011). Appendix C provides the name of the hydric inclusions, the percentage of the map unit which they represent, the landforms where they typically occur, and the reason why they are considered hydric.

Of the 21 map units in the Wetland Study Area with dominant hydric components, 3 are miscellaneous land types (riverwash), and not necessarily soils. Twelve of the 21 map units feature drained or partially drained hydric soils (as indicated by the phase at the end of the map unit name); therefore, these soils would most likely not support wetlands. As a result, only six map units in the Wetland Study Area are named for hydric soils that are not drained. However, the Grangeville soil occurs in three of the surveys (Fresno, Tulare, and Kings counties) and is represented by four different map units. Therefore, there are three undrained hydric map units that are mapped in the Wetland Study Area.

In addition to the Grangeville series, the other hydric soil series are the Nahrub soil and the Dello soil. The Grangeville and the Nahrub soils appear to be hydric due to frequent flooding, rather than a high water table. These soils are listed as “somewhat poorly drained,” with seasonal high water tables 24 inches or more below ground surface (bgs). Based on the Natural Resources Conservation Service (NRCS) Official Series Descriptions, neither of these soils meets hydric soil indicators (USDA and NRCS 2006). The Dello soil mainly occurs in depressions in sandy eolian deposits in the extreme northern part of the Wetland Study Area. This landscape has been highly modified by agricultural development.

Hydric soils mapped in the Wetland Study Area include a range of soil orders: mollisols, aridisols, vertisols, entisols, and inceptisols. Common diagnostic subsurface horizons found in these hydric soils include salic, natric, and calcic horizons. Soil particle size classes ranged from sandy and coarse-loamy, to fine-silty, fine-loamy, and fine. The soil temperature regime is thermic, with an assumed growing season of February through October. A xeric moisture regime occurs in approximately the northern half of the Wetland Study Area. Precipitation decreases sufficiently in the south half of the Wetland Study Area to produce an aridic soil moisture regime.

The concentration and depth of free calcium carbonates in the soil profile follow the north-south moisture gradient: soils in the southern part of the Wetland Study Area have a high calcium carbonate percentage at the soil surface, whereas soils in the northern part have a lower calcium carbonate percentage with carbonates deeper in the soil profile. Soluble salts and sodium are found in the basin rim landscape positions where evaporative concentration of saline waters was historically a dominant process.

2.4.2 Problematic Nature of Soils in the Wetland Study Area

Problematic hydric soils are those whose hydric nature is difficult to determine in the field. Soils in the Wetland Study Area have developed under several biogeochemical conditions which normally preclude or slow the development of readily apparent hydric soil indicators. Most indicators used for delineation of special aquatic resource boundaries rely on changes in the soil

resulting from the reduction of iron and/or manganese (redoximorphic features). These changes normally produce diagnostic colors which persist in the soil from year to year. The hydric soil indicators given in the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (USACE 2008b) assume a certain level of expression of this iron/manganese reduction-oxidation. At the same time, the Regional Supplement acknowledges that many hydric soils in the arid west either do not form redoximorphic features at all, or form them only to a minimal degree that does not meet the technical requirements of the indicators (USACE 2008b).

Most hydric saline and alkaline soils in the arid west do not develop hydric soil indicators due to: 1) high pH (low redox potentials are required to reduce iron and manganese); 2) low amounts of iron and manganese; and 3) low activity of microorganisms (Boettinger 1997). Alkalinity and salinity also create a harsh environment for the microbes responsible for the redox reactions, by causing dehydration and micronutrient deficiencies. This results in low plant biomass, which limits the supply of organic carbon also necessary for redox reactions to occur. Where soluble salts (salic or Az/Bz horizons) and calcium carbonates (calcic or Bk horizons) are present in the soil, any redoximorphic features that may form are easily masked.

Some soils in the southern portion of the Wetland Study Area (between the cities of Corcoran and Wasco) are saline, sparsely vegetated, and have very thin A horizons with low levels of organic matter. Soils in the Wetland Study Area also tend to be wettest when soil temperatures are low, further reducing microbial activity and development of redoximorphic features. In addition, many parent materials in the arid west are naturally low in iron and will therefore not form redoximorphic features even when reducing conditions are present. These low-chroma parent materials include lacustrine and some alluvial deposits that are low in iron due to a formerly reducing environment. This applies to many of the basin landforms in the San Joaquin Valley and the Wetland Study Area (USDA 1971, 1982, 1986, 1988).

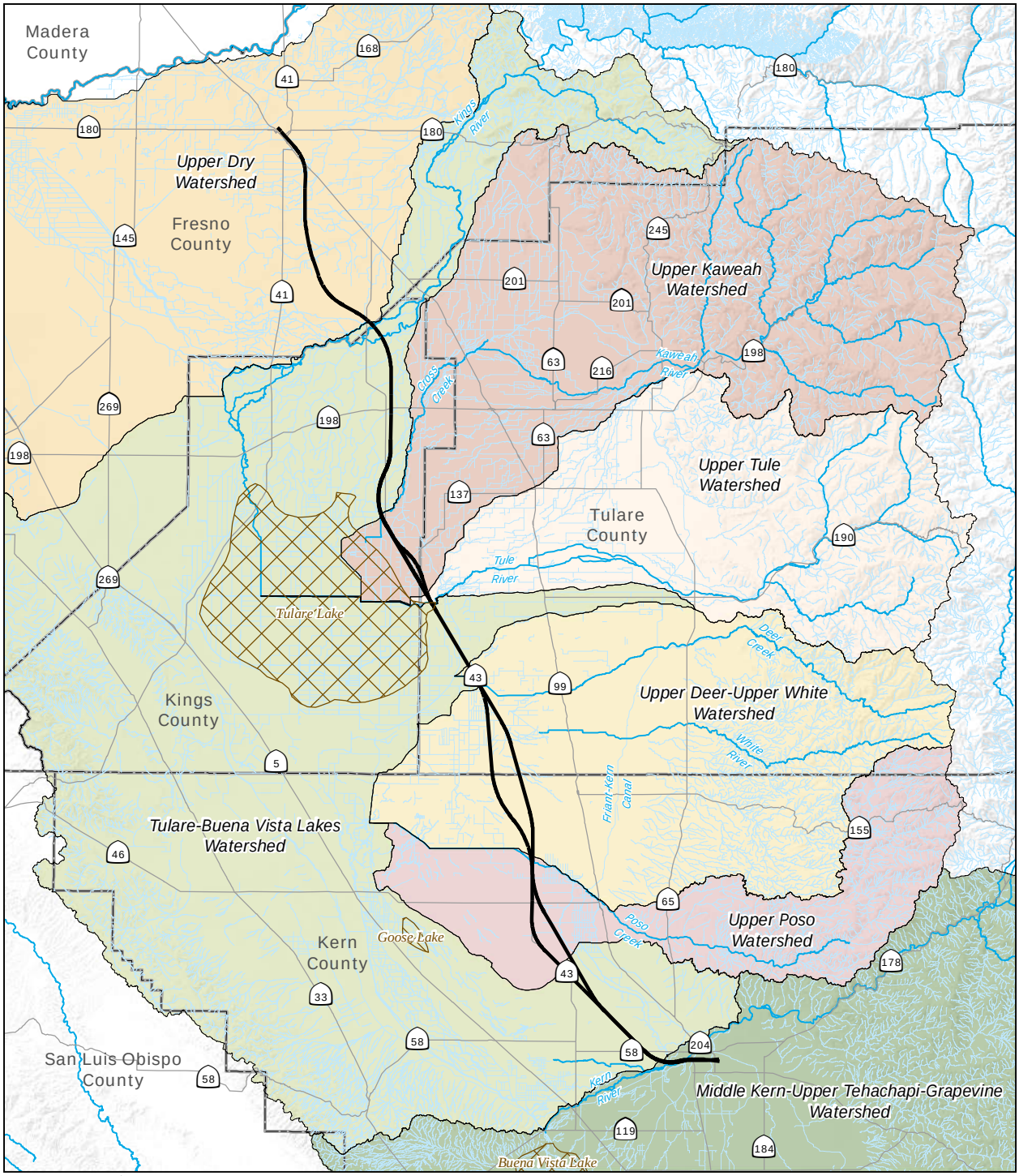
2.5 Hydrology

Hydrology within the Wetland Study Area is very complicated due to significant human-induced alteration and manipulations. Most of the data represented in this section, including large and small-scale water diversion and infrastructure projects, are from the *Fresno-Bakersfield Section: Hydrology and Water Resources Technical Report* (Authority and FRA 2011) and the local soil surveys (USDA 1982, 1986, 1988, 1998).

2.5.1 Watershed Hydrology

The San Joaquin Valley has a drainage area of approximately 34,100 square miles, and is divided into the San Joaquin River Basin and the Tulare Lake Basin (17,400 square miles). The Wetland Study Area is entirely in the Tulare Lake Basin. This area is generally flat and used extensively and intensively for agriculture. The Tulare Lake Basin is essentially closed, because water only drains north to the San Joaquin River during periods of extremely high rainfall. The contributing rivers are normally dewatered (for agricultural uses) before reaching the Central Valley floor (USDA 1982).

The Wetland Study Area occurs within seven Hydrologic Unit Code (HUC)-8 watersheds (**Figure 2-3**). Significant drainage features running through the Wetland Study Area include Kings River, Cross Creek, Deer Creek, Tule River, Poso Creek, and Kern River (**Figure 1-2**). The names of the HUC-8 watersheds and the major surface water features within each watershed are summarized in **Table 2.5-1**.



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

June 14, 2011

Source: URS, 2011; USGS, National Hydrography Dataset
USDA/NRCS - National Cartography & Geospatial Center, 1999
Endangered Species Recovery Program, 1999

N

0 5 10
Miles

0 10 20
Kilometers

Alternative alignments
Major surface water
Minor surface water
Highway
Historic lake
HUC-8 watershed boundary

Figure 2-3
Hydrology: Watersheds in the Wetland Study Area

Table 2.5-1
Watersheds within the Wetland Study Area

Subbasin (HUC—8 No.)	Major Water Features	Watershed Area (Acres)
Upper Dry (18030009)	Kings River	1,360,539
Tulare-Buena Vista Lakes (18030012)	Kings River, Cross Creek, Tule River	2,423,853
Upper Kaweah (18030007)	Cross Creek	974,462
Upper Tule (18030006)	Tule River	604,506
Upper Deer-Upper White (18030005)	Deer Creek, Friant-Kern Canal	782,998
Upper Poso (1803004)	Poso Creek, Friant Kern Canal	368,178
Middle Kern-Upper Tehachapi-Grapevine (1803003)	Kern River	1,675,939
Total	--	8,190,475

Acronym:
HUC = Hydrologic Unit Code

A. HISTORIC HYDROLOGY

Prior to agricultural development, the Tulare Lake Basin was dominated by four large, shallow, and mainly seasonal lakes (Tulare, Buena Vista, Goose, and Kern lakes). Tulare Lake and Goose Lake covered large portions of the Wetland Study Area. The historic Tulare Lake was originally one of the largest lakes in California, occupying much of southern Kings and Tulare counties and northern Kern County (USDA 1986). Tulare Lake was historically fed by the Kings River, Kaweah River (the source of Poso Creek), Tule River, and the Kern River from the Sierra Nevada. It was a terminal lake, having no natural outlet in dry years, and overflowing to reach the San Joaquin River during wet years (USDA 1982).

The Kern River once flowed south and west across the San Joaquin Valley through a complex system of sloughs, creeks, ponds, and permanent wetlands, and fed Buena Vista and Kern lakes. Evaporation of these historic lakes through water diversions and climate change has resulted in a wide area of saline-sodic soils on the southern Central Valley floor.

Large portions of the southern Central Valley floor were historically subject to frequent flood events, either from intense fall/winter rainfall, or from late-spring/early-summer snowmelt originating in the Sierra Nevada. Regular flooding is now largely controlled by dams, diversions, levees, and dredging. The previous floodplain and riparian habitat has also largely been replaced by agriculture or urban development. Infrequent but catastrophic floods now occur in parts of the San Joaquin Valley, made more severe by the loss of the flood-attenuating functions of riparian and wetland habitats (USDA 1982; Vileisis 1997).

B. PRESENT-DAY HYDROLOGY

The Wetland Study Area is within the San Joaquin Valley Groundwater Basin. Most of the San Joaquin Valley floor is underlain by several thousand feet of sediments, including coarse-grained, water-bearing zones. Groundwater exists under both unconfined and semi-confined conditions. Groundwater levels vary with seasonal rainfall, withdrawal, and recharge. Depth to groundwater in the valley ranges from a few inches to more than 100 feet.

Depth to groundwater ranges from 90 feet to 150 feet below ground surface (bgs) near Fresno, 115 feet bgs near Hanford, 110 feet bgs near Corcoran, and 150 feet bgs near Bakersfield (URS/HMM/Arup Joint Venture 2010a). Groundwater recharge occurs through percolation of applied irrigation water and leaking water from agricultural ditches, and infiltration of stream flow. High levels of soluble salts and/or nitrates in the groundwater are of local concern.

All of the streams and rivers within the Wetland Study Area have been dredged, culverted, diverted, dewatered, channelized, or have had their active floodplains severely reduced by levee construction. These areas once sustained rich riparian wetland habitats and shallow groundwater in the deltas of the major rivers draining into the San Joaquin Valley (USDA 1982), which are now greatly reduced or eliminated. Groundwater pumping for large agricultural and urban demands has resulted in groundwater subsidence in many areas of the Central Valley. Water levels in the Kings subbasin have declined up to 50 feet since 1982. Regular flooding, where implemented, is now largely controlled by dams, diversions, levees, and dredging. The previous floodplain and riparian habitat have largely been replaced by agriculture or urban development (USDA 1982; Vileisis 1997).

2.5.2 Wetland Hydrology

Alterations to both surface- and groundwater in the region have resulted in a significant decline in historic wetland area. This is reflected in the high proportion of “drained” or “partially drained” hydric soils mapped in the area (see Section 2.4).

Hydrology within the Wetland Study Area is highly manipulated. Most of the water present in the Wetland Study Area is diverted by the numerous irrigation canals that are found throughout the valley. Therefore, most of the surface water in the Wetland Study Area is found in either irrigation canals or water retention/detention basins, and occasionally in river channels or in precipitation-fed wetlands and vernal pools. The remaining wetlands are largely unrelated to the historic floodplains or regional aquifers.

Vernal pools have developed in mostly isolated depressions that receive water from precipitation and local surface and shallow subsurface, or sheet flow. Water is retained in these depressions by a shallow perching layer (largely clay pans), and is unconnected or only partially connected to deeper groundwater layers (Holland 2009a).

Vernal pools can vary widely in the frequency, timing, depth, and duration of their wet phase. The vegetation, hydrology, and soils of these pools are unique, due to the fact that they occur in an alkali-scrub–type habitat, rather than in true grassland, which is the case for vernal pools to the north (Solomeshch et al. 2007).

Most vernal pools in the Wetland Study Area probably remain inundated for no more than 2 months each year, some for much shorter periods. Soil moisture is recharged beginning in November and, typically, inundation occurs sometime between January and March. Inundation may not be continuous if a dry spell occurs during this time. Significant inundation may not occur at all during drought years. By April, rainfall has dropped, and temperatures have risen sufficiently to dry out the pools. By May, available soil moisture has declined, and annual wetland plants begin to desiccate. The pools range in depth from a few inches to no more than 2 feet.

2.5.3 Growing Season Analysis

The growing season is defined as the period when soil temperatures 12 inches bgs are greater than 41°F. The length of the growing season is typically approximated by the beginning and ending dates of 28°F or 32°F temperatures with 50% probability (USACE 2008a).

Table 2.5-2 provides a growing season analysis for three stations near the Wetland Study Area (NRCS 2010c). To meet USACE criteria for positive wetland hydrology, the required minimum number of days of continuous surface saturation and/or inundation to the surface is 14 days (5% of the growing season, which is 269 days in the local area).

Surface saturation and/or inundation would need to persist for 14 days (which is equal to 5% of the 269-day local growing season) to meet the wetland hydrology criteria. Observations of inundation and/or surface saturation during the early spring would be a strong positive indicator of meeting the wetland hydrology criteria, assuming that climate conditions were normal.

Table 2.5-2
Growing Season Analysis

Station	Relative Location	Elevation	Annual Rainfall	Rainfall Nov-April	28°F Growing Season	# of Days	32°F Growing Season	# of Days
Hanford	North	250 Feet	8.51 Inches	90%	1/9 – 12/17	344	2/19 – 11/23	279
Corcoran	Central	200 Feet	7.63 Inches	89%	1/8 – 12/9	336	2/24 – 11/19	269
Wasco	South	350 Feet	7.40 Inches	88%	1/9 – 12/13	338	2/18 – 11/22	278
Note: °F = Degrees Fahrenheit								

2.5.4 Precipitation Analysis

Indicators of hydrology may not be reliable during years with above- or below-normal rainfall. Using the standard methodology for assessing wetland hydrology developed by Sprecher and Warne (2000), current annual rainfall for the Wetland Study Area was analyzed to determine if conditions were normal, dryer than normal, or wetter than normal during the field inspections. Normality is defined as the range of rainfall that is within the 30th to 70th percentiles.

Table 2.5-3 provides the NRCS Wetlands Determination (WETS) table (USDA and NRCS 2010). The WETS table is a standardized NRCS table that provides a month-by-month summary and probability analysis of temperature and precipitation, specifically for wetland determinations (NRCS 2010c). This table summarizes actual observed rainfall for the 3 months prior to the field investigations for the Hanford airport station, in close proximity to the Wetland Study Area. Using weighted averages and thresholds developed by Sprecher and Warne (2000), the data show that rainfall conditions were normal at the time of the field investigations.

Based on this information, it is likely that inundation and surface saturation observed during the field inspections are representative of long-term average conditions, and are therefore reliable indicators of wetland hydrology.

Table 2.5-3
NRCS WETS Table Data for Hanford Airport Station

Month	Less than 3 out of 10 years	Average (inches)	More than 3 out of 10 years	Observed Rainfall (inches)	Condition	Condition Value	Month Weighting Factor	Product
February	0.59	1.63	1.99	1.93	Normal	2	3	6
January	0.56	1.64	1.99	2.30	Wet	3	2	6
December	0.45	1.07	1.34	1.27	Normal	2	1	2
							Sum =	**14[A]**

[A] 6-9 is drier than normal; 10-14 is normal; 15-18 is wetter than normal
Acronyms:
NRCS = Natural Resources Conservation Service
WETS = Wetlands Determination

Table 2.5-3 is useful for the initial March surveys. Since virtually all naturally occurring surface water, outside of river beds, had dried up by the end of March, and precipitation is limited beyond February, tables representing precipitation would not be useful for the additional survey periods. Therefore, they are not presented here.

2.6 Land Use and Wildlife Habitats

The Wetland Study Area is in the San Joaquin Valley sub-region of the California Floristic Province's Great Central Valley region. This sub-region extends from the northern border of Contra Costa and San Joaquin counties south to the northern boundary of Ventura and Santa Barbara counties (Hickman 1993). The majority of the land in the Wetland Study Area is actively being used for agriculture. Urban areas are the second greatest land use and include large cities such as Fresno and Bakersfield as well as multiple smaller cities such as Corcoran, Wasco and Shafter. Within these urban areas, native vegetation is absent or highly disturbed. Typical vegetation may consist of planted trees such as eucalyptus (*Eucalyptus* spp.) and mulberry (*Morus* spp.), in addition to a variety of non-native and ornamental species.

Land uses and wildlife habitats throughout the Wetland Study Area were mapped in accordance with *A Guide to Wildlife Habitats of California* (CDFG 1988) and *California Wildlife Habitat Relationship System* (CDFG 2008). Vegetation and wildlife habitat types identified in the Wetland Study Area are provided in **Table 2.6-1**.

Table 2.6-1
Land Use Types, Wildlife Habitat Types, Typical Vegetation, and Potential Special Aquatic Resources found within the Wetland Study Area

Land Use Wildlife Habitat Type	Typical Vegetation	Special Aquatic Resource Potentially Present
Land Use Types		
BNSF Urban	Unvegetated pavement, grass lawns, ornamental trees, disturbed ground, and hedges in the BNSF Railway right-of-way	Culvert water, canal, ditch, riparian, seasonal wetland, vernal pool, vernal swale, and vernal pool and swale complex
Cropland	Recently disturbed but unidentifiable crops	Culvert water, ditch, seasonal wetland
Dryland Grain Crops	Wheat	Culvert water, ditch
Irrigated Grain Crops	Wheat	Ditch, seasonal wetland
Irrigated Hayfield	Alfalfa	Ditch, seasonal wetland
Irrigated Row and Field Crops	Onions	Canal, ditch, seasonal wetland
Deciduous Orchard	Almonds, apricots	Culvert water, ditch,
Evergreen Orchard	Citrus	Culvert water, ditch
Vineyards	Grapes	Culvert water, ditch
Urban	Unvegetated pavement, grass lawns, ornamental trees, dirt roads, hedges	Canal, culvert water, ditch, retention/detention basin
Tree-Dominated Habitats		
Valley Foothill Riparian	Fremont cottonwood, western sycamore, valley oak, white alder, California blackberry, elderberry, poison oak, button bush, willows, rushes, mugwort, poison hemlock, stinging nettle	Ditch, riparian
Shrub- Dominated Habitats		
Alkali Desert Scrub	Cattle saltbush, spinescale saltbush, iodine bush, bush seepweed, golden bush, goldfields, tarweed, saltgrass	Seasonal wetland, vernal pool, vernal swale, vernal pool and swale complex
Herbaceous-Dominated Habitats		
Annual Grassland	Wild oats, brome species, barley, annual fescues, California oatgrass, hairgrass, sweet vernal grass	Ditch, , seasonal wetland, vernal pool, vernal swale, vernal pool and swale complex
Fresh Emergent Wetland	Cattail, bulrush	Seasonal wetland, ditch, riparian
Pasture	Grasses	Ditches, seasonal wetlands

Table 2.6-1
Land Use Types, Wildlife Habitat Types, Typical Vegetation, and Potential Special Aquatic Resources found within the Wetland Study Area

Land Use Wildlife Habitat Type	Typical Vegetation	Special Aquatic Resource Potentially Present
Aquatic Habitats		
Riverine	Unvegetated, rushes	Canal, culvert water, ditch, seasonal riverine
Lacustrine	Unvegetated, willows, rushes	Culvert water, reservoir, retention/detention basin, riparian
Non-vegetated Habitats		
Barren	Unvegetated, rock, gravel, soil	Culvert water, ditch
Acronyms: BNSF = BNSF Railway		

2.6.1 Land Use and Wildlife Habitat Types

The following section describes land use and wildlife habitats found in the Wetland Study Area. Appendix D (Plant Species List with Wetland Status) presents the individual plant species identified within the Wetland Study Area, and their wetland indicator status.

A. LAND USE TYPES

Nine land use types were identified within the Wetland Study Area: Cropland, Dryland Grain Crops, Irrigated Grain Crops, Irrigated Hayfield, Irrigated Row and Field Crops, Deciduous Orchard, Evergreen Orchard, Vineyard, and Urban. These land uses characterize the majority of the Wetland Study Area. Comparison of 2005 and 2009 aerial imagery to observations made during the 2010 survey effort revealed that non-developed natural habitats such as Alkali Desert Scrub, Valley Foothill Riparian, and Annual Grassland continue to decline through conversion to agricultural land uses. These habitat types generally have very low potential for special aquatic resources.

Croplands

Within the Wetland Study Area, croplands were mapped when a distinction between dryland grain crops, irrigated grain crops, irrigated hayfield, or irrigated row and field crops could not be made. This was the case when a field had been recently tilled, and it was not clear what would be planted. This habitat is very disturbed and is characterized by little to no natural vegetation, pesticide and herbicide use, or management.

Dryland Grain Crops

Dryland Grain Crops within the Wetland Study Area were typically characterized by non-irrigated fields of wheat (*Triticum* spp.). Wheat is an annual species and is usually planted by drilling in rows that produce solid stands, forming 100% cover at maturity in robust stands. In many areas of California, a dryland crop is grown one year, then the land may be fallowed (not planted) for one or more years. If fallowed, a combination of dropped grain and volunteer native or naturalized herbaceous species may grow.

Irrigated Grain Crops

Irrigated Grain Crops within the Wetland Study Area were typically characterized by irrigated fields of wheat. As with dryland grain crops, wheat is usually managed in a crop rotation system and grown in rows. The primary difference between areas mapped as irrigated grain crops and dryland grain crops is the presence of water that results in more robust fields generally with greater cover of the particular crop. Some fields may form 100% cover, while others may have significant bare areas between rows.

Irrigated Hayfields

Irrigated Hayfields within the Wetland Study Area include alfalfa fields and grass hayfields (cereal grain fields, whether harvested for hay, grain, or straw, do not fall into this category). Generally, alfalfa fields are maintained unplowed for approximately 3 years or more, and are then followed by a cereal grain crop, vegetables, potatoes, or tomatoes for 1 to 4 years before being planted to alfalfa again. Most hay fields in the warmer parts of California are monocultures of alfalfa. Designation of a hayfield as Irrigated Hayfield depends more on management of the site than on plant composition.

Excluding the 2- to 6-month initial growing period and depending on climate and soil conditions, this habitat is dense, with nearly 100% cover. Plowing is typically semi-annual. Layering generally does not occur in this habitat. In the Central Valley, alfalfa growth begins during February, with harvesting occurring 6 to 8 times per season.

Irrigated Row and Field Crops

Irrigated Row and Field Crops within the Wetland Study Area include root vegetables such as onions. Cotton is also grown as an irrigated row crop. Vegetative cover in these mosaics is variable: cultivars are often grown in rows and may approach 100% cover or contain significant bare areas.

Deciduous Orchard

Deciduous Orchards within the Wetland Study Area include rows of almonds and apricot trees *(Prunus armeniaca)* or pistachios (*Pistacia vera)*. The majority of Deciduous Orchards observed during the 2010 surveys had little or no understory vegetation. Generally, these areas are heavily managed with pesticides and herbicides to control the understory vegetation.

Evergreen Orchard

Evergreen Orchards within the Wetland Study Area are typically characterized by citrus species such as oranges or lemons. These are usually low, bushy trees with an open understory to facilitate harvest. The understory is usually composed of low-growing grasses, legumes, and other herbaceous plants, but may be managed to prevent understory growth totally or partially, such as along tree rows (CDFG 1988).

Vineyard

Vineyards within the Wetland Study Area are typically characterized by grapes planted in rows, usually supported on wood and wire trellises. Vines are normally intertwined in the rows, but open between rows. Areas under the vines are usually sprayed with herbicides to prevent growth of herbaceous plants. Between rows of vines, grasses and other herbaceous plants may be planted or allowed to grow as a cover crop to control erosion (CDFG 1988).

Urban

Urban areas within the Wetland Study Area include municipalities, industrial, residential, and agricultural structures (e.g., feedlots and poultry farms) and adjacent dedicated areas such as yards, roads, highways, parking lots, and stockpiles. In urban municipalities, the majority of land is covered by impervious materials; vegetated areas include landscaped plantings and shade trees along roads and buildings.

BNSF Urban

The BNSF Railway right-of-way travels along the length of the Central Valley in a north-south direction. The BNSF Railway right-of-way extends south from Fresno through Hanford, and parallels SR 43 from north of Corcoran to the town of Greenacres, just west of Bakersfield (a distance of roughly 62 miles). In general, the BNSF Railway right-of-way is 50 feet in width, and the rail tracks are set on an embankment a minimum of 5 feet above the surrounding grade. The embankment is constructed of compacted soil and imported gravel fill. Numerous culverts bisect the base of the embankment for drainage purposes. Crossings of larger drainages exist as free-standing bridges. Most road crossings of the BNSF Railway right-of-way consist of at-grade crossings that allow vehicles to drive over the embankment and tracks.

B. TREE-DOMINATED HABITATS

One tree-dominated habitat was identified within the Wetland Study Area: Valley Foothill Riparian.

Valley Foothill Riparian

Valley-Foothill Riparian vegetation is characterized by the presence of tall, broad-crowned trees, such as Fremont's cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), and valley oak (*Quercus lobata*). Subcanopy trees include white alder (*Alnus rhombifolia*), and ash (*Fraxinus* sp.). Understory shrubs and herbaceous species typically include California blackberry (*Rubus ursinus*), elderberry (*Sambucus mexicana*), poison oak (*Toxicodendron diversilobum*), buttonwillow (*Cephalanthus occidentalis*), willows (*Salix* sp.), rushes (*Juncus* spp.), mugwort (*Artemisia douglasiana)*, poison-hemlock (*Conium maculatum*), and stinging nettle (*Urtica dioica* ssp. *holosericea*).

Within the Wetland Study Area, Valley Foothill Riparian vegetation was identified along the riparian corridors and associated floodplains or terraces of the Kings River (Cole Slough, Dutch John Cut), Cross Creek, Deer Creek, Poso Creek, Tule River, and Kern River, as well as their associated sloughs and side channels. In these areas, riparian corridors typically are narrow and are bordered by agricultural land; the transition from riparian to cropland or orchard is usually abrupt.

C. SHRUB-DOMINATED HABITATS

One shrub-dominated habitat was identified within the Wetland Study Area: Alkali Desert Scrub.

Alkali Desert Scrub

Alkali Desert Scrub vegetation within the Wetland Study Area is dominated by shrublands with understory cover of herbs and forbs, and by vernally inundated or saturated areas lacking a shrub layer (vernal pools). These latter areas are characterized by herbs and forbs interspersed with barren, vernally inundated, or saturated alkali patches. Primary plant species observed during the various surveys included spinescale saltbush (*Atriplex spinifera*), cattle saltbush

(*Atriplex polycarpa*), iodine bush (*Allenrolfea occidentalis*), goldenbush (*Isocoma acradenia*), and bush seepweed (*Suaeda moquinii*).

Typical herbaceous species encountered include alkali heath (*Frankenia salina)*, goldfields (*Lasthenia* spp.), Menzie's fiddleneck (*Amsinckia menziesii)*, alkali weed (*Cressa truxillensis)*, foxtail (*Vulpia* spp.), pepperweed (*Lepidium* spp.), common tarweed (*Hemizonia pungens),* saltgrass (*Distichlis spicata),* bromes (*Bromus* spp.), and barley (*Hordeum* spp.). Notably, cacti are absent from this habitat.

Within the Wetland Study Area, this habitat was concentrated in the vicinity of Allensworth and other relatively undisturbed areas. Overall, alkali desert scrub provides the best habitat for special-status species and sensitive natural communities.

D. HERBACEOUS HABITATS

Three herbaceous habitats were identified within the Wetland Study Area: Annual Grassland, Fresh Emergent Wetland, and Pasture.

Annual Grassland

Within the Wetland Study Area, annual grasslands are typically characterized by non-native annual grass species. Dominant non-native grass species include several species of brome (*Bromus* spp.), fescue (*Festuca* spp. and *Vulpia* spp.), oats (*Avena* spp.), and barley (*Hordeum* spp.). Native species, including goldfields and owl's clover (*Castilleja* spp.), may be present in annual grasslands but typically in lower densities. Annual grasslands in the Wetland Study Area have typically experienced some level of past disturbance associated with various agriculture practices, row cropping, or grazing. Although these areas typically have a history of disturbance, they continue to provide suitable habitat for a number of special-status plant and wildlife species. Similar to alkali desert scrub habitats, annual grasslands that have experienced lower levels of disturbance often exhibit vernally inundated or saturated areas.

Fresh Emergent Wetland

Fresh Emergent Wetland is sparse within the Wetland Study Area and is typically associated with man-made structures such as detention basins, groundwater recharge reservoirs, and irrigation and drainage ditches. Typical species in these areas include willows (*Salix* sp.), rushes (*Juncus* sp.), bulrushes (*Scirpus* sp.), cattails (*Typha* spp.), and docks (*Rumex* spp.). Based on aerial photography and windshield surveys, a large complex of fresh emergent wetland exists in the vicinity of Cross Creek. Permission to enter this area was not granted, and the extent of fresh emergent wetland was mapped based on aerial photo interpretation. Fresh emergent wetland habitats outside of the Cross Creek area were typically small, vegetated areas that typically pond during the winter rain events.

Pasture

Pasture within the Wetland Study Area consisted of actively grazed fields associated with private residences. Generally, these areas are characterized by a mosaic of non-native annual grasses mixed with other herbaceous species. Typically, these areas were actively grazed, but not irrigated. Pastures provide limited potential for special aquatic resources.

E. AQUATIC HABITATS

Two aquatic habitats were identified within the Wetland Study Area: Riverine and Lacustrine.

Riverine

Riverine habitat within the Wetland Study Area was mapped as canals, irrigation ditches, and the flow channel of rivers such as the Kings and Kern. Due to the high level of water diversion for agricultural purposes, the riverine areas within the Wetland Study Area do not always exhibit flowing water and may be seasonally dry throughout the year. Vegetation within riverine areas was either absent due to maintenance activities, such as within an irrigation ditch, or was dominated by weedy species such as mustards (Brassicaceae) and annual grasses (Poeaceae). Vegetation growing on the banks of rivers was mapped separately.

Lacustrine

Lacustrine habitat within the Wetland Study Area is limited to man-made basins used for water storage and groundwater recharge. These basins range in size from less than 1,000 square feet to hundreds of acres. These basins typically have earthen berms and contain little or no emergent vegetation. One large basin observed was partially bordered by a narrow band of willows and other riparian vegetation. There are no natural, permanent lakes within the Wetland Study Area.

Based on the agricultural practices observed during the 2010 field surveys, lacustrine habitats are regularly exposed to pollutants such as fertilizers, pesticides, and other common agricultural chemicals. As with Riverine areas, basins used for water storage and groundwater recharge are subject to fluctuations in water level, and may be dry during portions of the year.

F. NON-VEGETATED HABITATS

One non-vegetated habitat was identified within the Wetland Study Area: Barren.

Barren

Barren areas within the Wetland Study Area are characterized by the permanent absence of vegetation. They are defined as any habitat with less than 2% total vegetation cover by herbaceous or non-wildland species and less than 10% cover by tree or shrub species. Barren ground mapped during the field survey effort included areas denuded of cover due to industrial activities such as gravel extraction.

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Section 3.0
Methodology

3.0 Methodology

The methodology for the Wetlands Delineation Report was largely established in the Central Valley Biological Resources and Wetland Survey Plan (Survey Plan) (URS HMM Arup JV 2009). The Survey Plan was prepared for the San Jose to Merced, Merced to Fresno, and Fresno to Bakersfield Sections of the California HST System. The Survey Plan was provided to the various regulatory agencies in October 2009, and comments from the agencies were received in November and December of 2009. Based on agency feedback, minor changes to the Survey Plan were incorporated.

This section summarizes the various methodologies established in the Survey Plan and provides additional information regarding the field surveys employed to identify, map, and categorize the various special aquatic resources in the Fresno to Bakersfield Section of the HST System.

3.1 Background Research

Background research to identify locations of special aquatic resource features potentially present in the Wetland Study Area was conducted at both a watershed level and a project level. The watersheds associated with the Fresno to Bakersfield Section were identified using the NRCS Hydrologic Unit Code Basins dataset (NRCS 2007). Additionally, the *Water Quality Control Plan for the Tulare Lake Basin* (CVRWQCB 2004) was reviewed to identify the watershed and sub-watershed areas, surface water features, and beneficial uses present in, and in the vicinity of, the Wetland Study Area.

The study area for background research of the special aquatic resources included the Fresno to Bakersfield project alternative alignments plus a 0.5-mile buffer on either side of the alignments. The 0.5-mile buffer was chosen to include special aquatic resources and habitats surrounding the alternative alignments. To determine the location, type, and potential extent of known special aquatic resources, Geographic Information System (GIS) data were obtained from the following sources:

- National Wetlands Inventory (USFWS 2009).
- National Hydrography Dataset (USGS 2009).
- Holland Central Valley Vernal Pool Complexes dataset, also known as the CDFG Central Valley Vernal Pool Habitat dataset (Holland 2009b).

3.1.1 Pre-Survey Investigations

In addition to the background research, and prior to conducting the field surveys, wetland delineators reviewed the following sources for information:

- Recent aerial photographs of the Wetland Study Area and vicinity (ESRI Virtual Earth Imagery Service 2009; Digital Globe's Image Connect Service June 2009).
- Historical aerial photographs of the Wetland Study Area and vicinity (Digital Globe's Image Connect Service June 2009).
- Soil Surveys of Eastern Fresno, Kings, Tulare, and Kern counties (USDA 1971, 1986, 1982, and 1988).
- Standard biological references and field guides, including the Jepson Manual (Hickman 1993).
- National List of Plant Species That Occur in Wetlands (Reed 1988).

- U.S. Geological Survey 7.5 minute (1:24,000) topographical quadrangle sheets (Fresno North, Malaga, Fresno South, Conejo, Caruthers, Burris Park, Laton, Remnoy, Waukena, Taylor Weir, Corcoran, Pixley, Alpaugh, Hacienda Ranch NE, Delano West, Allensworth, Pond, Famoso, Wasco, Oil Center, Oildale, Rosedale, Rio Bravo, Edison, Lamont, Gosford, Stevens).

In addition, wetland delineators reviewed recent and historic regional precipitation records.

3.2 Field Surveys

A summary of the field methodology used during the survey, and during post-processing, is presented below.

3.2.1 Delineation of Special Aquatic Resources

Teams of qualified wetland scientists recorded all special aquatic resources both manually on map sheets and electronically on sub-meter-accuracy Global Positioning System (GPS) units in accordance with the methods described in the USACE Wetlands Delineation Manual (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (USACE 2008b). The field maps covered the Wetland Study Area in the form of aerial photographs at a scale of 1 inch equals 200 feet. The Wetland Study Area, which encompassed different survey environments, warranted varying survey techniques during the onsite investigation.

Methodologies discussed include onsite investigation (by environment) and aerial photograph interpretation.

A. RECORDED SPECIAL AQUATIC RESOURCE FEATURES

Wetlands

All wetlands were described using the Cowardin classification system (Cowardin et al. 1979).

Wetland boundaries were determined by using paired data points in wetland and adjacent upland areas. At each sample point, the characteristic vegetation was recorded, and soil test pits were hand-excavated, (whenever possible to 18 inches) to determine groundwater hydrology and soil conditions. For large complexes of features, or repeated features of the same type, paired points were recorded at representative features instead of at individual features.

Additionally, where features varied from the larger complex, paired points were also taken. At these complexes, (and all test pits), photographs were taken of the soil and surrounding vegetation. After evaluating the hydrology, soils, and vegetation, data points were recorded on Wetland Determination Data Form-Arid West Region data sheets (USACE 2008b).

All features that potentially met USACE wetland criteria were recorded as line, point, or polygon features using the GPS unit and/or aerial photographs. The boundaries of wetlands were extrapolated by following topographic contours, wetland vegetation boundaries, and clear hydrologic boundaries. No determination on the connectivity for potential wetland features was made per preliminary determination guidelines (Appendix E [Arid West Region Wetland Determination Data Forms]).

In cases where problematic soils were encountered in wetlands, guidance from the *Regional Supplement* (USACE 2008b) was applied. The supplement provides guidance for addressing many (though not all) of the common problematic situations encountered in the arid west (pp. 96-101). The URS-HMM-Arup Joint Venture used this guidance in the following manner:

- In the remarks section, at the top of the Wetland Determination Data Forms, "naturally problematic" soils are identified when indications of moderately to very strongly alkaline soils (pH 7.9 or higher) were present.
- Under the "Soil" heading on the data forms, "Indicators for Problematic Hydric Soils: Other" is checked, with an explanation in the soil remarks. Reaction to hydrochloric acid (presence of carbonates) and pH (Hellige-Truog) were measured for many of the data points and are given either in the profile description or the soil remarks section.
- Soil map unit name is given at the top of the data form. Many of the soil series mapped in the Wetland Study Area have Natric or Salic horizons, or are otherwise characterized as high pH soils with free calcium carbonates and an accumulation of soluble salts near the soil surface.
- Wetland hydrology indicator B11 (Salt Crust) is often associated with problem soils in the Wetland Study Area and is indicated in the hydrology section of the Wetland Data Forms. Boettinger and Richardson (2001) suggest that the accumulation of soluble salts in the upper 12 inches of a soil, as well as a hard salt crust, be used as a hydric soil indicator.
- Sparse vegetation and/or halophytes or salt-tolerant plant species are associated with problem soils in the Wetland Study Area, and are indicated in the vegetation section of the Wetland Data Forms.

Other Waters of the U.S. (Other Waters)

Other waters of the U.S. in the Wetland Study Area were delineated using the methods described in *A Field Guide to the Identification of the Ordinary High Water Mark in the Arid West Region of the Western United States* (USACE 2008a) and USACE Regulatory Guidance Letter No. 05-05 (USACE 2005), where appropriate. These methodologies provided an approach for identifying the lateral limits of jurisdictional other waters of the U.S. using stream geomorphology and vegetation response to the dominant stream discharge (USACE 2008a).

Indicators of ordinary high water mark (OHWM) evaluated in the field included natural lines impressed on banks, stain lines, depositional features, shelving, changes in soil character, changes in vegetation, destruction of terrestrial vegetation, and the presence of litter and debris. Wetland scientists recorded information for each feature using GPS, photographs, and field notes (Appendix F [Arid West Region Ordinary High Water Mark Data Forms]).

Guidance from the USACE in August 2010 stated that any feature displaying an ordinary high water mark should be deemed as meeting USACE jurisdiction and, therefore, should be considered as other waters of the U.S. (Z. Simmons, project manager, USACE, Sacramento, California. August 12, 2010. Personal Communication).

Waters of the State, Including California Department of Fish and Game Lakes and Streambeds

No formal guidelines exist for the identification of the extent of Central Valley RWQCB or CDFG jurisdiction (waters of the state). Generally, wetlands under state jurisdiction are delineated in the same manner as federal waters (including *Corps of Engineers Wetlands Delineation Manual* [Environmental Laboratory 1987] and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* [USACE 2008b]). However, no guidance or policy is in place with respect to the identification or mapping of waters of the state. The extent of these state-regulated areas often extends beyond that of waters of the United States (above the OHWM). For example, isolated water bodies, and stream channels up to the top of the stream bank or to the riparian drip line, qualify as waters of the state.

Areas above the OHWM and below the top of bank of a number of rivers, irrigation ditches, canals, or detention basins were delineated as waters of the state. The State Water Resources Control Board (SWRCB), which oversees California's Regional Water Control Boards, views the stream channel and the surrounding biological community as providing important functions that affect water quality, including groundwater recharge, surface water supply, nutrient cycling, water filtration, temperature control, maintenance of plant and animal communities, sediment transport and storage, stream channel dynamic equilibrium, and stream bank stabilization (Polhemus, deputy director, SWRCB, Sacramento, California, November 17, 2010. Personal Communication). Both the SWRCB and CDFG view the areas between the bed and the top of the bank, as well as adjacent floodplain and riparian habitat (to the maximum extent of the riparian drip line), as important for flood conveyance and wildlife movement (Perry, project manager, CDFG, Sacramento, California, December 7, 2010. Personal Communication). As such, the extent of the area regulated as waters of the state and CDFG varies.

Wetland scientists mapped or recorded the extent of waters falling exclusively under state jurisdiction using GPS or by hand-drawing the estimated extent on aerial photographs. In areas where riparian vegetation was present, the extent of the vegetation was mapped, where appropriate, to indicate the outer drip line of the riparian shrub and tree species.

B. ONSITE METHODOLOGY AND CONSIDERATIONS FOR ENVIRONMENT

The survey methodology for onsite investigations was based upon wetland delineation techniques outlined by the U.S. Army Corps of Engineers Arid West Manual and then adapted slightly based on the differing environmental conditions encountered in the following landscape areas: fallow fields/natural areas, agricultural, urban, and BNSF Railway yards and right-of-way areas. The ways in which survey methodology varied between the four types of landscapes are described below.

Fallow Fields/Natural Areas

In general, where permission to enter was granted and where the environmental conditions warranted, wetland scientists walked meandering transects to visually assess the Wetland Study Area for special aquatic resources. Teams typically consisted of two to four wetland scientists.

Survey transects were spaced 100 feet apart, and wetland scientists recorded data points every 60 feet or as appropriate to the quality, topography, and character of the areas being examined. The extent of all observed special aquatic resources was identified and mapped using a handheld GPS unit with sub-meter accuracy. Locations of special aquatic resources were also marked on field maps. Data recorded at every point was categorized as upland (vegetated or non-vegetated) or wetland (vegetated or non-vegetated) habitat. Through this method, an overall percentage cover of the special aquatic resource was determined for a large area. Surveyors photographed each special aquatic resource to document physical characteristics. The landforms, vegetation, hydrology, and soil conditions were noted where these characteristics were relevant to the identification of the type, extent, or boundary of each feature. Survey data and personnel were recorded on the Wetland Determination Data Form-Arid West Region or OHWM Datasheet. Transect point data collected in the field was processed using ArcGIS to create a spatially explicit model of wetland and upland areas. The ArcGIS spatial analyst tool, Topo to Raster, interpolated a hydrologically accurate surface from the transect point data. The resulting surface was converted to polygons for subsequent analysis.

Where mapping of aquatic resources, specifically vernal pools, proved difficult due to their complex boundaries and the dense mosaic of upland and wetland features, the survey methodology was modified. In areas where vernal pools were sufficiently interconnected so that they couldn't be individually delineated, an overall boundary was established (by paired points)

around the perimeter of the vernal pool complex area. Isolated upland mounds, where present, were then delineated with paired points and separated out from the vernal pools as isolated uplands. Both vernal pools and upland data were recorded on the appropriate data sheets.

Agricultural Areas

A meandering pedestrian survey of agricultural areas was frequently unnecessary because many fields were laser-leveled and hence features were readily visible from the property edge. Laser-leveled fields are designed to drain surface water into drainage ditches or detention basins. Based on a combination of background research and on-site observations, further investigation was left to the discretion of the wetland scientists. These areas were often reviewed from the roadside. If conditions on the ground confirmed aerial imagery data and no special aquatic resources were identified during background research, no further surveys were conducted.

Where permission to access had been granted, agricultural fields were visually inspected to verify that they were consistent with aerial photography. Aerial imagery was used to locate detention basins, irrigation basins, drainage ditches, and canals. Specific details about each agricultural field were recorded on the field map, and all special aquatic resources were recorded on GPS units.

Urban Areas

Because permission to enter private property was not obtained in urban areas, wetland scientists conducted windshield surveys of the Wetland Study Area. Urban areas include the cities of Fresno, Corcoran, Wasco, Shafter, and Bakersfield. Pedestrian transects or detailed field assessments of these areas were not conducted because the likelihood of special aquatic resource presence was very low. Specific details about the urban areas were recorded on the field maps, and all observed special aquatic resources were recorded on GPS units.

BNSF Railway

The portion of the BNSF Railway right-of-way located in the Wetland Study Area was mapped by specialized teams that exclusively surveyed the BNSF Railway right-of-way. These multi-disciplinary teams consisted of a wetland delineator, a botanist, and a wildlife biologist. Where appropriate, the teams moved through the right-of-way by means of automobile, stopping at points of interest. If necessary, they conducted pedestrian transects of the right-of-way. Special aquatic resources in the Wetland Study Area were delineated using the methods described in this section.

Because access to the area extending 25 feet from the centerline of the BNSF Railway track was not permitted due to BNSF Health and Safety Regulations, some special aquatic resources, including vernal pools, were digitized on a GPS unit. Where special aquatic resources were accessible, teams individually recorded each feature with a GPS unit.

C. AERIAL IMAGE INTERPRETATION FOR PARCELS WITHOUT PERMISSION TO ENTER

Where properties within the Wetland Study Area were not accessible to wetland scientists due to lack of permission to enter, field crews performed visual surveys from adjacent public roads or adjacent parcels. The lateral extent of special aquatic resources was recorded on GPS by digitizing visible features and recording their extent on field maps. In the case of limited access, a GIS specialist, with the assistance of qualified wetland scientists, estimated the extent of the special aquatic resources remotely using background information, image interpretation, and image processing.

Field observations and visual inspection of aerial imagery revealed that some inaccessible areas in the vicinity the town of Allensworth (including the Allensworth Ecological Reserve) contain vernal pool complexes. For these areas, a GIS specialist used image processing software to perform a spectral classification of 2005 and 2009 National Agricultural Imagery Program (NAIP) natural-color aerial imagery. Natural-color NAIP imagery was used rather than available color-infrared NAIP imagery because the acquisition date of the natural-color imagery provided ground conditions that were better for detection of special aquatic resources.

To prepare the imagery for supervised classification, the GIS specialist performed a principal component analysis to simplify and reduce redundancy in the imagery (Campbell 2002). Using knowledge of the Wetland Study Area, along with known characteristics of vernal pool resources, a wetland scientist helped the GIS specialist identify jurisdictional special aquatic resources to create spectral training data to be used for classifying the imagery. The training data were then used to classify the restricted-access areas into specific aquatic and upland cover classes. The resulting classified image was then generalized using a geospatial statistical process (specifically, neighborhood majority within a six-cell radius) to better represent the natural boundaries of ground features. The final processed image was then converted into a vector geospatial format to be used for analysis and map production. Lastly, additional refinements to the classified data were made, as appropriate, using manual image interpretation and field observations. The classification results were then reviewed by additional wetland scientists and confirmed by other project ecologists to be appropriately representative of ground conditions. These mapped areas were classified as “vernal pool” features.

Certain areas were too complex for remote sensing or manual image interpretation. These areas were mapped on a landscape level as areas that could potentially support vernal pools and were termed “vernal pool potential.” At a landscape level, the vernal pool potential areas likely contain vernal pool complexes, which are areas where vernal pools occur in varying concentrations within a matrix of uplands. To quantify acreages of vernal pool potential SAR features, wetland scientists performed an analysis of the vernal pool potential areas consisting of two steps. The first step was to examine existing field survey data from vernal pool delineation performed near the Allensworth Ecological Reserve. The second step included digital image processing combined with a review of wet-season aerial images of the Wetland Study Area, where applicable. Based on the analysis of the known vernal pools (Step 1) and extent of the vernal pool aerial signature displayed over the landscape (Step 2), the relative cover of vernal pools within the landscape was determined (Step 1/Step 2=Relative Cover). The total acreage of the vernal pool potential areas was multiplied by this relative cover coefficient, 22%, to produce an estimate of the amount of vernal pools present within the vernal pool potential area in both the Wetland Study Area and in the construction footprint.

Post-Field Effort Data Processing

Information gathered in the field was organized in the office using GIS software and summarized in tables for future reference. All GPS data were differentially corrected to achieve sub-meter accuracy. All delineated features were labeled with acronyms that correspond to their status and overlaid on the same aerial imagery used for the field maps at a scale of 1 inch equals 200 feet (1:2,400).

D. PERMANENT AND TEMPORARY IMPACTS

Permanent and temporary impact acreages were calculated using ArcGIS software. Calculations were based on acreages of special aquatic resources located within the project footprint.

Construction impacts were considered temporary if they could be fully restored to pre-disturbance conditions following construction. Temporary impacts would include construction

staging areas, construction lay-down sites, relocation of underground utilities, and other work areas that would not be occupied by HST facilities during project operation.

Impacts were considered permanent when they would have lasting effects beyond the project construction period, or would not be fully restored following construction. Permanent impacts included the installation of at-grade track segments, viaduct track segments (everything under the aerial extent of the structure), road crossings, electrical substations, facilities for maintenance-of-way and regional stations.

Impacts associated with the stations are included in Section 4.3. Impacts associated with heavy maintenance facilities (HMF) are quantified in Section 4.3.7.

3.3 Survey Dates

A reconnaissance field trip was conducted to review and obtain preliminary information for the purpose of planning with various field survey efforts and to determine health and safety hazards, resources present, and potential biological resource issues. The reconnaissance survey was conducted on February 2, 2010, and was attended by Justin Whitfield, Biology Task Lead; Jan Novak, Senior Wetland Scientist; Todd Lemein, Botanist; Matthew Bettelheim, Senior Wildlife Biologist; and Melissa Newman, Senior Wildlife Biologist.

The spring season delineation of special aquatic resources was planned to coincide with the optimal period to observe and record the various special aquatic resources. The surveys for the spring season delineation were conducted over two 10-day periods in March and over three 5-day periods in April and May. The March surveys (March 1 to March 10, 2010 and March 15 to March 24, 2010) were led by Jan Novak, Senior Wetland Scientist. A special aquatic resource methodology meeting with all survey personnel was held on March 1, 2010, and a field trip was conducted on March 2, 2010 to review methodologies in the field and to discuss problem areas.

Because access to the BNSF right-of-way was not granted until the completion of the March special aquatic resource survey period, two multidisciplinary survey teams were established to conduct surveys for special aquatic resources on the west side of the BNSF right-of-way in April and May of 2010. The surveys were conducted from April 12 to 16 and from April 19 to 25. From May 23 to 28, 2010, additional surveys were conducted on the east side of the BNSF right-of-way in the area between Corcoran and Wasco. Surveys were not conducted on the east side of the BNSF right-of-way between Fresno and Corcoran and between Wasco and Bakersfield because of BNSF health and safety protocols. These protocols prohibited pedestrian crossings of the railroad tracks. Section 7 lists the names, education, years of experience, and areas of knowledge of the wetland scientists participating in the Special Aquatic Resource surveys.

Results from the spring season delineation of special aquatic resources were used to inform the route for the proposed Allensworth Bypass Alternative. An additional minor adjustment due to engineering considerations was made in the vicinity of Kimberlina Road (north of the city of Wasco). As a result, a summer season survey for special aquatic resources was conducted between July 12 and July 21, 2010.

Windshield surveys were conducted from March 15 through March 17, 2011 to examine additions to the project footprint resulting from cost containment engineering changes. The additional areas were located within the Wasco-Shafter Bypass Alternative Alignment and in the area between the Kings River and the town of Corcoran.

In the spring of 2011, engineering changes were made to the alternative alignments in the vicinity of the Corcoran Bypass and along the Wasco-Shafter Bypass to avoid impacts on the Tulare Lakebed Mitigation Site, on seasonal wetlands associated with Cross Creek, and on local

development plans. To examine the modifications to the alignment and project footprint resulting from these engineering changes, surveys were conducted by a multidisciplinary team between March 15 and March 17, 2011. These surveys were performed within the vicinity of the Wasco-Shafter Bypass Alternative Alignment and in the area between the Kings River and the town of Corcoran. The multidisciplinary team conducted surveys for special aquatic, botanical, and wildlife resources to maintain continuity with the previous survey efforts. Data were collected by windshield surveys from existing public roads. In areas where a lack of public access prevented windshield surveys, the field assessment was augmented with aerial photo interpretation and extrapolation of observations made on adjacent and nearby parcels. The names of the surveyors, their education, and their years of experience are outlined in Section 7, Preparer Qualifications.

3.4 Agency Coordination and Professional Contacts

The following agency coordination and professional contacts contributed to the development of the survey methodology and the results presented in this report. Copies of correspondences described below are consolidated in Appendix G (Agency Correspondence).

On September 25, 2009, the URS/HMM/Arup Joint Venture, along with representatives from CH2M HILL, and ICF Jones and Stokes, held a project workshop with the natural resources regulatory agencies (U.S. EPA, USFWS, National Marine Fisheries Service, USACE, CDFG, and the Central Valley RWQCB) to introduce the HST system and elicit agency feedback regarding HST alignment alternatives in the Central Valley. One of the key requests from the agencies was the consistency and approval of the proposed biological resources and wetlands survey methodologies to be used for surveys in the Central Valley.

The Central Valley regional environmental consultants prepared a survey plan entitled, “Central Valley Biological Resources and Wetlands Survey Plan (Survey Plan).” The Survey Plan was prepared and transmitted to the resource agencies on October 2009 (Authority and FRA 2009).

On October 29, 2009, Jan Novak of URS/HMM/Arup Joint Venture received an email from Leah Fisher at USACE suggesting that the Central Valley Delineation be conducted as a Preliminary Determination, as opposed to an Approved Determination (Fisher 2009). The *Preliminary Jurisdictional Determination* would eliminate the need for significant nexus determinations to be conducted in the field and documented on Rapanos forms[2]

On November 5, 2009, the Authority, along with its consultants, held a meeting with the various regulatory agencies (i.e., USFWS, USACE, and CDFG), URS, CH2M HILL, and ICF Jones and Stokes to discuss the Survey Plan. Revisions to the Survey Plan were made based on the comments received, the discussion at this meeting and on subsequent written comments received from agencies not in attendance.

On December 7, 2009, Justin Whitfield of URS-HMM-Arup Joint Venture spoke with Katie Perry of CDFG to discuss methodologies for the identification and delineation of CDFG lakes and streambeds (Perry 2009) .

On June 23 and subsequently on August 12, 2010, Jan Novak corresponded with Zachary Simmons of the USACE in an email to confirm Leah Fisher’s guidance regarding the delineation of

[2] The delineation for a Preliminary Jurisdictional Determination would only require that the three parameters (i.e., soils, hydrology, and vegetation) be assessed, and all features that met the three-parameter criteria would be defaulted to be considered a potentially jurisdictional water. In the delineation for a Preliminary Jurisdictional Determination, features such as stock ponds or upland ditches that are obviously non-jurisdictional would not need to be identified.

stock ponds and retention basins for a Preliminary Jurisdictional Delineation (Simmons 2010). Mr. Simmons requested that all features exhibiting either an OHWM or meeting the three parameter test be considered jurisdictional. He noted that this categorization may include waters that may not otherwise be jurisdictional under a jurisdictional delineation.

On February 22, 2011, Zachary Simmons contacted Bryan Porter, among others, to request shape files (.shp) for all delineated special aquatic resources within the Wetland Study Area (Simmons 2011a). In addition, Mr. Simmons requested that all future delineation maps not have any shading of aerial photography.

On March 1, 2011, Zachary Simmons contacted Jan Novak to share "Attachment 1," a High Speed Train specific document describing the suggestions by the USACE for the HST wetland determination process. Subsequently, Galen Peracca contacted Zachary Simmons to request a copy of the original letter that preceded Attachment 1 (Simmons 2011b).

On May 5, 2011, Zachary Simmons contacted Jan Novak to clarify that the standard USACE preliminary determination form has been modified by the Sacramento District (Simmons 2011c). Mr. Simmons attached the updated form.

On May 24, 2011, Zachary Simmons provided Lupe Jimenez (HSRA) with the USACE's comments on the special aquatic resource features delineated in the Wetland Study Area. Over the next month, URS corresponded by email and by phone with Zachary Simmons to (1) clarify the USACE's findings from its April 2011 field verification visit, and (2) reach a shared understanding of the requirements for submitting a Preliminary Jurisdictional Determination to the USACE.

The JV biologists received these comments on May 31, 2011 and responded to Zach Simmons that day requesting clarification on the comments. Jason Deters, USACE, responded to JV request for clarification on June 2, 2011 (Deters, 2011), and JV followed-up with a conference call between Zach Simmons, Kevin Melanephy, Jan Novak, and Galen Peracca on June 6, 2011 (Simmons 2011d). During the conference call JV and the USACE discussed two main topics:

1. Changes requested by the USACE to special aquatic resource (SAR) features mapped by the JV team within the FB HST alignment. These changes included:
    - Ditch and canal features that were re-mapped by the USACE during the April 2011 site visit,
    - The removal of culverted waters from impact calculations,
    - The USACE's request for a follow-up delineation of areas adjacent to the Kern River,
    - The USACE's request for clarification on mapping techniques used for vernal pool wetlands within Allensworth State Park.
2. How to address guidance provided to the HST regional consultants in Attachment 1 of the February 17, 2011 letter from Mark Cohen (USACE Deputy Chief of the Los Angeles Regulatory Division of the USACE) to Dan Leavitt (Deputy Director, CHSRA).

On June 7, 2011, Zachary Simmons replied by email regarding the deliverable displaying the potentially jurisdictional "status" of each inventoried aquatic feature (Simmons 2011e). Zach Simmons stated that, after conferring with the members of USACE in the Los Angeles District, parts one and three, dealing with SWANCC and Rapanos issues did not apply to the Sacramento District. Part two, which deals with preamble language, should be provided with the permit for discussion of jurisdiction issues.

On June 13, 2011, Justin Whitfield outlined a follow-up conversation in an email regarding the deliverable displaying the potentially jurisdictional "status" of each inventoried aquatic feature. Justin stated that the conversation between Zach Simmons and himself regarding preamble language concluded that features that drain from a traditional navigable water or relatively permanent water and drain back to a TNW or RPW are considered jurisdictional. On June 15, 2011, Zach Simmons confirmed the conversation and stated that the jurisdictional status of all features ultimately rests with USACE (Simmons 2011f).

On June 13, 2011, JV biologist Jan Novak requested additional guidance for four remaining features, and on June 15, 2011, Zach Simmons forwarded a .kmz from Jason Deters that offered guidance on these features. Zach Simmons and Jan Novak discussed the features over the telephone the same day (Simmons 2011g).

3.5 Limitations That May Influence Results

Several limitations may influence the results of the studies presented in this report. These limitations are beyond the Authority's control and are associated with permission to enter private property. Additional limitations associated with special aquatic resource surveys were related to the need for aerial photograph interpretation/remote sensing.

3.5.1 Permission to Enter

In general, permission to enter the properties in the various Wetland Study Areas was requested on behalf of the Authority by Bender Rosenthal Inc. Requests for permission to enter were not made for urban areas (Fresno, Corcoran, Wasco, Shafter, or Bakersfield) for properties less than 0.5 acre in size or for properties zoned as industrial.

In many instances, permission to enter was granted by private landowners; however, in some cases permission to enter was not granted because either the request was not made, the request was denied (not granted), no response was received, or the property owner requested indemnification. The result of the access limitations was that data could not be collected on the ground, and estimations and assumptions regarding the potential for special aquatic resources in inaccessible parcels were based on assessments from adjacent areas and in some instances solely on aerial photography. These limitations could result in an underestimation of special aquatic resources and biological resources in some areas within the Wetland Study Area.

3.5.2 Aerial Interpretation/Remote Sensing

When wetland scientists were unable to enter properties in the Wetland Study Area to assess wetlands, they used remote sensing techniques, including manual aerial image interpretation and digital image processing, to map the extent of special aquatic resources. Remote sensing was used in conjunction with field surveys in many areas, and was used exclusively in the vicinity of the town of Allensworth (south of Avenue 8), because access was limited and review of aerial imagery indicated that the areas are relatively undisturbed.

Results of manual image interpretation and digital image processing are directly related to characteristics of the aerial imagery used such as quality and acquisition date. The color-infrared and natural-color NAIP imagery analyzed was acquired by aircraft in summer 2005 and 2009. This imagery was selected for analysis primarily because it provides complete geographic coverage of the Wetland Study Area, is available as a color-infrared product suitable for wetlands mapping, and provides a relatively high spatial resolution (1-m^2 cell size). Because the imagery was acquired in 2005 and 2009, some features visible in the imagery may no longer be present on the landscape, younger features may not be visible, and/or recent land conversion may have occurred. These limitations only apply to those areas where remote sensing was the sole method

used for SAR delineation and, as a result, does not affect the majority of the SAR data reported because most of the data reported were based on field observations and direct verification.

Two inaccessible areas near Allensworth, in the vicinity of Avenue 44, were believed to contain vernal pools; however, neither remote sensing nor manual image interpretation could identify the extent of special aquatic resource features within the parcels. These areas were believed to contain vernal pool resources based on the similarity of their aerial photo signature to that of other local areas known to contain vernal pools. These pools were thus classified as “vernal pool potential.” Because the aerial image interpretation methodology involved the use of a coefficient to estimate the quantity of vernal pools within the vernal pool potential areas, the precise area of these specific resources is not known and the methodology employed could either overestimate or underestimate the quantity of the SAR.

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Section 4.0
Results

4.0 Results

This section provides the results of the various special aquatic resource surveys, details information regarding special aquatic resources, and summarizes survey results. Project-level analyses of impacts are discussed in terms of construction and operation of the Fresno to Bakersfield Section of the HST system. The functions and values of wetlands identified in the Wetland Study Area are also discussed.

4.1 Special Aquatic Resources

Special aquatic resources were identified using the methodologies set forth in Section 3 (Appendix H [Special Aquatic Resources Survey Results Figures]). The various types of special aquatic resources were categorized using a unique nomenclature to describe the various special aquatic resources (project type) and the Cowardin classification system (Cowardin et al. 1979). In addition to being classified by physical characteristics, special aquatic resources were classified as Wetlands (Waters of the U.S.), Other Waters of the U.S., or waters of the State. In most instances, other Waters of the U.S. are the same as Waters of the State; however; slight differences in the extent of some features were identified and are explained in this section. Appendix I (Photographs of Representative Jurisdictional Features in the Wetland Study Area) provides representative photographs of the special aquatic resources. A summary of the project type, of the corresponding Cowardin type, and of the special aquatic resource jurisdictional status is provided in **Table 4.1-1**. The sections below describe the different HST water types identified in the Wetland Study Area.

Table 4.1-1
Special Aquatic Features Found Within the Wetland Study Area, Based on Cowardin Classification, HST Water Type, and Jurisdictional Status

Cowardin Classification	HST Water Type	Jurisdiction
Riverine unconsolidated bottom	Canal[a]	Other Waters of the U.S. and Waters of the State[b]
None assigned	Culvert waters[a]	Other Waters of the U.S. and Waters of the State
Riverine unconsolidated bottom	Ditch[a]	Other Waters of the U.S. and Waters of the State[b]
Lacustrine unconsolidated bottom	Reservoir[a]	Other Waters of the U.S., and Waters of the State
Lacustrine unconsolidated bottom	Retention/detention basin[a]	Other Waters of the U.S., and Waters of the State
Riverine forested wetlands	Riparian	Waters of the State
Riverine unconsolidated bottom	Seasonal riverine	Other Waters of the U.S. and Waters of the State
Palustrine emergent nonpersistent	Seasonal wetland	Wetlands (Waters of the U.S.) and Waters of the State
Palustrine emergent nonpersistent	Vernal pool and vernal pool potential	Wetlands (Waters of the U.S.) and Waters of the State

Table 4.1-1
Special Aquatic Features Found Within the Wetland Study Area, Based on Cowardin Classification, HST Water Type, and Jurisdictional Status

Cowardin Classification	HST Water Type	Jurisdiction
Palustrine emergent nonpersistent	Vernal swale	Other Waters of the U.S. and Waters of the State
Palustrine emergent nonpersistent	Vernal swale and pool complex	Other Waters of the U.S. and Waters of the State

Notes:
[a] Man-made environment
[b] Wherever possible, federal and state jurisdictions were separated: federal jurisdiction was delineated to the ordinary high water mark, while state jurisdiction was delineated to either top of bank or edge of the riparian drip line.
Acronym:
HST = high-speed train

4.1.1 Canals

Canals are linear features, often concrete-lined and ranging from approximately 10 to 50 feet in width; they are, in most instances, features that are named in the National Hydrography Dataset (USGS 2009). Within the Wetland Study Area, canals occur in all segments of the Fresno to Bakersfield alternative alignments. Their purpose is to transport large quantities of water, typically for agricultural purposes.

Canals are typically linked to seasonal riverine areas and reservoirs by a series of ditches and culverts. These connections typically occur outside of the Wetland Study Area. Canals are typically devoid of vegetation and lack natural soils (because they are lined), although sediments often deposit at the bottom. They are regularly maintained, and are frequently bounded by parallel access roads. A series of pumps are often used to transport water between canals, ditches, or under roads and other infrastructure. The extent of these features is based on the presence and elevation of the OHWM, although in appropriate cases, state jurisdiction may extend beyond the OHWM to the top of the bank or the riparian drip-line. Although there is not a Cowardin classification that suits canals, they most closely resemble and are considered for the purpose of this report to be riverine unconsolidated bottom.

4.1.2 Culvert Waters

Culvert waters are the portions of waters of the U.S. (such as ditches, canals, and seasonal riverine) that are conveyed through metal or concrete engineered structures. These structures are round or square in shape, from 8 inches to 10 feet in diameter. Culvert waters are reported as a separate category of special aquatic resource. Culvert waters have recently received regulatory attention because of changes to the Clean Water Act legislation based on the Rapanos Case (Appendix A [Regulatory Requirements]).

Culvert waters only include the extent of the water feature within the culvert. Within the Wetland Study Area, culvert waters occur in all alternatives. Culverts connect sections of day-lighted water features, such as streams, canals, and ditches that travel beneath or adjacent to roads, trestles, or other terrestrial structures. Within the Wetland Study Area, culvert waters are often associated with conveyance of water under the BNSF embankment or public or private roads, and are connected to surface features at either end. Culverts are also frequently found in agricultural areas where they are used to connect irrigation ditches. There is no assigned Cowardin classification for culvert waters.

4.1.3 Ditches

Ditches share many characteristics with canals but are typically narrower, exhibit lower water-carrying capacity, and cover shorter distances. They are typically unlined, earthen features with regulated, intermittent, or near-continuous hydrology. Both drainage and irrigation ditches occur in the Wetland Study Area, with irrigation ditches being the predominant ditch type (drainage ditches occur in non-agricultural settings; irrigation ditches are strictly for agricultural purposes). Within the Wetland Study Area, ditches occur in all alternatives and are considered as other waters of the U.S.

Ditches typically have a bed and bank, and display evidence of an OHWM or other forms of visible hydrology. When ditches are classified as other waters of the U.S., they are connected to other irrigation ditches, canals, and larger navigable rivers via a network of other water features. In both cases, the Cowardin classification for ditches is riverine unconsolidated bottom. As with canals, the extent of a ditch feature is based on the presence and elevation of the OHWM, although in appropriate cases, state jurisdiction may extend beyond the OHWM to the top of the bank. Ditches are exclusively considered waters of the state when either or both of the following conditions apply:

- The ditch does not have an OHWM.
- The ditch has an identified beneficial use as a water of the State.

4.1.4 Retention/Detention Basins

Retention/detention basins are man-made features that are square, rectangular, round, or triangular in shape, often with constructed earthen walls, and always devoid of vegetation. Retention/detention basins are typically several hundred square feet but can be much larger. The spatial extent of retention/detention basins is determined by the location of the OHWM. Retention/detention basins are classified as other waters of the United States and are given the Cowardin classification of lacustrine unconsolidated bottom.

These features are closely associated with agriculture activities and in most instances are used as water storage, or retention, facilities. Occasionally, retention/detention basins are used to retain urban storm water. Surface water within the basins may be seasonal or perennial, depending on the location and use of the feature. These features are often associated with agriculture land uses, including pasture, cropland, irrigated grain crops, irrigated hayfield, irrigated row and field crops, deciduous orchard, evergreen orchard, vineyard, and urban.

4.1.5 Reservoirs

Reservoirs are large, steep-sided, man-made impoundments that may contain either drinking water or irrigation water storage. Reservoirs are usually larger than retention/detention basins. One of these features occurs in the Wetland Study Area and is located in the vicinity of Tule Creek and managed by the Alpaugh Irrigation District. The reservoir is a large, open-water features that is largely devoid of vegetation. Hydrologically, reservoirs are perennial water bodies.

Several other waters of the U.S. were identified in conjunction with the reservoir feature, including a number of ditches, seasonal wetland features, and retention/detention basins. The Cowardin classification for reservoirs is lacustrine unconsolidated bottom.

4.1.6 Riparian

Riparian areas are associated with the seasonal riverine special aquatic resource and are identified as waters of the State. Riparian features are the areas that lie between the maximum extent of other waters of the U.S. (the OHWM), and either the top of bank (of the river channel) or the outer drip line of riparian vegetation. Riparian areas in the Wetland Study Area are characterized by cottonwood, sycamore, valley oak, and willow trees. Riparian areas occur between the outer levee and the seasonal riverine communities along Kings River, Cole Slough, Deer Creek, Poso Creek, Tule River, and Kern River. The Cowardin classification for riparian areas is riverine forested wetlands.

4.1.7 Seasonal Riverine

Seasonal riverine features found within the Wetland Study Area include Kings River (Dutch John Ditch, Riverside Ditch), Cross Creek, Tule River, Deer Creek, Poso Creek, and Kern River. Many of these features originate in the Sierra Nevada, where their hydrology is less impacted by water developments. By the time these features reach the Wetland Study Area, they are highly manipulated for municipal and agricultural purposes, and much of their surface- and groundwater has been diverted, pumped, or captured. In the Wetland Study Area, these resources are often seasonally dry.

Additionally, the banks and floodplains of seasonal riverine resources in the Wetland Study Area have largely been channelized, and adjacent riparian vegetation has been removed, except where levees protect the upper floodplain. In general, the streambeds are unvegetated and are composed primarily of sandy or gravelly substrate. The Kings River contained flowing surface water at the time of the special aquatic resource surveys in March 2010 and during subsequent surveys in July 2010.

Seasonal riverine areas were mapped as other waters of the U.S. based on the extent of the OHWM. The extent of waters of the State in these seasonal riverine areas is delineated between the OHWM and the top of bank where riparian vegetation is absent. Many of these features were located immediately adjacent to narrow bands of valley foothill riparian, and often these bands occurred outside of the OHWM and the mapped extent of other waters of the U.S. However, where adjacent riparian vegetation is present, additional waters of the state were delineated based on the extent of the riparian vegetation beyond the top of the bank (as described in Section 4.1.6, above). The Cowardin classification for seasonal riverine is riverine unconsolidated bottom.

4.1.8 Seasonal Wetlands

Seasonal wetlands in the Wetland Study Area occur in disturbed habitats. These disturbed habitats include fallow agricultural areas, drainage ditches along the BNSF right-of-way, retention/detention basins, active agricultural fields, and roadside ditches.

Seasonal wetlands in the Wetland Study Area are found where the soils have sufficient clay content or sufficient compaction to allow water to pond. Typical vegetation includes broadleaf cattail (*Typha latifolia*), field horsetail (*Equisetum arvense*), barley (*Hordeum* spp.), saltgrass (*Distichlis spicata)*, meadow barley (*Hordeum brachyantherum*), bush seepweed (*Sueda moquinii*), asthmaweed (*Conyza bonariensis), Chenopodium* sp., summer Cyprus (*Kochia scoparia*), and fivehook bassia (*Bassia hyssopifolia*). In the most-manipulated areas, inundation is hydrologically controlled by pumps, weirs, and/or storm drain systems. In less-manipulated systems, natural inundation or saturation occurs during the winter and springs seasons and the seasonal wetlands are dry during the summer and fall. Although sharing a similar hydrologic regime, seasonal wetlands are distinguished from vernal pool wetlands by their lack of the

distinctive floristic components and by the absence of a distinctive claypan or hardpan. The Cowardin classification for seasonal wetlands is Palustrine emergent nonpersistent. Seasonal wetlands were identified within the BNSF right-of-way and various roadside ditches from southern Corcoran south to SR 46, in a ruderal field in the urban Fresno area, in two urban stormwater retention/detention basins in urban Bakersfield, and in two disturbed grassland/pasture areas north of Corcoran. The majority of the seasonal wetlands present in the Wetland Study Area were found within the BNSF right-of-way. These wetlands appear to pond shallow water seasonally and to support herbaceous hydrophytic vegetation. Urban retention/detention basins were observed to contain hydric vegetation, such as rushes (*Juncus* sp.) and broadleaf cattail and appear to collect runoff or irrigation water seasonally within the earthen basin.

4.1.9 Vernal Pools and Potential Vernal Pools

Vernal pools within the Wetland Study Area typically occur as a result of the saline-sodic soils. The dispersed clay particles allow water to pond long enough for hydric vegetation to germinate. At the time of the special aquatic resource surveys, the most prominent hydric plants present were several species of goldfields (*Lasthenia* spp.). Other prominent hydric vegetation found within vernal pools included alkali weed (*Cressa truxillensis)*, pepperweed (*Lepidium* spp.), common tarweed, saltgrass, and alkali heath (*Frankenia salina)*. Upland areas surrounding the vernal pools were dominated by Menzie's fiddleneck (*Amsinckia menziesii)*, bromes (*Bromus* spp.), barley, and foxtail (*Vulpia* spp.). The Cowardin classification for vernal pools is palustrine emergent nonpersistent.

Soil saturation, ponding, prominent sediment deposits, and biotic crust were the most common hydrology indicators of the vernal pool resources. Soils in these areas exhibited pH greater than 8, which masked redoximorphic features that may have been present. However, because positive wetland vegetation and hydrology were present, these naturally disturbed soils meet USACE criteria as problematic hydric soils with faint or no indicators (moderately to very strongly alkaline soils; USACE 2008b).

Vernal pools detected from aerial photographs were delineated remotely and classified as potential vernal pools. Within the Wetland Study Area, vernal pools occurred within alkali desert scrub habitat. They were located primarily in the Allensworth area and in the Upper Deer-Upper White watershed.

4.1.10 Vernal Swales

Vernal swales are shallow depressions with vegetation, hydrology, and soils similar to vernal pools. They were geographically located near the town of Allensworth and occurred exclusively within the BNSF right-of-way. These features were likely man-made due to construction of the BNSF and are likely affected by routine maintenance of the BNSF right-of-way. Due to a lack of riverine characteristics (absence of vegetation, lack of a distinguishable bed and bank, and lack of an ordinary high water mark), vernal swales are classified as wetlands (waters of the U.S. and waters of the State). Vernal swales within the Wetland Study Area were found primarily in alkali desert scrub habitat. The Cowardin classification for vernal swales is also palustrine emergent nonpersistent.

4.1.11 Vernal Swales and Pool Complexes

The vernal swale and pool complex encompasses features from both the vernal pool and vernal swale classes, as described above. They were geographically located primarily in the Allensworth area and occurred exclusively within the BNSF right-of-way. These features were also likely man-made due to construction of the BNSF and are likely affected by routine maintenance of the BNSF

right-of-way. These areas could not be separated out with polygons because the features were often too small for the GPS minimum mapping unit; therefore, these features were grouped. The vegetation community associated with vernal pools in the Wetland Study Area is Alkali Desert Scrub. The Cowardin classification for vernal swales and pool complexes is also palustrine emergent nonpersistent.

4.2 Survey Results

4.2.1 Results from the Wetland Study Area

The special aquatic resource survey yielded a number of different types of features that were classified either as wetlands (WL), other waters of the United States (OW), culverted waters (CW), or waters of the state (WS). **Table 4.2-1** presents a summary of these HST water types by watershed within the Wetland Study Area. The special aquatic resources are further summarized based on HST water type, as described in **Table 4.2-2**. Because there are a number of alternative alignments, SAR features may be present in the overlap area of the Wetland Study Area. Furthermore, because of the large number of SAR features and their various representations in different tables, rounding of the acreages results in slightly different totals. The notes at the bottom of each summary table provide more detailed information on the calculations that are presented.

The special aquatic resource survey identified 987 special aquatic resource features, totaling 515.66 acres (**Table 4.2-3**). Appendix J (USACE ORM Data Forms), Table J-1, provides the USACE ORM data, for all special aquatic resource features in the Wetland Study Area, including the area (acreage) of each feature in USACE jurisdiction. The majority of wetlands occurred in the Upper Kaweah Basin and the Upper Deer-Upper White Basin watersheds. Significant amounts (greater than 50 acres) of other waters occurred in the Upper Deer-Upper White Basin, the Upper Kaweah Basin, and the Tulare-Buena Vista Lake Basin watersheds. The largest acreage of waters of the state occurred in the Tulare-Buena Vista Lakes Basin Watershed.

The majority of wetlands found in the Upper Kaweah Basin Watershed are between Cross Creek and the city of Corcoran within the Wetland Study Area, and occur as part of a large reservoir complex that was interpreted using remote sensing techniques due to access limitations. The wetlands found in the Upper Deer-Upper White Basin consist primarily of vernal pool or potential vernal pool areas. Vernal pool areas are those that were delineated by wetland scientists in the field. Vernal pool potential areas are estimated to occur on approximately 1.74 acres, based on the methodology described in Section 3.2.1.C.

Table 4.2-1
Fresno-Bakersfield Special Aquatic Resources: Totals by Watershed in the Wetland Study Area[1]

Watershed	Wetlands		Other Waters of the U.S.		Culverted Waters		Waters of the State	
	Number of Features	Acreage	Number of Features	Acreage	Number of Features	Acreage	Number of Features	Acreage
Upper Dry Basin	10	0.67	69	21.13	23	0.18	18	0.93
Tulare-Buena Vista Lakes Basin	109	13.29	148	76.97	38	0.42	27	30.51
Upper Kaweah Basin	6	9.22	43	33.29	19	0.35	4	0.47
Upper Tule Basin	9	4.49	11	5.72	4	0.01	4	1.45
Upper Deer-Upper White Basin	228	87.89	69	139.51	39	0.11	20	8.18
Upper Poso Basin	--	--	50	10.87	9	0.09	7	4.15
Middle Kern-Upper Tehachapi-Grapevine Basin	1	0.24	21	48	7	0.29	7	11.07
Subtotal	363	115.78	411	335.49	139	1.43	87	56.77
Special Aquatic Resources Total	**Number of Features**		**1000**		**Acreage**		**509.48**	

Notes:
Calculations based on the Wetland Study Area. Wetland Study Area based on the Draft EIR/EIS 15% engineering design.
[1] Wetland Study Area includes linear and auxiliary project construction features (i.e., TPSS, switching stations, paralleling stations, road overcrossings, Heavy Maintenance Facilities) plus a 250' buffer.
[2] A significant portion of the SAR features in this watershed were determine through PCA and aerial interpretation.
[3] This acreage includes of potential vernal pool habitat with the 0.22 coefficient applied as described in Section 3.2.1.C.
[4] SAR features occur in multiple watershed basins, and therefore the number of features calculated by watershed is more than the actual number of features, there are 10 features which occur in more than one watershed basin. The actual total number of features is 987.

Table 4.2-2
Acreage of Special Aquatic Resource Water Types in the Wetland Study Area[1]

Wetlands			Other Waters of the U.S.			Waters of the State		
Special Aquatic Resource Type	**Cowardin Classification**	**Acreage**	**SAR Water Type**	**Cowardin Classification**	**Acreage**	**SAR Water Type**	**Cowardin Classification**	**Acreage**
Seasonal Wetland	Palustrine emergent nonpersistent	50.95	Canal	Riverine unconsolidated bottom	58.19	Canal	Riverine unconsolidated bottom	2.9
Vernal Pool	Palustrine emergent nonpersistent	18.02	Culvert Water	--	1.43	Ditch	Riverine unconsolidated bottom	7.36
Vernal Pool (potential)[2]	Palustrine emergent nonpersistent	1.74	Ditch	Riverine unconsolidated bottom	53.08	Riparian	Riverine forested wetland	46.51
Vernal Swale	Palustrine emergent nonpersistent	18.79	Reservoir	Lacustrine unconsolidated bottom	66.12	--	--	--
Vernal swale and pool complex	Palustrine emergent nonpersistent	26.29	Retention/Detention Basin	Lacustrine unconsolidated bottom	114.17	--	--	--
--	--	--	Seasonal Riverine	Riverine unconsolidated bottom	43.92	--	--	--
Total Wetlands		115.79	**Total Other Waters of the U.S.**		336.92	**Total Waters of the State**		56.77

Notes:
Calculations based on the Wetland RSA. Wetland Study Area based on the Draft EIR/EIS 15% engineering design.
[1] Wetland Study Area includes linear and auxiliary project construction features (i.e., TPSS, switching stations, paralleling stations, road overcrossings, Heavy Maintenance Facilities) plus a 250' buffer.
[2] This acreage includes of potential vernal pool habitat with the 0.22 coefficient applied as described in Section 3.2.1.C.
Acronym:
-- = denotes no SAR features are present
SAR = Special Aquatic Resource

Table 4.2-3
Special Aquatic Resources: Totals of HST Water Type in Wetland Study Area[1] by HST Alternative

Special Aquatic Resources Type	High-Speed Train Alternatives					
	BNSF Alternative	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South
	Acreage					
WETLANDS	99.99	--	9.03	21.82	--	0.51
Seasonal Wetland	45.61	--	6.23	11.23	--	0.51
Vernal Pool	14.48	--	1.43	3.53	--	--
Vernal Pool (Potential)[2]	1.74	--	--	--	--	--
Vernal Swale	11.87	--	1.37	7.06	--	--
Vernal Swale and Pool Complex	26.29	--	--	--	--	--
OTHER WATERS OF THE U.S.	233.00	8.10	44.51	91.48	19.96	29.13
Canal	41.32	6.88	18.13	0.18	--	12.84
Culvert Water	1.09	0.04	0.29	< 0.01	0.13	0.23
Ditch	47.54	0.40	15.52	5.53	6.28	0.03
Reservoir	21.85	--	--	45.21	--	--
Retention/Detention Basins	83.55	0.78	4.31	39.43	13.55	3.60
Seasonal Riverine	39.28	--	6.26	1.13		12.43
STATE WATERS	50.20	0.09	5.17	5.02	0.62	4.75
Canal	2.90	--	2.46	--	--	--
Ditch	7.00	0.09	0.34	0.20	0.62	--
Riparian	42.94	--	2.37	4.82	--	4.75
Total[3]	**387.49**	**8.19**	**58.70**	**118.34**	**20.58**	**34.40**

Note:
Calculations based on the Wetland Study Area. Wetland Study Area based on the Draft EIR/EIS 15% engineering design.
[1] Wetland Study Area includes linear and auxiliary project construction features (i.e., TPSS, switching stations, paralleling stations, road overcrossings, Heavy Maintenance Facilities) plus a 250' buffer.
[2] This acreage includes of potential vernal pool habitat with the 0.22 coefficient applied as described in Section 3.2.1.C.
[3] Where the alternative alignments diverge and converge the SAR features contained within the Wetland Study Area are reported for both alternatives. The SAR features present in these overlapping Wetland Study Area areas total approximately 114 acres.
-- = denotes no SAR feature is present
Acronyms: BNSF = BNSF Railway

4.2.2 Surveys of Alignments That Have Been Removed from Project Consideration

Special aquatic resource surveys were conducted to help site the location of the Allensworth Bypass Alternative. Based upon the results of these surveys, the Allensworth Bypass was relocated to avoid significant impacts to vernal pools. Initial surveys were primarily in areas under agricultural production that featured saline/sodic soils. These soil conditions made some of the fields unviable, and some of the land was either abandoned or never put into agricultural production. Natural areas in the Wetland Study Area featured high-quality vernal pools, formed in the slightly undulating topography. Vernal pools surveyed by wetland scientists were covered in California goldfields. Due to the high ecological value of habitat found in this area, the Allensworth Bypass Alternative was relocated to the west.

4.3 Special Aquatic Resource Impacts

Special aquatic resources, including agricultural ditches, canals, culverts and retention/detention basins, seasonal wetlands, vernal pool wetlands, and riverine features, are present throughout the HST alternatives. Impacts on special aquatic resources include any and all activities that have a permanent or temporary disturbance to features located within the project footprint and identified during special aquatic resource surveys. The construction, operation, and maintenance of roads, rail track, and associated infrastructure have the potential to remove or alter special aquatic resources through filling, hydrological interruption, or other means that disturb these resources. The methodology used to determine temporary and permanent impacts is discussed in Section 3.2.1.D.

Potential impacts to special aquatic resources associated with the HST Alternatives, proposed stations and heavy maintenance facilities (HMFs) are discussed and quantified in Section 4.3.7. Within each impact table, the column under the BNSF Alternative header represents the acreage of impacts to special aquatic resources for the entire alignment between Fresno and Bakersfield. The subsequent columns for the remaining HST alternatives (i.e., Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter Bypass, and Bakersfield South alternative alignments) indicate both the total acreage of the impact, and provide a comparison of the net change, or delta "Δ", that would result from selection the alternative alignment over the BNSF Alternative.

The delta "Δ" represents the difference in impact acreages between an alternative alignment and its corresponding segment in the BNSF Alternative: positive (+) deltas indicate that the alternative alignment results in a greater number of acres impacted than its corresponding segment in the BNSF Alternative; negative (-) deltas indicate that the alternative alignment results in fewer impacted acres than its corresponding segment in the BNSF Alternative. Notes located at the bottom of the tables provide more detailed information.

4.3.1 BNSF Alternative

Permanent and temporary direct impacts on special aquatic resources under the BNSF Alternative and the five alternative alignments are quantified in **Table 4.3-1**.

Table 4.3-1
Comparison of Impacts on Special Aquatic Resources by Alternative

Special Aquatic Resource Type (JURISDICTIONAL STATUS/HST water type)	Impact Type	High-Speed Train Alternatives					
		BNSF Alternative	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South Bypass
		Impact Acreage[1]	Impact Acreage/Delta "Δ" [2]				
WETLANDS (TOTAL)	***Perm.***	*10.97*	--	*1.23/-0.24*	*2.28/-6.96*	--	*-- / -0.13*
	Temp.	*0.44*	--	*0.31/+0.31*	*-- / -0.17*	--	--
Seasonal wetland	**Perm.**	3.67	--	0.48/-0.08	0.49/-2.41	--	-- / -0.13
	Temp.	0.18	--	0.03/+0.03	-- / -0.17	--	--
Vernal pool	**Perm.**	4.04	--	-- / -0.80	0.22/-3.02	--	--
	Temp.	--	--	--		--	--
Vernal pool (potential)[4]	**Perm.**	0.01	--	--	-- / -0.01	--	--
	Temp.	--	--	--	--	--	--
Vernal swale	**Perm.**	1.02	--	0.75 / +0.64	1.57 / +0.72	--	--
	Temp.	0.26	--	0.28 / +0.28		--	--
Vernal pool and swale complex	**Perm.**	2.23	--	--	-- / -2.23	--	--
	Temp.	--	--	--	--	--	--
OTHER WATERS OF THE U.S. (TOTAL)	***Perm.***	*42.68*	*2.09/-1.59*	*8.21/-8.5*	*16/+4.26*	*2.78/-0.64*	*3.58/-0.43*
	Temp.	*7.35*	*0.04/+0.04*	*4.09/+0.77*	*2.38/+2.11*	*0.92/-0.3*	*2.35/+0.53*
Canal	**Perm.**	7.90	2.06/-1.03	3.45/-1.49	--	--	1.69/+0.9
	Temp.	3.29	0.04/+0.04	2.9/+0.18	--	--	0.09/-0.06

Table 4.3-1
Comparison of Impacts on Special Aquatic Resources by Alternative

Special Aquatic Resource Type (JURISDICTIONAL STATUS/HST water type)	Impact Type	High-Speed Train Alternatives					
		BNSF Alternative	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South Bypass
		Impact Acreage[1]	Impact Acreage/Delta "Δ" [2]				
Culvert water	**Perm.**	0.35	<0.01 / -0.02	0.13/+0.06	-- / -0.01	0.10 / -0.04	0.03/+0.03
	Temp.	0.02	--	0.01 / 0.00	-- / -0.01	--	0.02/+0.02
Ditch	**Perm.**	17.62	0.04/-0.12	3.93 / -6.26	3.66/+1.15	1.31 / -0.81	0.02/0
	Temp.	1.01	--	1.00 / +0.52	--	0.26 / +0.01	--
Reservoir	**Perm.**	3.36	--	--	6.61/+3.24	--	--
	Temp.	--	--	--	--	--	--
Retention/detention basin	**Perm.**	10.01	-- / -0.42	0.04/-0.80	5.61/-0.13	1.37/+0.21	0.91/-0.28
	Temp.	2.82	--	0.02/+0.02	2.32/+2.14	0.66/-0.32	1.77/+0.10
Seasonal riverine	**Perm.**	3.44	--	0.66/-0.01	0.13/-0.01	--	0.93/-1.07
	Temp	0.20	--	0.16/+0.04	0.06/-0.02	--	0.47/+0.47
STATE WATERS (TOTAL)	***Perm.***	*7.28*	*0.01 / -0.02*	*1.60/-0.02*	*0.94/-0.59*	*0.33 / -0.03*	*0.31/+0.13*
	Temp.	*0.28*	--	*0.09/+0.09*	*0.14/-0.11*	*0.02 / +0.02*	*0.25/+0.25*
Canal	***Perm.***	1.21	--	1.02 / 0.00	--	--	--
	Temp.	--	--	--	--	--	--
Ditch	**Perm.**	1.55	0.01 / -0.02	0.05 / -0.05	0.04/-1	0.33 / -0.03	--
	Temp.	--	--	--	--	0.02 / +0.02	--

Table 4.3-1
Comparison of Impacts on Special Aquatic Resources by Alternative

Special Aquatic Resource Type (JURISDICTIONAL STATUS/HST water type)	Impact Type	High-Speed Train Alternatives					
		BNSF Alternative	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South Bypass
		Impact Acreage[1]	Impact Acreage/Delta "Δ" [2]				
Riparian	**Perm.**	4.52	--	0.53 / +0.03	0.91/+0.4	--	0.31/+0.13
	Temp.	0.27	--	0.09/+0.09	0.14/-0.11	--	0.25/+0.25
TOTAL IMPACTS	*Perm.*	*60.94*	*2.1/-1.62*	*11.04/-8.77*	*19.22/-3.3*	*3.11/-0.67*	*3.89/-0.43*
	Temp.	*8.06*	*0.04/+0.04*	*4.5/+1.18*	*2.51/+1.83*	*0.94/-0.29*	*2.60/+0.78*

Note:
All impacts were calculated based the Draft EIR/EIS 15% engineering design.
[1] Does not include Heavy Maintenance Facilities (see Table 4.3-2)
[2] "Δ" = the difference between the alternative alignment when compared to the corresponding segment of the BNSF Alternative Alignment.
[3] Where the alternative alignments diverge and converge with the BNSF Alternative, the SAR features contained within the construction footprint are reported for both alternatives. The delta calculations presented above are not affected by this overlap area since these areas are counted toward both the alternative and the BNSF alignments.
[4] This acreage includes of potential vernal pool habitat with the 0.22 coefficient applied as described in Section 3.2.1.C.
--denote no SAR feature is present
0.00 denotes impacts are less than 0.01 acres
Acronyms/Abbreviations:
BNSF = BNSF Railway
HST = high-speed train
"perm." = permanent
"temp" = temporary

Direct impacts on natural and man-made features include the removal or modification of local hydrology, the redirection of flow, and the placement of fill material. In the case of man-made features, these impacts would remove or disrupt the limited biological functions these features provide. In natural areas, these activities would remove or disrupt the hydrology, vegetation, wildlife use, water quality conditions, and other biological functions provided by the resources.

Direct impacts on special aquatic resources would result from construction of the various project components (e.g., embankments, rail bed, road overcrossings, and viaduct footings). Construction would require the use of heavy machinery to recontour the landscape and place fill materials (such as culverts, dirt, and/or engineering structures) in both man-made special aquatic resources (basins, canals, and ditches) and in natural features (wetlands, river beds, and riparian corridors). The contouring and placement of fill in special aquatic resources would permanently impact these resources in some places by removing them entirely, and in other locations only temporarily impact special aquatic resources by reducing their functionality for a season.

Permanent impacts on special aquatic resources would occur during construction of viaducts over natural special aquatic resources such as rivers or creeks (e.g., Kings River, Dutch John Cut, Cole Slough, Cross Creek, Tule River, Deer Creek, and Kern River) and wetlands, as well as man-made ditches and basins. Permanent impacts would result from the shading of aquatic resources by the viaduct structure (where the viaduct is located in proximity to the ground), the placement of piles to support the viaduct (e.g., Kings River), and the permanent removal of vegetation.

No impacts on special aquatic resources are anticipated to occur as a result of construction of the Fresno Station, King/Tulare Regional Station, or Bakersfield Station. Additionally, no impacts on special aquatic resources from operation and maintenance are anticipated because no special aquatic resources would be impacted following project construction.

Temporary impacts on special aquatic resources in the BNSF Alternative include the placement of temporary fill during construction in both man-made and natural special aquatic resources. Temporary fill could be placed during the construction of access roads and staging/equipment storage areas. This would result in a temporary loss of special aquatic resources and could potentially increase erosion and sediment transport into adjacent areas.

Potential indirect impacts include a number of water-quality-related impacts, from erosion and transport of fine sediments or fill downstream of construction and from unintentional release of contaminants into special aquatic resources that occur outside of the project footprint. These discharges could indirectly adversely impact adjacent or downstream special aquatic resources.

4.3.2 Corcoran Elevated Alternative

Special aquatic resources in the Corcoran Elevated Alternative Alignment include canals, culverts, ditches and retention/detention basins. Impacts on special aquatic resources from construction of this alignment are shown in **Table 4.3-1**. These impacts would occur through the same mechanisms as those described under the BNSF Alternative, namely, permanent loss where the resources overlap with the project footprint and potential temporary impacts in areas that may be disturbed during construction.

The Corcoran Elevated Alternative Alignment would be the same as the corresponding section of the BNSF Alternative Alignment, except that it would pass through the city of Corcoran on the eastern side of the BNSF right-of-way on an elevated structure. Given the similarity between the two alternative alignments, they contain similar special aquatic resources.

4.3.3 Corcoran Bypass Alternative

Special aquatic resources present in the Corcoran Bypass Alternative include seasonal wetlands, vernal pools, vernal swales, seasonal riverine (e.g., Cross Creek, Tule River), agricultural canals, ditches, reservoirs and retention/detention basins. Permanent and temporary impacts from construction of the Corcoran Bypass Alternative are summarized in **Table 4.3-1**. These impacts would occur through the same mechanisms as those described under the BNSF Alternative.

The Corcoran Bypass Alterative would be located in agricultural areas east of Corcoran, whereas the corresponding BNSF Alternative segment would be routed through Corcoran, along SR 43 and the BNSF right-of-way. Special aquatic features identified within urban Corcoran and the BNSF right-of-way are primarily man-made, while those located in the Corcoran Bypass Alternative are in the agricultural areas east of urban Corcoran and are primarily agricultural.

4.3.4 Allensworth Bypass Alternative

Surveys for vernal pools were used to inform routing of the Allensworth Bypass to minimize impacts on special aquatic resources (a reduction of more than 100 acres in the Wetland Study Area). Even following minimization of impacts, the Allensworth Bypass Alternative would affect seasonal wetlands, vernal pools, vernal swales, seasonal riverine (e.g., Deer Creek, Poso Creek); and man-made features including ditches, reservoirs, and retention/detention basins. Because of the presence of these resources within the project footprint, construction of the Allensworth Bypass Alternative would directly and indirectly result in permanent and temporary impacts on special aquatic resources (**Table 4.3-1**). These impacts would occur through the same mechanisms as those described under the BNSF Alternative.

The Allensworth Bypass Alternative travels primarily through agricultural lands, in contrast to its corresponding segment under the BNSF Alternative, which runs adjacent to SR 43 and occurs along BNSF right-of-way.

4.3.5 Wasco-Shafter Bypass Alternative

Special aquatic resources in the Wasco-Shafter Bypass Alternative include: seasonal riverine (e.g., Poso Creek), and associated riparian vegetation, ditches, and retention/detention basins. Because of the presence of these resources within the project footprint, construction of the project utilizing the Wasco-Shafter Bypass Alternative would directly and indirectly result in permanent and temporary impacts to special aquatic resources (**Table 4.3-1**). These impacts would occur through the same mechanisms as those described under the BNSF Alternative.

The Wasco-Shafter Bypass Alternative avoids urban centers and travels entirely through agricultural areas east of SR 43, whereas the corresponding BNSF Alternative segment travels through the urban centers of Wasco and Shafter along the existing, disturbed BNSF right-of-way.

4.3.6 Bakersfield South Bypass Alternative

Special aquatic resources in the Bakersfield South Bypass Alternative include: seasonal riverine (e.g., Kern River) and the associated riparian buffer, canals, and retention/detention basins. Construction of the project with the Bakersfield South Bypass Alternative would directly and indirectly result in permanent and temporary impacts to these special aquatic resources as summarized in **Table 4.3-1**. These impacts would occur through the same mechanisms as those described above under the BNSF Alternative.

Both the Bakersfield South Bypass Alternative and the corresponding BNSF Alternative segment would be located in areas of urban Bakersfield that contain similar man-made and natural special

aquatic resources. In some instances, because the alternatives are located close together, nearly identical impacts on the various special aquatic resources are anticipated.

4.3.7 Heavy Maintenance Facility Site Alternatives

If an HMF is constructed in the Fresno to Bakersfield Section, potential impacts on special aquatic resources would occur. **Table 4.3-2** lists the types of impacts anticipated from the construction of the HMF at the various HMF site alternatives within the Wetland Study Area.

4.4 Wetland Functions and Values

4.4.1 Wetland Study Area

Wetland resources found in the Wetland Study Area, including vernal pools and semi-natural as well as highly disturbed seasonal wetlands that meet the USACE three-parameter test, provide a number of important functions. Wetland functions are defined as the natural processes occurring within and between a wetland and adjacent non-wetland area. Typical wetland functions include hydrologic and nutrient cycling, which partially determines the character and quality of a wetland. Wetland values may also express the importance that these functions have for society based on economic, cultural, aesthetic, or other considerations.

Many wetland functions are difficult and time-consuming to measure directly. Ecosystem structure, therefore, has traditionally been used as a reliable guide to determine functions. Methodologies currently in use for analyzing wetland functions employ easily determined measurements (of vegetation, soil, water marks, etc.) to make a quantitative or qualitative assessment of function (often tied to “reference sites,” where more-detailed measurements of functions have been made). Since landscape position and water source determine much of the functional capacity of wetlands, functional assessment methods have been developed for various hydrogeomorphic (HGM) wetland types.

A detailed wetland functional assessment was not within the scope of the current study. This section attempts to provide a general overview of the functions and values expected to occur within each wetland type in the Wetland Study Area. The analysis is based upon commonly accepted relationships between wetland attributes and functions in similar types of wetlands. This overview relies upon various functional assessment tools that are still in the developmental stage, including the *California Rapid Assessment Method for Wetlands* (CRAM) *Individual Vernal Pools, Vernal Pool Systems, and Perennial Depressional Wetlands Field Books* (CWMW 2008, 2009a, 2009b); *A Draft Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Vernal Pool Depressional Wetlands in Southern California* (Bauder et al. 2009); and *Agate Desert Vernal Pool Final Draft Functional Assessment Methodology* (ESA and Adamus 2007).

Important functions associated with wetlands include hydrology functions (groundwater discharge and recharge; flood flow alteration; erosion control), water quality functions (sediment stabilization; sediment/toxicant retention; nutrient removal/transformation), and habitat functions (production and export of organic matter; terrestrial and aquatic wildlife habitat) (Adamus et al. 1991). The functions and values associated with each of the wetland resource types found in the Wetland Study Area are discussed below. Where possible, a qualitative assessment of function is provided, along with the general location in the Wetland Study Area where the wetlands with specific functions tend to occur.

Table 4.3-2
Summary of Heavy Maintenance Facility Permanent Impacts on Special Aquatic Resources

Special Aquatic Resource Type	Fresno Works-Fresno HMF	Kings County – Hanford HMF	Kern Council of Governments-Wasco HMF	Kern Council of Governments-Shafter East HMF	Kern Council of Governments-Shafter West HMF
Wetlands (in acres)					
Seasonal Wetland	0.67	--	--	--	--
Vernal Pool	--	--	--	--	--
Vernal Pool (Potential) a	--	--	--	--	--
Vernal Swale	--	--	--	--	--
Vernal Swale and Pool Complex	--	--	--	--	--
Other Waters of the U.S. (in acres)					
Canal	2.41	--	--	--	--
Culvert Water	0.02	0.01	--	--	--
Ditch	1.88	1.88	0.27	--	--
Reservoir	--	--	--	--	--
Retention/Detention Basins	1.66	--	1.00	1.14	--
Seasonal Riverine	--	--	--	--	--
State Waters (in acres)					
Canal	--	--	--	--	--
Ditch	--	--	--	--	--
Riparian	--	--	--	--	--
Total	**6.63**	**1.89**	**1.27**	**1.14**	--

Notes:
— = No impact or not applicable
All impacts were calculated based the Draft EIR/EIS 15% engineering design.
Acronyms:
HMF Heavy maintenance facility

4.4.2 Vernal Pools and Vernal Pool Systems

Vernal pools and vernal pool systems are concentrated in the southern part of the Wetland Study Area south of the city of Corcoran and north of the city of Wasco, on both sides of SR 43. The highest quality vernal pool habitat occurs south of the town of Alpaugh and northwest of the town of Delano where the pools are the least disturbed and least fragmented of all the pools within the Wetland Study Area. Although SR 43 bisects an extensive vernal pool system in this location, this vernal pool complex appears minimally affected by adjacent agricultural land uses.

Vernal pools and swales north of Alpaugh occur within the BNSF right-of-way. They are generally confined to areas between the railroad tracks and SR 43 or other roadways. These highly disturbed and fragmented habitats are severely limited in their capacity to sustain habitat functions. However, they still may provide valuable hydrology and water quality functions.

A. HYDROLOGY

Functions

Vernal pools store water both as surface water (ponding) and as subsurface water in the soil above the restrictive layer. Storage varies depending upon catchment and pool topography, location of the pool in the catchment and its connectivity to other pools, land use in the catchment and pool, and soil characteristics (Bauder et al. 2009). This function is not related strictly to absolute volumes of water stored, but to a reference wetland representing relatively undisturbed conditions in similar soil landscapes. Water depth, timing, duration, and frequency are all important aspects of the hydrology function, and together are responsible for sustaining vernal pool ecosystems.

Grading, tilling, ripping, and overgrazing in vernal pools and their catchments in the Wetland Study Area impair their hydrologic functions by altering pool topography and flow paths directly or through sedimentation, and by altering soil infiltration and permeability. Vernal pools and swales also convey surface and subsurface water to downslope pools during overflow events, thus sustaining vernal pool systems by recharging pools and transporting organic matter, nutrients, sediments, organisms, and propagules (Bauder et al. 2009). Disruption of this conveyance function by roads, ditches, canals, and pipelines impairs the function of the vernal pool system as a whole.

Values

The storage function of vernal pools attenuates downslope flooding by reducing peak flows. This likely has relatively minor value in most of the Wetland Study Area because of the area's aridity, the relatively small size of most vernal pools, and their down-basin landscape position (ESA and Adamus 2007). This effect may provide important local value, however, where storage reduces localized flooding of roads or developed areas. Water storage is also valuable since the slow release of water by surface or subsurface flow helps to recharge wetlands and/or streams downslope.

A portion of the water stored in vernal pool soils is available for plant growth, which normally extends the growing season beyond that of surrounding uplands that dry out sooner. This extended growth provides forage for native or domestic grazers when vegetation in surrounding uplands has withered. Domestic and wild animals also use the pools for watering.

Occurrence in the Wetland Study Area

It is expected that vernal pools and vernal pool systems between Alpaugh and Wasco (outside of the BNSF right-of-way) provide hydrology functions at a relatively high level, since they are the

least disturbed systems in the Wetland Study Area. Vernal pools and swales within the BNSF right-of-way provide hydrology functions at relatively lower levels, since they are highly disturbed. Where water has been diverted from the pools, or where drainage ditches run through them, the vernal pools have shallower depths of ponding, and dry out earlier in the season than undisturbed pools.

B. WATER QUALITY

Functions

Vernal pools and vernal pool systems are sustained by complex biogeochemical cycles that provide valuable water quality functions. These functions include the retention of sediments and toxicants from the reduction of flow velocity and filtration by vegetation and soils, and the retention, transformation, and removal of nutrients and toxins through biotic and abiotic processes. The ability of vernal pools to provide these functions is impaired where the hydrologic regime and hydrologic connectivity have been altered by agricultural or urban land uses. Likewise, disturbances that reduce pool size and depth, vegetation cover, soil infiltration, and permeability also reduce water quality functions.

The cycling of nitrogen and phosphorus is a particularly important function provided by vernal pools in the agricultural landscapes of the Wetland Study Area. Excess phosphorus runoff of agricultural fields is retained in sediments in the pools and either held by the soil in inorganic forms or taken up by plants. This is notable in the calcium-carbonate-rich soils of the Wetland Study Area where the phosphorus is precipitated with calcium. Ammonia-nitrogen that is not taken up by plants may be converted to nitrate during the dry season or gaseous nitrogen during the wet season, thus removing it from the system. The amount of sediment and nutrients that a particular vernal pool system can retain is exceedingly difficult to quantify. A system that receives more sediment or nutrients than it can store, remove, or transform will have a reduced water quality function, which will also be reflected in an impaired habitat function.

Values

The water quality functions of vernal pool systems provide economic and ecological value by reducing the load of sediment, nutrients, and toxicants that enter downstream water resources (both surface and groundwater). This is important where habitat for fish and other aquatic organisms is dependent upon good water quality. It is also important where groundwater and surface water sources are used for human consumption or irrigation. Groundwater in the San Joaquin Valley accounts for a high percentage of the water supply for irrigation, industry, and drinking water in the region.

Insecticides, herbicides, fungicides, and chemical fertilizers are used throughout the Wetland Study Area. Soluble chemicals that are not used by crops in the Wetland Study Area are carried downslope. Insoluble chemicals are also transported down-gradient through soil erosion and sedimentation. Through both means, water contaminants concentrate in low areas on the landscape, or wherever groundwater discharges. Many vernal pools and other seasonal wetlands occur in these landscape positions, and the water purification functions they perform can be significant.

Occurrence in the Wetland Study Area

It is expected that vernal pools and vernal pool systems between Alpaugh and Wasco (outside of the BNSF right-of-way) provide water quality functions at a relatively high level, since they are the least disturbed systems in the Wetland Study Area. Vernal pools and swales within the BNSF right-of-way provide water quality functions at relatively lower levels, since they are highly disturbed. Pools in the right-of-way tend to have less dense vegetation and less structure and to

have compacted soils and impaired hydrology, all of which reduce their effectiveness to retain or remove pollutants. They have, however, a greater opportunity to purify water, since there are more sources of pollutants in their proximity than in undisturbed systems.

C. HABITAT

Functions

In spite of their small size, vernal pools provide habitat for numerous sensitive plant species. They also provide permanent or seasonal habitat for rare or sensitive animal species, including crustaceans, amphibians, insects, and migratory waterfowl. In 1998, a CDFG Assessment found that 19 sensitive plant species and 9 sensitive animal species occur within vernal pool habitats in the San Joaquin Valley (Keeler-Wolf et al. 1998). Onsite investigations during the spring and summer of 2010 observed the following sensitive-plant species in and around vernal pool systems within the Wetland Study Area: little mouse tail (*Myosurus minumus* spp. *apus*). Onsite investigations during the spring and summer of 2010 observed the following sensitive-animal species in and around vernal pools systems within the Wetland Study Area: western spadefoot toad (*Spea hammondii*), coast horned lizard (*Phrynosoma coronatum*), and burrowing owl (*Athene cunicularia*). Although fairy shrimp (*Branchinecta* sp.) were not observed during surveys in pools within the Wetland Study Area, they were observed in pools outside of the Wetland Study Area in the vicinity of Allensworth, which may be hydrologically connected to vernal pool complexes in the Wetland Study Area.

Vernal pools are generally small, and their habitat functions are dependent upon the buffer and landscape context in which they are found. Vernal pools and swales connected to other vernal pools, aquatic habitats, or intact upland habitats have a much greater functional capacity than similar pools or swales that are fragmented on the landscape (CWMW 2009a; Butterwick 1998). The long-term sustainability of unique vernal pool plant and animal communities is dependent on these spatial linkages. With respect to habitat functions, intact buffers and corridors between other habitats are essential for maintaining genetic and species diversity.

Values

The importance of vernal pools for plant and animal habitats far outweighs their limited distribution on the landscape. Vernal pools support a diverse population of threatened and endangered flora and fauna that are endemic to the Central Valley and rely upon vernal pools to fulfill critical life history stages. Vernal pools have significant heritage value as indicated by the numerous rare species that use them; however, current estimates of vernal pool losses in the Central Valley range from 50-85% of pre-settlement acreages (King 1998). As a result, vernal pool preservation and restoration are critical for sustaining biodiversity in the San Joaquin Valley. They are utilized for research and education and provide recreational and aesthetic opportunities such as bird watching, botanical observations, and hunting.

Occurrence in the Wetland Study Area

Vernal pools and vernal pool systems between Alpaugh and Wasco (outside of the BNSF right-of-way) are expected to provide habitat functions at a relatively high level, since they are the least-disturbed systems in the Wetland Study Area, and this is the area where most of the sensitive plant species were identified during surveys. Vernal pools and swales within the BNSF right-of-way provide habitat functions at relatively lower levels, since they are highly disturbed and have less habitat complexity and species diversity than the relatively undisturbed pools in similar landscapes. Their connectivity with other pools and other habitats is also severely impaired.

4.4.3 Seasonal Wetlands

Seasonal wetlands occur throughout the Wetland Study Area and are not confined to soil-landscapes in the southern half of the Wetland Study Area as are the vernal pools. Seasonal wetlands are more prevalent south of Corcoran because of the less-permeable soils in this area than in the northern half of the Wetland Study Area. Many of these wetlands occur as linear features in the BNSF right-of-way between the railroad tracks and SR 43 or other roads. The remaining features occur in retention/detention basins, in ditches, and in agricultural fields.

A. HYDROLOGY

Functions

Temporary and long-term storage of surface and subsurface water is a significant function of seasonal wetlands. Storage is mainly dependent on the size and depth of the depression, its outlet characteristics, and soil infiltration and water-holding capacity. Water held in the depressions attenuates flooding and erosion downstream by reducing peak flows. This water also becomes available for recharging downslope wetlands and streams and regional water tables.

The lack of a shallow impervious substrate in these wetlands means that wetland hydrology is generally sustained by larger catchment areas, catchments containing significant impervious surfaces, return flow from irrigated lands, and/or surface or subsurface flow from irrigation channels. As a result, the timing, depth, and duration of saturation and inundation in these wetlands are different from vernal pools. Inundation may be deeper and last longer into the dry season where irrigation is a major hydrology source. Conversely, where the source is runoff from adjacent roads and other impervious surfaces, hydrology will be flashy (sporadically heavy, followed by long, dry periods).

Values

The storage function of seasonal wetlands attenuates downslope flooding by reducing peak flows. This likely has relatively minor value in most of the Wetland Study Area due to its aridity, the relatively small size of most of the wetlands, and their down-basin landscape position (ESA and Adamus 2007). It may be important locally, however, where storage reduces localized flooding of roads or developed areas. Water storage is also valuable since the slow release of that water by surface or subsurface flow helps to recharge wetlands and/or streams downslope. Many of these wetlands also help to recharge regional groundwater tables.

Occurrence in the Wetland Study Area

All of the seasonal wetlands in the Wetland Study Area show evidence of disturbance, which may impair their effectiveness in providing hydrology functions. Seasonal wetlands within the BNSF right-of-way and retention/detention basins are especially impaired because of their lack of connectivity to natural flow paths and from the diversion and drainage of water, resulting in either excessive water or lack of water. These wetlands do provide storage and reduce localized flooding, especially where their storage capacity has been increased by excavation or impoundment (as a result of road embankments or rail track). However, their lack of natural hydrologic connectivity impairs other functions.

Remaining seasonal wetlands occur in agricultural fields and in roadside ditches, where they are frequently disturbed by cultivation, mowing, grazing, and other routine agricultural operations. Many of these wetlands are sustained by return flow from irrigation or from excess water from irrigation channels. They provide storage of excess water that may otherwise contribute to local flooding.

B WATER QUALITY

Functions

Water that flows into and through depressions in seasonal wetlands is exposed to physical and biological mechanisms that help to purify it. These mechanisms include soils and colloidal material that bind nutrients, vegetation that slows water velocity and takes up available nutrients, and micro-organisms that drive chemical transformations and help to stabilize or remove excess nutrients and toxicants. Seasonal wetlands that pond deeply but also dry out, that contain dense, persistent vegetation, and are composed of soils high in clay and organic matter, perform this function the best. The wetlands in the Wetland Study Area vary in all of these features and in their corresponding water quality functions.

Values

The water quality functions of seasonal wetlands provide economic and ecological value by reducing the amount and types of sediment, nutrients, and toxicants that enter downstream water resources, including surface and groundwater. This is important where downstream habitat for fish and other aquatic organisms would be impaired by poor water quality. It is also important where groundwater and surface water sources are used for human consumption or irrigation.

Occurrence in the Wetland Study Area

Seasonal wetlands within the BNSF right-of-way provide water quality functions at relatively low levels since they are highly disturbed. Seasonal wetlands in the right-of-way tend to have less dense vegetation and less structure and to have compacted soils and impaired hydrology, all of which reduce their effectiveness to retain or remove pollutants in the water. They do, however, have a greater opportunity to purify water since there are many more sources of pollutants in their proximity than in undisturbed systems.

Seasonal wetlands within agricultural fields vary in their effectiveness to purify water based on their disturbance regimes. Annually cultivated or heavily grazed areas will have sparse vegetation and little ability to improve water quality. Many of these wetlands are overloaded with sediment or nutrients.

C. HABITAT

Functions

Due to the significantly altered hydrology, low species and habitat diversity, and lack of connectivity to other wetlands and habitats, these seasonal wetlands provide fewer habitat functions than do the vernal pool systems. However, the relative scarcity of wetlands remaining in the San Joaquin Valley means that the few habitat functions they do perform are very valuable. The larger and deeper ponded seasonal wetlands in the Wetland Study Area provide important resting and feeding habitat for migratory waterfowl. Wetlands with moderate ponding depths, relatively high water quality, and appropriate vegetation provide suitable habitat for amphibians, including the Western spadefoot toad. Some aquatic invertebrates normally associated with vernal pools, such as the vernal pool fairy shrimp and the vernal pool tadpole shrimp, may also occur in other seasonal wetlands with hydrology regimes similar to vernal pools.

Values

Because of their importance for wildlife, these seasonal wetlands have value for recreation (bird watching and hunting) and aesthetics. Some of the larger or more diverse wetlands may have

heritage value where special-status plants or animal species are present. These wetlands may also have value for education if they are accessible to the general public.

Occurrence in the Wetland Study Area

Seasonal wetlands within the Wetland Study Area that still retain connections to other wetlands or habitats will tend to have the highest value for wildlife habitat. Wetlands that are completely surrounded by development, such as those in the BNSF right-of-way and in retention/detention basins, will have little value for wildlife.

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Section 5.0
Discussion

5.0 Discussion

Based on the results of the special aquatic resources surveys conducted in the spring and summer of 2010, special aquatic features, including seasonal wetlands, vernal pools, vernal pool and swale complexes, irrigation channels, ditches, retention/detention basins, seasonal riverine areas, reservoirs, and culverts, were identified. Construction of the project, as currently proposed, is anticipated to have permanent and temporary impacts to special aquatic resources. To comply with federal and state regulations protecting special aquatic resources, permits will be required from the USACE, the CDFG, and the State Water Resources Control Board. Additionally, a Biological Opinion will need to be issued by the USFWS to comply with the Endangered Species Act and USACE permit requirements. The following section describes the various requirements in more detail. (For a complete description of the regulatory setting, see Appendix A [Regulatory Requirements].)

5.1 Section 404 Permit

A Section 404 permit is required when a project will result in the discharge of dredged and fill materials into wetlands and other waters under USACE and U.S. EPA jurisdiction. The proposed project will result in fill being placed in waters of the U.S., as well as alterations of the bed and bank of seasonal riverine features in the project footprint. These activities will result in permanent and temporary impacts on wetlands and other waters of the U.S. that are of a magnitude greater than the minimum acreage allowed under a nationwide permit application. The project will, therefore, need to apply for an individual permit, which is necessary when greater than 0.5 acre of waters of the U.S. will be impacted. In order to do so, this report, which constitutes a preliminary jurisdictional determination of waters of the U.S. under USACE jurisdiction, will be submitted to USACE for verification.

Processing individual permits involves pre-application consultation, formal project review and decision making. The pre-application consultation involves several meetings with interested resource agencies designed to provide the applicant with an assessment of the viability of some of the more obvious alternatives available to accomplish the project purpose, to discuss measures for reducing the impacts of the project, and to inform the applicant of the factors the USACE must consider in its decision-making process.

Formal project review starts once a complete application is received. Next, the USACE project manager prepares a public notice, evaluates the impacts of the project and all comments received, negotiates necessary modifications of the project if required, and drafts or oversees drafting of appropriate documentation to support a recommended permit decision.

The permit decision document includes a discussion of the environmental impacts of the project, the findings of the public interest review process, and any special evaluation required by the type of activity, such as compliance determinations with the Section 404(b)(1) Guidelines (USACE 2010).

5.2 Section 401 Certification

A Section 401 Water Quality Certification is necessary when a project that is authorized by a federal permit or license (including a Section 404 permit) will result in adverse impacts on federal and waters of the state. In California, Section 401 Water Quality Certifications are issued by the RWQCB for a region, except in cases where a project crosses through multiple Regional Board Jurisdictions, in which case the SWRCB takes authority. Since the proposed project will require a 404 permit and because the HST project crosses through multiple Regional Board service areas, Section 401 Water Quality Certification will need to be requested from the SWRCB.

5.3 California Department of Fish and Game Lake and Streambed Alteration Agreement

Section 1600-1616 of the State Fish and Game Code requires notifying the CDFG prior to any project activity that would result in any of the following:

- Substantially divert or obstruct the natural flow of any river, stream, or lake.
- Substantially change or use any material from the bed, channel, or bank of any river, stream, or lake.
- Deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake.

The notification requirement applies to any work undertaken in or near a river, stream, or lake that flows at least intermittently through a bed or channel. This includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It may also apply to work undertaken within the floodplain of a body of water. Preliminary notification and project review generally occur during the environmental process. The HST project will result in permanent alterations to the bed and banks of the Kern River as well as temporary alternations to other smaller creeks that cross through the project footprint. In addition, all work within canals, irrigation channels and drainage ditches will fall under CDFG jurisdiction. As a result, a lake and streambed alternation agreement will be required from the CDFG for this project.

5.4 Executive Order 11990

Executive Order 11990 was designed to protect wetlands and minimize adverse impacts associated with the destruction of wetlands. It requires all projects with a federal nexus to avoid construction in wetlands unless there is no alternative or the construction is designed in such a way that it includes all practicable measures to minimize impacts on wetlands. Compliance with this Executive Order will be achieved through coordination with the USACE and the SWRCB. The Fresno to Bakersfield Section of the HST project has and will continue to coordinate with USACE and SWRCB, and in addition to future correspondence, this technical report will help to satisfy coordination requirements under this executive order by providing a record of past coordination between the project and the regulatory agencies.

Section 6.0
References and Personal Communications Cited

6.0 References and Personal Communications Cited

6.1 Documents and Websites

Adamus, P.R., L.T. Stockwell, E.J. Clairain, Jr., M.E. Morrow, L.P. Rozas, and R.D. Smith. 1991. Wetlands Evaluation Technique (WET). Vol. 1. *Literature Review and Evaluation Rationale*. U.S. Army Corps of Engineers, Waterways Experiment Station, Technical Report WRP-DE-2.

Bauder, E.T., A.J. Bohonak, B. Hecht, M.A. Simovich, D. Shaw, D.G. Jenkins, and M. Rains. 2009. A Draft Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Vernal Pool Depressional Wetlands in Southern California. San Diego State University, San Diego.

Boettinger, J.L. 1997. "Aquisalids (Salorthids) and Other Wet Saline and Alkaline Soils: Problems Identifying Aquic Conditions and Hydric Soils." In: *Aquic Conditions and Hydric Soils: The Problem Soils*. S.W. Sprecher and M.J. Vepraskas (eds.). Madison, WI: Soil Science Society of America. pp. 79–97.

Boettinger, J.L. and J.L. Richardson. 2001. "Saline and Wet Soils of Wetlands in Dry Climates." In: *Wetland Soils: Genesis, Hydrology, Landscapes, and Classification*. J.L. Richardson and M.J. Vepraskas (eds.). Boca Raton, FL: CRC Press. pp. 383–390.

Butterwick, Mary. 1998. "The Hydrogeomorphic Approach and Its Use in Vernal Pool Functional Assessment." pp. 50–55. In: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (eds.). *Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference*. California Native Plant Society, Sacramento.

California Department of Fish and Game (CDFG). 1988. *A Guide to Wildlife Habitats of California.* Kenneth E. Mayer and William F. Laudenslayer (eds.).

———. 2008. California Wildlife Habitat Relationship System-Version 8.2. California Interagency Wildlife Task Group. Personal Computer Program and GIS Shapefiles. Sacramento, California.

California High-Speed Rail Authority and Federal Railroad Administration (Authority and FRA). 2009. *Central Valley Biological Resources and Wetlands Survey Plan.* California High-Speed Train Project: Environmental Impact Report/Environmental Impact Statement. October. Subsequently revised in February 2010 and 2011.

———. 2011. *Fresno to Bakersfield Section: Hydrology and Water Resources Technical Report*. Oakland: URS/HMM/Arup Joint Venture.

California Soil Resource Lab. 2005. Online Soil Survey. Available from web site, http://casoilresource.lawr.ucdavis.edu/drupal/node/27. Accessed March 2010.

California Wetlands Monitoring Workgroup (CWMW). 2008. California Rapid Assessment Method for Wetlands (CRAM), version 5.0.2: Perennial Depressional Wetlands Field Book.

———. 2009a. California Rapid Assessment Method for Wetlands (CRAM), version 5.0.3: Vernal Pool Systems Field Book.

———. 2009b. California Rapid Assessment Method for Wetlands (CRAM), version 5.0.3: Individual Vernal Pools Field Book.

Campbell, J.B. 2002. *Introduction to Remote Sensing.* New York: The Guilford Press.

Central Valley Regional Water Quality Control Board (CVRWQCB). 2004. *Water Quality Control Plan for the Tulare Lake Basin*. 2nd ed. California Regional Water Quality Control Board, Central Valley Region. January.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C., Jamestown, North Dakota: Northern Prairie Wildlife Research Center Online. Available from web site, http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm (Version 04DEC1998).

Digital Globe's Image Connect Service. June 2009.

Environmental Laboratory. 1987. *Corps of Engineers Wetland Delineation Manual*. Technical Report Y-87-1, U.S. Army Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Environmental Science Associates (ESA) and Paul Adamus. 2007. *Agate Desert Vernal Pool Final Draft Functional Assessment Methodology*. Prepared for the Agate Desert Technical Advisory Committee.

ESRI. 2009. Virtual Earth Imagery Service.

Hickman, J.C. (ed.). 1993. *The Jepson Manual: Higher Plants of California*. Berkeley: University of California Press.

Holland, R.F. 2009a. *California's Great Valley Vernal Pool Habitat Status and Loss: Rephotorevised 2005*. Prepared for Placer County Land Trust, Auburn, California. December.

———. 2009b. The data set containing Central Valley Vernal Pool Complexes. California Department of Fish and Game, Sacramento, California.

Jenny, Hans. 1941. *Factors of Soil Formation*. New York: McGraw Hill.

Keeler-Wolf, Todd, Diane R. Elam, Scott A. Flint, and Kari Lewis. 1998. California Vernal Pool Assessment Preliminary Report. California Department of Fish and Game.

King, Jamie L. 1998. Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference. Pages 119-123 in: C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (Editors). California Native Plant Society, Sacramento, CA.

Natural Resources Conservation Service (NRCS). 1999a. Official Nahrub Soil Series Description. Available from web site, http://www2.ftw.nrcs.usda.gov/osd/dat/N/NAHRUB.html. Accessed June 2010.

———. 1999b. Official Grangeville Soil Series. Available from web site, http://www2.ftw.nrcs.usda.gov/osd/dat/G/GRANGEVILLE.html. Accessed June 2010.

———. 2007. *Watersheds, Hydrologic Units, Hydrologic Unit Codes, Watershed Approach, and Rapid Watershed Assessments*. Available from web site, www.nrcs.usda.gov/.../Watershed_HU_HUC_WatershedApproach_defined_6-18-07.pdf. Accessed June 2010.

———. 2009. *Web Soil Survey.* Available from web site, http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm. Accessed March 2010.

———. 2010a. *National Hydric Soils List by State.* Available from web site, http://soils.usda.gov/use/ hydric/lists/state.html. Accessed February 2010.

———. 2010b. *Official Soil Series Descriptions.* Lincoln, NE: United States Department of Agriculture. Available from web site, http://soils.usda.gov/technical/classification/osd/index.html. Accessed March 2010.

———. 2010c. Climate Analysis for Wetlands (WETS). Web site, http://www.wcc.nrcs.usda.gov/climate/wetlands.html. Accessed April 2010.

Pooley, D.S. 2002. *The Future of Wetlands Regulation in the Wake of the SWANCC Decision*. Sacramento: The Environmental Monitor, Association of Environmental Professionals.

Reed, P.B., Jr. 1988. *National List of Plant Species That Occur in Wetlands: California (Region 0)*. U.S. Fish and Wildlife Service Biological Report 88(26.10). 135 pp.

Smith, D.W. and W.L. Verrill. 1996. "Vernal Pool – Soil – Landform Relationships in the Central Valley, California." In *Ecology, Conservation, and Management of Vernal Pool Ecosystems – Proceedings from a 1996 Conference.* C.W. Witham, E.T. Bauder, D. Belk, W.R. Ferren Jr., and R. Ornduff (eds.). Sacramento: California Native Plant Society. pp. 15–23.

Solomeshch, A.I., M.G. Barbour, and R.F. Holland. 2007. "Vernal Pools." In *Terrestrial Vegetation of California*. 3rd ed. M.G. Barbour, T. Keeler-Wolf, and A.A. Schoenherr (eds.) Berkeley: University of California Press, pp. 394–424.

Sprecher, S.W. and A.G. Warne. 2000. *Accessing and Using Meteorological Data to Evaluate Wetland Hydrology*. ERDC/EL TR-WRAP-00-01. Vicksburg, Mississippi: U.S. Army Engineer Research and Development Center.

Technical Advisory Team, California Wetland and Riparian Area Protection Policy. 2009. Technical Memorandum No. 2 – Final Wetland Definition. June 25, 2009.

U.S. Army Corps of Engineers (USACE). 2005. Regulatory Guidance Letter No. 05-05: Ordinary High Water Mark Identification. December 7, 2005.

———. 2008a. *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States*. U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory. R.W. Lichvar, and S.M. McColley. Hanover, NH. ERDC/CRREL TR-08-12.

———. 2008b. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region*. Wetlands Regulatory Assistance Program. Washington, D.C.

———. 2008c. Regulatory Guidance Letter No. 08-02: Jurisdictional Determinations. June 26, 2008.

———. 2010. Regulatory (Permits). Available from web site, http://www.usace.army.mil/CECW/Pages/cecwo_reg.aspx. Accessed October 2010.

———. 2011. Personal communication from Mark Cohen Deputy Chief Regulatory branch of Los Angeles USACE to Dan Leavitt, Deputy Director HST. February 17, 2011.

U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA). 2007. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* & *Carabell v. United States*. Memorandum. June 5, 2007.

U.S. Department of Agriculture (USDA). 1971. *Soil Survey of Eastern Fresno Area, California*. Available from web site, http://soils.usda.gov/survey/printed_surveys/state.asp?state=california&abbr=CA.

———. 1982. *Soil Survey of Tulare County, California, Western Part*. Survey Area CA659. Available from web site, http://soils.usda.gov/survey/printed_surveys?state.asp?state=California&abbr=CA.

———. 1986. *Soil Survey of Kings County, California*. Available from web site, http://soils.usda.gov/survey/printed_surveys/state.asp?state=California&abbr=CA.

———. 1988. *Soil Survey of Kern County, California, Northwestern Part*. Available from web site, http://soils.usda.gov/survey/printed _surveys/state.asp?state_California&abbr=CA.

———. 1998. *Hydric Soils of California*. Natural Resource Conservation Service. Available from web site, www.statlab.iastate.edu/soils/ hydric/ca.html. Accessed on June 2009.

USDA and NRCS. 1999. *Soil Taxonomy. A Basic System of Soil Classification for Making and Interpreting Soil Surveys,* Second Edition. Agricultural Handbook Number 436.

———. 2006. *Field Indicators of Hydric Soils in the United States*, *Guide for Identifying and Delineating Hydric Soils,* Version 6.0. G.W. Hurt and L.M. Vasilas (eds.). USDA and NRCS in cooperation with the National Technical Committee for Hydric Soils.

———. 2010. *Climate Analysis for Wetlands by County*. National Water and Climate Center. Available from web site, http://www.wcc.nrcs.usda.gov/ftpref/support/climate/wetlands/ca/06031.txt. Accessed on May 2010.

U.S. EPA. 1980. Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material. 40 CFR 230. December 24, 1980.

U.S. Fish and Wildlife Service (USFWS). 1996. Programmatic Formal Endangered Species Act Consultation on Issuance of 404 Permits for Projects with Relatively Small Effects on Listed Vernal Pool Crustaceans Within the Jurisdiction of the Sacramento Field Office, California. Reference Number 1-1-96-F-1. Letter to Mr. Art Champ, US Army Corps of Engineers, Sacramento, California. 17 pgs.

———. 2009. National Wetlands Inventory (NWI). Available from web site, http://www.fws.gov/Wetlands/Data/DataDownload.html. Accessed September and October 2009.

U.S. Geological Survey (USGS). 1998. Environmental Setting of the San Joaquin–Tulare Basins, California. Available from web site, http://water.usgs.gov/pubs/circ1159. Accessed April 2010.

———. 1999. "San Joaquin Valley, California—Largest Human Alteration of the Earth's Surface." In: *Land Subsidence in the United States*. D.L. Galloway, D.R. Jones, and S.E. Ingebritsen (eds.). U.S. Geological Survey Circular 1182, pp. 23–34. Available from web site, http://pubs.usgs.gov/circ/circ1182/. Accessed April, 2010.

———. 2009. National Hydrography Dataset. Available from web site, http://nhd.usgs.gov/techref.html. Accessed October 2009.

Vileisis, A. 1997. *Discovering the Unknown Landscape: A History of America's Wetlands.* Washington, DC: Island Press.

Western Regional Climate Center (WRCC). 2010. Local Climate Data summaries for Western U.S. (2008). Available from web site, http://www.wrcc.dri.edu/Climsum.html. Accessed April 2010.

6.2 Personal Communications

Deters, Jason. 2011. Staff, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, providing .kmz of USACE site visit findings. June 2, 2011.

Fisher, Leah. 2009. Project manager, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, regarding USACE jurisdictional questions, October 29, 2009.

Perry, Katie. 2009. California Department of Fish and Game (CDFG). Telephone interview by Justin Whitfield, URS/HMM/Arup Joint Venture, regarding *Central Valley Biological Resources and Wetland Survey Plan* and comments from CDFG for lake and streambed identification, December 7, 2009.

Polhemus, Darrin. 2009. State Water Resources Control Board. Letter to Dan Leavitt, California High-Speed Rail Authority, regarding Central Valley Biological Resources and Wetland Survey Plan (Survey Plan)—Comments Regarding the Proposed California High-Speed Train (HST) Project—San Jose to Merced Section, Merced to Fresno Section, and Fresno to Bakersfield Section, November 17, 2009.

Simmons, Zachary. 2010. Project manager, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, regarding mapping waters for the HST project, June 23, 2010; email to Jan Novak, URS-HMM-Arup Joint Venture, regarding guidance for USACE jurisdiction, August 12, 2010.

———. 2011a. Project manager, USACE, Sacramento, California. Email to Bryan Porter et al., regarding the locations of special aquatic resources identified within the HST Fresno to Bakersfield Alignment. February 22.

———. 2011b. Project manager, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, regarding USACE suggestions for HST wetland determinations. March 1.

———. 2011c. Project manager, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, to provide an updated version of the preliminary jurisdictional determination form for the Sacramento District of the USACE. May 5.

———. 2011d. Project manager, USACE, Sacramento, California. Phone call with Galen Peracca, Kevin Melanephy and Jan Novak of URS/HMM/Arup Joint Venture regarding the USACE site visit, findings, and actionable items. June 6.

———. 2011e. Project manager, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, to provide clarification on Attachment 1. June 7.

———. 2011f. Project manager, USACE, Sacramento, California. Email to Justin Whitfield, URS/HMM/Arup Joint Venture, stating accuracy of phone conversation. June 15.

———. 2011g. Project manager, USACE, Sacramento, California. Email to Jan Novak, URS/HMM/Arup Joint Venture, to provide an updated .kmz to URS for the delineation. Sacramento District of the USACE. June 15.

Section 7.0
Preparer Qualifications

7.0 Preparer Qualifications

This section summarizes the URS-HMM-Arup Joint Venture employees, and provides a summary of their qualifications, roles, and responsibilities in the preparation of this report.

Report Staffing

Alexandra Fraser, Ph.D. Senior Project Biologist	Ph.D., Ecology, University of Kansas; M.A., Ecology, University of Kansas; B.S., Biology, Baylor University. 16 years of experience in wetland science, restoration ecology, botany, and environmental impact assessments. • Deputy Environmental Project Manager.
Michael Monroe Senior Regulatory Specialist	M.S., Ecology, University of California, Davis; B.S., Conservation of Natural Resources, University of California, Berkeley. 25 years of experience in wetlands regulatory issues and planning. • Internal technical review of document.
Justin Whitfield Project Ecologist	B.S., Biological Sciences, Florida State University. 10 years of experience in biological assessments and preparation of environmental documents. • Biological Resources and Wetland Task Manager. • Oversight of all field surveys. • Organized and planned technical report preparation. • Prepared, reviewed, and edited sections within this report.
Jan Novak Senior Soil Scientist	B.S., Soil Science, California Polytechnic State University, San Luis Obispo. 9 years of experience conducting wetland delineations and preparing Wetlands Delineation Reports, environmental documents, and permit applications. • Wetland Subtask Manager. • Field Surveys Wetland Delineation Manager. • Prepared and reviewed wetland data and text. • Coordinated production of wetland-related sections. • Coordinated preparation of wetland GIS Figures.
Galen Peracca Biologist	Master of Forestry, Forestry, University of California, Berkeley; B.S., Resource Management, University of California, Berkeley. 7 years of experience in wetland delineations, botanical surveys, biological impact analysis, and development of California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) compliance documents for hazard mitigation and infrastructure projects. • Author of the special aquatic resource survey methodology section. Author of revised text resulting from changes in the project alignment footprint, and comments from reviewers.

Report Staffing

Biology	
Ode Bernstein Wildlife Biologist	B.S., Biological Sciences, Humboldt State University. 8 years of experience in tidal wetland ecology and restoration, avian ecology, and invasive species mapping. • Prepared Environmental Setting: climate and topography. • GIS support and wetland data analysis.
Andrea Coleman Biologist	B.S., Biology, University of California, Los Angeles. 2 years of experience in environmental document preparation, Section 7 consultations, and plant and wildlife surveys. • Assisted in table production, reference collection, and technical assistance.
Connor Dibble Biologist	B.S., Environmental Sciences, University of California, Berkeley; B.A., Integrative Biology, University of California, Berkeley. 3 years of experience in invasive species management and community ecology. • Assisted with wetland data tables, wetland plant table, and various other tasks.
Fletcher Halliday Biologist	B.S., Molecular Environmental Biology, University of California, Berkeley. 2 years of experience conducting a variety of biological surveys and preparation of environmental documents. • Data sheet review and analysis, technical assistance.
David Pecora Biologist	B.S., Marine Science, Kutztown University of Pennsylvania. 6 years of experience in environmental document preparation, biological monitoring, aquatic biology, and environmental permitting. • Author of vegetation and wildlife habitat descriptions.
GIS	
Chris Bente, GISP Senior GIS Analyst	B.A., Geography, San Francisco State University. 8 years of experience in environmental and geotechnical mapping programs; Geographic Information System (GIS) data transformation, management, and analysis; and methodologies of land surveys. • Technical GIS lead and map production lead. • Reviewed and assisted with maps and data production. • GIS support for project-level map and figures and tables related to permission to enter.
Jason Castaneda GIS Specialist	B.A., Geography, San Diego State University. 8 years of experience in GIS, cartographic design, and environmental analysis. • GIS support for production of wetlands-related figures and tables.
Jeffrey Owen GIS Specialist	B.A., Geography, Virginia Polytechnic Institute and State University. 3 years of experience in GIS, remote sensing, and GPS. • GIS support for production of environmental-setting–related figures. • Technical assistance to identify wetland features by remote sensing.

Report Staffing

Editing	
Dennis Rowcliffe Senior Technical Editor	B.A., American Studies and Journalism, California State University-Los Angeles. 22 years of experience conducting a variety of technical editing, document coordination, and document production duties. • Lead editor for project, verified technical details.
Pamela Cory Senior Technical Editor	M.A., Professional Writing and Publishing, Emerson College, Boston, MA. B.A., English Literature, University of California, Santa Cruz. 19 years of experience editing public- and private-sector documents, document coordination, and document production. • Edited text for grammar, punctuation, syntax, and clarity.
Deb Fournier Senior Word Processing Technician	11 years of experience creating, formatting, and processing word-processing requests. • Formatted and prepared document for reproduction

Field Staff
2010 & 2011 Field Surveys

Wetland Scientist	Education / Degree	Years of Experience	Knowledge Areas
Sundeep Amin	B.S., Ecology, Behavior, and Evolution, University of California-San Diego	5	Habitat restoration and mitigation monitoring, sensitive species surveys, habitat assessments, vegetation mapping and botanical surveys.
Joe Bandel	B.S., Wildlife, Fish, and Conservation Biology, University of California, Davis	8	Wetland delineations, tree surveys, vegetation management projects, pre-construction surveys, fisheries surveys and biological monitoring.
Jessica Birnbaum	M.S., Natural Resources: Planning and Interpretation, Humboldt State University; B.S., Biology, Trinity College	4	Botanical and wildlife surveys, endangered species habitat assessment, vegetation and stream monitoring, and habitat restoration.
Brian Carver	B.S., Aquatic Biology, University of California-Santa Barbara	12	Construction staking, evaluation, and adjustments of field survey data, design/drafting, topographic surveys, control surveys, right-of-way surveys, record of surveys, and as-built surveys.
John Davis IV	M.S., Biology, Cal Poly State University, San Luis Obispo; B.S., Ecology, San Diego State University	13	Special-status species surveys, sensitive biological resource assessment, restoration ecology, watershed management.
Fletcher Halliday	B.S., Molecular Environmental Biology, University of California, Berkeley	2	Biological surveys, population surveys, seedling monitoring, and California grassland species identification.

Field Staff
2010 & 2011 Field Surveys

Wetland Scientist	Education / Degree	Years of Experience	Knowledge Areas
Paul Hamidi	M.S., Forestry, University of Montana; B.S., Forestry, University of Montana	14	Soil surveys; ecological inventory and mapping; wetland delineation, assessment, mitigation and monitoring; fish and wildlife evaluation.
Greg Hoisington	M.S., Biology, California State University-Long Beach; B.S., Ecology and Environmental Biology, California State University-Long Beach	5	Biological resource identification and assessment, special aquatic resource delineation, biological permitting and compliance, environmental document preparation, and construction monitoring.
Jeffrey Jarvis	M.S., Biology, California State University-Fullerton; B.S., Biological Science, California State University-Fullerton	3	Protocol surveys for reptiles, vegetation mapping, small mammal trapping; wetland delineations, vernal pool branchiopod, avian, and rare plant surveys.
Chris Julian	B.S., Biology, University of California-Santa Barbara	8	State and federal stream and wetlands permitting (including preparation of agency permit application packages, jurisdictional delineations, wetlands functional assessment, and 404(b)(1) analysis), and Section 7 Consultations.
Marina Kasa	M.S. Environmental Science and Management, University of California- Santa Barbara B.S.; Animal Biology – Wildlife Conservation, University of California- Davis	2	General biological surveys and environmental planning.
Bill Kidder	Certificate of Wetland Science and Management, University of Washington; B.S., Wildlife Ecology, University of Maine; B.S., Forestry, University of Maine	11	Baseline surveys and impacts analysis of fish and wildlife species for Section 7 consultations.
Julie Love	M.S., Environmental Science and Management, University of California-Santa Barbara; B.S., Marine Biology, University of California-Los Angeles	8	Botanical surveys, habitat restoration and monitoring, wetland delineations and jurisdictional determinations, vegetation surveys and mapping, habitat assessment, stream and algae monitoring, special-status wildlife surveys, fish relocation, and database management.

Field Staff
2010 & 2011 Field Surveys

Wetland Scientist	Education / Degree	Years of Experience	Knowledge Areas
Mary McClanahan	M.S., Plant Science, California State University-Fresno; B.S., Range Science, University of Idaho-Moscow	25	Environmental assessments and compliance, and ecological restoration.
Jan Novak	B.S., Soil Science, California Polytechnic State University, San Luis Obispo	8	Soil science, wetland delineations, and preparation of Wetlands Delineation Reports, environmental documents, and permit applications.
Galen Peracca	M. F., Forestry, University of California, Berkeley; B.S., Resource Management, University of California, Berkeley.	7	Wetland delineations, botanical surveys, forest ecology, biological impact analysis, California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) compliance documents for hazard mitigation and infrastructure projects
Kristiaan Stuart	M.S., Biology, Plant Ecology, California State University-Chico; B.S., Biology, Ecology, California State University-Chico	18	Botanical and wildlife resource surveys, wetland delineations, stream inventory surveys, and mitigation development and implementation.
Jennifer Teschler	B.S., Environmental Systems: Ecology, Behavior, and Evolution, University of California-San Diego	2	Preparation of environmental documents and environmental planning.

BNSF Railway and Alignment Modification Surveys

BNSF Railway Surveyor	Education / Degree	Years of Experience	Knowledge Areas
Galen Peracca	M.F., Forestry, University of California, Berkeley; B.S., Resource Management, University of California, Berkeley	7	Wetland delineations, forestry, botanical surveys, and biological impact analysis.
Brian Latta	B.S., Natural Resource Management, University of Maryland	21	Wildlife biology, raptors, avian predator management, USFWS post-delisting monitoring, and avian collision deterrence.
Ivan Parr	B.S., Environmental Science, Saint Mary's College of California.	3	Special-status species surveys, wetland delineations, and habitat assessments.
Kate Eldredge	B.S., Biology, California State University-Bakersfield; B.A., Anthropology, California State University-Bakersfield	21	Plant and animal surveys, mammology, and preparation of survey plans and environmental documents.
Kristiaan Stuart	M.S., Biology, Plant Ecology, California State University-Chico; B.S., Biology, Ecology, California State University-Chico	18	Botanical and wildlife resource surveys, wetland delineations, stream inventory surveys, and mitigation development and implementation.
Jeffery Jarvis	M.S., Biology, California State University-Fullerton; B.S., Biological Science, California State University-Fullerton	3	Protocol surveys for reptiles, vegetation mapping, small mammal trapping; wetland delineations, vernal pool branchiopod, avian, and rare plant surveys.
Chris Hargreaves	B.S., Environmental Studies, University of Utah	6	Biological field studies, including plant identification and wetland delineations.